River Sowy and King's Sedgemoor Drain Enhancements Scheme: Phase 1 Environmental Statement

ENVRESW001353-CH2-XX-400-RP-EN-1042

V3 August 2020

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Quality Assurance

Project name	River Sowy and King's Sedgemoor Drain Enhancements Scheme: Phase 1
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Author	Miriam Olivier, Will Maclennan

Approvals

Name	Signature	Title	Date	Version
Simon Keys	S J Keys	Divisional Director	06/08/2020	2
Gary Cutts	G B Cutts	Lead Project Manager	14/08/2020	3

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 IEMA, through which EIA activity is independently reviewed, on an annual basis, to ensure it delivers excellence in the following areas:

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- *EIA Team Capabilities*
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- *EIA Context & Influence*
- *EIA Content*
- *EIA Presentation*
- *Improving EIA practice*

To find out more about the EIA Quality Mark please visit: http://www.iema.net/eia-quality-mark/

Statement of competency

Environment leads

Simon Keys, BSc, MSc (1990)

Simon Keys has 30 years of experience in the fields of Environmental Impact Assessment (EIA) and Flood Risk Management as a consultant and regulator. Simon has worked on numerous EIAs for flood risk management projects in all capacities from writing to management and review. In 2016 Simon was appointed by the Environment Agency (EA) to the Yorkshire Regional Flood and Coastal Committee.

Miriam Olivier, MESci Environmental Geoscience (2011), PhD Geomicrobiology (2016)

Miriam is a full member of the Institute for Environmental Sciences (IES) and has four years' experience in environmental consultancy and regulation. She is experienced in most types of impact assessment including EIA, Strategic Environmental Assessment (SEA) and Equalities Impact Assessment (EQIA). Miriam works as an environmental coordinator and technical author (population and health, climate) for projects of various scale and stage of development across a wide range of sectors including flood risk management, water, highway, nuclear and renewables.

Water technical lead

Rebecca Westlake, BSc Hons Physical Geography (1997), MSc Coastal and Marine Resource Management (1998), LLM Environmental Law and Practice (2018), PhD Geomorphology (2007)

Rebecca Westlake has 23 years of experience in the field of geomorphology and Water Framework Directive as a consultant, regulator and an academic. She previously worked for the EA as a technical specialist in the Solent and South Downs Regional office. She has been a Chartered Scientist and Chartered Marine Scientist since 2009 (CSci, CMarSci) with IMaREST (Institute of Marine Science and Technology).

Flora and fauna technical lead

Richard Thompson

Richard has worked in consultancy (Halcrow/CH2M/Jacobs) since 2006. His responsibilities have included leading on botanical, habitat and protected species surveys, and the preparation of ecological impact assessments, inputs into Environmental Statements, mitigation method statements and habitat management plans. Richard is a full member of the Chartered Institute for Ecology and Environmental Management (CIEEM).

Cultural heritage technical lead

Nathan Thomas, BSc Archaeology (2006), MSc Archaeological Prospection (2008)

Member of the Chartered Institute for Archaeologists (MCIfA). Professional archaeologist and geophysicist since 2006. He has experience of a wide range of archaeological projects, including flood protection and coastal defence schemes for the EA.

Landscape technical lead

Daniel Mounsdon, BA Hons Landscape Architecture (2003), PGDip Landscape Architecture (2005)

Daniel has been a Chartered Member of the Landscape Institute (CMLI) since 2009 and has extensive experience creating integrated designs that bring together best practice approaches to habitat creation in river channels, floodplains and flood storage areas, the assimilation of flood defence works into sensitive landscapes, and the restoration or urban river corridors. Daniel has a wealth of experience with landscape and visual impact assessment (LVIA) over a wide range of development types, including large scale residential, infrastructure and highways, and is well versed in the current guidance described in the Guidance for Landscape and Visual Impact Assessment Third Edition (GLVIA3).

Population and health technical lead

Matthew Beacon, BA Environmental Management (2012), MSc Environmental Impact Assessment and Management (2013)

Matthew is a Chartered Environmentalist and full member of the Institute of Environmental Sciences with over five years' experience as an environmental consultant on a wide variety of projects for different sectors. Matthew has a proven high-quality delivery record on projects of differing sizes and complexity predominantly for the water and highways sectors and has also worked closely with regulators, government and private clients. Matthew has experience of writing technical chapters for population and human health for numerous environmental assessments and statements.

Noise technical lead

Richard Stait, BSc Mathematics and Statistics (1994), PG Diploma Acoustics and Noise Control (2004)

Richard Stait has over 25 years' experience in the assessment of the impacts of noise and vibration from large infrastructure projects, both from the construction and operation. Throughout the UK and in the Middle East, these include road and rail transport projects, flood defence schemes, and power and energy installations. He is a full member of the Institute of Acoustics (IoA).

Non-Technical Summary

Introduction

Following the significant flood event that affected Somerset in 2013/14, the Somerset Levels and Moors 20-year Flood Action Plan was developed.

This plan was published in March 2014 and set out six key objectives to tackle flooding in the region:

- Reduce the frequency, depth and duration of flooding
- Maintain access for communities and businesses
- Increase resilience to flooding for families, agriculture, businesses, communities and wildlife
- Make the most of the special characteristics of the Somerset Levels and Moors (the internationally important biodiversity, environment and cultural heritage)
- Ensure strategic transport connectivity, both within Somerset and through the county to the South West peninsula
- Promote business confidence and growth

It established the need for the River Sowy and King's Sedgemoor Drain (KSD) Enhancements Scheme. This project (which is referred to as the Proposed Scheme from now on) is Phase 1 of the River Sowy and King's Sedgemoor Drain Enhancements Scheme.

The Proposed Scheme will reduce fluvial flood risk in Somerset, protecting people and properties situated within the Somerset Moors and Levels downstream of Langport by increasing conveyance along the River Sowy and the King's Sedgemoor Drain (KSD). The Proposed Scheme is being developed and managed by the Environment Agency (EA), on behalf of the Somerset Rivers Authority (SRA), and falls under the definition of improvement works under the Environmental Impact Assessment (Land Drainage Improvement Works) (Amendment) Regulations 2017 (the EIA Regulations).

Scheme location

The Proposed Scheme is situated in Somerset within the Somerset Levels and Moors (see Figure 1, pii). The Somerset Levels and Moors are one of the largest remaining lowland wet grassland areas within the UK and, as such, has several international ecological designations such as the Somerset Levels and Moors Somerset Levels and Moors Special Protection Area (SPA) and Somerset Levels and Moors Ramsar site.

The Sowy and KSD system is approximately 21 km long, comprising mainly agricultural and conservation land with scattered residential properties and a few access roads that allow travel across the river corridor.

The Sowy and KSD are manmade structures that act as a flood relief channel for the River Parrett. Flood relief is achieved by diverting water from the River Parrett, just

downstream of Langport, into the Sowy which, in turn, connects to the KSD. The water is diverted via a number of spillways and sluice gates that can be used during times of high water (either naturally via the spillway or manually via opening the sluice gates). Diverting water from the River Parrett into the Sowy / KSD means that there is more capacity to drain water from the moors to reduce the duration and extent of flooding across the wider area.

The Somerset Levels and Moors are known for flooding which is often caused by either one ‘large’ high intensity storm or several ‘smaller’ low intensity storms. These storms then cause the water within the existing channels to overtop the river banks and the water is stored within the moors before it reaches the estuary. There is added difficulty with the drainage of the Somerset Levels and Moors during times of high tide as this further reduces the capacity of water within the River Parrett which means that less water is drained from the moors.

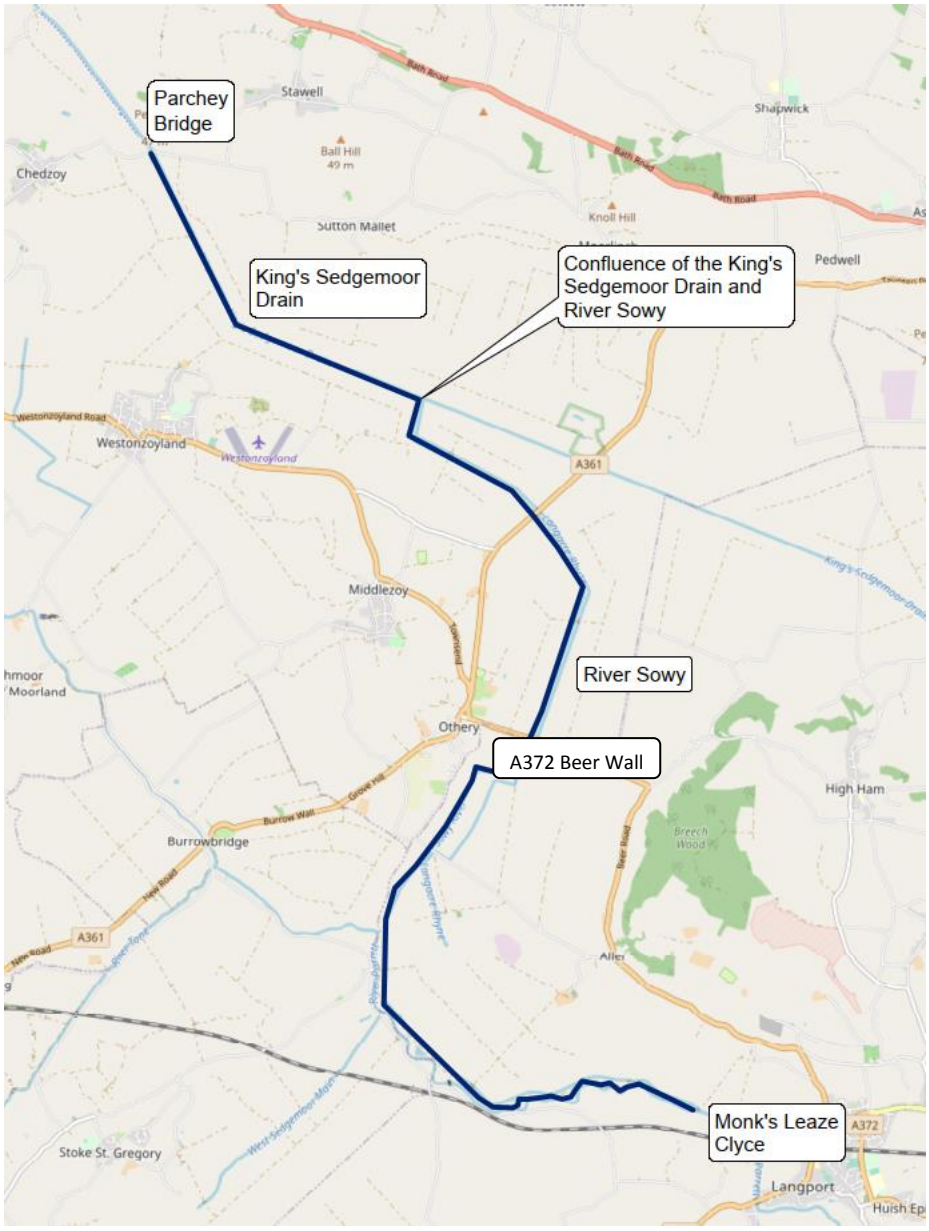

Figure 1 Location of the Proposed Scheme

EIA and other consents

The Environmental Impact Assessment (EIA) for the Proposed Scheme falls under the Environmental Impact Assessment (Land Drainage Improvement Works) (Amendment) Regulations 2017 (the EIA Regulations).

Due to the location of the Proposed Scheme (within close proximity to several designated ecological sites) a Habitat Regulations Assessment (HRA) has been undertaken in accordance with the Conservation of Habitats and Species Regulations 2017. Other environmental consents required for the Proposed Scheme, due to the location of the Scheme and because it involves works to a river, include a Site of Special Scientific Interest (SSSI) Assent, Water Framework Directive (WFD) Assessment, a Flood Risk Assessment Permit (FRAP), and European protected species licences.

Consultation to date

The Preliminary Environmental Information Report (PEIR) which set out the scope of the EIA was sent to key stakeholders in March 2020, comments from those key stakeholders were considered within the ongoing design and environmental assessment process. In addition, to inform the impact assessments, desktop studies and field surveys were carried out by relevant qualified technical specialists for each topic area.

Stakeholder engagement has been carried out to consult and share information on the Proposed Scheme with statutory consultees, stakeholders, businesses, community groups and local residents. After meeting with local land owners, a series of public consultation events were conducted over three consecutive evenings in February 2020 (17th – 19th), in order to present key information to the public. A total of 132 people attended the three events with the vast majority providing feedback that was either positive or gave constructive feedback on the Proposed Scheme. These comments have been taken into account where feasible within the ongoing scheme design and environmental assessment process.

Alternatives considered

In developing the preferred option for the Proposed Scheme a range of options were discussed.

Strategic level options

Strategic level alternatives considered for the full River Sowy and King's Sedgemoor Drain Enhancements Scheme included:

- '**Do nothing' scenario**': No works to enhance the capacity of the Sowy / KSD system and therefore continued risk to properties and infrastructure within the area.
- **'Do something' capacity enhancement options**: During 2014 a series of different options were considered that would act in combination to increase the capacity of the system without increasing any flood risk to any of the surrounding properties or infrastructure. A total of seven individual options were developed that consisted of three main aspects: (i) enhanced operation of Monk's Leaze Clyce, (ii) enhanced capacity of the Sowy and KSD system

or (iii) floodplain storage. These options were taken to public consultation in 2014 and 2015, where feedback highlighted that opinions were spread across the options with a slight preference for three of the seven options (enhancing operation of Monk's Leaze Clyce, widening the Sowy and KSD and removing channel constrictions at Dunball).

- '**Do something' capacity enhancement scenarios**: An Options Appraisal Report undertaken by CH2MHill identified three 'packages' of options that could be combined. The first package or 'scenario' focused on combination of enhancement via channel widening and embankment building. The second scenario considered was a 'comprehensive' scheme that aimed to achieve channel widening, bank raising, installation of pumps in certain locations and overall improvements to the KSD. The third and alternative scenario was to focus on land management including floodplain storage.

It was concluded that at a strategic level the 'Do something' capacity enhancement scenarios (outlined in the last bullet point above) were the preference for development, with the first scenario (channel widening and bank raising to achieve an increase in capacity of the KSD and Sowy system of up to 40%) being the preferred option.

Project level options

Project level design alternatives were also considered for the preferred option, which included consideration of different options for the re-profiling of the existing flood embankments between Monk's Leaze Clyce on the Sowy and Parchey Bridge on the KSD. These design alternatives considered:

- **Source of fill material required to support raising of the existing informal flood embankments**: Three options were considered in respect to sourcing the fill material required. These included getting the material from channel widening (and / or from the creation of additional channel bank features), via reworking the existing embankments or importing material from another location. At detailed design it was decided that material will be obtained on-site by reworking the existing embankments where possible, and importing where not, as material dug from the channel will likely not have the right properties to ensure the flood banks serve their purpose.
- **Transport of material required for bank raising within the Lower Sowy and Upper Sowy**: Three options were considered which included a barge along the Sowy and KSD, road haulage via tractor and trailer and road haulage via tipper truck. Due to time and space restrictions, road haulage was the preferred method with a mixture of tipper trucks on major roads and tractor and trailers along minor roads and access routes.
- **Design of re-profiled flood embankments**: Two options were considered, both of which focused on changes to the existing embankments. The first option focused on the slope of the embankment whilst the second focused on the width. The final outcome involved a combination both options.

Scheme description

Phase 1 (the Proposed Scheme i.e. the works covered within this ES) of the River Sowy and King's Sedgemoor Drain Enhancements Scheme focuses on raising the

existing embankments situated between the A372 Beer Wall on the River Sowy and Parchey Bridge on the KSD to a level such that the capacity of the Lower Sowy and KSD system in this stretch is increased by up to 40% (increased from 17m^3/s to 24m^3/s). This scheme also involves very minor 'filling' in of the existing embankments between the A372 Beer Wall and Monk's Leaze Clyce such that the capacity of the Sowy at this location is maintained at 17 m^3/s (see Figure 1, pii).

We will not divert more water from the Parrett to the Sowy/KSD system through Monk's Leaze Clyce as part of the Proposed Scheme. This will only occur once later phases of the full River Sowy and King's Sedgemoor Drain Enhancements Scheme have been completed, as and when funding becomes available.

As part of the Proposed Scheme the following work will take place:

- **Raising and re-profiling of existing informal flood embankments**: Existing flood embankments will be re-profiled to a consistent design as shown in Figure 2 (pvii). The material needed for this work will be sourced on site where possible from the KSD, otherwise imported from an off-site source under the Contaminated Land: Applications in Real Environments (CL:AIRE) Code of Practice (CoP).
- **Channel widening**: The Proposed Scheme involves the creation of channel bank features along the Lower Sowy and KSD. This includes two sections of two-stage channel (with a deeper channel centre and shallow 'shelved' channel sides), embayments (shelves) and backwaters (which will be another smaller channel located adjacent to the existing channel). A cross-section of a backwater feature can be seen in Figure 3 (pviii). These works will increase the diversity of habitats within these areas which will be of benefit for biodiversity and will support the obligations under the Water Framework Directive (WFD) to improve the condition of the watercourse.
- **Landscaping**: which includes tree planting and reseeding of embankments with neutral wet grassland or other grass mix if appropriate (which in turn will help with the stability of the soil on the embankments).
- **Additional works**: which include modification to existing outfall structures at Cossington Right Rhyne and Chilton Right Rhyne to ensure they provide a continuous defence level when combined with the other works associated with the Proposed Scheme.

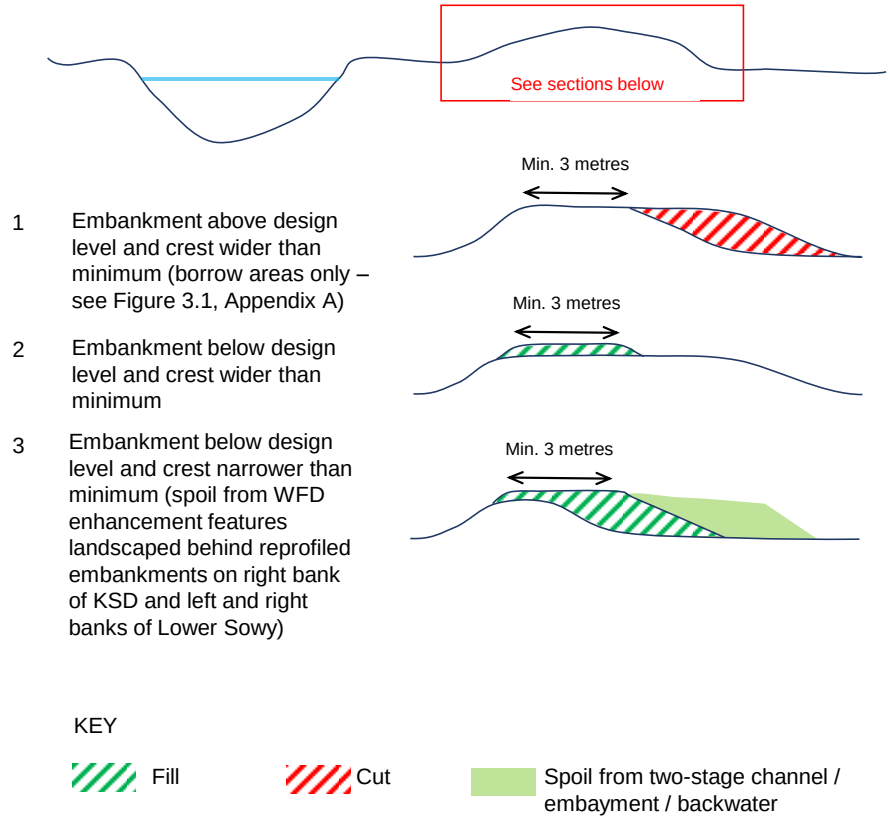

Figure 2 Schematic illustration of bank re-profiling process

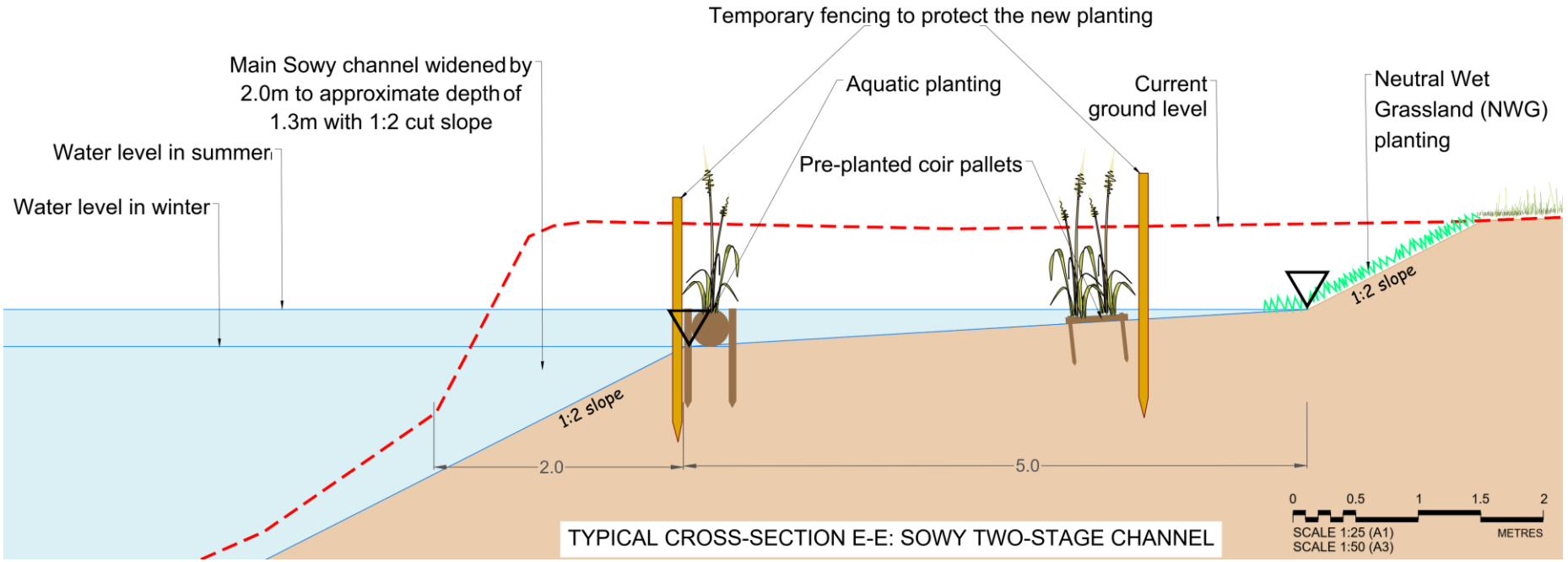

Figure 3 Example cross section of a two stage channel which will be created on the eastern side (right bank) of the Sowy

Note: It is currently proposed to plant the bank with a NWG seed mix, however alternative appropriate mix may be used if necessary.

The river bank on the Sowy typically looks like the dashed red line above. The sides of the bank are very steep, and then flatten off at the water's edge. The two-stage channels that will be created will make the river bank under the water less steep. They will have two sections, one steeper than the other. Once the wider shallow section has been dug out, coir rolls which are ready planted will be placed on the shelf and tied down with stakes.

Where the channel bank is affected by the construction works, it will be seeded with a grassland mix that has similar species to the grass currently present next to the channel. As the KSD and Sowy are manmade they are quite uniform in their appearance in the habitats that they provide at the moment. These channel bank features improve the number of different types of aquatic habitat available in the KSD and Sowy for wildlife such as invertebrates, water vole and fish.

Likely significant environmental effects and mitigation

The following chapter themes briefly state the residual environmental impacts and the actions we will take across the Proposed Scheme area. For any further detail please refer to the relevant chapters within the Environmental Statement.

Water: The Proposed Scheme is concluded to have an overall beneficial effect as it will help reduce flood risk in the local area and will improve the range of aquatic habitats in the KSD and Sowy.

Flora and Fauna: The construction of the Proposed Scheme could potentially have adverse impacts on ecological features including internationally designated sites and protected species. Specific mitigation has been included to minimise these effects during construction and operation of the Proposed Scheme in order to ensure there are no significant residual impacts. Such measures include:

- Creation of enhancement features which will contribute to the objective of 'good ecological' potential for these watercourses under the Water Framework Directive.
- Specific construction practices including but not limited to - appointment of an environmental site supervisor, plant and vehicle to be kept in good working order and use of biodegradable hydraulic fuels where possible
- Management of invasive non-native species
- A suite of mitigation measures to avoid adverse effects on the European protected site including a package of works involving refurbishment of structures used to sustain the existing Raised Water Level Areas for overwintering birds protected by the Somerset Levels and Moors SPA.
- Development of a Mitigation Action Plan in conjunction with Natural England and the Somerset Drainage Boards Consortium for the long term management of water levels within the Somerset Levels and Moors.

Cultural Heritage: Due to the setting of the Proposed Scheme (a landscape with high archaeological potential) archaeological monitoring will be implemented throughout the construction period where required to ensure that there are no significant residual effects on cultural heritage assets. Potential risks have been minimised through careful placement of WFD enhancement features to avoid areas of high archaeological risk.

Landscape: During construction there will be some temporary significant effects on a range of visual receptors. Operational impacts of the Proposed Scheme will be both short and long term. In the short term there will be localised moderate to negligible adverse and beneficial effects on both landscape character areas and visual receptors. In the long term there will be both adverse and positive effects on landscape character and visual amenity which overall are anticipated to balance out one another, leaving no significant residual effects.

Population and Health: During both construction and operation there are no significant effects anticipated on the surrounding population. During construction there will be minor adverse effects in the form of disruption to footpaths and recreational areas along the Sowy and KSD and for adjoining landowners and

agricultural businesses, however several mitigation measures have been identified to avoid or reduce these impacts where possible.

Noise: The assessment of noise and vibration has determined that construction traffic will have no significant impact on the surrounding sensitive receptors including residential properties, commercial buildings (e.g. offices), farmland, industrial premises etc. However, measures to control the noise from vehicles on the road network will be implemented within the Proposed Scheme area as best practice.

Cumulative Impacts: The assessment of cumulative impacts concludes that the Proposed Scheme is not likely to cause significant adverse effects, even in combination with other nearby schemes, once the mitigation mentioned above for potential adverse impacts on designated sites has been implemented.

Conclusions

With the mitigation identified in place, no significant adverse effects will occur as a result of the Proposed Scheme. Through consultation and by undertaking an EIA, we have sought to avoid or minimise any remaining residual impacts to an acceptable level. There will however be a significant beneficial impact as a result of the improved diversity of aquatic habitats with the KSD and Sowy which will contribute to the objective of 'good ecological' potential for these watercourses under the Water Framework Directive.

The Proposed Scheme is the first phase of the full River Sowy and King's Sedgemoor Drain Enhancements Scheme which is identified as required under the Somerset Levels and Moors 20 Year Flood Action Plan, and as such, will have a beneficial impact on flood risk for local communities.

Ongoing ES Consultation

Copies of this NTS and the Environmental Statement may be inspected online via a consultation website named Citizen Space. Citizen Space contains a copy of the statement and provides an online survey facility to record consultation responses as well. The web address for Citizen Space is:

https://consult.environment-agency.gov.uk/wessex/river-sowy-and-ksd-enhancements

With regret due to the Coronavirus, hard copies of the statement will not be available for inspection at any public location.

Any person wishing to make representations in relation to the likely environmental effects of the proposed improvement works should do so via the Citizen Space survey or to the following email address: sowy.ksd@environment-agency.gov.uk , within 30 days of publication of this document.

Should you have any problems with using the Citizen Space facility, you can reach the project team on 07950 955 527 for further assistance. If no representations are received in respect of the environmental effects of the proposal within this time period, then the proposal will proceed to be implemented. It is anticipated that works will commence in Autumn 2020.

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1. Introduction

1.1. Background

On behalf of the Somerset Rivers Authority (SRA), we are proposing to reduce the flood risk from the River Parrett to people and properties in the Somerset Levels and Moors downstream of Langport.

The Sowy and King's Sedgemoor Drain (KSD) Enhancements Scheme has been identified as a priority in the Somerset Levels and Moors 20 Year Flood Action Plan[1] prepared subsequent to the extensive flooding of the Somerset Levels and Moors in the winter of 2013-14.

In 2016 we consulted with interested parties regarding early stage proposals to increase the capacity of the Sowy and KSD through a combination of methods including bank raising, channel widening and dredging. At this time, the extents of the scheme consulted upon covered from Dunball Sluice to Monk's Leaze Clyce, and involved the River Parrett, River Sowy and the KSD. The scheme described in 2016 was found to be unaffordable in its entirety, and therefore we now propose to take forward the first phase of works between Parchey Bridge and Monk's Leaze Clyce (see Figure 1.1, Appendix A) as Phase 1 of the River Sowy and King's Sedgemoor Drain Enhancements Scheme (referred to as the 'Proposed Scheme'). As further funding becomes available, additional capacity enhancement works will be undertaken as future phases of the full River Sowy and King's Sedgemoor Drain Enhancements Scheme.

1.1.1. Proposed scheme location

The Sowy and King's Sedgemoor Drain (KSD) corridor is in the Somerset Levels and Moors, part of the coastal plain and wetland area which contains the Parrett catchment (Figure 1.2, p2). The Sowy and KSD are man-made embanked flood relief channels, which carry excess water from the Parrett.

The Somerset Levels and Moors are the largest area of lowland wet grassland and associated wetland habitat remaining in Britain, covering about 60,000 hectares in the floodplains of the rivers Axe, Brue, Parrett, Tone and their tributaries. The majority of the area is only a few metres above mean sea level. This is a landscape of rivers and wetlands, artificially drained, irrigated and modified to allow productive farming.

The Sowy/KSD corridor is approximately 21km long, mostly comprising agricultural land with a relatively low density of residential properties, and several access roads across the associated river corridor. Land towards the western (downstream) end of the Sowy system and its confluence with the KSD has a number of international nature conservation designations, principally due to wetland habitat value and overwintering birds.

[1] https://somersetnewsroom.files.wordpress.com/2014/03/20yearactionplanfull3.pdf

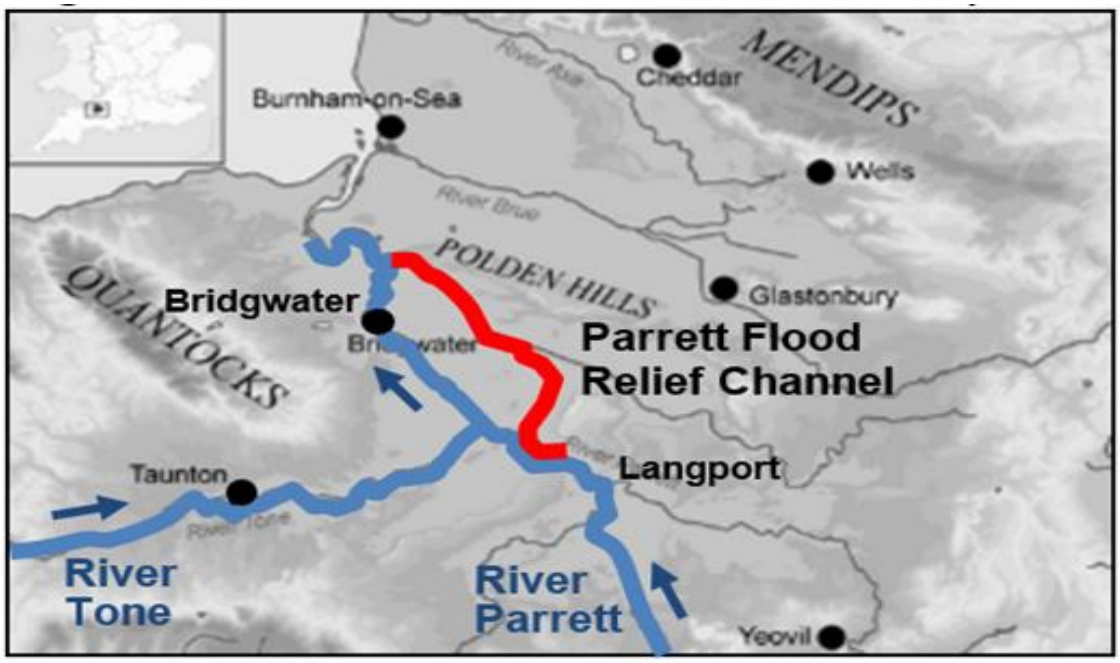

Figure 1.2 Extent of the full River Sowy and King's Sedgemoor Drain Enhancements Scheme

1.2. The problem and need for the Scheme

In the Somerset Levels and Moors, flooding can be caused by long duration storms or a series of storms of low intensity over a wide area. The embanked channels overflow and flood water is stored in the moors before it can reach the estuary. The capacity of these channels to contain flood water can be significantly reduced by high tidal conditions backing up the Parrett.

The Parrett and its main tributary rivers start in the steep uplands, then flows through flat lower moors, where they are embanked and in some places perched above the surrounding floodplain. The lower reaches of the rivers Tone and Parrett are tidal for some 30km inland from the Severn Estuary. The steepness of the uplands, coupled with the geology and soil conditions, generates quick run-off from rainfall.

The Sowy was constructed in the 1960s to function as a flood relief channel which diverts water from the Parrett to the sea at Dunball, via the King's Sedgemoor Drain (KSD). This creates space in the Parrett so that more flood water can be pumped out from the moors, reducing the extent and duration of flooding across a wide area.

Under normal operations, when the Parrett reaches a pre-determined operational level, water flows over spillways near Langport (Aller Moor and Beazley Spillways) and into the Sowy. When water levels in the Parrett are below the levels of the spillways, water can also be managed by diverting water into the Sowy via the Monk's Leaze Clyce. However, to avoid passing too much water into the Sowy flood relief channel, the Monk's Leaze Clyce is closed when the spillways are operational.

During the period from mid-December 2013 to mid-February 2014 at least 12 major winter storms hit south-west England and, when considered overall, this was the stormiest period of weather the UK has experienced for at least 20 years. The resultant flooding experienced on the Somerset Levels and Moors was caused by insufficient discharge capacity to the sea, made worse by high tides preventing flow

through the sluice at Dunball. Based on appraisal of the flooding from mid-December 2013 to February 2014 the following is estimated based on modelling:

- 455 million m^3 of floodwater entered the Parrett/Tone system
- 380 million m^3 of floodwater discharged by the Parrett River and Dunball sluice by gravity
- balance of 75+ million m^3 (possibly 100 million m^3) stored as flooding throughout the moors

During this flooding, we diverted additional water by opening Monk's Leaze Clyce when the spillways were running through the Sowy and KSD to evacuate flood water from the levels and moors more quickly. The Somerset Levels and Moors 20 Year Flood Action Plan published in 2014 subsequently identified that we should investigate opportunities to improve this system so that it could be used as an option in the future to reduce the duration and/or frequency of flooding.

1.3. Regulatory context

1.3.1. Planning

A Certificate of Proposed Lawful Use or Development (CLOPUD) for the full River Sowy and King's Sedgemoor Drain Enhancements Scheme was obtained from Sedgemoor District Council in February 2017 (see Appendix B), confirming that the Proposed Scheme constitutes permitted development under Schedule 2, Part 13, Class D Parts D.1. (b) and (f) of the Town and Country Planning (General Permitted Development) (England) Order 2015 (as amended). The Proposed Scheme therefore does not require planning consent.

1.3.2. Environmental Impact Assessment

Environmental Impact Assessment (EIA) procedures in European Commission (EC) countries are based on the European Community Directive 'The Assessment of the Effects of Certain Public and Private Projects on the Environment' (85/337/EEC) as amended by the Council Directive 97/11/EC and Council Directive 2014/52/EC.

The Directive is transposed into UK law in various EIA Regulations. The Proposed Scheme meets the definition of improvement works under the Environmental Impact Assessment (Land Drainage Improvement Works) (Amendment) Regulations 2017 (the EIA Regulations), meaning that we are both the proponent and the determining authority of the Proposed Scheme.

Under the EIA Regulations we must consider whether a development is likely to have significant effects on the environment taking into account the criteria set out in Schedule 2 which includes the characteristics and location of the improvement works and the characteristics of the potential impact.

A Preliminary Environmental Information Report (PEIR) for the Proposed Scheme was prepared and consulted upon in March 2020 (see Chapter 3.3 for further information regarding the consultation process for the Proposed Scheme). The PEIR identified potential significant effects on the environment (see Chapter 5 for further information) and therefore an Environmental Statement (ES) has been prepared for the Proposed Scheme. This report is the ES for the Proposed Scheme.

1.3.3. Habitat Regulations Assessment

The basis for Habitats Regulations Assessments (HRA) in England is the EU Directive 92/43/EEC on the conservation of habitats and of wild flora and fauna (known as the 'Habitats Directive'). This Directive, together with Directive 2009/147/EC on the conservation of wild birds (the 'Birds Directive') establishes a network of internationally important sites designated for their ecological status. The Conservation of Habitats and Species Regulations 2017 (the 'Habitats Regulations') implement the Habitats Directive and the Birds Directive in the UK.

The Habitats Regulations incorporate all SACs and SPAs into the definition of 'European Sites' and, consequently, the protection afforded to European Sites under the Habitats Directive apply to SPAs designated under the Birds Directive.

The HRA for the Proposed Scheme will be considered through two separate but interdependent processes. These are as follows:

- Strategic HRA focussing on the operational impacts of the full River Sowy and King's Sedgemoor Drain Enhancements Scheme (as described in section 3.1, including Phase 1)
- Project level HRA focussing mainly on the construction level impacts associated specifically with the Proposed Scheme (as described in section 3.2).

The strategic level HRA screening (Stage 1) and Appropriate Assessment (AA) (Stage 2) reports for the full River Sowy and King's Sedgemoor Drain Enhancements Scheme are provided in Appendix C.

The project level HRA screening (Stage 1) and Appropriate Assessment (AA) (Stage 2) reports for the Proposed Scheme are provided in Appendix D.

The assessment of impacts on flora and fauna provided in Chapter 7 of this report has been informed by the strategic and project level HRA assessments undertaken.

1.3.4. Water Framework Directive

The EU Water Framework Directive (WFD) (Directive 2000/60/EC of the European Parliament and of the Council establishing a framework for the Community action in the field of water policy), is transposed into law in England through Water Environment (Water Framework Directive) (England and Wales) Regulations 2017 (SI 2017/407), requiring that all natural water bodies must achieve both good chemical status and good ecological status. For each River Basin District, a River Basin Management Plan (RBMP) outlines the actions required to enable natural water bodies to achieve this. Water bodies that are designated in the RBMP as 'Heavily Modified Water Bodies' or 'Artificial Water Bodies' may be prevented from reaching good ecological status by the physical modifications for which they are designated or purpose for which they were constructed (e.g. navigation, flood defence, urbanisation). Instead they are required to achieve good ecological potential, through implementation of a series of mitigation measures outlined in the applicable RBMP (and in some cases updated since the publication of the RBMP).

A Preliminary WFD Compliance Assessment (screening) was undertaken and consulted on during April 2020. The Preliminary WFD Compliance Assessment identified that the Proposed Scheme has potential to cause deterioration to the King's Sedgemoor Drain -Henley Sluice to Mouth WFD waterbody and recommended that a detailed assessment be undertaken.

The Preliminary WFD Compliance Assessment (screening) and Detailed WFD Compliance Assessment (detailed assessment) for the Proposed Scheme are provided within Appendix E of this report.

The assessment of impacts on the water environment provided in Chapter 6 of this report has been informed by the Detailed WFD Compliance Assessment for the Proposed Scheme (see Appendix E).

1.3.5. Other consenting pathways

Protected species licensing

Water vole surveys undertaken during spring and autumn 2019 (see Chapter 7 and Appendix F) identified the presence of water vole along the majority of the KSD and Sowy between Parchey Bridge and Monk's Leaze Clyce. Water vole are a nationally protected species that will be displaced from several locations along the length of the scheme under our organisational licence (WML-OR23) prior to commencement of construction and during the appropriate seasonal timescales. Further details regarding impacts on water vole and proposed mitigation are provided in Chapter 7.

Requirements for protected species licences will be reviewed and confirmed following completion of further ecological survey work that will be undertaken in the weeks immediately preceding commencement of construction works September (see Chapter 7 and Appendix K for further information).

Site of Special Scientific Interest (SSSI) assent

Under Section 28H of the Countryside and Rights of Way Act 2000, public bodies must obtain assent from Natural England for works that are likely to damage the condition or special features of a SSSI. The Proposed Scheme falls within the King's Sedgemoor SSSI and a SSSI assent for the Proposed Scheme will be obtained from Natural England before construction of the Proposed Scheme commences.

Scheduled Monument Consent (SMC)

Under the Ancient Monuments and Archaeological Areas Act 1979 (as amended), Scheduled Monument Consent (SMC) must be obtained for works likely to affect a Scheduled Monument. Consent is granted by the Secretary of State (SoS) following recommendation from Historic England. A SMC is required for the SM located on the east bank of the KSD, immediately south of Parchey Bridge (Prehistoric timber trackways, 670m SSE of Parchey Bridge). Further detail is provided in Chapter 8.

Landowner consent

The temporary and permanent works areas for the Proposed Scheme fall mainly within land that we own. However, consent from other landowners who are directly affected by the Proposed Scheme will be required before the works commence, and we will continue to liaise with the affected parties until the Proposed Scheme is completed.

Environmental permits

A Flood Risk Activity Permit (FRAP) is required for any flood risk activities if work is carried out:

- in, under, over or near a main river (including where the river is in a culvert)
- on or near a flood defence on a main river
- in the flood plain of a main river
- on or near a sea defence
- or activities carried out within 8 metres of the bank of a non-tidal main river (or within 8 metres of a culvert or flood defence structure on that river) or within 16 metres of the bank of a tidal main river (or within 16 metres of any flood defence structure or culvert on that river)

We will apply to the Environment Agency for a FRAP for the Proposed Scheme.

2. Project development

2.1. Strategic context

Following the devastating winter floods of 2013-14 the former Environment Secretary Owen Paterson requested a single, overarching plan be developed which will guide water and land management policies and investment on the Somerset Levels and Moors over the next 20 years. Known as the Somerset Levels and Moors 20 Year Flood Action Plan[1], the plan was published in March 2014 and set out six key objectives to tackle flooding in the region:

- Reduce the frequency, depth and duration of flooding
- Maintain access for communities and businesses
- Increase resilience to flooding for families, agriculture, businesses, communities and wildlife
- Make the most of the special characteristics of the Somerset Levels and Moors (the internationally important biodiversity, environment and cultural heritage)
- Ensure strategic transport connectivity, both within Somerset and through the county to the South West peninsula
- Promote business confidence and growth

As part of the Action Plan, a number of recommendations were outlined, including dredging and river management actions, land management actions, urban water management and building local resilience to flooding.

One of the key elements identified in the plan was the need to increase the capacity of the Sowy and KSD, recognising that this solution will reduce the need for additional pumping at Dunball during future flooding events.

2.2. Consideration of alternatives

2.2.1. Strategic level alternatives considered for the full River Sowy and King's Sedgemoor Drain Enhancements Scheme

'Do nothing' scenario

In the absence of any works to increase the capacity of the Sowy and KSD system, housing, businesses and infrastructure within the Parrett and Tone Moors will continue to be at risk of flooding under extreme winter events.

'Do something' capacity enhancement options

Between 2014 and 2016 we carried out an investigation into the different options to enhance the capacity of the Sowy and the KSD, allowing the system to carry more water without increasing the risk to property and infrastructure. In order to enhance the capacity of the system, we considered three main aspects: enhanced operation, enhanced capacity and floodplain storage. This investigation came up with seven options, as listed below, which could be combined in different ways to provide a solution.

- Option A – enhanced operation. This option involves increased opening of the Monk's Leaze Clyce (sluice) to divert more water from the Parrett into the Sowy and KSD during high flows.
- Option B – enhanced capacity: KSD simple improvements at Dunball. This option involves resolving an existing constriction at the A38 Bridge.
- Option C – enhanced capacity: channel widening. This involves the Sowy/KSD being widened by up to 30%, which would increase the water carrying capacity in the channel by up to 75%.
- Option D – enhanced capacity: bank raising/set-back. This involves either raising and extending the existing embankments that run along the sides of significant lengths of the Sowy and KSD or setting-back the embankments to provide a wider area of land for high flows to run through.
- Option E – enhanced capacity: floodplain storage/water spreading. This option assumes that it would be acceptable to increase flooding in some parts of the moors through the Sowy/KSD system, particularly during tide-lock periods (when high tides prevent river discharge at Dunball) and if we use option A (enhanced operation).
- Option F – enhanced capacity: KSD comprehensive improvements at Dunball. This requires a complete rebuild of the KSD outlet at Dunball, including: widening the approach channel to Dunball; increasing the capacity of the Dunball gravity outlet sluice; and extending the span or replacing the old A38 (southbound) bridge.
- Option G – Enhanced Capacity: sub-option G1 Dunball temporary pumps. This involves the temporary installation of pumps from Holland at Dunball to continue to evacuate water when the sluice is tide locked; and sub-option G2 Dunball permanent pumps. This will involve developing a permanent pumping station at the Dunball sluice.

Key economic, environmental and technical considerations associated with option A and each of the options B to G are provided in Table 2.1.

Table 2.1 Strategic level options appraisal summary (replicated from Environment Agency, 2016)

Option		Requirements	Cost	Benefits and risks
A	Enhanced operation	Agreement of landowners and stakeholders to open Monk's Leaze Clyce whilst spillways are running. (The clyce is normally closed when the spillways run)	Costs of associated options as described	• Average > 5 day reduction in flood duration in Parrett and Tone moors. • Requires that pumps are positioned at Dunball if flood risk to the Sowy/KSD floodplain is to be minimised, or that river widening (option C or D) compensates for the need to pump
B	KSD simple improvements at Dunball Choose between option B or F	• Remove concrete obstruction from A38 bridge (if not already done) • Channel/bridge fluming • Widening constricted channel	£4-7 million	• Protect highways network. • More efficient outlet at Dunball. • Modest flood reduction impact at the top end of the KSD system.
C	Channel widening (by up to 30%): • up to 2m wider on Sowy	• Over 9km of Sowy • Over 9km of KSD (this may not be necessary if pumps at Dunball) • Could increase flow capacity to around	£4-7 million	• Less flooding in Sowy-KSD floodplain. • Fewer summer floods. • Greater operational flexibility i.e. we can put through more water without creating more flood in flood plain

Option		Requirements	Cost	Benefits and risks
	• up to 8m wider on KSD	20m^3/s, though 30m^3/s may be possible		• Impact on conservation sites and archaeology from ground works. • Impact on conservation requirements. • Impact on stewardship payments if less water is on the land.
D	Bank raising or extension in the lower section of the system	• Infill low spots (as part of channel widening) • More extensive raising or extending banks	£4-7 million	• As for option C • Additional structures required
E	Floodplain storage / water spreading	• Potential storage downstream of Beer Wall based on conservation areas • Agreement from landowners	Unconfirmed at the time of publication	• Obtaining agreements takes time. • Storing water here has limited value during bigger and longer floods. • Benefit to wildlife and eco-tourism through improved conservation opportunities.
F	KSD comprehensive improvements at Dunball	• Replacement • Fully widening constricted channel • Improvements to Dunball basin	> £10 million (as for option B but larger scale)	• Costs are significant • Will provide robust foundation for other system improvements in future

Option		Requirements	Cost	Benefits and risks
		• Upgrade/expansion of tidal sluice bridge extension		
G	Dunball pumps	• Temporary pumps (15m^3/s), or • Permanent pumps with total capacity from 10 to 40m^3/s	• Temporary: ~£0.7 million (assumed 10 weeks operation per annum) • Pumping station: £5 – 20 million	• Similar benefits to option C • May be alternative to channel improvements in KSD (option F) • High energy/operational/maintenance

These seven options were put forward for public consultation in December 2014. The enhanced capacity options (other than option E) support option A (enhanced operation) by minimising flooding within the Sowy/KSD system flood plain either by allowing water to be pumped out of the system when the KSD is tide locked (option G) or by increasing the capacity of the Sowy/KSD system (options B and C).

In February 2015, we published a public consultation feedback report, which outlined the next steps. In total, we received 101 responses to the consultation, with opinions relatively evenly spread across all options A to G, with a very slight preference for options A, B and C. Further detail regarding consultation undertaken to date in support of the Proposed Scheme is provided in Chapter 4.

'Do something' capacity enhancement scenarios

The Options Appraisal Report for the full River Sowy and King's Sedgemoor Drain Enhancements Scheme (CH2MHill, unpublished) considered three different packages of individual options (as described above) which met the defined scheme objective as set out below:

'The objective is to develop a flood management scheme that will:

- Safely divert additional flood waters from the River Parrett and hence allow more rapid drainage of the complex Parrett and Tone Moors area of the Somerset Levels in the future
- Allow the Sowy/KSD system to accommodate more floodwater from uncontrolled overtopping of the Parrett spillways'

The three packages of options considered[2], termed scenarios, are set out below.

- Scenario 2: 'Mid-range'. Option A as described in Table 2.1, combined with widening of the existing channel and/or raising/setting back of the existing informal flood embankments to achieve a capacity increase of up to 40% (i.e. up to 24m^3/s) within the Sowy/KSD system (options C and D as described in Table 2.1) and also potentially with sub-option G1.
- Scenario 3: 'Comprehensive scheme'. Options as described under scenario 2 except more extensive channel widening and bank raising works, in addition with installation of permanent pumps at Dunball (sub-option G2) and comprehensive improvements to the KSD (option F). This scenario will increase the capacity of the Sowy/KSD system by at least 75% (i.e. up to 30 m^3/s).
- Alternative scenario 'Land management'. Option E as described in Table 2.1 (floodplain storage/water spreading down stream of Beer Wall). Flood storage / water spreading to reduce flood peaks is an alternative or complementary measure to those described above to increase flow capacity.

Separately, the SRA also endorsed a separate study in 2015, led by conservation representatives with support from the Environment Agency and others. This involved

[2] A fourth scenario (Scenario 1) which comprised many of the measures identified under option B was also considered at an early stage of the options appraisal process, however it was decided to progress with these measures independently and in advance of the River Sowy and King's Sedgemoor Enhancements Scheme

engagement with farmers and landowners to canvass views on potential future changes in flood management, centred on flood storage / water spreading within the Sowy/KSD system and upland management measures. It concluded that there was limited appetite for flood spreading at the present time (see Appendix G for further information).

The options appraisal process for the River Sowy and King's Sedgemoor Drain Enhancements Scheme considered these three scenarios against criteria for cost effectives, deliverability, flood risk benefit and land management (i.e. risks to nature conservation sites, archaeology and sustainability concerns). Through this process 'Scenario 2 'Mid-range' (capacity enhancements of 20-40% or up to 24m^3/s) was identified the preferred option for the full River Sowy and King's Sedgemoor Drain Enhancements Scheme. This option meets the required criteria for deliverability, cost effectiveness and land management, allows routine annual flooding and does not prejudice future scenarios for flood storage / water spreading in the Sowy/KSD corridor (i.e. future implementation of the alternative scenario described above).

Subsequent to completion of the strategic level options appraisal process for the River Sowy and King's Sedgemoor Drain Enhancements Scheme, several further programmes and schemes have been implemented. These seek to help improve flood resilience on the Somerset Levels and Moors using natural flood management approaches and further explore the feasibility of implementing whole floodplain approaches. These include the Hills to Levels, Co-Adapt and Land Management and Water Storage Auction projects, for which further information is provided in Appendix G. Implementation of the preferred option for the River Sowy and King's Sedgemoor Drain Enhancements Scheme will not prejudice potential longer-term management options such as those being explored under these projects in the future.

2.2.2. Project level design alternatives considered for the Proposed Scheme

The Proposed Scheme constitutes Phase 1 of the full River Sowy and King's Sedgemoor Drain Enhancement Scheme. The Proposed Scheme involves the re-profiling of existing flood embankments along the Sowy and KSD between Monk's Leaze Clyce and Parchey Bridge, along with small-scale channel widening works through the creation of WFD enhancement features (embayment, two-stage channel and back waters). As part of the design development for the Proposed Scheme the following alternatives were considered:

- Source of fill material required to support raising of the existing informal flood embankments
- Transport method for material required for bank raising within the Lower Sowy and Upper Sowy
- Slope and crest width of re-profiled flood embankments
- Location of WFD enhancement features

The alternatives considered at each stage, and the reason for taking the preferred design forward, are discussed in further detail below.

Source of fill material required to support raising of the existing informal flood embankments

The following design alternatives were considered with respect to sourcing of the fill material required for re-profiling of the existing informal flood embankments along the Sowy and KSD to meet the required design profile.

1. *Obtain material from channel widening and/or creation of Water Framework Directive (WFD) enhancement features*. Material could be won from the left and right channel bank of the Sowy and KSD through channel widening, however the geology of this area comprises peat and silt underlain by clay and prior experience suggests the unconsolidated nature of material won from the channel makes it unsuitable for engineering uses unless subject to a significant (at least six months) period of drying out.
2. *Obtain material through re-profiling of existing flood embankments*. There is sufficient material available within the existing informal flood banks on the KSD and Upper Sowy to win material required for bank raising from areas of the existing informal flood embankments where current height and/or width exceeds the target design height or width. Under this approach a cut-fill balance could be achieved for the Proposed Scheme on the KSD, Lower Sowy between the A361 and A372 (Beer Wall) and Upper Sowy, however an alternative source of material will be required for raising of the existing flood embankments on the Lower Sowy between the A361 and A372 (Beer Wall).
3. *Import material from alternative source(s), potentially including borrow pits at Chilton Trinity (3a) or import under CL:AIRE CoP (3b*). This option will minimise disturbance to habitats, wildlife and landowners adjoining the scheme by reducing the requirement for topsoil strip within the construction footprint. This option was also the most cost-effective option.

Option 1 was discarded at an early stage of the design process on the basis that previous experience suggests that material won from the channel bank will be peaty and unconsolidated and would require a significant drying out period before it would be suitable for use in bank raising in a structural capacity.

The final design uses option 2 for the KSD and option 3b for the Lower and Upper Sowy. There are two relatively small areas towards the far north of the KSD where the existing informal flood embankments are particularly high and wide (see Figure 3.1, Appendix A) and can be re-profiled to generate fill material for bank raising along the remainder of the KSD. The existing informal flood embankments on the Sowy are generally smaller with significantly less potential to generate fill material, and therefore material will be imported for bank re-profiling in these areas.

Transport of material required for bank raising within the Lower Sowy and Upper Sowy

Three different potential methods were considered for the transport of fill material for re-profiling of the existing informal flood embankments on the Upper and Lower Sowy from either the KSD or from remote sources under CL:AIRE CoP. The three options initially considered were:

1. *Barge along the Sowy and KSD*: this option would minimise the degree of ground disturbance through vehicle tracking

2. *Road haulage via tractor and trailer (8t (tonne) capacity)*: this option could make a positive contribution to the local economy as it provides an opportunity to employ local agricultural businesses
3. *Road haulage via Heavy Goods Vehicle (HGV) (20t capacity)*: this option would reduce the required number of movements, to and from site

Option 1 was found not to be feasible due to space limitations (there is insufficient space on KSD for two barges to pass side by side), combined with the requirement to complete construction within a relatively narrow window of three months in the late summer and early autumn in order to minimise risks to environmental receptors.

The more limited load capacity and speed of tractors and with trailers compared to HGVs means that to meet the available programme window a proportion of the fill material required must be transported by HGVs. However, to minimise impacts on residents and other road users, it is proposed to use HGVs for material transferred to the site access points directly on the A372 and A361 only, with tractor with trailers used for haulage along minor roads and access routes.

Design of re-profiled flood embankments

Design alternatives of the target profile for the raised flood embankments are considered in the following subsections.

Slope of landward bank of re-profiled flood embankments

Options considered for design of the landward slope of the re-profiled embankments included:

- 1:3 slope
- 1:5 slope

A 1:3 back slope is the minimum slope angle required to reduce the risk of instability and to provide safe access for maintenance equipment. A 1:3 back slope will also minimise the requirement for land take from adjoining landowners where the scheme passes through land parcels which we do not own. However, much of the land adjoining the Proposed Scheme is under agricultural use and grazed by cattle which utilise the Sowy as a water source. Using a 1:5 back-slope for the re-profiled flood banks will reduce the potential for slope failure due to cattle poaching, and therefore this option was taken forward.

Crest width of re-profiled flood embankments

Options considered for the design crest width for the re-profiled embankments include:

- 3m crest width (requires 2m control zone[3] to either side of the embankment for safety reasons)
- 4m crest width

To minimise the need to win material on site and/or import of material, the 3m crest width option has been taken forward for the majority of the scheme except in

[3] A minimum distance of 2m maintained between the foot of the embankment and a water course for safety reasons

localised areas where there is insufficient space to provide a 2m control zone[3] either side of the re-profiled embankment, and therefore a 4m crest width is required.

Locations of WFD enhancement features

The proposed WFD enhancement features (embayments, two-stage channels and backwaters) are located within land that we own to avoid land-take impacts on adjacent land owners. Preliminary results from the spring water vole survey undertaken in 2019 (see Chapter 7 for further details, and Appendix F) and the Cultural Heritage Desk Based Assessment (CHDBA) prepared in 2016 (see Chapter 8 and Appendix O) were utilised to identify potential locations which:

- Minimised impacts to known and unknown buried archaeology by avoiding high risk areas such as the Scheduled Monument at Sutton Hams and areas immediately to the north and south of the A361 near Greylake where a late Bronze age brushwood trackway, Bronze Age piles and cut roundwood and burtle beds are known to be present (see Chapter 8 for further detail).
- Benefits water vole by creating new good quality habitat in areas currently identified as sub-optimal (see Chapter 7 and Appendix F for further detail).

Using these principles, 15 potential locations for WFD enhancements were identified at an early stage of design on the right bank of the KSD and Lower Sowy and presented within the PEIR.

Following completion of further geoarchaeological and ecological survey work in 2019 and 2020 (second water vole survey, tree bat potential survey and badger survey) the WFD enhancement feature locations were further refined using the principles outlined above. Placement and dimensions of embayments, two-stage channels and back waters were designed to avoid any tree loss or impacts on badger setts.

3. The preferred option

3.1. Full River Sowy and King's Sedgemoor Drain Enhancements Scheme

The preferred option for the full River Sowy and King's Sedgemoor Drain Enhancements Scheme will provide up to a 40% increase in the nominal flow capacity of the Sowy (from 17m³/s to 24m³/s) and for the KSD (from 17m^3 to 27m^3). This will be achieved by a combination of enhanced capacity (channel widening and/or raising or setting back of informal flood embankments) and enhanced operation of Monk's Leaze Clyce.

3.2. River Sowy and King's Sedgemoor Drain Enhancements Scheme: Phase 1 (the Proposed Scheme)

3.2.1. Scheme design

Phase 1 of the full River Sowy and King's Sedgemoor Drain Enhancements Scheme focusses on capacity enhancements between Monk's Leaze Clyce on the Sowy and Parchey Bridge on the KSD as shown on Figure 3.1 (Appendix A) and set out in Table 3.1 below.

Table 3.1 Proposed capacity enhancement works, by location

Location		Bank raising	Channel widening
Upper Sowy	Sowy between Monk's Leaze Clyce and A372 Beer Wall	Raising of existing informal flood banks on right bank by up to 0.5m to achieve capacity of 17m^3/s.	None
Lower Sowy	Sowy between A372 Beer Wall and A361	Raising of existing informal flood banks on left and right bank by up to 0.3m to achieve a capacity of 24m^3/s.	On the right banks: • One embayment • One section of two-stage channel
	Sowy between A361 and Sowy/KSD confluence	Raising of existing informal flood banks on left bank by up to 0.3m to achieve a capacity of 24m^3/s. No bank raising on the right bank.	On the right bank: • One embayment • One section of two-stage channel
KSD	KSD between Sowy/KSD confluence and Parchey Bridge	Raising of existing informal flood banks on left and right bank by up to 0.5m to achieve a capacity of up to 27m^3/s	On the right bank: • One embayment • One backwater

Location		Bank raising	Channel widening
			• One section of two-stage channel

Raising and re-profiling of existing informal flood embankments

Where existing informal flood embankments are to be re-profiled or raised, the crest width will be maintained at a minimum of 3m or increased to 3m, with formed battered embankment sides of 1 in 3 slopes on the channel side and 1 in 5 slopes on the landward side (see Figure 3.2 on p19) and indicative cross sections provided in Appendix H). Material required for raising of the existing informal flood embankments on the KSD will be won through re-profiling of the existing informal flood embankments on the right bank and left bank in the locations shown on Figure 3.1 (Appendix A), in accordance with the process shown in Figure 3.2 (p19). Material required for raising of the existing informal flood embankments on the Upper and Lower Sowy will be imported under CL:AIRE Code of Practice (CoP) from a soils processing plant located off the A372 near Westonzoyland (see Figure 3.1, Appendix A). Material won through creation of channel widening features will be landscaped on the landward side of the existing informal flood embankments.

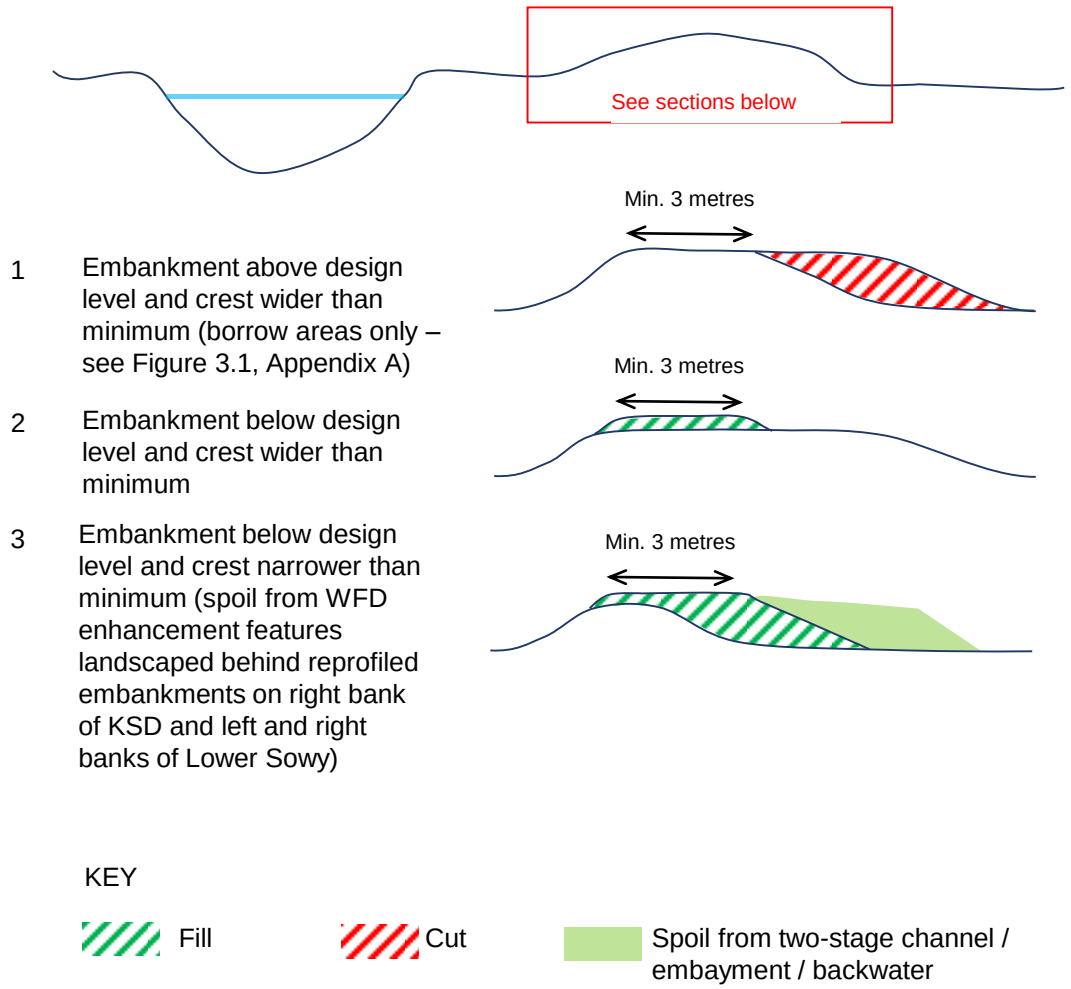

Figure 3.2 Schematic illustration of bank re-profiling process

Channel widening: embayments, two-stage channel and back waters

The Proposed Scheme includes creation of channel bank features on the right bank of the KSD and Lower Sowy at the locations indicated on Figure 3.1 (Appendix A) and outlined in Table 3.1 which both provide a small degree of additional channel capacity within the Sowy and KSD corridor and help to increase the diversity of aquatic and riparian habitats available within these man-made artificial waterbodies.

- Two-stage channels: 150m in length, with channel widening of 1.5-2m and a c. 5m marginal shelf with shelf level of 300mm below summer pen
- Embayments: 135-150m in length depending on location and 5-6m in width, with shelf level of 300mm below summer pen
- Backwaters: 100-150m in length depending upon location, back channel 5-6m wide, with a “planted island” of 5m width

Proposed locations for the WFD enhancement features, along with typical plan view layouts and cross sections for each type of enhancement (e.g. embayment, two-stage channel and backwater), are shown on the indicative design drawings provided in Appendix H as well as the Landscape Masterplan (LMP) in Appendix I.

Landscaping

Landscaping proposals include riparian ‘wet scrub’ planting on the backwater ‘island’ to provide biodiversity habitat and bank stabilisation benefits and replacement tree planting (birch, crack willow and goat willow) at a 1:5 ratio for any trees which will be removed to facilitate bank raising works.

Re-profiled flood embankments, new channel banks and working areas will be reseeded with a neutral wet grassland (NWG) or other appropriate seed mix. Full landscaping proposals are illustrated on the LMP (Appendix I) and described further within Chapter 11.

Additional works

The Cossington Right and Chilton Right outfalls (see Figure 3.1, Appendix A) both include concrete headwalls and steel sheet-piled wing walls. Crest levels of both structures are below the required design level and will be modified as shown in the design drawings provided in Appendix H to provide a continuous defence level when combined with the bank raising works identified in Table 3.1.

3.2.2. Operation and maintenance (including Mitigation Action Plan provisions)

Operation

Existing water control structures will continue to provide a mechanism to achieve the required summer and winter pen levels on the moors. Uncontrolled flooding across the wider floodplain will also continue to occur when either one or both of the spillways run when the channel capacity of the Sowy and informal flood embankments is exceeded. This effect is particularly noticeable at the Aller Moor spillway because a culverted crossing immediately downstream causes a throttle effect with excess water spilling over the Sowy, into Middle Moor and, from there through Aller Moor and down to Beer Wall (Figure 3.3, p21). However, due to the increase in channel capacity there could be a reduction in the frequency, duration and extent of some of the more regular, low level events that provide temporary ‘splash’ conditions that are beneficial for water birds during the winter months. This situation would typically occur once the full River Sowy and King’s Sedgemoor Drain Enhancements Scheme (all phases) have been completed and the ‘enhanced operation’ aspects of the Scheme implemented.

The Proposed Scheme (Phase 1 of the full River Sowy and King’s Sedgemoor Drain Enhancements Scheme) includes only a proportion of the capacity enhancement element of the full River Sowy and King’s Sedgemoor Drain Enhancements Scheme. Nevertheless, together with Natural England (NE) and the Somerset Drainage Board Consortium (SDBC), we have developed a Mitigation Action Plan (MAP) (see Appendix J). This will ensure that there is no deterioration in habitat availability or quality within the Somerset Levels and Moors Special Protection Area (SPA), as a consequence of the combined effects of the full River Sowy and King’s Sedgemoor Drain Enhancements Scheme and the Oath to Burrowbridge Dredging scheme undertaken by the Parrett Internal Drainage Board (IDB) in 2019.

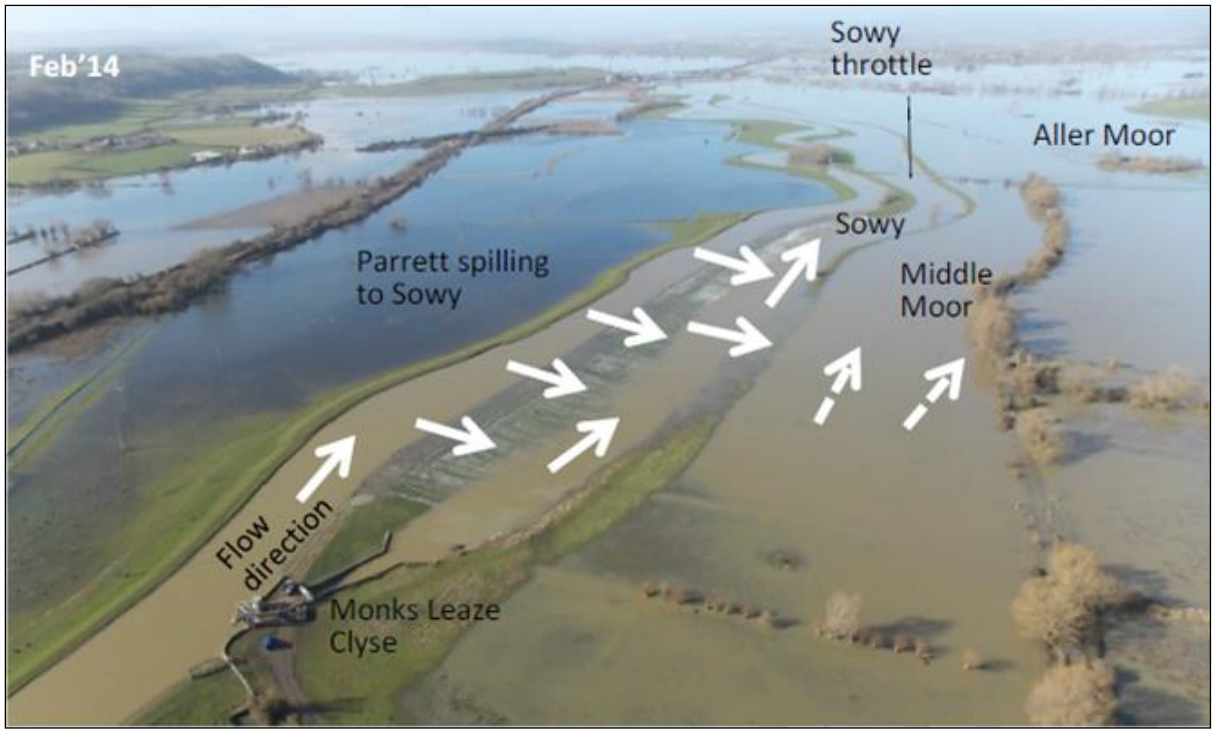

Figure 3.3 Flood pathways when the Sowy capacity is exceeded and Aller Moor spillway is running

Parrett Dredging and River Sowy and King's Sedgemoor Drain Enhancements Scheme Mitigation Plan

The MAP was developed between the EA, IDB and NE and includes both general mitigation measures and short (<5 years) and longer (5 years plus) term site specific mitigation measures for each SSSI component of the SPA. Measures included within the MAP were informed by hydraulic modelling undertaken by the Parrett IDB to explore the potential effects on the combined full River Sowy and King's Sedgemoor Drain Enhancements Scheme and Oath to Burrowbridge Dredging scheme on the Somerset Levels and Moors SPA.

General measures include, but are not limited to:

- Extension of existing Water Level Management Plans (WLMPS) to include functionally linked land in areas impacted by the combined project and where current WLMPs do not include winter penning levels for nature conservation
- Review of existing channel maintenance procedures to ensure these are sympathetic to nature conservation
- Site specific mitigation actions identified consist of: (i) monitoring of ecological changes within the SPA and water level monitoring and (ii) mitigation actions to be implemented should detrimental change to the SPA as a consequence of the combined projects be identified through monitoring. Site specific mitigation actions include the following types of measures:
- Replacement or new water control structures – Replace failing structures, or build new structures, that are necessary to effect 'no change' to existing surface water conditions during winter months (December to February). Refurbishment of existing water level control structures at Moorlinch, West

Moor and Egypt's Clyce will be completed during summer 2020 in advance of construction of the Proposed Scheme.

- Operational protocols – Where monitoring indicates it is necessary, and it is agreed that other measures are less suitable, existing water level control structures such as pumping stations and sluices can be operated to effect 'no change' to existing surface water conditions during winter months (December to February)
- Update WLMPs – WLMPs will be reviewed with partner organisations by 2022. Changes to water control structures and water levels, agreed in the intervening period, will be incorporated in WLMPs
- Maintain a depth of water (minimum of 300mm) in ditches through the winter period
- Creation of in-field wet features – to maintain surface water conditions for water birds in winter, such as creation of shallow water scrapes and wet field gutters
- The MAP also includes alternative options for mitigation, such as the opportunity to develop new RWLAs on functionally linked land, as well as strategic longer term mitigation options that could be implemented in the longer term which focus more on soft engineering measures to enhance flood plain connectivity and potentially permit flood storage.

The delivery of the MAP and thereafter future management of the outcomes will be facilitated through the existing governance framework established for the current Water Level Management Plans and the SRA Management Group; to agree the outcomes and actions outlined in the MAP, based on results of ongoing monitoring. This will be achieved through their regular meetings, as deemed necessary and managed by a small group of officers from each partner organisation (Natural England, Environment Agency and the SDBC).

Further detailed discussions regarding the MAP will also take place with landowners which will happen in parallel with the ES consultation.

Additional information regarding general and site specific measures outlined in the MAP, including implementation timescales, can be found in Appendix J.

Maintenance

Current reactive maintenance undertaken on the section of the KSD included within the Proposed Scheme may include removal of fallen branches or occasional desilting. Desilting works were undertaken at Parchey Bridge during 2018.

The principal current maintenance activity along the Sowy is routine weed cutting and clearing, carried out at least once, and sometimes twice, per year depending on need. In theory, this work is undertaken from alternate banks in order to share the burden of deposited cut weed on the adjacent farm land. However, the majority of the work is undertaken from the right bank as there are fewer access (and therefore safety) constraints. A new maintenance regime will be developed in conjunction with our internal specialist teams, however the onus will remain on newly created WFD enhancement feature habitats developing naturally following completion of the initial construction aftercare period.

3.2.3. Decommissioning

No decommissioning works are proposed.

3.2.4. Mitigation embedded with the Proposed Scheme design

The design process has been continually improved to “design out” key risks, ultimately reducing its impact on the local environment and where appropriate, provide an improvement to the present conditions. This is referred to as “embedded mitigation” as these aspects of the design are considered to be an intrinsic part of the Proposed Scheme. Some of these design elements were identified within the PEIR and have now been developed further for inclusion within the Proposed Scheme (as shown on the LMP provided in Appendix I). Elements of the design considered to be embedded mitigation are detailed below.

WFD enhancement features

Placement and dimensions of embayments, two-stage channels and backwaters have been designed to minimise the risk of disturbance to known and unknown buried archaeology (including paleoenvironmental deposits), maximise benefit to water vole through providing good quality habitat within areas currently identified as sub-optimal and avoid impacts to trees and conflicts with known badger setts.

Alignment and cross-section of re-profiled informal flood banks

The alignment and design (crest width, angle of back-slope) have been designed to:

- Ensure continued access along Public Rights of Way (PRoW)
- Minimise loss and/or potential adverse impacts on established vegetation including trees
- Minimise the requirement for land take, whilst ensuring the new flood defences are resilient to damage from cattle poaching
- Minimise requirement for encroachment within 5m of the KSD, KSD back ditch, Sowy or Langacre Rhyne channel bank to reduce risks of disturbance to water vole burrows

3.2.5. Design uncertainties

It should be noted that it is currently uncertain whether the full programme of works set out in Table 3.1 can be undertaken within the currently available funding and within the programme identified in section 3.3.1.

Should funding or programme constrain delivery of the Proposed Scheme, raising of the existing informal flood embankments on the Lower Sowy (between the confluence of the Sowy and KSD and Beer Wall) and the Upper Sowy (between Monk’s Leaze Clyce and Beer Wall) will be prioritised along with the WFD enhancement features along this stretch. The next priority for Phase 1 delivery will then be raising of the existing informal flood embankments on the KSD along with the WFD enhancement features along this stretch. Any works not delivered in Phase 1 will be undertaken as part of the Phase 2 proposals.

The assessments provided in this report consider the likely worst-case scenario in terms of effects on environmental receptors, within the bounds of the current design uncertainties identified above.

3.3. Construction of the Proposed Scheme

3.3.1. Programme

Construction of the Proposed Scheme will commence at the earliest in September 2020, taking up to eight weeks for the completion of earthworks activities. Landscape planting for areas of new wet woodland and alder planting (as shown on the LMP in Appendix I) will then be undertaken in early November 2020 (subject to agreement with NE).

There will be up to five gangs working at any one time during the eight-week construction period. Four gangs will be required for bank raising works, with one gang working on each of the KSD right bank, KSD left bank, Lower Sowy right bank and Lower Sowy left bank. Works on the KSD and Lower Sowy will be undertaken concurrently. On the Lower Sowy raising will start at the mid-point between access locations, working backwards towards the access locations. This will prevent the need for construction traffic to cross areas of completed raising work. Once one of the gangs on the KSD have completed their works, they will move onto the right bank of the Upper Sowy to complete the works in this section. The fifth gang will focus on creation of the WFD enhancement features, starting on the right bank of the Lower Sowy and moving onto the KSD.

3.3.2. Construction footprint

The extents of the construction footprint for the Proposed Scheme, including site accesses, locations of main (off site) and satellite compounds and temporary 'just in time' material stockpiles and temporary fencing requirements are shown in Figure 3.1 (Appendix A). The main compound for Proposed Scheme will be offsite, however given the nature and scale of the project it is anticipated that very minimal traffic movements associated with works travelling to site, or between the offsite compound and site, will be required.

All PRoW within the construction footprint will remain open throughout the construction phase. Users of BW 8/6 and BW 36/5 will be segregated from the works area using post and rope fencing, and a banksman will marshal crossings where required.

3.3.3. Material haulage

Material for bank raising on the Upper and Lower Sowy will be transported from a soil reprocessing facility located directly off the A372 near Westonzoyland to site using a combination of 20t HGVs (for the A372 and A361 site accesses only) and tractor with trailer (8t). Figure 3.1 (Appendix A) shows the proposed haul routes for road based material transport and the location of the soil reprocessing site. Average daily two-way movements between the source of imported material and the Lower and Upper Sowy are shown below:

- Lower Sowy: up to 36 HGV movements per day (i.e. 18 return journeys) over a 4-week period and 38 tractor and trailer movements per day (i.e. 19 return journeys) over an 8-week period
- Upper Sowy: up to 8 tractor and trailer movements in total (i.e. 4 return journeys per day)

A Construction Traffic Management Plan (CTMP) and Dust Management Plan (DMP) will be prepared in advance of the start of construction and agreed with the relevant authorities as detailed within the Environmental Action Plan (EAP) (Appendix K) for the Proposed Scheme.

Material transferred by HGV will be deposited adjacent to the proposed site access points from the A361 and A372 (see 'just in time' stockpile locations on Figure 3.1, Appendix A) and immediately transferred onto site using light weight tracked dumpers. Should ground conditions be suitable, material transported onto site via other access routes will be transported to the location that is needed by tractor and trailer. If ground conditions are poor then either lightweight tracked dumpers or short

lengths of aluminium tracking will be used to help reduce ground disturbance or where required to protect the Scheduled Monument at Sutton Hams (see LMPs, Appendix I) or in proximity to active badger setts in accordance with a Badger Method Statement (see Chapter 7 and Appendix F).

A Materials Management Plan (MMP) and Site Waste Management Plan (SWMP) will be prepared by the contractor and agreed with the relevant authorities in advance of the start of construction to ensure that any excess imported material, or material won on site and found to be unsuitable for use in bank raising, is appropriately managed and disposed of (if found necessary).

3.3.4. Re-profiling of existing informal flood embankments

A 25t excavator will be used to strip and stockpile topsoil won from the 'borrow' areas on the right and left bank of the KSD that will provide fill material for bank raising on the KSD. In areas where bank raising is required, topsoil will be stripped to a depth of up to 150mm in areas where bank raising or re-profiling required using a bulldozer. As for the borrow areas, this will be completed on an 'as and when' basis.

Lightweight tracked dumpers will transfer material from either the borrow areas on the right and left bank of the KSD (for KSD only) or from the 'just in time' stockpiles of imported material described above (for Upper and Lower Sowy) onto the footprint of the area to be raised, and a bulldozer used to place the material to the required profile. Fill will be compacted using either the bulldozer or other plant, with either a roller (potentially vibratory) used on the Upper and Lower Sowy. Topsoil will then be reinstated and reseeded for 'borrow areas' and re-profiled embankments
Two stage vegetation clearance is required in some areas of the Proposed Scheme (see Chapter 7 for further detail) which provide suitable habitat for grass snake, and this will be undertaken in accordance with a method statement prepared and agreed with our internal ecological specialists. Tree protection measures will be implemented as identified within the Arboricultural Impact Assessment (AIA) and Arboricultural Method Statement (AMS) (Appendix L) for the Proposed Scheme and outlined in the EAP (Appendix K)

3.3.5. Headwall raising at Cossington Right Rhyne and Chilton Right Rhyne outfalls

The existing steel sheet piled wing walls at Cossington Rhyne and Chilton Right Rhyne will be replaced with new steel sheet piled walls. The existing steel will be removed from site. The crest level of the headwall will be raised with the addition of new coping. The steel sheet piles will be driven to the design level and finished with a steel capping beam. New steel sheet piles will be vibro-driven to reduce noise during installation.

3.3.6. Temporary works to Chedzoy New Cut and Cossington Right Rhyne culverts

The existing culvert crossings on the left bank of the KSD at Chedzoy New Cut and Cossington Right Rhyne near Parchey Bridge (see Figure 3.1, Appendix A) will need to be strengthened prior to commencement of construction works. This will involve replacing the existing edge protecting fencing and utilising a combination aggregate and matting to reinforce the existing track surface.

3.3.7. WFD enhancement features and landscaping

Long reach excavators will be used for the creation of the WFD enhancement features, which is programmed towards the end of the earthworks phase in order to minimise the risk of adverse impacts to water quality (dissolved oxygen). In addition, a Surface Water Management Plan (SWMP) will be developed and agreed with the relevant authorities in advance of the start of construction. This will include measures such as the use of silt curtains, provision for dissolved oxygen monitoring where necessary, and other measures to protect water quality during construction (see EAP provided in Appendix K for further details). Creation of the WFD enhancement features will be undertaken under an archaeological watching brief (see Chapter 8).

Aquatic planting of the WFD enhancement features will be completed immediately following their construction to minimise the risk of sediment erosion. Riparian planting of the backwater island and on the right bank of the KSD and Upper Sowy will require access by 4x4 only and will be completed in early November 2021 pending agreement with NE.

3.3.8. Site reinstatement

All land within the construction footprint will be fully reinstated with reseeding completed in late 2020. It is anticipated that land reinstatement within the construction footprint, including fencing to the existing specification (including provision of stiles and gateways where footpaths BW 8/6 and BW 36/5 pass through the construction footprint), will be completed in early 2022 once vegetation cover is well established once again. However, we will take every opportunity to return the land sooner to the landowners if seed germination and sward development allows – this will be in agreement with landowners.

4. Consultation

4.1. Full River Sowy and King's Sedgemoor Drain Enhancements Scheme

4.1.1. Options appraisal

Public consultation was undertaken in December 2014 and January 2015 regarding the strategic level combination of capacity and operational enhancements for the full River Sowy and King's Sedgemoor Drain Enhancements Scheme as discussed in Chapter 2. A public consultation event was held in Othery village hall on 10th December 2014 and an online survey made available between 10th December 2014 and 9th January 2015.

Public opinion on which options should be taken forward was fairly evenly distributed, with no options particularly being favoured. There was a slight preference for the following options.

- Option A – enhanced operation. This option will involve increased opening of the Monk's Leaze Clyce (sluice) to divert more water from the Parrett into the Sowy and KSD during high flows.
- Option B – enhanced capacity: KSD simple improvements at Dunball. This option will involve resolving the constriction at the A38 Bridge.
- Option C – enhanced capacity: channel widening. This will involve the Sowy/KSD being widened by up to 30%, which will increase the water carrying capacity in the channel by up to 75%.

The options appraisal report and public consultation feedback report produced in support of this consultation is available on the .gov website[4]. A summary of the key issues raised during the options appraisal consultation process is provided in Table 4.1.

Table 4.1 Key issues raised during options appraisal consultation process

Key issue	Response
Concern that engineering-only solutions will encourage further intensification of land use within the floodplain, and hence there was support for proposals that don't rely on hard engineering solutions, and offer greater potential for delivering sustainable flood risk management	This was taken into account during selection of the preferred option for the full River Sowy and King's Sedgemoor Drain Enhancements Scheme as described in this report.
Detailed assessments will need to be undertaken to determine the effects on	In advance of the Proposed Scheme a strategic level Habitat Regulations Assessment (HRA) which considers the

[4] https://www.gov.uk/government/publications/river-sowy-kings-sedgemoor-drain-enhancement-options-2016

Key issue	Response
the Somerset Levels and Moors SPA, Ramsar, SSSI and protected species.	potential impacts associated with the full River Sowy and King's Sedgemoor Drain Enhancements Scheme will be undertaken, in addition to a project level HRA which focuses primarily on the construction related effects of the Proposed Scheme (Phase 1). Draft strategic and project level HRA Stage 1 and Stage 2 assessments are provided in Appendices C and D.
Consideration also needs to be given on how to enhance farm business resilience within the high-risk areas of the flood plain, in line with the "Somerset Levels and Moors Vision".	This action is separate from the delivery of the enhanced capacity scheme.

4.1.2. Preliminary Environmental Information Report (PEIR) for the full River Sowy and King's Sedgemoor Drain Enhancements Scheme in 2016

Stakeholders were consulted on the PEIR prepared for the full River Sowy and King's Sedgemoor Drain Enhancements Scheme in 2016. A summary of their responses, along with considerations within the ongoing EIA process, are provided in Appendix M.

4.2. Proposed Scheme

4.2.1. PEIR for the Proposed Scheme (2019)

Stakeholders consulted on the PEIR prepared for the Proposed Scheme include the following:

- Natural England (NE)
- Royal Society for the Protection of Birds (RSPB)
- Historic England (HE)
- South West Heritage Trust (SWHT)
- Somerset Wildlife Trust (SWT)
- Sedgemoor District Council (SDCC)
- Somerset Rivers Authority (SRA)
- Somerset Drainage Boards Consortium (SDBC)

Table 4.2 summarises key comments received from consultees.

Table 4.2 Summary of key comments on PEIR (including responses and actions taken)

Key issue	Consultee	Response
ES should consider presence of additional Invasive Non-Native Species (INNS) present within the local area	SDBC	Chapter 7 considers additional information provided by the SDBC on the distribution of INNS on the Somerset levels and moors within the baseline and assessment.
Fish passage along the Sowy/KSD system may not be as restricted as indicated in the PEIR	SDBC	Chapter 7 considers risks associated with fish passage as identified from conversations with the IDB ecologist.
Water vole likely to be present within the study area	SDBC	Water vole surveys carried out in 2019 showed water vole to be abundant throughout much of the scheme corridor (see Appendix F). Chapter 7 considers impacts on water vole arising from the Proposed Scheme and identifies appropriate mitigation.
Consideration of climate impacts associated with peat excavation, as well as potential impacts on peatland habitats from reduced flood duration and extents should be explored	SDBC	The PEIR identified that a maximum of 20,000 m^3 of peat will be excavated and reused on site, however following further design development this has been reduced by approximately a third. A package of mitigation measures to avoid adverse effects on habitats from the full King's Sedgemoor Drain Enhanced Capacity in combination with the Oath to Burrowbridge dredging scheme undertaken by IDB has been identified and agreed with NE and RSPB (see Chapter 7 and Appendices D and E for further information).
Concern regarding; • Consideration of archaeological potential of area between Othery and High Ham, and of evidence for relic landscape remains in the floodplain between Sowy and the Poldens • Potential impacts of tree planting near any remains excavated during works and impact of	SWHT	Additional areas of risk and pathways of impact identified by SWHT are considered within the heritage assessment in this report (see Chapter 8). As agreed, the PEIR and ES reflect up to date Historic Environment Record (HER) and Portable Antiquity Scheme (PAS) data and therefore an update to the 2016 DBA prepared by Wessex Archaeology was not considered necessary. Mitigation requirements based on more current design information are detailed in section 8.6 of this report and in the EAP for the Proposed Scheme (see

Key issue	Consultee	Response
aquatic plant rhizomes on archaeological remains required • Consideration of peat shrinkage and consequent vulnerability of wooden remains to tracking required • Comment regarding requirement to update archaeological desk-based assessment (DBA) and on timing and wording of mitigation requirements in the draft EAP that accompanied the PEIR		Appendix K). We have begun developing a Written Scheme of Investigation (WSI) upon which SWHT and Historic England will be consulted.
Concern regarding potential impact of the scheme on designated sites including the Somerset Levels and Moors SPA, on Greylake RSPB reserve and on areas downstream of the KSD at Parchey Bridge (see Appendix J for further detail)	RSPB	We provided a letter to the RSPB responding to each of their concerns (see Appendix M for further detail), which were discussed further during a subsequent telephone conference meeting. Potential impacts on nature conservation sites are assessed within Chapter 7 in this ES, and mitigation identified for all potential adverse impacts.
Concern regarding: • Construction impacts on breeding waders, other bird species and protected species in general, particularly if programme delays arise due to COVID-19 • Maintenance requirements for WFD enhancement features and for raised flood embankments • Queries regarding impacts on agricultural land, agri-environment schemes and potential for intensification of agricultural practices	NE	• Potential impacts on birds are considered within Chapter 7, with mitigation identified where required. The earthworks phase of the Proposed Scheme will be undertaken during September and October 2020, with landscape planting carried out in the first week of November (pending agreement with NE) • Further detail regarding the proposed maintenance of landscape elements of the Proposed Scheme is provide in Appendix N. No maintenance of WFD enhancement features will take place following the initial two year aftercare period for aquatic planting and five year aftercare period for tree planning.

Key issue	Consultee	Response
• Queries regarding content, timing and landowner consents required for measures included within the MAP prepared by the EA, NE and IDB.		• Potential impacts on agricultural land, including agri-environment schemes, are considered within Chapter 10. Whilst the full River Sowy and King's Sedgemoor Drain Enhancements Scheme will reduce the frequency, extents and duration of flood events on the levels in conjunction with other measures identified under the 20-year Flood Action Plan[1], flooding will still occur on a regular basis. • A MAP (see Appendix J) has been developed by the EA in conjunction with NE and the IDB which provides information on the timings of identified actions and consents required.

4.2.2. Public information events

After meetings with local land owners, a series of public information events were conducted in February 2020 over three consecutive evenings. The events took place in village halls at Westonzoyland, Othery and Aller.

The events were advertised via a poster which was sent out to:

- A variety of local newspapers and publications, including a popular newspaper within the area (The Leveller), which were identified by the Environment Agency and the Somerset Rivers Authority as being local to the areas in which stakeholders will live.
- All local Parish Councils, 10 days prior to the first event. Parish Councils were asked to share the poster with their constituents and place a copy outside their local halls where this was feasible. Parish Councils that received the poster included: Aller, Ashcott, Bridgwater Without, Burrowbridge, Chedzoy, Curry Rivel, Greinton, High Ham, Huish Episcopi, Kingsbury Episcopi, Langport Town Council, Long Load, Muchelney, Middlezoy, Moorlinch, North Petherton, Othery, Stawell and Stoke St Gregory.

The events were also publicised via social media with the SRA sharing the poster on their website and LinkedIn page.

132 people attended the three events with individual attendance as follows:

- 52 attendees on Monday 17 February at Westonzoyland (15:30-19:00)
- 37 attendees on Tuesday 18 February at Othery (15:30 -19:00)
- 43 attendees on Wednesday 19 February at Aller (14:00 - 18:30)

Attendees were asked to sign in on a sheet upon arrival to the halls, they were also offered refreshments.

At each event 'stalls' were set up around the hall with information on the scheme. Staff were available to discuss or answer questions on the scheme. At each event the following information was made available:

- A presentation slideshow highlighting key points of the scheme
- A video showing drone footage slowly progressing along the channel between the downstream and upstream extents of the scheme. A second interactive video was also used showing drone footage slowly progressing along the channel with changes in the direction of the camera angle
- A draft of the Preliminary Environmental Impact Report (PEIR) dated February 2020
- Several other scheme plans and figures such as the Indicative Landscape Plans (ILPs) which accompanied the PEIR

Key issues raised of relevance to the EIA for the Proposed Scheme are set out in Table 4.3 below.

Table 4.3 Key issues raised through public information events

Key issue	Response
Concern regarding potential impacts on a listed building as a result of proposed haulage route through Chedzoy. Better understanding required regarding the method of works and the impacts to the Chedzoy and Westonzoyland communities, roads and infrastructure.	Following further design development, it is no longer necessary to transport material through the villages of Chedzoy and Westonzoyland, although construction plant may need to use these routes in order to access the site occasionally. A Construction Traffic Management Plan (CTMP) for the Proposed Scheme will be prepared by the contractor in consultation with the relevant authorities. See Chapter 10 for further information regarding impacts on local communities.
Local footpaths are being flooded more often and to higher levels	The Proposed Scheme will not increase the frequency or duration at which local footpaths are flooded. See Chapter 10 for further detail regarding impacts on the Proposed Scheme on Public Rights of Way (PRoW).
A change in water level management procedures will be required if more water is diverted from the Parrett to the Sowy/KSD system	The KSD, Sowy and rhyne system offers the capability to effectively manage water levels in the channel and the surrounding fields. The management system will be modified in the future when the full River Sowy and KSD Enhancements Scheme has been implemented to maximise the flood and land use benefits, including potential changes to penning levels and sluice opening procedures/conditions. However, no change in management procedures will take place following implementation of the Proposed Scheme (Phase 1).
Impact of the Proposed Scheme on the rhyne system – concern that raising the existing informal flood embankments will impede outflow of the rhynes	Rhynes discharge to the Sowy/KSD system via a sluice or outfall, and these are currently locked when water levels within the Sowy and KSD are high. The duration of locking may be longer following implementation of the full River Sowy and King's Sedgemoor Drain Enhancements Scheme when additional water is diverted through the system, however, bank raising will also reduce the overspill of water from the system onto surrounding areas. See Chapter 10 for

Key issue	Response
	further information regarding impacts on local communities and businesses.
Impact on raising existing informal flood embankments on drainage for adjoining land owner fields	See Chapter 10 for further information regarding impacts on local communities and businesses.

4.2.3. Other topic specific consultation activities

Further consultation undertaken throughout the EIA process is summarised in Table 4.4 below. Technical consultation with consultees, including our own internal specialist teams, has been used to agree the general approach to the environmental assessments presented within this report including the scope of further ecological and archaeological surveys and methodologies, and to obtain advice on sources of existing relevant surveys and other baseline information.

Table 4.4 Stakeholder engagement undertaken between 2016 and 2020

Date	Name and organisation	Approach (email, letter, telephone, meeting, etc.)	Consultation issues/ comments
10th December 2018	Meeting with Historic England (Helen Woodhouse) to discuss approach to archaeology from revised scheme.	Meeting at HE offices in Bristol.	Agreement on approach to archaeological works.
5th March 2019	Meeting with IDB on site to discuss water control structures.	Meeting on site.	Reviewing structures previously identified as being required for HRA Mitigation.
4th April 2019	Meeting with Richard Brunning, County archaeologist to discuss the key archaeological features and risks and scope of archaeological work.	Meeting on site at the scheduled monument just south of Parchey Bridge.	Agreement on approach to take and scope of works.
15th August 2019	Meeting with IDB to discuss HRA mitigations.	Meeting at IDB offices.	
6th September 2019	Meeting with SRA, IDBs and NE to discuss and approve approach to revised scheme and HRA mitigation measures.	Meeting at IDB offices.	Agreed approach to HRA mitigation.
28th November 2019	Meeting with NE to talk through approach to strategic and project level HRAs.	Meeting at EA offices.	Updates on changes to the scheme and the implementation of mitigation measures.

Date	Name and organisation	Approach (email, letter, telephone, meeting, etc.)	Consultation issues/ comments
	Attendees: • John Rowlands (EA) • Gary Cutts (EA) • Will Maclennan (EA) • Steve Parker (NE) • Donna Gowler (NE)		
13th January 2020	Correspondence with Sedgemoor District Council (Stephanie Parsons).	Email to discuss projects within the wider area which may need to be considered in terms of cumulative impacts in the ES for the Proposed Scheme.	Sedgemoor District Council provided a list of projects for our consideration.
3rd February 2020	Correspondence with Natural England (Donna Gowler).	Email.	Confirmation that an appropriate assessment under regulation 63 of the Habitats Regulations is required, following receipt of the strategic and project level screening assessments.
9th January 2020	John Rowlands meeting with RSPB. RSPB were given a presentation of the scheme and its benefits with further discussions around flooding and scheme boundaries.	Meeting in person.	Agreement to attend the public drop-ins.

Date	Name and organisation	Approach (email, letter, telephone, meeting, etc.)	Consultation issues/ comments
31st March 2020	EA and Jacobs meeting with Historic England (Helen Woodhouse and Hayley McPartland) and SWHT (Richard Brunning)	Teleconference call.	General discussion regarding evolving scheme design and programme, impacts on buried archaeology, and potential mitigation requirements. Requirement for SMC discussed.
1st June 2020	RSPB (Helen Booker and Damon Bridge)	Letter to RSPB from the EA, sent via email	Addressing concerns raised by RSPB regarding alternatives, Mitigation and impacts on the lower part of the system (see Appendix M)
16th June 2020	Attendees: • Helen Booker (RSPB) • Damon Bridge (RSPB) • Donna Gowler (NE) • Stephen Parker (NE) • Will Maclennan (EA) • Graham Quarrier (EA	Teleconference call	A productive discussion addressing all of the concerns and outlining the approach to mitigation.

5. Assessment methodology

5.1. Introduction

This section describes the approach to, scope and methodology of the Environmental Impact Assessment (EIA) presented in this ES. The EIA has been informed by the requirements of:

The EIA (Land Drainage, Improvement Works) Regulations

The specific characteristics and location of the proposed development

The PEIR for the Proposed Scheme (February 2020) and consultee responses

Consultee responses provided during public exhibition events undertaken in February 2020

Advice provided by internal technical staff and external other than mentioned above, including NE, HE and SWHT

5.2. Overview of the assessment approach

5.2.1. Scope of assessment

A Preliminary Environmental Information Report (PEIR) for the Proposed Scheme was produced and consulted upon in April and May 2020. Topic areas scoped into assessment within the PEIR for the Proposed Scheme and therefore included in this ES as follows.

- Water
- Flora and fauna
- Cultural heritage
- Landscape
- Population and health
- Noise

Specific aspects scoped into assessment for each of the topics identified above are detailed in the methodology sections of chapters 6-11 of this report. Each of these chapters inherently considers the risk of major accidents and disasters as relevant. Topics scoped out of further assessment within the PEIR included traffic and transport, resource and waste management, air quality and climate for which no potential for significant effects has been identified. Table 5.1 outlines the reasons for scoping out these topic areas.

Table 5.1 Topic areas scoped out of assessment in ES and justification

Topic area	Reason for scoping out
Traffic and transport	While it is recognised that the traffic and transport elements of the project have the potential to pose some localised risks on the road network, it is envisaged that any effects on access or disruption will be minor and can be safely managed using the contractor's CTMP.

Topic area	Reason for scoping out
	By implementing suitable mitigation measures in agreement with the local highway authority, the transport impacts can be reduced and managed effectively. It should also be noted that any transport impacts will not be long term; they will be temporary and over a relatively short period of approximately three months
Air quality	• Potential impacts from dust emissions during construction can be managed through implementation of standard good practice in accordance with IAQM guidance. Therefore, based on professional judgement and in the interests of proportionality, a construction dust assessment is not considered necessary. • Haulage movements during construction and vehicle movements required during the operational phase of the Proposed Scheme for maintenance activities etc. are below the screening threshold for an air quality assessment as identified in the Land Use Planning and Development Control: Planning for Air Quality guidance (IAQM/EPUK, 2017).
Resource and waste management	• Given the low risk, rural nature of the site, potential impacts on human health, soils, surface water and groundwater associated with construction activities, including the use of construction plant and vehicles, are therefore considered to have negligible effect (not significant) following implementation of standard good practice measures • With a SWMP and MMP in place, potential impacts associated with the management of waste and materials management are considered negligible (not significant) and are scoped out of further assessment.
Climate	• Given the scale of the Proposed Scheme, carbon emissions associated with the excavation and reuse of site won peat material and fuel usage during construction, are also not considered significant in the context of the UK's carbon budget. • The Proposed Scheme will not increase the vulnerability of residents, businesses or material assets to climate change.

As described in Table 5.1, the PEIR identified that impacts on these topic areas will be mitigated through standard control measures such as the implementation of CTMP, SWMP, MMP and DMP. These measures, amongst others, have been included within the EAP for the Proposed Scheme provided in Appendix K and will be developed by the contractor in consultation with the relevant authorities (e.g. our internal technical specialists, local highways authority and environmental health officers).

5.2.2. Format of the assessment

For each topic area (chapters 6 to 11), the assessment is split into the following sub-headings:

- Introduction: brief introduction to the environmental topic area, including broad types of receptors
- Regulation and policy background: topic specific legislation and policy relevant to assessment provided
- Methodology: identifies sources of information on which the assessment has been based, and describes in detail criteria for sensitivity/value of receptors and magnitude of impacts used to assess the significance of identified impacts
- Existing environment: includes the summary of the baseline review and describes the key features within the study area and their sensitivity to the project
- Likely significant effects: includes the impacts associated with the project in terms of scale (both time and effect on the receptor) following inclusion of the embedded mitigation measures described in section 3.2.4.
- Mitigation: this identifies any additional mitigation measures over and above those embedded with the design that we are proposing to take to mitigate (minimise) the negative impacts from the Proposed Scheme identified
- Residual effects: this outlines the residual effect after additional mitigation is assumed to be in place

5.2.3. Study areas

Study areas for EIA vary depending on the topic being assessed and the nature of receptor, and therefore study areas are defined within the topic area specific chapters 6 to 12 of this report.

5.2.4. Assessment approach (including definition of significance)

The EIA aims to determine the significance of potential environment effects of the proposed scheme by assessing the magnitude of a possible impact in relation to the sensitivity (or value) of relevant receptors within the defined study area, which is based upon the requirements outlined in Schedule 2 of the EIA Regulations. Quantitative methods are used wherever possible, although qualitative approaches are often employed, drawing upon available information. The steps below outline the general approach to the EIA used in all topic chapters, with further information regarding topic specific approaches outlined in the topic area specific chapters 6 to 12 of this report.

1. Identification of the environmental resources (the receptors) likely to be affected by the proposed scheme.
2. Assessment of the sensitivity or value of receptors. Criteria defining the level of sensitivity or value differ with respect to each topic area and are defined, as appropriate, in each technical chapter of the ES. The sensitivity or value of receptors is described as either negligible – low – medium – high in accordance with Figure 5.1 (p44).
3. Characterisation of effects and assessment of impact magnitude. The impact magnitude of an effect on a receptor is described as either negligible – low – medium – high in accordance with Figure 5.1 (p44). The likely effects on receptors as a result of activities or environmental changes arising due to the scheme are identified and characterised with reference to their nature (adverse or beneficial) and the type of effect (e.g. whether it is direct or indirect, secondary, cumulative, short (e.g. 0 to 5 years) or long-term (e.g. >5 years), permanent or temporary, reversible or irreversible).
4. Assessment of the significance of the impact on a receptor. By combining the sensitivity of the baseline environment with the magnitude of the impact, we can assess the significance of the impact on a receptor. The significance is based on technical judgement and guided by the matrix provided in Figure 5.1 (p44). The assessment of significance is undertaken in two stages:
    i. Likely significant effects: a number of design decisions relating to the location and form of the bank raising and WFD enhancement works which are referred to as “embedded” mitigation as detailed in section 3.2.4. These are considered to be intrinsic aspects of the Proposed Scheme and so have been included in the initial impact assessment. At this stage, the significance of effects are described as either not-significant – minor – moderate – major – substantial in accordance with Figure 5.1 (p44).
    ii. Residual significance: following the application of additional mitigation measures, an identification of residual effects and assessment of their significance. Residual effects are described as either significant or not significant. For the purposes of this assessment, only moderate and major residual effects are considered significant.

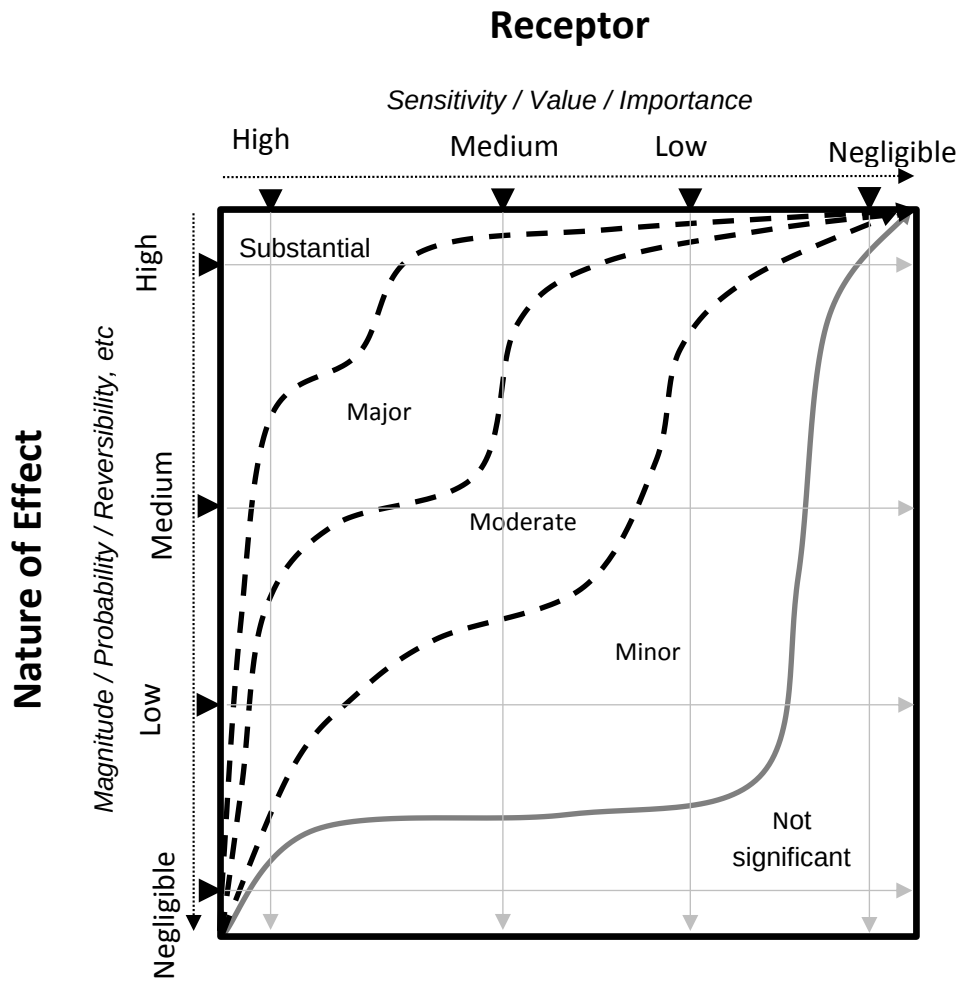

Figure 5.1 Significance matrix

5.2.5. Worst case scenarios

As the detailed design and construction approach for the Proposed Scheme is still progressing, there are a number of information gaps and uncertainties which need to be accounted for in our assessment. We have used worst-case assumptions to fill these gaps and address these uncertainties. Key limitations, gaps and uncertainties are presented in section 3.2.5, and in more detail in each topic chapter.

6. Water

6.1. Introduction

This chapter considers the impact on water resources which includes: fluvial geomorphology, flood risk, and water quality issues. This chapter assesses the surface and features within the footprint of the Proposed Scheme and hydraulically linked features in the surrounding environment and incorporates the potential effects on the fluvial (freshwater) sections of the Sowy and KSD.

6.2. Regulation and policy background

The following table (Table 6.1) summarises the fundamental pieces of legislation adopted for water.

Table 6.1 Relevant legislation

Legislation	Principal functions of adoption
Water Framework Directive (2000/60/EC)	Introduced a comprehensive river basin management planning system to help protect and improve the ecological health of our rivers, lakes, estuaries and coastal and groundwaters. This is underpinned by the use of environmental standards to help assess risks to the ecological quality of the water environment and to identify the scale of improvements that will be needed to bring waters under pressure back into a good condition.
Water Environment (Water Framework Directive) (England and Wales) Regulations 2003	Transposed the Water Framework Directive to enable water body management in England and Wales.
Floods Directive 2007/60/EC	Addresses the assessment and management of flood risks and entered into force on 26 November 2007. Requires Member States to assess if all water courses and coast lines are at risk from flooding, to map the flood extent and assets and humans at risk in these areas and to take adequate and coordinated measures to reduce this flood risk
Environmental Protection Act 1990	Makes provision for the improved control of pollution to the air, water and land by regulating the management of waste and the control of emissions
Water Resources Act 1991	Regulates water resources, water quality and pollution, and flood defence.

Legislation	Principal functions of adoption
Water Act 2003	Regulates water companies to increase the resilience of water supplies to natural hazards such as droughts and floods**.**

A Detailed Water Framework Directive (WFD) Compliance Assessment has been undertaken (see Appendix E) to assess the impacts of the Proposed Scheme on the quality elements of the relevant water bodies. This includes impacts to biology (including fish), chemical, and hydromorphology indicators. This includes a review of the proposed various elements of the Proposed Scheme and a consideration of their impact on the relevant water bodies.

6.3. Methodology

6.3.1. Scope

The scope of assessment as identified in the PEIR for the Proposed Scheme is shown below in Table 6.2.

Table 6.2 Scope of assessment

Scoped in	Scoped out
Impacts to WFD quality elements and requirement for detailed assessment on King's Sedgemoor Drain.	Impacts to River Cary scoped out due to no works affecting a WFD water body
Construction and operational impacts to King's Sedgemoor Drain	
Operational impact to flood risk	
Construction and operational risk of haul road/tracking of plant	

6.3.2. Scope

Three study areas are defined for this assessment as follows:

- Impacts on WFD waterbodies – construction footprint (see Figure 3.1, Appendix A). Upstream and downstream water bodies are not included as the Preliminary WFD Compliance Assessment (Appendix F) identified that impacts of the Proposed Scheme will not propagate that far.
- Impacts on non-WFD waterbodies – construction footprint (see Figure 3.1, Appendix A)
- Flood risk – geographical extent of areas benefitting from flood risk protection from the full River Sowy and King's Sedgemoor Drain Enhancements Scheme, including residential and commercial properties and holdings and infrastructure within Kings Moor, Curry Moor, Hay Moor, Salt Moor and North Moor, King's Sedgemoor and Earlake Moor (Environment Agency, 2015)

6.3.3. Guidance

Our internal guidance (Operating Instruction 488-10) provides an overview of what the regulators will like to see in a WFD compliance assessment and has been used to inform this assessment. Additionally, reference to the WFD Regulations 2003 is also used as this lays out what the regulations consider as assessment.

6.3.4. Establishing the baseline

The baseline information for the study area has been established primarily from a desk-based review of the following sources:

- South West River Basin District River Basin Management Plan (DEFRA, 2015)
- Environment Agency data, including Catchment data explorer (https://environment.data.gov.uk/)

6.3.5. Determination of significance

Water quality and quantity (including WFD status)

The methodology used for assessing the impacts on water resources follows the general approach set out in Chapter 5. The definitions of value/sensitivity and magnitude criteria specifically relevant to impacts on water quality and quantity is set out in Tables 6.3 and 6.4 below.

Table 6.3 Indicative criteria for estimating the value/sensitivity for water resources

Value /sensitivity of the receptor	Criteria
High	Has no capacity to accommodate the proposed form of change. The receptor is of international importance. Likely to be rare with minimal potential for substitution. May also be of high or very high socio-economic importance. A surface water resource of pristine or near pristine water quality, and/or international scale:

Value /sensitivity of the receptor	Criteria
	• 'High' or 'Good' overall WFD water quality status, and/or water feature is a valuable water supply • Protected/designated under EC legislation (Special Area of Conservation (SAC), Special Protection Area (SPA), Ramsar site) • Water feature appears in complete equilibrium with natural processes occurring
Medium	Has low to moderate capacity to accommodate the proposed form of change. The receptor is designated and/ or of national importance. Likely to be relatively rare. May also be of high socioeconomic importance. A surface water resource with a measurable degradation in its water quality as a result of anthropogenic factors, and/ or rarity on national scale: • 'Moderate' overall WFD water quality status or considered to exhibit 'Moderate' water quality based on professional judgement • 'Moderate' overall ecology status or potential • Water feature with some natural processes, including varied flow types Modifications and anthropogenic influences having an obvious impact on natural flow regime, flow pathways and processes
Low	Has moderate to high capacity to accommodate the proposed form of change and/ or includes non-statutory sites of regional or local importance designated for water dependent ecosystems. • A surface water resource with poor water quality resulting from anthropogenic factors, where the species diversity of flora and fauna is greatly affected by water quality degradation • 'Poor' overall WFD water quality status or potential, or considered to exhibit 'Poor' water quality based on professional judgement • 'Poor' overall ecology status • Water feature which shows limited evidence of active natural processes with unnatural flow regime or/and uniform flow types and minimal secondary currents

Value /sensitivity of the receptor	Criteria
Negligible	Has high capacity to accommodate the proposed form of change and/ or is non-statutory sites of local importance. A surface water resource with bad water quality resulting from anthropogenic factors, where the species diversity of flora and fauna is greatly affected by water quality degradation: • 'Bad' overall WFD water quality status or potential, or considered to exhibit 'Bad' water quality based on professional judgement • 'Bad' overall ecology status • Water feature which shows no evidence of active natural processes with unnatural flow regime or/and uniform flow types and minimal secondary currents

Table 6.4 Indicative criteria for determining the magnitude of the impact

Magnitude of Impact	Criteria
High	Continuous change, over the whole development area and beyond (i.e. offsite extending into the far-field), of a scale that will change key characteristics or features of the particular environmental aspect's character or distinctiveness. Proposed development results in a reduction (or improvement) in the quality and integrity and/ or loss (or gain) of the water feature, i.e.: • Material changes to the baseline condition of the water feature, hydrology or hydrodynamics, and morphology which may be long-term or permanent • Effects that result in a fundamental change to water quality condition either by a relatively high amount over a long-term period or by a very high amount over an episodic event • Likely to result in a reduction in the overall WFD chemical/ecological classification level and therefore WFD status • Long-term loss or change to designated species/habitats or water supply
Medium	Noticeable, temporary (during the project duration) or infrequent change, over the far-field, of a scale that will

Magnitude of Impact	Criteria
	partially change key characteristics or features of the particular environmental aspect's character or distinctiveness; or continuous change to the near-field environment of a scale that will change key characteristics Proposed development results in a moderate measurable change in the quality and integrity and/or the loss of the water feature, i.e. • Moderate changes to the baseline condition of the water feature hydrology or hydrodynamics, and morphology which may be long-term or permanent • Likely to result in a decline in water quality but not sufficient to change the overall WFD chemical/ecological classification level and therefore WFD status • May result in temporary impacts on designated species/habitats or water supply
Low	Noticeable, temporary (for part of the project duration) change, or barely discernible change for any length of time, over a small area, to key characteristics or features of the particular environmental aspect's character or distinctiveness. Proposed development results in a minor measurable change in the quality or vulnerability of water feature, i.e. • Observable changes to the water feature hydrology or hydrodynamics, and morphology but temporary in nature • A temporary decline in water quality during construction; and/or a slight decline in water quality during operation but insufficient to change the current WFD chemical/ecological classification level and therefore WFD status
Negligible	Changes which are not discernible from background conditions. Proposed development results in an effect on water feature but of insufficient magnitude to affect the use or condition, i.e. • No observable changes to the water feature, hydrology or hydrodynamics and morphology • No measurable change in water quality at any time during construction and/or operation, thus no change to WFD chemical/ecological classification level and therefore WFD status

The nature and characteristics of impacts have been described to enable their magnitude to be determined. The nature of the impacts has first been expressed as:

- Adverse – detrimental or negative impacts on an environmental resource or receptor
- Beneficial – advantageous or positive impact on an environmental resource or receptor

The significance of effect is calculated based on the value/sensitivity of a resource and the magnitude of impact using the matrix shown in Figure 5.1 (p44).

Flood risk

For the assessment of flood risk, a qualitative assessment of the impact of the Proposed Scheme during construction and operation is provided. The Proposed Scheme assessed within this report is Phase 1 of the full River Sowy and King's Sedgemoor Drain Enhancements Scheme, and no flood modelling has been specifically undertaken for this first stage which comprises only enhancements to the capacity of the Sowy/KSD system and does not include operational enhancements to allow the volume of water diverted from the Parrett into the Sowy/KSD system to increase.

6.3.6. Assumptions and Limitations

Assumptions for the assessment of impacts of WFD waterbodies are that no substantial changes in quality assessments have occurred since the 2016 data input to Catchment Data Explorer.

6.4. Existing environment

The Proposed Scheme lies within the Somerset Levels which comprises lowlands, ditches and wetland habitat. The Somerset Levels area comprises floodplains within the 65,000 ha area of the Rivers Axe, Brue, Parrett, Tone and their tributaries. The majority of the area is only a few metres above mean sea level and drains via a large network of ditches, rhynes and rivers, including the Sowy and KSD. A series of WLMPs are in place to control the timing, extent, and duration of floodplain inundation for the management of designated nature conservation sites (considered within Chapter 7).

Water body features

The Proposed Scheme lies within the South West River Basin District (RBD) and within the "King's Sedgemoor Drain - Henley Sluice to mouth" WFD water body. Figure 6.1 in Appendix A illustrates the location of this and associated water bodies.

The Proposed Scheme lies within the waterbody:

- King's Sedgemoor Drain – Henley Sluice to mouth (water body ID GB108052021150).

The connected water bodies scoped into assessment are:

- Cary - source to confluence with KSD (water body GB108052015140)

Baseline details for these water bodies are provided in Appendix E.
In addition to the WFD water bodies listed above, there are also a number of rhynes and ditches discharging into the Cary and KSD

Morphologically, the KSD and Sowy are artificial embanked drainage channels, connected to smaller field drains. These channels are homogeneous in nature and comprise embankments along the floodplain with steep channel sides. They possess very few morphological features. Channels are predominantly straight and exhibit little variation in channel morphology, bed morphology and sediment type. Sediment abundance is high due to the nature of the catchment and water velocities are slow. This is because of the low-lying nature of the landscape, its low elevation not far above sea level, and agricultural soil losses being high resulting in high sediment loading in the channels.

In terms of WFD, the water courses are important for fish, particularly coarse fish, and eels. Although many of the flow control structures on the rhynes have fish pass structures, fish passage is restricted during normal and low flows on the KSD, due to the operation of the KSD water level management structures. During high flows there is enough volume of water for fish to pass through the KSD. Eels migrate through the KSD and beyond via Dunball.

The network of rhynes and ditches in the study area provides suitable habitat for a diverse range of aquatic invertebrates, which are also status elements within WFD classification.

Water quality
In terms of water quality, both generally and for WFD classification purposes, there have been 20 years of steady water quality improvements across the Somerset Levels and Moors catchments; however, phosphate levels remain a concern. There are some local water quality issues in the study catchment due to diffuse and point sources of pollution. Diffuse pollution is primarily caused by high phosphate levels from nutrient enrichment (fertilisers) and private septic tank overflows. Point sources of pollution mainly occur at sewage treatment works.

Weed-cutting activities can also cause significant drops in dissolved oxygen (DO) levels on watercourses and are undertaken by various bodies including Environment Agency and the Internal Drainage Board (IDB). The Environment Agency's Operations Delivery team take DO readings before and during weed cutting to ensure water quality does not deteriorate rapidly. If DO levels drop below 20%, all operations stop immediately, including the operation of pumping stations. This practice helps to prevent fish kills and unnecessary damage to the aquatic environment.

Flooding

On the Somerset Levels and Moors, serious flooding (if defined as >10 properties flooded) was experienced in 1872, 1894, 1929, 1960, 1999, 2000, 2012 and 2013/14, which implies on average serious flooding every 15 years. Extreme flooding of similar scale to 2013/14 was experienced possibly only in 1960 in 142 years of records, which implies extreme flooding once every 70 years on average.

Floodwater in the Somerset Levels and Moors system is managed via a complex of drains, pumps, natural river channels and flood relief systems. The majority of the area is only a few metres above mean sea level. This is a landscape of rivers and wetlands, artificially drained, irrigated and modified to allow productive farming. The levels are mainly used for summer cattle grazing, often in conjunction with hay or silage production. In response to severe flooding in the 1960s the Parrett Flood Relief Channel, combining the Sowy-KSD system, was built in the early 1970s. The system conveys flood flow from the Parrett, just downstream of Langport at Monk's Leaze Clyce, via the Sowy and KSD to the tidal sluice at Dunball in the Parrett Estuary.

The Parrett Flood Relief Channel (Sowy and lower KSD) was designed for moderate winter flooding, but not on the scale of the exceptional flooding experienced in 2013-14. Due to funding constraints, the 1970s as-built scheme was of a reduced capacity (flow of 17 m^3/s) compared with the original scheme design (flow of 30 m^3/s). However, many of the bridges were built or modified to provide the full 30 m^3/s capacity in case the opportunity arose to enlarge the channels in the future.

The Sowy/KSD system is used to reduce flood risk, to drain land in winter and to supply water to agricultural land including designated conservation sites in summer, in accordance with the local WLMP. The system was designed without pumping at Dunball, with the KSD sized to accommodate a degree of tide-locking.

6.5. Likely significant effects

6.5.1. Construction

During construction, there will be some impacts to the aquatic/geomorphic environments. These are outlined in the following sections.

WFD compliance

Impacts are likely to be confined to the channel and floodplain at the areas of work plus the downstream channel. These impacts are likely to include:

- Potential increase in suspended sediment concentrations and release of materials into the water column from construction of embankments, backwaters and two stage channel features
- Increased sedimentation following on from the above
- Compaction of the floodplain from plant tracking across the site, which can change permeability of the substrate, interrupt hydrology of both the riparian zone substrate and the area’s surface, and increase erosion potential
- Impacts to WFD quality elements such as disturbance to fish, invertebrates and macrophytes during construction, due to noise, increased suspended sediment and actual disturbance/removal of existing habitat

Factors with the potential to contribute to these risks include activities in construction compounds, temporary stockpiles of loose material and movement of plant all of which could provide a pathway to the receptor from sediment disturbance, and risk of spillages into the water course, or on adjacent land.

Factors which will undoubtedly contribute to these risks are:

- In-channel construction works. These will increase the risk of reduced oxygen levels from disturbance of sediment within the channel
- Activities associated with the raising and re-profiling of the existing informal flood banks, which will result in some sediment runoff

The KSD and Sowy are of medium sensitivity, and the impact magnitude is medium. Before mitigation, there will be a moderate adverse (i.e. significant) effect upon these receptors.

Surface water (non WFD waterbodies)

This section covering impacts to surface water bodies that are not WFD waterbodies. This includes the Langacre Rhyne, KSD back ditch and other ditches/rhynes within the study area, including Cossington Right Rhyne.

Works to Cossington Right Rhyne and Chilton outfalls could affect the KSD Back Ditch by affecting the amount of water discharging into it via runoff. Headwall raising can reduce connectivity of overwash/runoff between the two. Headwall raising is unlikely to impact on substrate, so should have negligible effect in terms of morphology or sedimentation risks.

The non-WFD surface waters within the study area are of medium sensitivity, and the impact magnitude is medium. Before mitigation, there will therefore be a moderate adverse (i.e. significant) effect upon the receptors.

Flood risk

Construction involves a net removal of soil/sediment from the KSD and Sowy channels associated with the construction of the WFD enhancement features. There is also a substantial amount of material being imported into the area to raise the existing informal flood banks adjacent to the Sowy and KSD channels. There will be short periods during the construction phase, where excavated material will be stockpiled on site prior to placement for permanent works.

The available flood storage volume in the floodplain is not expected to be significantly affected by this temporary stock piling of material; the overall loss of storage capacity will be negligible compared to the total volume. Therefore, the risk of flooding during construction is not expected to change.

6.5.2. Operation

During operation, there will be some beneficial impacts to the aquatic/geomorphic environments of the KSD. These are outlined in the following sections.

Impacts to WFD quality elements and requirement for detailed assessment on the KSD

The Proposed Scheme will result in an increase in channel conveyance by the construction of a two-stage channel and embayments along “King’s Sedgemoor Drain – Henley Sluice to mouth”. This will lead to increased channel and riparian

habitat, and reduced duration and frequency of extreme flooding on the intensive agriculture floodplain.

Additional positive benefits include improving water quality, riparian habitat and hydromorphology due to increasing heterogeneity in the channel, adding backwaters, and improving channel cross section, which will have an overall benefit to the water body and adjacent environment.

Consequently, the Detailed WFD Compliance Assessment (Appendix E, Annex E2) concludes that the Proposed Scheme will improve aquatic habitats, riparian habitat and flow diversity and maintain fish passage. Recognising the artificial (AWB) classification of the water body, the channel structural changes that will be delivered by the scheme are likely to complement progress towards good ecological potential.

There is some potential for adverse residual effects with regard to river processes in the water body after the scheme is completed, i.e. related to ponding of water in the two-stage channel during flood flows. This is an unavoidable consequence of the Proposed Scheme. On balance the establishment of more diverse in-stream habitats is considered to outweigh any adverse effects of ponding of water, especially considering that without the Proposed Scheme the AWB is already largely impounded through the summer months.

In summary, operational impacts will benefit the Sowy and KSD due to the improvement of the aquatic environment and the improvement to the overall hydromorphology. The receptor is medium sensitivity, the impacts will be medium magnitude, and the significance of effects will therefore be moderate beneficial (i.e. significant) effect.

Surface water (non WFD waterbodies)

Works in non WFD water bodies will result in similar impacts to the WFD water bodies. The Proposed Scheme will lead to increased channel and riparian habitat, and reduced flooding on the intensive agriculture floodplain.

In summary, operational impacts will benefit the non WFD water bodies due to the improvement of the aquatic environment and the improvement to the overall hydromorphology where there is a hydrological connection, in particular. The receptor is medium sensitivity, the impacts will be medium magnitude and the significance will therefore be a moderate beneficial (i.e. significant).

Flood risk

With implementation, the frequency of overtopping of banks along the KSD and Sowy within the scheme extents will reduce, with attendant beneficial impacts for flood risk in adjoining lands. The Proposed Scheme will contribute towards the flood risk benefits achieved through the full River Sowy and King's Sedgemoor Drain Enhancements Scheme once implemented, in combination with other measures included within Somerset Levels and Moors Flood Action Plan.

6.6. Mitigation

The following best practice mitigation measures will be applied during construction to reduce the risk of pollution of the water environment:

- Production of an Emergency Pollution Response Plan (EPRP)
- Adherence to best practice pollution prevention
- Polluting materials will not be stored closer than 5m from any watercourse, including storage and compound areas
- Production of a Surface Water Management Plan (SWMP) (including measures to minimise site runoff as agreed with our internal technical specialists)
- Implementation of standard spill/leak control measures (e.g. bunded fuel storage area, spill kits, interceptors)
- Consideration and mitigation of the risk of silt generation from 'just in time' stockpile areas from rainfall/flood events, and of leachate generation from excavated materials, e.g. by the use of impermeable bases, flood bunds, and temporary covering of exposed material.
- Use of silt curtains or booms to minimise sediment dispersal during construction of WFD enhancement features, or if not practicable, implementation of dissolved oxygen monitoring during warmer weather periods
- Use of drip trays, which will be of adequate capacity and regularly maintained
- Fuel storage will be in appropriately bunded areas and refuelling activities will take place in designated areas away from the river
- The contractor shall register for flood warnings and shall ensure that no equipment or potentially polluting materials are left at risk of flooding
- Specific toolbox talks will be given about the risk of water pollution
- Construction of the WFD enhancement feature to be supervised by a suitably experienced Ecological Clerk of Works (ECoW) and a geomorphologist

6.7. Conclusions and summary of residual effects

During construction potential significant effects on water quality during construction will be mitigated through the preparation of a SWMP and use of best practice pollution control measures. Once operational the Proposed Scheme is deemed to have an overall beneficial change in terms of flood risk through its contribution to the full River Sowy and King's Sedgemoor Drain Enhancements Scheme and in combination with other measures implemented under the Somerset Levels and Moors Flood Action Plan. Table 6.5 provides a summary of residual effects, where significant effects (i.e. moderate or above) are predicted in the absence of mitigation.

Table 6.5 Residual effects where significant effects are predicted in the absence of mitigation

Receptor (sensitivity/value)	Nature of impact (magnitude)	Significance (pre-mitigation)	Mitigation	Residual effect
Construction				
WFD water bodies (King's Sedgemoor Drain and Sowy) (medium)	Increase in suspended sediments within water column; disturbance to marginal habitat; risk of reduced oxygen levels in-channel (medium, temporary)	Moderate adverse	Preparation and implementation of a SWMP and EERP Compliance with best practice pollution prevention measures Use of silt curtains/booms or DO monitoring in summer Toolbox talks regarding water quality risks Geomorphologist and ECoW to supervise in channel works	Minor adverse (not significant)
Non-WFD water bodies (Langacre, and other rhynes) (medium)	Increase in suspended sediments within water column; disturbance to marginal habitat; risk of reduced oxygen levels in-channel (medium, temporary)	Moderate adverse	Preparation and implementation of a SWMP and EERP Compliance with best practice pollution prevention measures	Minor adverse (not significant)

Receptor (sensitivity/value)	Nature of impact (magnitude)	Significance (pre-mitigation)	Mitigation	Residual effect
			Use of silt curtains/booms or DO monitoring in summer Toolbox talks regarding water quality risks Geomorphologist and ECoW to supervise in channel works	
Operation				
WFD water bodies (King's Sedgemoor Drain and Sowy) (medium)	Overall improvement due to provision of WFD enhancement features (embayments, two stage channels and backwaters) (medium, permanent)	Moderate beneficial (significant)	None identified	Moderate beneficial (significant)
Non-WFD water bodies (Langacre, and other rhynes) (medium)	Overall improvement due to implementation of works within KSD (medium, permanent)	Moderate beneficial (significant)	None identified	Moderate beneficial (significant)

Receptor (sensitivity/value)	Nature of impact (magnitude)	Significance (pre-mitigation)	Mitigation	Residual effect
Communities and infrastructure benefitting from flood risk protection from the full River Sowy and King's Sedgemoor Drain Enhancements Scheme (N/A -qualitative descriptive assessment only)	Positive contribution towards flood risk alleviation in combination with other measures and future works	Not assessed (qualitative descriptive assessment only)	None identified	Beneficial (qualitative descriptive assessment only)

7. Flora and fauna

7.1. Introduction

This chapter considers the potential effects of the Proposed Scheme on flora and fauna. It describes the impact upon important ecological features: designated sites for nature conservation; habitats; and species, where there is the potential for significant effects from the Proposed Scheme to occur.

7.2. Regulation and policy background

Consideration of the potential impacts of the Proposed Scheme on ecological features takes into account the following legislation:

- The Wildlife and Countryside Act 1981 (as amended)
- Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora (the “Habitats Directive”)
- EC Birds Directive (Council Directive 79/409/EEC on the conservation of wild birds)
- The Conservation of Habitats and Species Regulations 2017
- The Protection of Badgers Act 1992
- Eels (England and Wales) Regulations 2009
- Salmon and Freshwater Fisheries Act 1975
- The Countryside and Rights of Way (CRoW) Act 2000
- The Natural Environment and Rural Communities Act 2006

7.3. Methodology

7.3.1. Scope of the assessment

This chapter focusses on how the Proposed Scheme may impact upon the nature conservation status of relevant ecological features, and outlines actions required to ensure legislative compliance in relation to species protected under the Wildlife and Countryside Act 1981 (as amended) and Protection of Badgers Act 1992. Additional detail relating to the actions required to ensure legislative compliance in relation to the Conservation of Habitats and Species Regulations 2017 is provided in Appendices C and D.

The following key issues were identified at the EIA scoping stage for consideration in the assessment (see Table 7.1).

Table 7.1 Scope of assessment

Scoped in	Scoped out
Adverse construction impacts as a result of loss and/or damage to habitats, mortality and/or disturbance effects to species and changes in water quality	Adverse operational effects: for fish, aquatic invertebrates, GCN, reptiles, bats, otter, water vole and badger.

Scoped in	Scoped out
on; statutory designated sites, non-statutory designated sites, habitats of principal importance, fish, aquatic invertebrates, GCN, reptiles (grass snake), birds, roosting bats, otter, water vole and badger	
Adverse operational impacts as a result of changes in flooding extent, frequency and duration on; statutory and non-statutory sites, habitats of principal importance and birds.	
Beneficial operational impacts as a consequence of a net increase in open water and marginal habitat created from species-poor grassland; on habitats (including Section 41 habitats and habitats within statutory and non-statutory designated sites) and on invertebrates and water vole	

7.3.2. Study area

The study area for statutorily designated European sites (i.e. Special Areas of Conservation (SAC), Special Protection Areas (SPA) and Ramsar sites) and Sites of Special Scientific Interest (SSSIs) was based on Natural England's (NE) Impact Risk Zones (IRZ). The IRZs[5] are a GIS tool developed by Natural England to make a rapid initial assessment of the potential risks posed by development proposals to: SSSIs, SACs, SPAs and Ramsar sites. Where the Proposed Scheme overlaps with an IRZ, the SSSI/European site was included in the study area for the assessment.

A 1km study area based on a 1km buffer of the Proposed Scheme boundary has been used for the local records desk study which comprises records of protected and notable species and non-statutory designated sites.

The Phase 1 habitat survey study area included the area within and 100m either side of Proposed Scheme boundary. This was considered sufficient to cover potential areas of habitat loss as a result of the Proposed Scheme and to provide an understanding of habitat suitability and connectivity in respect of mobile species which could be impacted.

[5] The Impact Risk Zones are a GIS tool developed by Natural England to make a rapid initial assessment of the potential risks posed by development proposals to: Sites of Special Scientific Interest (SSSIs), Special Areas of Conservation (SACs), Special Protection Areas (SPAs) and Ramsar sites. They define zones around each site which reflect the particular sensitivities of the features for which it is notified and indicate the types of development proposal which could potentially have adverse impacts.

In each case, the aim has been to identify the likely zone of influence[6] that the Proposed Scheme will have on ecological features. This is informed by published guidance and the professional judgement of suitably qualified and experienced specialists. The distances the study area extends for each ecological feature are summarised in Table 7.2 and detailed in the appended baseline reports (Appendix F).

7.3.3. Guidance

The assessment for flora and fauna has been undertaken in accordance with the common framework set out in Chapter 5 and, specific to this topic, the Chartered Institute of Ecology and Environmental Management (CIEEM) Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater and Coastal (CIEEM, 2018).

To establish the baseline, in conjunction with the desk study, field surveys were carried out using nationally recognised standard survey methodologies, where available, as detailed in Table 7.2.

7.3.4. Establishing the baseline

A number of studies have been undertaken to establish the baseline ecological conditions within the study area. A summary of the work undertaken is provided in Table 7.2.

Works are programmed to avoid the breeding bird season (considered to be March to August inclusive) and as such breeding bird surveys were not undertaken.

National Vegetation Classification surveys were also not considered to be required, due both to the nature of the habitats present and the nature of the Proposed Scheme, however the Phase 1 habitat survey included consideration of the presence of MG4 and MG5 grassland within the study area.

[6] The 'zone of influence' for a project is the area over which ecological features may be affected by biophysical changes as a result of the proposed project and associated activities. This is likely to extend beyond the project site (CIEEM 2018).

Table 7.2 Summary of ecological information and surveys undertaken to establish the study area baseline

Ecological feature	Survey type	Date	Methodology	Study area
Statutory designated sites	Desk study	October 2019	Compiled from Multi Agency Geographical Information for the Countryside (MAGIC) data (Defra 2019)	The study area for statutorily designated European sites (i.e. SAC, SPA and Ramsar sites and SSSIs) was based on Natural England's Impact Risk Zones (extended for the strategic level Habitats Regulations Assessment (HRA), see Appendix C)
Non-statutory designated sites	Desk study	September 2019	Data provided by Somerset Environmental Records Centre (SERC)	1km either side of the Proposed Scheme (Parchey Bridge to Monk's Leaze Clyce)
Protected and notable species	Desk study	September 2019	Data provided by SERC	1km either side of the Proposed Scheme (Parchey Bridge to Monk's Leaze Clyce)
European Protected Species (EPS)	Desk study	September 2019	Search of MAGIC website for records of EPS licences	1km either side of the Proposed Scheme (Parchey Bridge to Monk's Leaze Clyce)
Birds	Desk study	2011/12-2015/16	Wetland Bird Survey (WeBS) winter count data provided by the RSPB	For selected designated and non-designated sites through the Sowy/KSD corridor
		2012-2015	Annual Breeding Wader Survey Data, supplied by RSPB who co-ordinate the survey	Across the Somerset Levels including designated and non-designated sites

Ecological feature	Survey type	Date	Methodology	Study area
Habitats	Extended Phase 1 habitat survey	August-September 2019	Survey in accordance with Handbook for Phase 1 habitat survey (JNCC, 2010) extended to include consideration of NVC habitats MG4 and MG5 grassland and the potential for habitats to support protected and notable species and non-native invasive plant species (see Appendix F for full details)	Within and 100m either side of the Proposed Scheme (Parchey Bridge to Monk's Leaze Clyce)
	Walkover survey	May 2015	Ecological walkover survey to identify potential constraints	Length of Proposed Scheme (Down End to Langport)
Aquatic invertebrates	Invertebrate sampling focussing on presence/absence of certain key beetle species	June 2016	Pond netting with reference to the Buglife methodology for invertebrate sampling as found in the Survey Manual by Palmer, Drake and Stewart (2013) (see Appendix F for full details)	Nine 50m sections of Sowy selected by Environment Agency/Natural England in stands of marginal and in-channel vegetation
Great crested newts (GCN)	eDNA survey	June 2019	eDNA analysis in accordance with Biggs et al. (2014) (see Appendix F for full details)	Nine ponds within 250m of the Proposed Scheme (Parchey Bridge to Monk's Leaze Clyce)

Ecological feature	Survey type	Date	Methodology	Study area
(*Triturus cristatus*)	eDNA survey	June 2015	eDNA analysis (Biggs et al. 2014)	Ponds within 500m of the Proposed Scheme (Down End to Langport) and not separated from the Proposed Scheme by a significant barrier to newt dispersal. Included 2 ponds with an HSI >0.5
	Habitat suitability index survey (HSI)	June 2015	Habitat Suitability Index (Oldham et al. 2000)	Ponds within 500m of the Proposed Scheme (Down End to Langport) and not separated from the Proposed Scheme by a significant barrier to newt dispersal.
Bats (roosting)	Bat roost ground assessment	August-September 2019	Visual inspection of trees and structures for potential roost features (Collins ed. 2016) (see Appendix F for full details)	30m either side of the Proposed Scheme (Parchey Bridge to Monk's Leaze Clyce)
Otter (*Lutra lutra*)	Presence/likely absence survey	October 2015	The habitat was assessed for its suitability to support otters for foraging, commuting, resting and breeding. Water courses and wetland areas were surveyed for evidence of spraints, slides, anal jelly, footprints, holts, runs, resting sites, feeding areas (see Appendix F for full details)	50m either side of the Proposed Scheme (Down End to Langport)

Ecological feature	Survey type	Date	Methodology	Study area
Water vole (*Arvicola amphibius*)	Presence/likely absence survey	June-July 2019 and September-October 2019	Two surveys, one in spring/summer and a second in autumn. Habitat suitability assessment and search for field signs with reference to the Water Vole Mitigation Handbook (Dean et al. 2016) (see Appendix F for full details)	Length of the Proposed Scheme (Parchey Bridge to Monk's Leaze Clyce) plus 500m upstream and downstream
	Presence/likely absence survey	September 2015	A single survey in autumn. Habitat suitability assessment and search for field signs with reference to the Water Vole Conservation Handbook (Strachan et al 2011)	Length of the Proposed Scheme (Down End to Langport) plus 500m upstream, and downstream and connecting ditches up to 150m from the channel
Badger (*Meles meles*)	Presence/likely absence survey	February 2020	Visual assessment for evidence of badger in line with Badger: Survey and Mitigation guidance provided by Natural England and Defra (GOV UK, 2015) (see Appendix F for full details)	50m either side of the Proposed Scheme (Parchey Bridge to Monk's Leaze Clyce)
	Presence/likely absence survey	October 2015	Search for field signs in accordance with Cresswell et al. 1990 and Wilson et al. 1997	30m either side of the Proposed Scheme (Down End to Langport) and an additional 500m of the channel upstream and downstream

7.3.5. Determination of significance

Determining importance (sensitivity)

The CIEEM guidelines (CIEEM, 2018) recommend that the importance of each ecological feature is described in terms of its geographic frame of reference. The following definitions have been used for the geographic frame of reference for the importance of ecological features that may be impacted by the proposal. To allow comparisons with other technical chapters in the ES, importance has also been described (*in brackets*) using the more familiar terms used for sensitivity as per Chapter 5:

- International and European (*High*) - Special Areas of Conservation (SACs), Special Protection Areas (SPAs) and Ramsar sites and habitats or populations of species, outside of protected sites, considered to be important at an international/European level
- National (*Medium*) - Sites of Special Scientific Interest (SSSIs) and habitats or populations of species, outside of SSSIs, considered to be important at a National level
- Regional (*Low*) - Habitats or populations of species considered to be important within the South West of England
- County (*Low*) e.g. Non-statutory designated sites (CWS), habitats or populations of species considered to be important in Somerset
- Local/Site (*Negligible)* e.g. habitats or species populations considered to be important at the site level and its immediate surrounds

It is not necessary to carry out detailed assessment of features that are sufficiently widespread, unthreatened and resilient to project impacts and will remain viable and sustainable (CIEEM, 2018). In this assessment, those features of '*low*' value and above and/or which have some sort of legal protection, are included in the detailed assessment and are described as 'important ecological features'. This approach is consistent with the EIA Regulations, which only requires investigation of likely significant effects, as opposed to all effects.
For important ecological features a detailed assessment was undertaken to:

- Identify impacts and characterise effects
- Incorporate measures to avoid, mitigate and compensate for effects (in a hierarchical process)

Characterisation of impacts (magnitude)

Characterisation of impacts makes reference to the following, where relevant, to determining significance:

- Whether the effect is beneficial or adverse
- Extent (e.g. area/length/numbers of individuals)
- Duration (Short-term - the impact is temporary and lasts for up to 12 months; Medium-term – the impact occurs for up to 10 years; and Long-term – the impact remains for a substantial time, perhaps permanently; see chapter 5).
- Frequency and timing (how many times and when)

- Reversibility (i.e. is recovery possible within a reasonable timeframe either spontaneously or with the implementation of mitigation)

For the purpose of this assessment, the level of impact is described as the 'magnitude' of impact to provide consistency across technical chapters. The magnitude of impact is reported in accordance with the criteria provided in Table 7.3.

All aspects of construction and operation of the Proposed Scheme have been subject to an assessment of impacts. The assessment is made in relation to the predicted baseline within the zone of influence at the time of the impact, with reference to other assessments (e.g. water quality).

Table 7.3 Level of magnitude (change) and typical descriptions[7]

Level of magnitude (change)		Typical description
High	Adverse	Permanent/irreversible damage. The extent, duration and/or frequency/timing of the impact will negatively affect the integrity or key characteristics of the important ecological feature.
	Beneficial	Permanent addition of, improvement to or restoration of an important ecological feature. The extent, duration and/or frequency/timing of the impact will positively affect the integrity or key characteristics of the important ecological feature.
Medium	Adverse	Temporary/reversible damage. The extent, duration and/or frequency/timing of the impact will negatively affect the integrity or key characteristics of the important ecological feature.
	Beneficial	Temporary addition of, improvement to or restoration of an important ecological feature. The extent, duration and/or frequency/timing of the impact will positively affect the integrity or key characteristics of the important ecological feature.
Low	Adverse	Permanent/irreversible damage. The extent, duration and/or frequency/timing of the impact will not affect the integrity or key characteristics of the important ecological feature.
	Beneficial	Permanent addition of, improvement to or restoration of an important ecological feature. The extent, duration and/or frequency/timing of the impact will not affect the integrity or key characteristics of the important ecological feature.
Negligible	Adverse	Temporary/reversible damage. The extent, duration and/or frequency/timing of the impact will not negatively

[7] Descriptions based on those outlined in DMRB LA108 Biodiversity (Highways Agency, 2019).

Level of magnitude (change)		Typical description
		affect the integrity or key characteristics of the important ecological feature.
	Beneficial	Temporary addition of, improvement to or restoration of an important ecological feature. The extent, duration and/or frequency/timing of the impact will not affect the integrity or key characteristics of the important ecological feature.

Significance of effects

The significance of each effect has been defined based on the importance (sensitivity) of the ecological feature and the level of magnitude of the impact identified using the matrix in Figure 5.1 (p44). For this assessment, significant effects are considered to be those of moderate value or above. The significance of the effects of the Proposed Scheme are assessed before and after the implementation of mitigation.

The initial assessment i.e. before mitigation, includes consideration of embedded mitigation which captures those aspects of the Proposed Scheme design that have been designed to take into account important ecological features. Embedded mitigation includes the placement and dimensions of WFD enhancements which have been designed to maximise benefit to water vole through providing good quality habitat within areas currently identified as sub-optimal, to avoid any tree loss which could impact roosting bats and to ensure that there is no conflict with active badger setts.

Any significant residual effects remaining after the inclusion of mitigation and compensation are the factors to be considered in determining the application.

7.3.6. Assumptions and limitations

Assumptions

It is assumed that if, following further survey effort, trees currently anticipated as requiring removal are found to be tree bat roosts, these trees will not be removed and the required adjustments to the Proposed Scheme design made.

Limitations

Any survey of flora and fauna will be unavoidably constrained in a number of respects. In an effort to mitigate those constraints, nationally recognised standard survey methodologies have been used to minimise these limitations for ecological evaluation and impact assessment.

Specific limitations relevant to each survey, such as access constraints, are detailed in the relevant technical reports (see Appendix F). It is not considered that any of these survey specific constraints represent a significant limitation to adequately assessing the importance/sensitivity of ecological features for the purposes of undertaking a reasonable ecological impact assessment.

Ecological mitigation measures are described in this chapter (see section 7.6. The detailed design of some aspects of mitigation (such as those measures needed to support protected species method statements and licence applications) will be

developed during the detailed design phase. However, the impact assessment has taken account of the worst-case scenarios and mitigation measures are included within the outline design accordingly.

Where it is considered that the status of an ecological feature(s) is likely to be subject to change before construction commences, pre-construction surveys are recommended.

7.4. Existing environment

7.4.1. Baseline context

The Proposed Scheme (see Figure 3.1, Appendix A) lies within the Somerset Levels and Moors Natural Character Area (NCA). It is the largest area of lowland wet grassland and associated wetland habitat remaining in Britain, covering about 65,000ha in the floodplains of the Rivers Axe, Brue, Parrett, Tone and their tributaries. The majority of the area is only a few metres above mean sea level and drains via a large network of ditches, rhynes and rivers, including the Sowy and KSD. The levels are mainly used for summer cattle grazing, often in conjunction with hay or silage production. The NCA supports internationally important numbers of waterfowl in winter, protected by the Somerset Levels and Moors SPA. Breeding birds include significant populations of waders associated with lowland wet grassland and the NCA is regarded as one of the best areas for breeding waders in lowland Britain. A series of Water Level Management Plans (WLMPs) are in place to control the timing, extent, and duration of floodplain inundation in the SSSIs across the levels and moors and to ensure maintenance of Raised Water Level Areas (RWLA) for biodiversity benefit.

7.4.2. Statutory and non-statutory designated sites for nature conservation

A summary of those statutory and non-statutory designated sites within the zone of influence of the Proposed Scheme is provided in Table 7.4 and illustrated in Figure 7.1 (Appendix A). The Proposed Scheme overlaps with a number statutory international and national designations and county level, non-statutory designations for nature conservation.

Table 7.4 Statutory and non-statutory designated sites for nature conservation within the zone of influence of the Proposed Scheme

Site Name	Distance from the Proposed Scheme	Description
Statutory designated sites		
Somerset Levels and Moors SPA/Ramsar	Overlaps	The SPA covers 6,395 ha and includes areas of open water, fen and reed bed. The site attracts important numbers of water birds (swans, ducks and waders) in winter. Qualifying Features: • A037 *Cygnus columbianus bewickii*; Bewick's swan (Non-breeding) • A052 *Anas crecca*; Eurasian teal (Non-breeding) • A140 *Pluvialis apricaria*; European golden plover (Non-breeding) • A142 *Vanellus*; Northern lapwing (Non-breeding) • Water bird assemblage
		The Ramsar site attracts internationally important numbers of wildfowl in winter. The network of rhynes and ditches support an outstanding assemblage of aquatic invertebrates, particularly beetles. Qualifies under Ramsar criterion 2, 5 and 6. Ramsar criterion 2 • Supports 17 species of British Red Data Book invertebrates. Ramsar criterion 5 Assemblages of international importance: • Species with peak counts in winter: 97,155 waterfowl (5-year peak mean 1998/99-2002/2003) Ramsar criterion 6 Species/populations occurring at levels of international importance.

Site Name	Distance from the Proposed Scheme	Description
		Species with peak counts in winter: • Bewick's swan *(Cygnus columbianus bewickii*) • Eurasian teal (*Anas crecca*) • Northern lapwing (*Vanellus vanellus*)
Somerset Levels NNR	Overlaps	Covers 463 ha. Main habitats: open water, lowland grassland. Includes parts of the Moorlinch SSSI, Southlake Moor SSSI and Kings Sedgemoor SSSI.
King's Sedgemoor SSSI	Overlaps	The SSSI covers 822ha and is notified for the following features: • Aggregations of non-breeding birds; Bewick's swan, dunlin (*Calidris alpina alpina*), golden plover (*Pluvialis apricaria*), Green sandpiper (*Tringa ochropus*), Jack snipe, (*Lymnocryptes minimus*), lapwing, mallard (*Anas platyrhynchos*), snipe (*Gallinago gallinago*) and teal. • *Agrostis* - *Carex* inland wet grassland • Assemblages of breeding birds -Lowland damp grasslands • Invertebrate assemblage • Lowland ditch systems • M22 - *Juncus subnodulosus* - *Cirsium palustre* fen meadow • MG13 - *Agrostis stolonifera* - *Alopecurus geniculatus* grassland • MG5 - *Cynosurus cristatus* - *Centaurea nigra* grassland • MG8 - *Cynosurus cristatus* - *Caltha palustris* grassland • Otter (*Lutra lutra*)

Site Name	Distance from the Proposed Scheme	Description
Southlake Moor SSSI	Overlaps	The SSSI covers 196ha and is notified for the following features: • Aggregations of non-breeding birds - Bewick's swan, black-tailed Godwit, (*Limosa islandica*), teal, wigeon (*Anas penelope*) • Agrostis - Carex inland wet grassland • Invertebrate assemblage • Lowland ditch systems • MG13 - Agrostis stolonifera - *Alopecurus geniculatus* grassland • MG5 - Cynosurus cristatus - *Centaurea nigra* grassland • MG8 - Cynosurus cristatus - *Caltha palustris* grassland • Otter
West Sedgemoor SSSI (part of RSPB reserve)	0.13km (Proposed Scheme is within the SSSI zone of influence)	The SSSI covers 1,016ha and is notified for the following features: • Aggregations of non-breeding birds: Bewick's swan, dunlin, golden plover, lapwing, snipe, teal, whimbrel (*Numenius phaeopus*), wigeon. • Agrostis - *Carex* inland wet grassland • Assemblages of breeding birds - Lowland fen without open water • Invertebrate assemblage • Lowland ditch systems • M22 - *Juncus subnodulosus* - *Cirsium palustre* fen meadow • M23 - *Juncus effusus/acutiflorus* - *Galium palustre* rush pasture • M27 - *Filipendula ulmaria* - *Angelica sylvestris* mire

Site Name	Distance from the Proposed Scheme	Description
		• MG13 - *Agrostis stolonifera* - *Alopecurus geniculatus* grassland • MG5 - *Cynosurus cristatus* - *Centaurea nigra* grassland • MG8 - Cynosurus cristatus - Caltha palustris grassland
Moorlinch SSSI	0.48km (Proposed Scheme is within the SSSI zone of influence)	The SSSI covers 226ha and is notified for the following features: • Aggregations of non-breeding birds: Bewick's swan, golden plover, lapwing, snipe, teal, whimbrel, wigeon. • Agrostis - *Carex* inland wet grassland • Assemblages of breeding birds – Lowland damp grasslands • Invertebrate assemblage • Lowland ditch systems • M22 - *Juncus subnodulosus* - *Cirsium palustre* fen meadow • M23 - *Juncus effusus/acutiflorus* - *Galium palustre* rush pasture • MG13 - *Agrostis stolonifera* - *Alopecurus geniculatus* grassland • MG5 - *Cynosurus cristatus* - *Centaurea nigra* grassland • MG8 - *Cynosurus cristatus* - *Caltha palustris* grassland
Aller Hill SSSI	0.86km (Proposed Scheme is within the SSSI zone of influence)	The SSSI covers 18.4ha and is notified for the following features: • CG2 - *Festuca ovina* - *Avenula pratensis* lowland calcareous grassland • Population of RDB plant - *Gastridium ventricosum*, nit grass • Population of RDB plant - *Lithospermum purpureocaeruleum*, purple gromwell • Population of Schedule 8 plant - *Althaea hirsuta*, rough marsh-mallow

Site Name	Distance from the Proposed Scheme	Description
Wet Moor SSSI	3.89km (scoped in for strategic and project level HRA)	The SSSI covers 491ha and is notified for the following features: • Aggregations of non-breeding birds: Bewick's swan, dunlin, gadwall (*Anas strepera*), golden plover, lapwing, mallard (*Anas platyrhynchos*), pintail (*Anas acuta*), pochard (*Aythya farina*), shoveler (*Anas clypeata*), snipe, teal, tufted duck (*Aythya fuligula*), wigeon. • *Agrostis - Carex* inland wet grassland • Assemblages of breeding birds – Lowland damp grasslands • Invertebrate assemblage • Lowland ditch systems • MG11 - *Festuca rubra - Agrostis stolonifera - Potentilla anserina* grassland • MG13 - *Agrostis stolonifera - Alopecurus geniculatus* grassland • MG8 - *Cynosurus cristatus - Caltha palustris* grassland
West Moor SSSI	4.11km (scoped in for strategic and project level HRA)	The SSSI covers 213ha and is notified for the following features: • Aggregations of non-breeding birds: Bewick's swan, curlew (*Numenius arquata*), dunlin, golden plover, hen harrier (*Circus cyaneus*), lapwing, little grebe (*Tachybaptus ruficollis*), mallard, mute swan (*Cygnus olor*), pintail, pochard, redshank (*Tringa tetanus*), ruff (*Philomachus pugnax*), shoveler, snipe, teal and tufted duck. • Assemblages of breeding birds – Lowland damp grasslands • Invertebrate assemblage • Otter

Site Name	Distance from the Proposed Scheme	Description
Severn Estuary SPA	6.8km (scoped in for strategic and project level HRA)	The SPA covers 24,488ha. The Severn Estuary is one of the largest estuaries in Britain and it has the second largest tidal range in the world. Qualifies under Article 4.1 of the EC Birds Directive by regularly supporting an internationally important wintering population of Bewick's swan, an Annex 1 species. Qualifies under Article 4.2 as a wetland of international importance by regularly supporting in winter over 20,000 waterfowl. Qualifies under Article 4.2 by regularly supporting in winter internationally important numbers of the following 5 species of migratory waterfowl: • European white-fronted goose *Anser albifrons* • Shelduck *Tadorna tadorna* • Gadwall • Dunlin • Redshank
Severn Estuary Ramsar	6.8km (scoped in for strategic and project level HRA)	Qualifies under Ramsar criterion 1, 3, 4, 5, 6 Criterion 1 due to its immense tidal range. Criterion 3 due to its unusual estuarine communities, reduced species diversity and high productivity. Criterion 4, as it is particularly important for the run of migratory fish between the sea and rivers via the estuary. Species using the estuary include salmon *Salmo solar*, sea trout *S. trutta*, sea lamprey *Petromyzon marinus*, river lamprey *Lampetra fluviatilis*, allis shad *Alosa*, twaite shad *A. fallax* and eel *Anguilla anguilla*. It is also important for migratory birds during passage periods in spring and autumn.

Site Name	Distance from the Proposed Scheme	Description
		Criterion 5: Assemblages of international importance: species with peak counts in winter: 70,919 waterfowl. Criterion 6: Species/populations occurring at levels of international importance. Bewick's swan, greater white-fronted goose, common shelduck, gadwall, dunlin, common redshank. Criterion 8: The fish of the whole estuarine and river system is one of the most diverse in Britain with over 110 species recorded.
Non-statutory sites		
Aller Moor LWS	Overlaps	Rhyne and wet meadow site, important wintering bird population.
Lang Moor LWS	Overlaps	Improved grassland with extensive rhyne system
Greylake RSPB Reserve/LWS	Overlaps	Historically arable fields now managed for wetland birds and wildlife
River Parrett, Middle Moor to Scree LWS	Adjacent	River with legally protected species and rare invertebrate species
Langport Moor LWS	0.42km	Semi-improved grassland crossed by a network of species rich rhynes
Pendon Hill LWS	0.44km	A long (1km) stretch of unimproved calcareous grassland and scrub, enclosed and subdivided by tall hedges, on the steep, south-facing slope of this outlier of the Poldens
Badgers Wood LWS	0.52km	Semi-natural broadleaved woodland, coppiced with standards, on a north facing slope
Mill Batch LWS	0.64km	Steep south-facing calcareous to neutral grassland
North Street Moor LWS	0.71km	Semi-improved grassland bisected by species rich rhynes

7.4.3. Habitats

The KSD and Sowy are artificial embanked drainage channels. Marginal vegetation is frequent along both banks of the Sowy and KSD. The botanical diversity of marginal vegetation is relatively high.

The dominant land-use across the study area is grassland used for cattle grazing and haymaking. Field sizes are relatively small and field boundaries are defined by water-filled ditches, most without trees, hedgerows or scrub. Fields were either improved grassland, poor semi-improved grassland or semi-improved neutral grassland.

Marshy grassland was the most botanically diverse habitat recorded during the 2019 Phase 1 Habitat Survey (Appendix F). It was scarce across the study area and contains a variety of water tolerant species. However, none of these fields were particularly botanically diverse, and there were no fields recorded during the survey described as NVC types MG4 *Alopecurus pratensis-Sanguisorba officinalis* or MG5 *Cynosurus cristatus* - *Centaura nigra* grassland.

The 2019 Phase 1 habitat survey (see Appendix F) also recorded the following habitat types within the study area:

- Semi-natural broadleaved woodland (A1.1.1)
- Broadleaved plantation woodland (A1.1.2)
- Dense scrub (A2.1)
- Scattered scrub (A2.2)
- Broadleaved scattered trees (A3.1.1)
- Neutral semi-improved grassland (B2)
- Improved grassland (B4)
- Marshy grassland (B5)
- Poor semi-improved grassland (B6) – present on many flood defence embankments
- Tall ruderals (C3.1) – present on many flood defence embankments
- Marginal vegetation (F2.1) frequent along margins of watercourses and ponds
- Standing water (ponds) and water filled ditches (G1)
- Running water (G2)
- Arable fields, crops and Cultivated/disturbed ground (J1.1)
- Amenity grassland (J1.2)
- Hedgerows intact, species poor (J2.1.2), (includes intact species poor hedge with trees, J2.3.2)
- Buildings (J3.6)
- Hardstanding (no code)

Based on the Phase 1 habitat survey results, and supported by a review of MAGIC Priority Habitat Inventory data (Defra, 2019), the following Section 41 Habitats of

Principal Importance for Biodiversity Conservation in England (NERC Act, 2006) (hereafter referred to a 'S41 Habitats') are considered to be present in the study area:

- Coastal and floodplain grazing marsh – coastal and floodplain grazing marsh is not a specific habitat but a landscape type which supports a variety of habitats; the defining features being hydrological and topographical rather than botanical. Grazing marsh is defined as periodically inundated pasture or meadow, typically with ditches or rills containing standing brackish or fresh water.
- Hedgerows – which are of limited extent in the study area.
- Ponds – four recorded in the study area, two of which are seasonally dry.

The KSD and Sowy are not considered to be S41 Habitats, given they are not natural or near natural running waters and ditches are excluded from the definition of rivers of Principal Importance.

7.4.4. Species

Through a combination of desk study, consultation, survey work (see Table 7.2) and Environment Agency Technical Specialist local knowledge, the following protected and notable species were considered in the establishment of the baseline.

Notable plant species

Three notable plant species were recorded during the Phase 1 habitat survey, as follows:

- Tubular water dropwort (*Oenanthe fistulosa*)
- Frogbit (*Hydrocharis morsus-ranae*)
- Water violet (*Hottonia palustr*is)

Several individuals of tubular water dropwort were recorded in one area of marshy grassland within the study area. Frogbit was a commonly encountered species in many of the field drainage ditches. Water violet was recorded in one field drainage ditch. These species are all classified as 'vulnerable' in the Vascular Plant Red List for England (Stroh et al., 2014).

Fish

All the major watercourses in the Somerset Levels and Moors are important coarse fisheries; regular angling takes place on the KSD, Langacre Rhyne, Sowy and Parrett with roach (*Rutilus rutilus*), bream (*Abramis brama*), pike (*Esox lucius*), tench (*Tinca tinca*), ruffe (*Gymnocephalus cernua*) and eels the dominant species. Rudd, gudgeon, perch and carp are also locally important. Chub (*Squalius cephalus*) and dace (*Leuciscus leuciscus*) are also present though these species may move upstream at certain times of the year.

The Somerset Drainage Boards Consortium (Philip Brewin 07 April 2020 via e-mail) advised that there are fish passes on several of the primary structures in the area and that and the area is characterised by a dense network of highly interconnected watercourses so that, although there are some structures with passage issues, there are often many routes into the system, bypassing barriers. Fish passage issues tend to be a seasonal problem, when weirs are raised or valves shut.

Watercourses within the study area are homogenous in nature, with artificial drainage channels limiting habitat diversity for fish. Currently fish passage is restricted during normal and low flows, due to the operation of the KSD water level management structures. During high flows there is enough volume of water for fish to pass through the KSD. Eels migrate through the KSD and beyond via Dunball.

Aquatic invertebrates

The network of rhynes and ditches in the study area provides suitable habitat for a diverse range of aquatic invertebrates. The Somerset Levels and Moors Ramsar wetland site, which overlaps with the Proposed Scheme, is designated in part because the land's network of rhynes and ditches support an outstanding assemblage of aquatic invertebrates, particularly beetles.

Somerset Ecology Services undertook a sampling survey for the purpose of establishing presence /absence of relevant Ramsar invertebrate species, focussing on aquatic beetles, along the length of the Proposed Scheme (see Appendix F). The results of the survey did not indicate that, in terms of the aquatic beetle fauna, the Sowy makes a vital contribution to the diversity or conservation value of the Somerset Levels and Moors Ramsar site. The survey methodology was not designed so as to maximise the chances of finding scarce and rare terrestrial beetles associated with marginal vegetation, nevertheless there is evidence from the survey to suggest that the tall vegetation growing at the very edge of the Sowy may harbour some species of conservation value, the Red Data Book (RDB) 3 species *Donacia bicolor* being the most significant found.

Great Crested Newts (GCN)

The network of rhynes and ditches within the study area were considered unlikely to support amphibians, due to the likely influx of fish from flood waters and high usage by waterfowl.

Several ponds are present within 500m of the Proposed Scheme meaning GCN could, if using these ponds, be present in terrestrial habitat in the study area. No evidence of GCN was found in surveys conducted in 2015. In 2019 a single pond (Pond 5) (see Figure 1 of 2019 GCN survey report, Appendix F) within 500m of the Proposed Scheme was recorded as positive for GCN. However, this pond is separated from the Sowy by the Parrett and Stathe Road. These features are both considered likely to be a physical barrier to GCN dispersal. As such, GCN from Pond 5 are unlikely to be within the immediate area of the Proposed Scheme along the banks of the Sowy. Nonetheless this result does indicate GCN populations are present within the general area of the Proposed Scheme.

Reptiles

Habitat within the study area is considered suitable to support grass snake (*Natrix natrix*). SERC provided records of grass snake within 1km of the Proposed Scheme but no records of any other reptile species, and incidental records of grass snake have been made during the ecological surveys conducted in 2019. Other reptile species are unlikely to be present in the study area due to the generally unfavourable homogenous habitat structure and regular flooding.

Birds

Excluding those qualifying bird features of designated sites (which are described in Table 7.4), the habitats within the study area are likely to offer foraging habitat for

birds listed on Schedule 1 of the Wildlife and Countryside Act 1981 (as amended), such as barn owl (*Tyto alba*), as well as a range of common species including non-water birds in winter.

Scattered, localised trees and scrub, along with lengths of hedgerow, provide nesting opportunities for common bird species. Lowland wet grassland will also provide suitable habitat for ground nesting birds such as snipe, lapwing and skylark (*Alauda arvensis*) which are also listed as birds of conservation concern (Eaton *et al.* 2015).

Bats

SERC provided records of the following species recorded within 1km of the Proposed Scheme in the last 10 years (none of these were for roosts):

- Brown long-eared bat (*Plecotus auritus*)
- Common pipistrelle (*Pipistrellus pipistrellus*)
- Greater horseshoe (*Rhinolophus ferrumequinum*)
- Noctule (*Nyctalus noctule*)
- Serotine (*Eptesicus serotinus*)

Rhynes and ditches and lowland wet grassland habitats in the study area provide extensive foraging habitat for bats.

The bat roost ground assessments conducted in 2019 (see Appendix F) identified 47 trees with potential to support roosting bats within the study area. Of the structures present within the study area, Monk's Leaze Clyce sluice control room had moderate potential for roosting bats. Two bridges had low potential for roosting bats, and one had moderate potential for roosting bats. Two barn owl boxes installed on poles were identified with low potential for roosting bats. On the western end of the Proposed Scheme there was sheep housing with an area of hay storage; this structure had moderate potential for roosting bats.

Otter

The study area provides suitable habitat for breeding, resting, foraging and commuting otters.

The 2015 otter survey (see Appendix F) recorded frequent otter activity between the Aller Drove Bridge and the confluence of the Sowy and KSD, including the presence of spraints, slides and an otter running across a field from the Langacre Rhyne to the Sowy. Limited activity was observed along the KSD, with the only spraint being observed under a drain bridge of the M5 outside the current study area. No evidence of holts or layups were recorded, but there were areas of potentially suitable habitat that could support these features within the study area.

Incidental records of otter activity were recorded on both the KSD and Sowy during the 2019 water vole survey but there was no evidence of any otter holts.

Water vole

During surveys in 2015 (Capita, 2015a), signs of water vole were recorded in four of 23 survey segments suggesting that animals were present within the survey area but in low numbers and in limited locations. There were no latrines recorded during the 2015 surveys and as such the population density could not be estimated.

Surveys in 2019 (see Appendix F) indicate that water voles are present along more extensive stretches of the Proposed Scheme than was the case in 2015. During the first survey conducted in 2019 between June and July, signs of water vole were recorded in 14 out of 20 survey segments in low to medium population densities (based on Dean *et al.* 2016). A second survey conducted between September and October 2019 recorded signs of water vole in 17 of the 20 segments in low to medium population densities. Latrines were more frequently encountered during the first survey however other signs of water vole presence were recorded at a similar level during both surveys.

Badger

The study area was found to support suitable habitat for badgers, with the network of hedgerows and scrub providing cover and permanent grassland for foraging.

The 2015 badger survey (Capita, 2015b) recorded 17 setts, of which eight were within 30m of the Sowy/KSD. The survey identified a total of five main setts (three of which were within 30m of the Sowy/KSD) and ten outlier setts (five of which were within 30m of the Sowy/KSD). This activity was found to be focussed around three main areas of badger activity.

Surveys conducted in February 2020 recorded badger activity across much of the Proposed Scheme (see Appendix F – confidential). Nine setts were recorded within 50m of the Sowy/KSD. Five of these were main setts, one was a subsidiary sett and three were outlier setts (see Table 7.5).

Table 7. 5. Badger setts recorded in February 2020

Sett no.	Classification	Description
1	Outlier	Two partially active, currently flooded, holes. This outlier sett was flooded at the time of survey but showed signs of recent excavation and therefore was considered to be partially active.
2	Main	A partially active main sett containing 19 flooded holes. This sett was largely flooded at the time of survey but showed signs of recent excavation.
3	Main	Main sett containing 10 holes. 8 appear well used with fresh bedding material.
4	Main	Main sett containing 3 well used holes, fresh spoil heap, large entrances and fresh bedding.
5	Main	Main sett under mature willow, well used containing 30 holes.
6	Outlier	Two well defined mammal tracks running toward 2 partially active sett entrances and fresh dung pits.
7	Main	Active main sett containing 15 holes. Lots of fresh bedding and dung pits.

Sett no.	Classification	Description
8	Outlier	Partially used. Recently collapsed/flooded badger sett of approximately 4 holes. One hole intact but appeared inactive at time of survey.
9	Subsidiary	Active sett containing 3 holes and fresh spoil and bedding material.

Non-native, invasive plant species

The following non-native, invasive plant species, listed on Schedule 9 of the Wildlife and Countryside Act 1981 (as amended), were recorded during the Phase 1 habitat survey:

- Giant Hogweed (*Heracleum mantegazzianum*) was recorded on the Sowy River at Beer Wall.
- Water fern (*Azolla filiculoides*) was recorded on a ditch in a field adjacent to the KSD near Westonzoyland.
- Himalayan Balsam (*Impatiens glandulifera*) was recorded in the study area on the Parrett.
- Canadian pond weed (*Elodea canadensis*) was recorded in an agricultural drainage ditch.
- Nuttall's waterweed (*Elodea nuttallii*) was recorded at two locations in the Sowy.

Further information on non-native, invasive plant species was also provided by the Somerset Drainage Board Consortium (Philip Brewin 07 April 2020 via e-mail) stating that parrots feather (*Myriophyllum aquaticum*) is widespread on Aller moor and known to be present in the Langacre Rhyne. The extent of Parrots feather is increasing as no control measures have been implemented. Also, water lettuce (*Pistia stratiotes*) and water hyacinth (*Eichhornia crassipes*) have been found on the KSD in recent years, but these are not thought to be currently present in the study area. There are also records of floating pennywort (*Hydrocotyle ranunculoides*) in drainage systems connected to the Sowy corridor and there is therefore a significant likelihood that floating pennywort may already be in, or close to the Sowy, or may become present during the implementation period of the scheme.

7.4.5. Summary of importance (sensitivity) of ecological features identified in the baseline

Based on the existing baseline, ecological features have been assigned a level of importance (sensitivity) (see Table 7.6 below) using the approach outlined in section 7.3.

Table 7.6 Importance (sensitivity) of ecological features present within the study area

Ecological feature	Sensitivity (Importance)	Justification
Somerset Levels and Moors SPA / Ramsar Severn Estuary SPA/Ramsar	High (European)	Sites designated as part of a network of internationally important nature conservation sites. The SPA/Ramsar site is taken forward into the assessment of likely significant effects.
Somerset Levels NNR	Medium (National)	Site designated as an NNR as part of a network of nationally important nature conservation sites. The site is split across a number of locations and overlapping SSSIs include Moorlinch, King's Sedgemoor and Southlake SSSIs. The NNR is taken forward into the assessment of likely significant effects.
King's Sedgemoor SSSI/Southlake Moor SSSI/Moorlinch SSSI/West Sedgemoor SSSI/Aller Hill SSSI/Wet Moor SSSI/West Moor SSSI	Medium (National)	Sites designated as a SSSI as part of a network of nationally important nature conservation sites. SSSIs are taken forward into the assessment of likely significant effects.
Aller Moor LWS, Lang Moor LWS, River Parrett, Middle Moor to Scree LWS, Greylake RSPB Reserve LWS, Langport Moor LWS, Pendon Hill LWS, Badgers Wood LWS, Mill Batch LWS, North Street Moor LWS	Low (County)	The LWS classification provides a means of identifying and safeguarding some of the county's best sites for wildlife. The intention is to complement the network of internationally and nationally designated sites, helping to ensure the survival of important areas for wildlife. LWSs are taken forward into the assessment of likely significant effects.
Coastal flood plain grazing marsh	Low (Regional)	Collectively the terrestrial habitats within the study area form part of the S41 Habitat, coastal flood plain grazing marsh. S41 Habitats are considered the most important habitats for wildlife and a focus for conservation

Ecological feature	Sensitivity (Importance)	Justification
		action in England. Given the extent of this habitat within the study area it is considered to be of Regional value. Coastal flood plain grazing marsh is taken forward into the assessment of likely significant effects.
Hedgerows	Negligible (Site)	Hedgerows are a S41 Habitat. However, within the study area they are species poor and limited in extent and are therefore considered to be of site importance only. Hedgerows are not taken forward into the assessment of likely significant effects.
Ponds	Negligible (Local)	Four ponds were recorded within the study area. Ponds are a S41 Habitat. Ponds are considered to be important at the local level. Ponds are not taken forward into the assessment of likely significant effects.
All other individual habitats (see habitat list section 7.4.3)	Negligible (Local or Site)	Individually all other habitats recorded during the Phase 1 habitat survey, with the exception of those detailed above, are considered to be of local or site value. These habitats are not considered to be notable for their botanical diversity and are either common and widespread within the wider area and/or limited in extent within the study area. Habitats in this category are not taken forward into the assessment of likely significant effects.
Notable plant species	Low (County)	Tubular water dropwort, frogbit and water violet were all recorded in the study area. These species are all classified as 'vulnerable' in the Vascular Plant Red List for England (Stroh et al., 2014). Notable plant species are taken forward into the assessment of likely significant effects.
Fish (excluding eels)	Negligible (Site)	Watercourses within the study area are homogenous in nature, with artificial drainage channels having limited habitat diversity for fish. Fish (excluding eels) are not taken forward into the assessment of likely significant effects.

Ecological feature	Sensitivity (Importance)	Justification
Eel (Anguilla anguilla)	Low (Regional)	Eels are present in the watercourses in the study area. The European eel is a critically endangered species listed on the IUCN Red List (IUCN 2020-1), a S41 Species and is protected under the Eels (England and Wales) Regulations 2009. Eels are taken forward into the assessment of likely significant effects.
Aquatic invertebrates	Low (County)	There is evidence to suggest that the tall vegetation growing at the very edge of the Sowy may harbour some species of conservation value, the Red Data Book (RDB) 3 species *Donacia bicolor* being the most significant found. Aquatic invertebrates are taken forward into the assessment of likely significant effects.
GCN	Negligible (Site)	The GCN is protected under Schedule 2 of the Conservation of Habitats and Species Regulations 2017 and under Schedule 5 of the Wildlife and Countryside Act 1981 (as amended). GCN is also listed as a S41 Species. The species is not uncommon, either in Somerset or the unitary authorities, although their distribution is localised and patchy and they are absent from large swathes of the county (Reptile and Amphibian Group for Somerset, 2020). No evidence of GCN was found in surveys conducted in 2015. A single pond within 500m of the Proposed Scheme was recorded as positive for GCN in 2019. This pond is separated from the Sowy by the Parrett and Stathe Road. The study area is considered to be of no more than site level importance for GCN however, as there is the low risk that GCN could be present in terrestrial habitat in the study area, and therefore that there could be a breach of the legislation, this species is taken forward into the assessment of likely significant effects.
Grass snake	Negligible (Local)	All reptiles are listed on Schedule 5 of the Wildlife and Countryside Act 1981 (as amended) and as S41 Species.

Ecological feature	Sensitivity (Importance)	Justification
		Habitat within the study area is considered suitable to support to support grass snake. And incidental records of grass snake were recorded within the study area during the 2019 ecology field surveys. Grass snakes are widespread in Somerset and the unitary authorities, particularly concentrated wherever there is fresh water. They are common throughout the levels and moors and the population in the study area are considered to be of local importance (Reptile and Amphibian Group for Somerset, 2020). Due the legislation relating to the killing and injury of grass snake, this species is taken forward into the assessment of likely significant effects.
Birds (excluding qualifying features of designated sites)	Low (County)	Beyond statutory designated sites, the habitats within the study area are likely to provide foraging habitat for Wildlife and Countryside Act 1981 (as amended) Schedule 1 birds, such as barn owl, as well as a range of common species. Scattered, localised trees and scrub, along with short lengths of hedgerow, provide nesting opportunities for common bird species. Lowland wet grassland will also provide suitable habitat for ground nesting birds such as snipe (an amber listed bird of conservation concern), lapwing and skylark (both Red Listed birds of conservation concern) (Eaton et al. 2015). Birds are taken forward into the assessment of likely significant effects.
Bat assemblage	Low (County)	All UK bat species are protected under Schedule 2 of the Conservation of Habitats and Species Regulations 2017 and under Schedule 5 of the Wildlife and Countryside Act 1981 (as amended). A number of bat species are also listed as a S41 Species. Rhynes and ditches and lowland wet grassland habitats in the study area provide extensive foraging habitat for bats. Trees and structures within the study area provide potential roost features.

Ecological feature	Sensitivity (Importance)	Justification
		Bats are taken forward into the assessment of likely significant effects.
Otter	Negligible (Local)	Otter is protected under Schedule 2 of the Conservation of Habitats and Species Regulations 2017 and under Schedule 5 of the Wildlife and Countryside Act 1981 (as amended). Otter is also listed as a S41 Species. Records of otter activity were recorded on both the KSD and Sowy however no evidence of holts or lay-ups were recorded. The watercourses present within the study area are likely to provide important commuting and foraging opportunities for otter. Due the legislation relating to otter, this species is taken forward into the assessment of likely significant effects.
Water vole	Low (County)	Water vole is listed on Schedule 5 of the Wildlife and Countryside Act 1981 (as amended) and as a S41 Species. In England and Wales the water vole has suffered an overall decline estimated at 30% between 2006 and 2015 (McGuire and Whitfield, 2017). Water vole were recorded at a low-medium population along the length of the Proposed Scheme. Water vole is taken forward into the assessment of likely significant effects.
Badger	Negligible (Local)	Badgers receive legal protection under the Protection of Badgers Act 1992. Badger are common and widely distributed throughout Somerset and within the study area. 2019 surveys recorded nine setts within 50m of the Sowy/KSD. Five of these were main setts. Whilst badgers are common and widespread, due to the potential for breach of the legislation, this species is taken forward into the assessment of likely significant effects.

7.5. Likely significant effects

7.5.1. Construction

The assessment of construction impacts assumes that construction of the Proposed Scheme will commence in September 2020, taking approximately eight weeks for the completion of earthworks activities. Reseeding and planting of the WFD enhancement features (embayments, two-stage channels and backwaters) will also take place during this period, with riparian tree planting taking place in early November (pending agreement with NE).

Statutory designated sites for nature conservation

There are a number of statutory designated sites for nature conservation in the study area (see Table 7.4 and Figure 7.1 (Appendix A)).

European designated sites

In accordance with the Habitats and Species Regulations 2017, a project level HRA has been carried out to assess the implications of the Proposed Scheme on European designated sites and further information on European sites, and those features for which potentially significant effects are likely/have been ruled out, is provided in Appendix D. Those sites and features for which potential significant effects are considered include:

- Somerset Levels and Moors SPA – non-breeding bird qualifying features
- Somerset Levels and Moors Ramsar – non-breeding bird qualifying features only
- Severn Estuary SPA - non-breeding bird qualifying features only
- Severn Estuary Ramsar - non-breeding bird qualifying features and eels only

<u>Non-breeding bird qualifying features</u>

The Proposed Scheme lies directly within the Somerset Levels and Moors SPA/Ramsar at two locations within the King's Sedgemoor Drain SSSI and Southlake Moors SSSI components (see Figure 7.1, Appendix A). Habitats within the study area, outside of the Somerset Levels and Moors SPA/Ramsar, will also provide functional habitat for the qualifying winter bird features of the SPA/Ramsar site. Potential pathways to effects were also considered for the Severn Estuary SPA/Ramsar site due to potential effects on non-breeding bird features that utilise both the estuary and the Somerset Levels and Moors depending on prevailing weather, tidal and other conditions, where is it assumed likely interchange of birds will be with the Bridgewater Bay SSSI component.

Non-breeding bird qualifying features could be impacted by loss of habitat in the study area, which is either directly within the designated sites or functionally linked, and by disturbance effects.

The only habitats being lost to birds during construction are loss of open water habitat and existing marginal plants along the lengths of the WFD enhancement locations (totalling c.0.9km of bank), and the loss of a strip of grassland for material winning, bank raising and landscaping of material won from the WFD enhancement features on the landwards side of the re-profiled flood embankments along an extent

of c. 21km. This 21km takes into account both sides of the main channel, and consists of predominantly poor semi-improved grassland, where material will be won from existing flood banks on the left and right bank sides of the KSD and where the existing informal flood embankments will be raised on the right and left bank sides of the Lower Sowy and right bank only of the Upper Sowy. Some additional small areas of scrub and hedge may also be lost where fencing is removed for access on the left bank of the Sowy/KSD. These losses will be largely temporary, short-term and limited in extent along the corridor of the Proposed Scheme. Loss of open water habitat will only be for the period of construction and marginal vegetation and grassland will re-establish in the short-medium terms. There is significant alternative habitat available in the surrounding area and it is unlikely that this limited habitat loss will undermine site conservation objectives for non-breeding birds either in the Somerset Levels and Moors SPA/Ramsar or Severn Estuary SPA/Ramsar.

In addition to the impact of direct habitat loss, the presence of construction plant, vehicles and operatives could result in disturbance and displacement of birds. However, construction works are proposed to take place between September and October/very early November (pending agreement with NE) thus avoiding the most sensitive times for wintering birds. Given that the works will be programmed outside of the winter period when the largest numbers of non-breeding birds are present and also when temperatures are at their lowest (making birds more vulnerable to the effects of disturbance), the risk of there being a significant effect is low. There is the potential for disturbance during autumn months when numbers of some species will be beginning to build. However, the localised nature of the works, with a relatively small zone of influence (maximum of 300m for noise and visual disturbance) and with a degree of habituation once works are underway, means that there is unlikely to be any impacts that will undermine site conservation objectives for non-breeding birds either in the Somerset Levels and Moors SPA/Ramsar or Severn Estuary SPA/Ramsar.

The magnitude of effects on the non-breeding bird qualifying features of the Somerset Levels and Moors SPA/Ramsar or Severn Estuary SPA/Ramsar (High / European sensitivity) is considered to be negligible adverse and the significance of effect, minor. Mitigation measures to further reduce the magnitude of effect are outlined in section 7.7 and Table 7.9

Eels

For the Severn Estuary Ramsar site, potential effects are also considered for eels which migrate through the KSD and beyond via Dunball.

In-channel activities could kill or injure eels as well as adversely affect water quality. Given the limited nature of the in-channel works at the seven WFD enhancement features locations and sluice upgrades, the likelihood of killing/injuring ells is considered low and is unlikely to significantly reduce population levels. Any impacts on water quality will be temporary and reversible and will not compromise the habitat used by eels or reduce population levels.

The magnitude of effects on the eel qualifying feature of the Severn Estuary Ramsar (Low / Regional sensitivity) is considered to be negligible adverse and the significance of effect, negligible. Mitigation measures to further reduce the magnitude of effect are outlined in section 7.7 and Table 7.9.

Somerset Levels NNR

The NNR is split over several sites including components in the Moorlinch, King's Sedgemoor and Southlake SSSIs. There will be no habitat loss within the NNR as a result of the Proposed Scheme and no impacts on this designation exist during construction.

Sites of Special Scientific Interest

Of the seven SSSIs identified within the study area, no impacts are assessed for Aller Hill SSSI. This site is 0.86km north-east of the Proposed Scheme and is designated for habitats and plant species which will not be impacted by the Proposed Scheme.

Of the remaining six sites, King's Sedgemoor Drain SSSI, Southlake SSSI, Moorlinch SSSI, West Sedgemoor SSSI, Wet Moor SSSI and West Moor SSSI, potential significant effects were identified at the scoping stage in respect of habitat loss and impacts to breeding and non-breeding qualifying bird features and are discussed below.

Direct habitat loss within SSSIs

The Proposed Scheme passes directly through the King's Sedgemoor Drain SSSI on both bank sides of the Lower Sowy, and through the Southlake Moors SSSI on the left bank side only on the Upper Sowy (see Figure 7.1, Appendix A). Habitat from within a SSSI will be directly lost within the King's Sedgemoor Drain SSSI, but no works are proposed on the left bank of the Upper Sowy thus there will be no direct loss of habitat in the Southlake Moors SSSI.

The King's Sedgemoor Drain SSSI is cited for its neutral grassland habitats which include; M22 - *Juncus subnodulosus - Cirsium palustre* fen meadow, MG13 - *Agrostis stolonifera - Alopecurus geniculatus* grassland, MG5 - *Cynosurus cristatus - Centaurea nigra* grassland and MG8 - *Cynosurus cristatus - Caltha palustris* grassland, and for its standing water (lowland ditch systems).

The only habitats that will be lost in the Kings Sedgemoor Drain SSSI during construction are open water habitat and existing marginal plants along the lengths of the five WFD enhancement locations within the SSSI; and the loss of grassland, predominantly poor semi-improved grassland, where flood banks will be raised on the right and left bank sides of the Lower Sowy. None of the habitats recorded in the Phase 1 habitat survey were considered to match those habitats listed on the SSSI citation and the grassland habitat lost will be predominantly poor semi-improved grassland. Some additional small areas of scrub and hedge may also be lost where fencing is removed for access on the left bank of the Sowy/KSD. These losses are largely temporary, short-term and limited in extent along the corridor of the Proposed Scheme. Loss of open water habitat will only be for the period of construction and marginal vegetation and grassland will re-establish in the short-medium term.

The magnitude of effects of habitat loss on the King's Sedgemoor SSSI (medium / national sensitivity) is considered to be negligible adverse and the significance of effect, minor. Mitigation measures to further reduce the magnitude of effect are outlined in section 7.7 and Table 7.9.

Impacts to breeding and non-breeding qualifying bird features

King's Sedgemoor Drain SSSI, Southlake SSSI, Moorlinch SSSI, West Sedgemoor SSSI, Wet Moor SSSI and West Moor SSSI are all designated for non-breeding birds and all except Southlake Moors SSSI are also designated for breeding bird features. These features could be impacted by loss of habitat in functionally linked habitats within the study area, and for habitat loss within the SSSI at Kings Sedgemoor Drain SSSI, as well as via disturbance of birds in SSSIs (Kings Sedgemoor Drain SSSI, Southlake Moors SSSI) and functionally linked habitat.

The only habitats being lost to birds during construction are loss of open water habitat and existing marginal plants along the lengths of the WFD enhancement locations (totalling c.0.9km of bank), and the loss of a strip of grassland for material winning bank raising along an extent of c. 21km. This 21km takes into account both sides of the main channel, and consists of predominantly poor semi-improved grassland, where material will be won from existing flood banks on the left and right bank sides of the KSD and where flood banks will be raised on the right and left bank sides of the Lower Sowy and right bank only of the Upper Sowy. Some additional small areas of scrub and hedge may also be lost where fencing is removed for access on the left bank of the Sowy/KSD. These losses will be largely temporary, short-term and limited in extent along the corridor of the Proposed Scheme. Loss of open water habitat will only be for the period of construction and marginal vegetation and grassland will re-establish in the short-medium term. There is significant alternative habitat available in the surrounding area and it unlikely that this limited habitat loss will undermine site conservation objectives for breeding or non-breeding birds in any of the SSSIs considered.

In addition to the impact of direct habitat loss, the presence of construction plant, vehicles and operatives could result in disturbance and displacement of birds. However, construction works are proposed to take place between early September and October/November thus avoiding the most sensitive times for wintering and breeding birds and meaning the risk of there being a significant effect is low. There is the potential for disturbance during autumn months when numbers of some species will be beginning to build. However, the localised nature of the works, with a relatively small zone of influence (maximum of 300m) and with a degree of habituation once works are underway, means that there is unlikely to be any impacts that will undermine site conservation objectives for breeding non-breeding birds for any of the SSSIs considered.

The magnitude of effects on breeding and non-breeding qualifying bird features of SSSIs (medium / national sensitivity) is considered to be negligible adverse and the significance of effect, minor adverse. Mitigation measures to further reduce the magnitude of effect are outlined in section 7.7 and Table 7.9.

Non-statutory designated sites for nature conservation

Nine LWS were identified in the study area. Of these, three overlap with the Proposed Scheme, these are Aller Moor LWS, Long Moor LWS and Greylake LWS (see Figure 7.1, Appendix A) and these three sites are considered below. For those six that do not overlap with the Proposed Scheme, no impacts are considered likely. The River Parrett LWS runs adjacent to the Upper Sowy section of the Proposed Scheme on the left bank but no works are proposed on the left bank here and there will be no impacts on the LWS. The Langport, Pendon Hills, Badgers Wood, Mill

Batch and North Street LWSs are all >0.4km from the Proposed Scheme and cite habitats as their reason for designation. There will be no impacts on these sites.

Aller Moor LWS overlaps with the Proposed Scheme on the right bank of the Upper Sowy. This site is designated as a 'rhyne and wet meadow site, important wintering bird population'. In this location there are no WFD enhancement locations and only limited bank raising is proposed. As discussed for statutory designated sites, habitat loss will be limited and temporary, short-medium term, and disturbance to will avoid the most sensitive times for wintering birds and be localised, with a relatively small zone of influence (maximum of 300m) and with a degree of habituation once works are underway. The magnitude of impact on Aller Moor LWS is considered to be negligible adverse and the significance of effect, minor adverse. Mitigation is outlined in section 7.7 and Table 7.9 to further reduce the magnitude of this effect.

Greylake LWS overlaps the Proposed Scheme on the right bank of the KSD at the confluence with the Sowy and is a site managed for wetland birds. In this location there is a WFD enhancement feature location and proposed bank raising works which will include the loss of three trees. Habitat loss will be limited and temporary, short-medium term with the exception of tree loss. Disturbance will avoid the most sensitive times for breeding and wintering birds and be localised, with a relatively small zone of influence (maximum of 300m) and with a degree of habituation once works are underway. The magnitude of impact on Greylake LWS (low / county sensitivity) is considered to be negligible adverse and the significance of effect, minor adverse. Mitigation is outlined in section 7.7 and Table 7.9 to further reduce the magnitude of this effect.

Longmoor LWS overlaps the Proposed Scheme on the left bank of the KSD. The site is designated for 'improved grassland with extensive rhyne system'. In this location there are no WFD enhancement locations and habitat loss will be limited to locations where material will be won from existing informal flood embankments and where bank raising is proposed. Some additional small areas of scrub and hedge may also be lost where fencing is removed for access on the left bank of the Sowy/KSD. Habitat loss will largely be limited to poor-semi-improved and semi-improved neutral grassland, will be temporary, short-medium term. The magnitude of impact on Longmoor LWS (low / county sensitivity) is considered to be negligible adverse and the significance of effect, minor adverse. Mitigation is outlined in section 7.7 and Table 7.9 to further reduce the magnitude of this effect.

Coastal and flood plain grazing marsh

Grazing marsh is defined as periodically inundated pasture, or meadow with ditches which maintain the water levels. The habitats being lost during construction are loss of open water habitat and existing marginal plants along the lengths of the WFD enhancement locations (totalling c.0.9 km of bank), and the loss of a strip of grassland for material winning and bank raising along an extent of c. 21km. This 21km consists of predominantly poor semi-improved grassland, where material will be won from existing flood banks on the left and right bank sides of the KSD and where flood banks will be raised on the right and left bank sides of the Lower Sowy and right bank only of the Upper Sowy. Some additional small areas of scrub and hedge may also be lost where fencing is removed for access on the left bank of the Sowy/KSD. These losses are considered to be largely temporary, short-term as, even the absence of mitigation, vegetation will be expected re-establish.

Given the extent of this landscape type within the study area and the limited and temporary nature of the impacts, the magnitude of impact on flood plain grazing marsh (low / regional) is considered to be negligible adverse and the significance of effect, minor adverse. Mitigation is outlined in section 7.7 and Table 7.9 to further reduce the magnitude of this effect.

Notable plant species

Three notable plant species classified as 'vulnerable' in the Vascular Plant Red List for England (Stroh et al. 2014) were recorded in the study area.

Several individuals of tubular water dropwort were recorded in one area of marshy grassland within the study area. This location is adjacent to bank raising works on the KSD right bank. The bank raising works will be in poor-semi-improved and ruderal habitat and are not within the marshy grassland habitat. However, incidental damage to the marshy grassland habitat in which the tubular water dropwort was recorded is possible as a consequence of vehicle and machinery access although any damage, should it occur, will be temporary and limited in extent. Given the limited nature of the potential impacts the magnitude of effects on tubular water dropwort (low / county sensitivity) is considered to be negligible adverse, and the significance of effect, minor adverse. Mitigation is outlined in Table 7.9 to further reduce the magnitude of this effect.

Frogbit was found to be most abundant in the study area in side draining ditches where it was often abundant occurring across their width and these ditches are one of its strongholds nationally (Online Atlas of the British and Irish Fauna, None Dated). In the Sowy/KSD itself, it was much less abundant (occasional to rare) and occurred only at the margins of these larger channels. This will be due to the ditches having much less water movement than the main channel. Strengthening works to two existing culvert crossings and WFD enhancement features on the main channel will impact frogbit potentially via direct loss and indirectly thought changes in water quality. Given the limited nature of the in-channel works at the culvert crossings and seven WFD enhancement feature locations, the magnitude of effect on frogbit (low / county sensitivity) is considered to be negligible adverse, given its prevalence at this locality, and the significance of effect, minor adverse. Mitigation is outlined in Table 7.9 to further reduce the magnitude of this effect.

Water violet was recorded in one field drainage ditch away from the main Sowy and KSD channels. This location will not be impacted by the Proposed Scheme and no pathways to effects on water violet are considered to exist.

Aquatic invertebrates

During works at culvert crossings and the creation of the WFD enhancement features there is the potential for the direct loss/death of individual aquatic invertebrates due to the removal of silt and marginal and aquatic plants and potential pollution incidents. There is also the potential for sediment remobilisation during works with potential for smothering downstream channel bed features. Construction impacts will be localised. The loss of individuals will likely be a temporary, short-term effect on aquatic invertebrate populations and impacts on water quality will be temporary during construction only. The magnitude of impact on aquatic invertebrates (low / county sensitivity) is considered to be negligible adverse and the significance of effect, minor. Mitigation is outlined in section 7.7 and Table 7.9 to further reduce the magnitude of this effect.

Eels

In-channel activities could kill or injure eels as well as adversely affect water quality. Given the limited nature of the in-channel works at the seven WFD enhancement locations and two sluices, the likelihood of killing/injuring eels is considered low and is unlikely to significantly reduce population levels. Any effects on water quality will be temporary and reversible and will not compromise the habitat used by eels or reduce population levels.

The magnitude of effects on eels (low / regional sensitivity) is considered to be negligible adverse and the significance of effect, minor. Mitigation measures to further reduce the magnitude of effect are outlined in section 7.7 and Table 7.9.

GCN

The majority of the construction works will be undertaken during September and October when GCN are increasingly moving into terrestrial habitats as opposed to being in ponds. During both the raising and re-profiling of existing flood embankments and channel widening, GCN could be killed or injured, as a result of conflict with machinery during access and earthworks albeit the risk is considered low based on the baseline data.
No ponds are being impacted by the Proposed Scheme and the potential for death or injury to a small number of animals only exists in the short-term during construction and is not considered likely to have a significant effect on their conservation status in this area. The magnitude of impact is therefore considered to be negligible adverse and the significance of effect, negligible. However, death or injury to individual animals will constitute an offense under the legislation and mitigation is therefore proposed (see Table 7.9).

Grass snake

During both the raising of existing flood embankments and channel widening, grass snakes could be killed or injured as a result of conflict with machinery during access and earthworks.

Construction works will be undertaken between September and October when reptiles are active and thus more likely to escape harm.

Grass snakes are widespread in Somerset and the unitary authorities and are common throughout the levels and moors. The potential death or injury to a small number of animals only exists in the short-term during construction and is not considered likely to have a significant effect on their conservation status in this area. The magnitude of impact on grass snake (negligible / local sensitivity) is therefore considered to be low adverse and the significance of effect not significant. However, death or injury to individual animals will constitute an offense under the legislation and mitigation is therefore proposed (see Table 7.9).

Birds

For birds excluding those which form part of the qualifying features of designated sites, potential effects were identified via loss or damage to active nests and disturbance.
There is potential for breeding birds to be killed and active nests damaged or destroyed during the vegetation removal process, particularly for ground nesting birds. Works are programmed to start in September and thus avoid the majority of

the main breeding bird season (March-August) however works in September could impact on nests.

The presence of construction plant, vehicles and operatives could result in disturbance and displacement of birds. However, construction works are proposed to take place between September and October thus avoiding the most sensitive times for wintering and breeding birds and meaning the risk of there being a significant effect is low. The localised nature of the works, with a relatively small zone of influence (maximum of 300m) and with a degree of habituation once works are underway, means that there are unlikely to be any impacts that will undermine conservation status for breeding or non-breeding birds.
The magnitude of impacts on birds (low / county sensitivity) is considered to be negligible adverse and the significance of effect, minor adverse. Damage and destruction of nests will constitute an offense under the legislation and mitigation is therefore proposed (see Table 7.9).

Bats
Given the nature of the proposed works, no impacts are considered likely for commuting and foraging bats as there will be no significant impacts on habitat connectivity and habitat loss is limited and largely temporary.

A limited number of trees with bat roost potential, estimated at thirteen of the 47 identified, are proposed for removal. However, subject to the appropriate survey effort, should any of these trees prove to be bat roosts, they will not be removed.

The magnitude of impacts on bats (low / county sensitivity) is considered to be negligible adverse and the significance of effect, minor adverse as a result of the loss of a small number of trees with bat roost potential and mitigation is proposed to ensure no breach of the legislation (see Table 7.9).

Otter

Otter activity was recorded along the Proposed Scheme and although no holts and/or resting places have been recorded, suitable habitat exists.

During channel widening, impacts on otter could include direct loss/injury or disturbance of individuals and loss of holts or resting places. During both channel widening and raising of existing informal flood embankments, otters could be also be directly and indirectly impacted by changes in water quality as a result of sedimentation and pollution incidents.

Given the lack of any recorded holts or resting places, the direct loss/injury of individuals and loss of holts is considered very unlikely. However, as any loss/injury or disturbance to individuals or loss/damage to holts will constitute a breach of the legislation, pre-construction surveys are recommended to ensure baseline data is up-to-date prior to construction commencing, see Table 7.9.

Changes in water quality as a result of sedimentation and pollution incidents could impact otters directly or indirectly through impacts on its prey species. Severe pollution incidents could result in the death of individuals however, due to the nature of the proposals, the likelihood of such a severe incident is low. Changes in water quality as a result of sedimentation and pollution incidents could affect the availability of prey species. However, given the limited nature of the works, the temporary nature of construction impacts and the large home ranges of animals, the magnitude of any impact on otter (negligible / local sensitivity) is considered likely to be

negligible adverse in terms of the local population and the significance of effect, negligible.

Water vole

A low water vole population size was estimated within the majority of the Proposed Scheme. During channel widening, impacts on water vole could include direct loss/injury of individuals and loss of burrows/habitat. During channel widening, raising of existing flood banks, sluice and culvert works, water voles could be impacted by changes in water quality as a result of pollution incidents.

Direct killing and injury to water voles and a temporary loss of habitat/burrows could have an effect on the conservation status of the local water vole population. Low population sizes can be particularly vulnerable to habitat loss, predation and disturbance. Displacement of animals, potentially into other water vole territories, could reduce survival rates due to territorial behaviour and increased predation. This combined with direct deaths and injury to animals during construction could, in-combination with other pressures on water vole populations such as mink predation, increase the chance of local extinctions in a species which has suffered a significant decline in England and Wales.
Bank raising works have been designed to have a minimum 5m standoff from the main Sowy and KSD channels, where possible, and therefore should not impact upon water voles directly. The length of the seven WFD enhancement locations in total is c. 0.9km. Therefore, c. 0.9 km of habitat with a low water vole population will be temporarily lost during construction. This habitat could support between 10-48 female water vole territories given that the length of female territories typically varies between 30-150m (Strachan *et al*. 2011). To reduce the impacts on water vole, embedded mitigation includes placing WFD enhancement areas in areas currently identified as sub-optimal habitat, for water vole and avoiding the one area of the Proposed Scheme identified as having a medium sized population. These locations are likely to support relatively fewer water voles than optimal habitat areas and have a greater potential for enhancement. All the WFD enhancement areas are on the right bank of the KSD and Lower Sowy and are separated by a minimum of c.100m and generally 300m, thus allowing plenty of alternative suitable habitat for any water voles temporarily displaced by construction.

Changes in water quality as a result of pollution incidents during the construction period could also directly impact upon the conservation status of the location water vole population.

In the absence of mitigation, effects on water vole could be permanent, if the death of animals leads to local extinctions, and temporary, short-term in respect of the loss of burrows, as bank habitat will be available again following construction and establishment of vegetation, and potential water quality impacts. The magnitude of impact on water vole (low / county sensitivity) is considered to be high adverse in terms of the local population and the significance of effect, moderate. Any direct loss/injury of individuals and loss of burrows constitute an offense under the legislation and mitigation is therefore proposed (see section 7.7 and Table 7.9).

Badger

During both the raising of existing flood embankments and channel widening, there is a risk of direct death or injury to individual badgers, destruction or damage/obstruction of setts and disturbance to badger in setts.

Direct death or injury could occur as a result of badgers colliding with construction machinery, however the likelihood of this impact is considered low due to the relatively slow speeds vehicles will be travelling and the absence of night working, which means construction activity will not be occurring when badgers are most active. Death or injury could also occur if badgers fall into uncovered excavations and become trapped, or if badgers are killed, injured or trapped in destroyed/damaged or obstructed setts during construction activities.

Bank raising works over or in close proximity to i.e. within 30m, of a sett could cause damage to, destroy or cause obstruction of access to a badger sett. Damage or destruction of a sett could occur as a result of machinery causing sett tunnels to collapse. Obstruction of a sett entrance could occur where material used in bank raising works blocks a sett entrance or where a sett entrance is collapsed as a result the pressure from machinery. Noise and activity created by bank raising works could also potentially disturb a badger occupying a sett.

Construction access also poses a risk to badgers and their setts. Key construction access risks are considered likely to relate to those setts on the right bank of the KSD between the KSD and left bank of the KSD Back Ditch. Vehicle access, including excavators, will require tracking back and forth within 30m (and in some cases the distance is likely to be <10m) of badger setts whilst accessing bank raising and WFD enhancement locations from Parchey Bridge. These setts include main setts 3, 2 and 7 (noting that sett 2 was only in partial use at the time of survey) and outlier sett 1. The plant used will need to pass these setts on multiple occasions to get to the WFD enhancement areas on the right bank of the KSD as well as proposed bank raising locations. Table 7.7 summarises anticipated numbers of vehicle passes at main setts 3 and 7.

Table 7.7 Vehicle movement over badger setts on right bank KSD

Sett no.	Number of Journeys			
	8-ton dumper loads	Bulldozer	4x4	13-ton excavator
3	344	4	250	4
7	120	2	10	2

The repeated passing of vehicles and machinery in close proximity to setts are considered to have the potential to damage, destroy or obstruct a sett as a result of sett tunnel collapse. These risks could be exacerbated by soft ground conditions at the time of work, depending on the weather at the time, and the associated risk that tunnels are close to the surface due to the high level of the ground water. Repeated access close to setts could also be considered to constitute a disturbance offense in relation to badgers occupying a sett (as per Natural England, 2009).

A review of the badger sett locations against the proposed works and identification of where impacts may exist is summarised in Table 7.8.

Potential effects on badger populations are likely to be temporary, short-term-medium term (i.e. setts destruction/damage or obstruction and disturbance affecting the success of the inhabiting clan, particularly where a main sett is impacted). During the proposed construction period September -November, badgers spend less time underground than in the winter months and don't have dependant cubs, and so they will be less vulnerable to impacts on setts and from disturbance. In the absence of mitigation, the magnitude of impacts on badger populations (negligible / local sensitivity) is likely to be negligible adverse in terms of the conservation status of the local population and the significance of effect not significant. However, damaging/destroying or obstructing setts and/or disturbing badgers in their sett will constitute an offense under the legislation and mitigation is therefore proposed (see Table 7.9).

Table 7.8 Potential impacts identified on individual badger setts

Sett no.	Classification	Location	Description	Potential impacts
1	Outlier	Right bank KSD	Two partially active, currently flooded, holes. This outlier sett was flooded at the time of survey but showed signs of recent excavation and therefore was considered to be partially active.	No bank raising proposed within 30m. Access for WFD enhancement and bank raising works will pass within 30m of sett and will involve significant vehicle movements due to limited access options on KSD right bank. Risk of damaging, destroying or obstructing badger setts and of disturbance if crossing sett.
2	Main	Right bank KSD	A partially active main sett containing 19 flooded holes. This sett was largely flooded at the time of survey but showed signs of recent excavation.	Bank raising proposed within 30m. Access for WFD enhancement and bank raising works will need to pass within 30m of sett and will involve significant vehicle movements due to limited access options on KSD right bank. Risk of damaging, destroying or obstructing badger setts and of disturbance if crossing sett.
3	Main	Right bank KSD	Main sett containing 10 holes. Eight appear well used with fresh bedding material.	No bank raising proposed within 30m. Access for WFD enhancement and bank raising works will need to pass within 30m of sett and will involve significant vehicle movements due to limited access options on KSD right bank. Risk of damaging, destroying or obstructing badger setts and of disturbance if crossing sett.
4	Main	Left bank Upper Sowy	Main sett containing three well used holes, fresh spoil heap, large entrances and fresh bedding.	No impacts identified

Sett no.	Classification	Location	Description	Potential impacts
5	Main	Left bank Upper Sowy	Main sett under mature willow, well used containing 31 holes.	No impacts identified
6	Outlier	Left bank Upper Sowy	Two well defined mammal tracks running toward two partially active sett entrances and fresh dung pits.	No impacts identified
7	Main	Right bank KSD	Active main sett containing 15 holes. Lots of fresh bedding and dung pits.	No bank raising proposed within 30m. Access for WFD enhancement and bank raising works will need to pass within 30m of sett and will involve significant vehicle movements due to limited access options on KSD right bank. Risk of damaging, destroying or obstructing badger setts and of disturbance if crossing sett.
8	Outlier	Right bank Upper Sowy	Partially used. Recently collapsed/flooded badger sett of approximately four holes. One hole intact but appeared inactive at time of survey.	Bank raising proposed within 30m. Access for bank raising works will need to pass within 30m of sett. Risk of damaging, destroying or obstructing badger setts and of disturbance if crossing sett.
9	Subsidiary	Right bank Upper Sowy	Active sett containing 3 holes and fresh spoil and bedding material.	Bank raising proposed within 30m. Access for bank raising works will need to pass within 30m of sett. Risk of damaging, destroying or obstructing badger setts and of disturbance if crossing sett.

7.5.2. Operation

Operational effects are limited to potential adverse effects as a result of changes in flooding extent, frequency and duration as a result of the enhanced capacity of the Sowy/KSD system and potential beneficial effects as a consequence of a net increase in open water and marginal habitat created from species-poor grassland.

The potential for significant effects during operation was scoped out at scoping stage for the following important ecological features; eels, GCN, grass snake, bats, otter and badger and additionally here, no effects are considered likely for notable plants. The impacts of the changes in flooding extent, frequency and duration as a result of the enhanced capacity of the Sowy/KSD are also not considered likely to have any significant effects on habitats (either inside designated sites or S41 Habitat outside designated sites). The implementation of the Proposed Scheme to increase the carrying capacity of the Sowy/KSD flood relief channel will reduce the duration and extent of flooding from the current low-level events that result in the flood relief channel from spilling onto the adjoining floodplain. These changes in flooding will therefore be changes in small scale, out of banks events. Habitats in the study area are not reliant on direct inputs from the Sowy/KSD system thus should not be impacted by the operation of the Proposed Scheme.

Statutory designated sites for nature conservation

European designated sites

The Proposed Scheme has the potential to result in a reduction in the frequency and extent of shallow-water fluvial flooding within the Somerset Levels and Moors SPA/Ramsar and functionally linked habitat for both the Somerset Levels and Moors SPA/Ramsar and Severn Estuary SPA/Ramsar.

The implementation of the Proposed Scheme to increase the carrying capacity of the Sowy/KSD flood relief channel will reduce the duration and extent of flooding from the current low-level events that result in excess water from the flood relief channel spilling onto the adjoining floodplain. Hydraulic modelling has confirmed that there will be reductions in the extent and duration of flooding following implementation of the full River Sowy and King's Sedgemoor Drain Enhancements Scheme and once the operational procedures for Monk's Leaze Clyce have been amended to reflect the increased capacity of the Sowy/KSD system, albeit the majority of the areas affected will be outside of the designated sites (see strategic level HRA, Appendix C). Nevertheless, for the purpose of the assessment all land within the floodplain has been assumed to represent supporting, functional habitat (see project level HRA, Appendix D).

Of the qualifying bird species/species which are part of the water bird assemblage, for these European designated sites, a number will not be impacted by changes in areas of splash and shallow flood, either because they are not present in significant numbers or because they do not rely on these specific habitat conditions. The following species are considered to be highly dependent upon the existence of temporary areas of splash and shallow flood in the study area during the core winter period (December to February inclusive) (see project level HRA, Appendix D):

- Mute swan
- Dabbling ducks – shoveler, teal (qualifying feature), pintail, wigeon (mostly grazing but always in close proximity to water)
- Little egret
- Waders – lapwing (qualifying feature), dunlin (qualifying feature), snipe and black-tailed godwit

Increasing the channel capacity to accommodate flows of 27m^3/s in the KSD and 17m^3/s in the Sowy (to be increased to 24 m^3/s following implementation of later phases of the full River Sowy and King's Sedgemoor Enhancements Scheme) will result in a number of potential impacts that could compromise the Conservation Objectives of the European designated sites (see strategic level HRA, Appendix C): D):

- A reduction in the frequency and duration of small-scale flood events through King's Sedgemoor SSSI, which provide valuable feeding and roosting conditions for many of the non-breeding bird features
- The increased capacity and ability to divert water along the Sowy in advance of a flood event could mean that some of the moors along the River Parrett will no longer flood
- For larger events where land along the River Parrett was flooded then the ability to reduce river levels quicker, through sending more water down the Sowy, will mean that the pumps could operate earlier and thereby remove standing flood water

These impacts could affect all the species scoped into the assessment but especially the large numbers of dabbling ducks, mute swan and lapwing that rely on the additional areas of temporary flooded grassland outside of designated sites, for at least part of the time. Depending on the presence and extent of additional flooding outside of RWLAs, most birds will usually spend the daytime loafing and roosting at undisturbed sites with extensive areas of open water, such as the RSPB reserves at West Sedgemoor and Greylake. They will then fly out to feed over a more extensive area at night-time, so these additional areas of flood are important for their survival over the winter period (Chown, 2003). Changes in surface water flooding are therefore the highest risk hazard to maintaining the integrity of the designated sites (see project level HRA, Appendix D). The loss of suitable foraging and roosting habitat will put additional pressure on qualifying wintering bird features to find alternative sites, including potential displacement outside of the Somerset Levels. An increase in energy requirements could lead to loss of condition and ultimately death if only sub-optimal sites subject to disturbance are available. These impacts will be long-term, permanent.

The potential magnitude of effects on the non-breeding bird qualifying features of the Somerset Levels and Moors SPA/Ramsar and Severn Estuary SPA/Ramsar (High / European sensitivity) is considered to be high adverse and the significance of effect, substantial adverse.

This could be further exacerbated once the full River Sowy and King's Sedgemoor Drain Enhancements Scheme has been implemented with the capacity of the Sowy has been increased to 24m^3/s throughout (Monk's Leaze Clyce to Beer Wall), and the operational procedures for Monk's Leaze Clyce amended accordingly, however even following the capacity enhancement works undertaken under Phase 1 more water will be able to travel down the Sowy and KSD corridor without overtopping the banks than is currently possible. No specific modelling has been undertaken for the Proposed Scheme (Phase 1) but that is not an issue given that the mitigation measures detailed in section 7.7 and Table 7.9 for the full River Sowy and King's Sedgemoor Drain Enhancements Scheme are to be implemented before completion of the construction phase for the Proposed Scheme.

Sites of Special Scientific Interest

The King's Sedgemoor Drain SSSI, Southlake SSSI, Moorlinch SSSI and West Sedgemoor SSSI are all component SSSIs of the Somerset Levels and Moors SPA and the non-breeding bird qualifying features of these sites could be impacted via the same pathways as discussed above for European designated sites as a result of the Proposed Scheme and the full River Sowy and King's Sedgemoor Drain Scheme.

The potential magnitude of effects on the non-breeding bird qualifying features of the Somerset Levels and Moors SPA/Ramsar and Severn Estuary SPA/Ramsar (High / European sensitivity) is considered to be high adverse and the significance of effect, major adverse. Mitigation measures to reduce the magnitude of effect are outlined in section 7.7 and Table 7.9.

The increased capacity of the Sowy/KSD system and associated increased flexibility to manage flood flows once the full River Sowy and King's Sedgemoor Drain Enhancements Scheme is implemented, also represents a potential beneficial effect for SSSI designated site features. Prolonged and/or deep flooding on the moors can result in damage to vegetation and other supporting features. The potential magnitude of beneficial effects on the qualifying features of SSSIs (medium / national sensitivity) is considered to be low beneficial and the significance of effect, minor adverse.

Non-statutory designated sites for conservation

Of those LWSs identified within the study area, potential significant effects during operation of the Proposed Scheme are considered to exist where birds are a qualifying feature. This includes Aller Moor LWS and Greylake LWS. The non-breeding bird features of these sites could be impacted via the same pathways as discussed above for European designated sites and SSSIs as a result of the Proposed Scheme and the full River Sowy and King's Sedgemoor Drain Enhancements Scheme.

The potential magnitude of effects on the non-breeding bird features of the Aller Moor LWS and Greylake LWS (low / county sensitivity) is considered to be high

adverse and the significance of effect, moderate adverse. Mitigation measures to reduce the magnitude of effect are outlined in section 7.7 and Table 7.9.

Aquatic invertebrates

During operation it is considered that the Proposed Scheme will be beneficial for aquatic invertebrates.

The embayments, two stage channel and backwaters created as part of the WFD enhancement works will create additional habitats for benthic invertebrates.

The creation of a two-stage channel will also lead to decreased sediment loads to the main channel following flooding events due the increased storage capacity resulting in decreased nutrient enrichment caused by major flooding of agricultural land, highways, and developed areas.

These impacts will lead to permanent, long-term, beneficial effects for aquatic invertebrates. The potential magnitude of effects on aquatic invertebrates (low / county sensitivity) is considered to be medium beneficial and the significance of effect, minor beneficial. Proposed landscaping will further increase the beneficial effects of the Proposed Scheme for aquatic invertebrates see section 7.7 and Table 7.9.

Birds

The potential impacts on non-breeding birds of conservation concern in the study area are captured in the assessment for operational effects on statutory and non-statutory designated sites (see above). The operation of the Proposed Scheme will not have any significant effects on breeding birds or non-breeding birds which are not covered by the designations assessed above.

Water vole

During operation it is considered that the Proposed Scheme will be beneficial for water vole.

The embayments, two stage channel and backwaters created as part of the WFD enhancement works will create additional habitats for water voles.

These impacts will lead to permanent, long-term, beneficial effects for water vole. The potential magnitude of effects on water vole (low / county sensitivity) is considered to be medium beneficial and the significance of effect, minor. Proposed landscaping will also increase the beneficial effects of the Proposed Scheme for water vole see section 7.7 and Table 7.9.

7.6. Mitigation

7.6.1. Landscaping

The landscape proposals have been designed to mitigate adverse effects identified for a number of important ecological features (see Table 7. 9). Full landscaping proposals are illustrated on the LMP provided in Appendix I and further details on landscaping are provided in Chapter 9.

To mitigate the impacts of soil stripping, re-profiled flood embankments, channel banks and working areas reseeded with a neutral wet grassland or other appropriate seed mix which includes species listed as present within the King's Sedgemoor SSSI citation.

To mitigate tree losses, trees will be replaced at a ratio of 5:1.

To maximise the benefits of channel widening the LMP (Appendix I) includes riparian planting to the backwater location on the right bank of the KSD immediately downstream of the confluence with the Sowy and pre-vegetated coir rolls and/or pallets at all seven WFD enhancement feature locations. Continuous lengths of pe-vegetated coir rolls will protect the river edge of the berm from erosion and pre-vegetated coir pallets will seed the bank side of the berm with marginal species. Backwater channels will be planted with either/both pre-vegetated coir rolls and pallets. The extents of newly created habitats are estimated to be:

- Marginal wetland – 4184m^2
- Rough/wet grassland – 2031m^2
- Willow scrub – 250m^2
- Open water – 750m^2

Reseeding and planting of the embayments, two stage channels and backwaters will take place throughout the construction period as soon as practicable following completion of earthworks.

7.6.2. Standard construction practices for drainage / run off management

To reduce the risk of pollution to the water environment via pollution incidents and sedimentation during construction, which could impact upon a number of important ecological features (see Table 7.9), standard construction practices for drainage / run off management will be followed (see Chapter 6 for further details). These will be detailed in a SWMP and EPRP (as per EAP, Appendix K). These will include the following measures:

- Appointment of an environmental site supervisor
- Plant and vehicle to be kept in good working order
- Use of biodegradable hydraulic fuels where possible
- Plant and vehicles will be kept in the site compound overnight, securely fenced
- Refuelling to take place away from the river in a designated refuelling area
- Fuels, oils and chemicals will be kept within the offsite compound
- Spill kits will be available on site
- Drip trays to be used under vehicles and plant when not in operation
- Use of silt curtains and/or booms to contain and control the dispersion of suspended solids in the water column during channel widening. Dissolved oxygen (DO) monitoring will be required during summer month if these measures cannot be implemented.
- Plant up newly excavated WFD enhancement areas immediately following creation.

7.6.3. Non-native invasive plant species

Given the recorded presence of, and potential for, a number of non-native invasive plant species, an Invasive Species Management Plan will be required. This will

highlight the species likely/with potential to be present in the construction area and the biosecurity measures needed to prevent the spread of these species and thus to ensure compliance with Wildlife and Countryside Act 1981 (as amended) where species are listed on Schedule 9 of the Act. These biosecurity measures will include;

- Pre-construction survey for non-native invasive plant species
- Environmental Clerk of Works to undertake toolbox talk for all site workers (and visitors when appropriate) to aid identification and appropriate responses to encountering invasive species
- Areas of possible contamination should be identified in the site management plan
- Where contaminated soil, materials or water are located, signage should be erected to indicate them
- Only accepting machinery to site that is clean. Pressure washing in a designated area for all vehicles before entering and after leaving site to avoid accidental transfer of invasive plant material.
- Personnel working on or between sites should ensure their clothing and footwear are cleaned where appropriate to prevent spread
- All wash facilities including waste water from washing vehicles, equipment or personnel should be managed in a responsible way so as not to not cause harm to the environment.

7.6.4. Specific important ecological features

Mitigation measures, beyond those discussed above, have been identified to address the specific adverse effects identified for important ecological features. These are captured in the EAP (Appendix K), are summarised in Table 7.9 and are discussed in further detail for statutory designated sites, water vole and badger where key constraints have been identified.

Designated sites for nature conservation

Due to the potential for the full River Sowy and King's Sedgemoor Drain Enhancements Scheme and the Proposed Scheme (Phase 1 of full River Sowy and King's Sedgemoor Drain Enhancements Scheme) to result in a reduction in the frequency and extent of shallow-water fluvial flooding across the Somerset Levels and Moors SPA/Ramsar, component SSSIs and other supporting habitat, it has been agreed with Natural England that a package of mitigation measures will be implemented as a separate programme of works.

The proposed mitigation measures include the repair and refurbishment of several structures within RWLAs of three of the component SSSIs at King's Sedgemoor (Egypt's Clyce), Moorlinch and West Moor to maintain condition status of the designated sites during operation of the Proposed Scheme. The selection of these structures is based on the potential impacts identified by hydraulic modelling (see project level HRA, Appendix D). It has been agreed with NE and other SRA delivery partners to reduce the previous design life for the structures from 25 years down to a shorter 5-10 year life expectancy. This reduction is to make the mitigation proportionate to the full River Sowy and King's Sedgemoor Drain Enhancements Scheme and reflect the uncertainty surrounding the future of the agri-environment

schemes in these areas (all current schemes will end within the next 5 years). Works on the mitigation structures were started in May/June 2020 ahead of construction of the Proposed Scheme.

In addition to the work on the structures, a MAP has been drafted and accepted by delivery partners to ensure mitigation for the Scheme is in place for the short and longer term.

The primary purpose of the MAP is to ensure that there will be no deterioration in SPA habitat availability or quality as a result of the full River Sowy and King's Sedgemoor Drain Enhancements Scheme. The MAP contains a range of general and site specific mitigation measures to achieve this. These measures include:

- Ensuring water level management meets the operational requirements (target water levels) of the agreed WLMPs
- Maintaining and updating WLMPs and extending them to Functionally Linked Land (FLL) where necessary
- Sustaining the existing RWLA
- Maintaining and improving the water management infrastructure required to achieve the conservation objectives of protected sites and FLL.
- Ensuring channel maintenance is sympathetic to nature conservation.
- Mitigating for the changes in small winter flooding within SSSIs through such actions as:
  - the replacement of failing water control structures or the provision of new structures to effect 'no change' to existing winter surface water conditions
  - adjustments to operational protocols to effect 'no change' to existing winter surface water conditions; a review of WLMPs with partner organisations by 2022
  - maintaining a minimum 300mm water depth in ditches through the winter within and outside designated sites (where this will not increase flood risk)
  - creation of in-field wet features such as shallow water scrapes and wet field gutters.

The delivery of the MAP and thereafter future management of the outcomes will be facilitated through the existing governance framework established for the current Water Level Management Plans and the SRA Management Group; to agree the outcomes and actions outlined in the MAP, based on results of ongoing monitoring.

This will be achieved through their regular meetings, as deemed necessary and managed by a small group of officers from each partner organisation (Natural England, Environment Agency and the SDBC).

For additional information regarding the MAP see Appendix J, and also the strategic level HRA (Appendix C).

Water vole mitigation

The following mitigation strategy will minimise the risk of disturbing or injuring a water vole during the works by displacing them from the areas where the WFD

enhancement works are proposed and will also ensure that that there are no burrows within the footprint of works during construction. These works will be carried out under the Environment Agency's Organisational Licence to ensure there is no breach of the Wildlife and Countryside Act 1981 (as amended). The vegetation clearance works to displace water vole is as follows:

- The vegetation clearance is being carried out under licence, under the supervision of the accredited ecologist and at the appropriate seasonal timescales.
- Prior to undertaking vegetation clearance, the area cleared has been surveyed, with any burrow locations marked up, and any other water vole signs noted.
- The Contractor should clear vegetation from each WFD habitat enhancement area along its whole 160m length. Vegetation has been scraped to bare earth using long reach excavator to avoid compression of burrows. Where vegetation was encountered that exceeds 250mm in sward length, the area was flailed in the first instance, which was undertaken under the direction of an accredited ecologist.
- Field signs were removed from the footprint of the enhancements upon completion of vegetation clearance, so that no evidence of water vole field signs are present. This has minimised any confusion with fresh field signs that may be recorded during the monitoring period.
- Once first cut the vegetation is being kept at <100mm and unsuitable for water vole re-colonisation until the commencement of the works on the ground. The timing of these maintenance cuts will vary depending on growing season and will be agreed with the accredited water vole environmentalist.
- Prior to the WFD habitat enhancement works commencing, the cleared sites will be monitored by a suitably qualified ecologist for fresh signs of water vole activity for a period of seven days (minimum) after the last maintenance cut. If fresh signs of activity are observed the monitoring period may need to be extended and further vegetation clearance may be required.
- Should no fresh signs of water vole use be observed, any burrows within the affected area will be subject to a destructive search and the burrow will be dug out from the bankside using the long reach excavator as advised by the accredited agent.
- If any animals are encountered during the destructive search, they will be relocated into adjacent unaffected habitat areas as soon as possible. No animals will be kept in captivity overnight or for any length of time. Where no water vole burrows are located within the cleared area, no destructive search will be required.

To adhere to the requirements of the Environment Agency's Organisational Licence it will be necessary to monitor the sites impacted upon by the works for the presence/absence of water voles for up to three years following displacement, or until it is confirmed that water voles are present in similar numbers to that prior to works taking place. Records will be supplied to Natural England.

In addition to the water vole mitigation measures required at the WFD enhancement feature locations, outlined above, in any locations where a minimum 5m standoff from the main Sowy and KSD channels cannot be maintained, pre-construction checks for water vole burrows will be undertaken and appropriate mitigation measures agreed, which may include avoidance.

Badger mitigation

A badger mitigation strategy will be developed to ensure that works do not contravene the Protection of Badgers Act 1992 and if required, works will be carried out under licence, either the Environment Agency, Organisational Licence for exclusion of badgers from their setts, or a Natural England licence to 'interfere with a badger sett for development purposes' (which will cover potential disturbance impacts if appropriate).

General mitigation recommendations are summarised below and the approach specific to each sett will be detailed in a method statement:

- Where possible all works within 30m of a badger sett should be avoided, including the passage of machinery and vehicles for access.
- Pre-construction survey of Proposed Scheme.
- Should it not be possible to rule out the potential for interference and/or disturbance of an active sett, an appropriate licence will need to be sought to permit activities that will otherwise be unlawful.
- All works/access within 30m of a sett should be supervised by a suitably qualified Ecological Clerk of Works (ECoW)
- A 30m buffer should be marked out around each active sett ahead of construction.
- Ahead of accessing works areas via locations within 30m of a sett, the ECoW should mark out with surface flags, cones or ground marking paint, the location of all active sett entrances. Subsequently the ECoW should agree the appropriate route for access and again mark this out with cones or ground marking paint.
- Measures to prevent tunnel collapse during access may need to include ground protection measures, including selecting appropriate low ground pressure plant and the use of track matting.
- Sett closure under licence may be considered for non-main setts where closure does not require the creation of an artificial sett. Sett closure can only be undertaken between 1st July and 30th November.
- Use of heavy plant and machinery should cease at least two hours before sunset.
- Excavations should be covered at the end of each working day, or a means of escape provided for any animal that could fall into a trench. This can be in the form of a wooden plank sloping into the trench or a slope in the construction of the trench itself.

Table 7.9. Summary of mitigation appropriate to important ecological features

Ecological feature	Potential impact	Potential effects	Mitigation measure(s)
Statutory designated sites (SPA, Ramsar, NNR and SSSIs) Non-statutory designated sites (LWSs)	Construction - raising of existing flood embankments/channel widening	Loss or damage to habitats within designated sites	Protective fencing and defined working areas should prevent incidental loss or damage to retained habitats. Reseeding grassland areas with an appropriate seed mix (to be agreed with NE) (see section 7.6.1 and Chapter 9 and Appendix H for further details).
		Disturbance of qualifying wintering and/or breeding bird features	Working restrictions in the event of any severe, cold weather that will make bird displacement due to disturbance an issue. Monitoring by an ECoW to record presence of any significant numbers of birds (>1% of the current 5-year peak mean for any species) within the disturbance zone of influence (up to 300m). No working or lighting after dark close to any areas known to be favoured by birds (to be identified and agreed with Natural England).
	Operation - reduction in extent, frequency and duration of beneficial 'splash' conditions provided by small-scale flood events when the Sowy reaches capacity	Loss of suitable foraging and roosting habitat will put additional pressure on qualifying wintering bird features to find alternative sites, including potential displacement outside of	Refurbishment and installation of water level control structures across several sites where adverse effects have been identified. Implementation of the MAP designed to ensure no deterioration in SPA habitat availability or quality, including functionally linked land. See section 7.6.4 and strategic level HRA (Appendix C) for further detail.

Ecological feature	Potential impact	Potential effects	Mitigation measure(s)
	and spills onto the floodplain.	the Somerset Levels. Increase in energy requirements could lead to loss of condition and ultimately death if only sub-optimal sites, subject to disturbance are available.	
Coastal Grazing Marsh	Construction - raising of existing flood embankments/channel widening	Loss or damage of S41 Habitat	Defined working areas should prevent incidental loss or damage to retained habitats. Riparian planting to the two backwater WFD enhancement feature locations. Provision of pre-vegetated coir rolls and/or pallets at all seven WFD enhancement feature locations. Reseeding grassland areas with an appropriate seed mix (to be agreed with Natural England) (see section 7.6.1 and chapter 9 and Appendix I for further details).
Notable plant species	Construction - raising of existing flood embankments/channel widening	Direct loss of tubular water dropwort due to incidental construction damage Indirect loss of frogbit due to changes in water quality as a result of sedimentation and pollution incidents	Protective fencing and defined working areas should prevent incidental loss or damage to tubular water dropwort. Standard construction best practice for drainage / runoff management. See section 7.6.2 and Chapter 6 for further details.

Ecological feature	Potential impact	Potential effects	Mitigation measure(s)
Eel	Construction - raising of existing flood embankments/channel widening	Changes in water quality as a result of sedimentation and pollution incidents	Standard construction best practice for drainage / runoff management. See section 7.6.2 and Chapter 6 for further details/
Aquatic invertebrates	Construction channel widening	Direct loss of individuals due to removal of silt and marginal/aquatic plants	Material won from the edge of the existing river should be pulled back a short distance from the margin of the river and allowed to rest for a short time to allow animals that can to escape back to the water.
		Changes in water quality as a result of sedimentation and pollution incidents	Standard construction best practice for drainage / runoff management. See section 7.6.2 and Chapter 6 for further details
GCN / grass snake	Construction - raising of existing flood embankments/channel widening	Direct death or injury to GCN / grass snake	In suitable habitats works should take place under a method statement and supervision of an ECoW. Mitigation will include timing of works and phased vegetation clearance. These measures are required to ensure compliance with the Wildlife and Countryside Act 1981 (as amended) and the Species and Habitats Regulations 2017.
Birds (excluding qualifying features of designated sites)	Construction - raising of existing flood embankments/channel widening	Loss or damage to active nests	Where works cannot be conducted outside of the main breeding bird period (March to August inclusive), an ECoW should check potential nesting habitat prior to construction works. Where nesting is occurring, appropriate restrictions for the species should be put in

Ecological feature	Potential impact	Potential effects	Mitigation measure(s)
			place to avoid the nest from being damaged or abandoned. These measures are required to ensure compliance with the Wildlife and Countryside Act 1981 (as amended).
Bats	Construction - raising of existing flood embankments/channel widening	Loss of trees with potential bat roost features.	Trees with bat roost potential that are proposed for removal will be subject to appropriate survey effort to determine likely presence/absence of a roost. Trees found to be roosts will be retained. A pre-construction check will also be carried out immediately prior to felling. These measures are required to ensure compliance with the Wildlife and Countryside Act 1981 (as amended) and the Species and Habitats Regulations 2017.
Otter	Construction - channel widening	Direct loss/injury of individuals	Pre-construction check for otter holts should be conducted prior to works commencing. If otter holts present a European Protected Species licence may be required to permit activities that will otherwise be unlawful. These measures are required to ensure compliance with the Wildlife and Countryside Act 1981 (as amended) and the Species and Habitats Regulations 2017.
		Direct loss of holts	
	Construction - raising of existing flood embankments/channel widening	Disturbance of individuals	
		Changes in water quality as a result of	Standard construction best practice for drainage / runoff management.

Ecological feature	Potential impact	Potential effects	Mitigation measure(s)
		sedimentation and pollution incidents affecting prey species and/or otters directly.	See section 7.6.2 and Chapter 6 for further details
Water vole	Construction - channel widening	Direct loss/injury of individuals	Works should be carried out under the Environment Agency Organisational licence. Working methods under the licence will involve working within restricted time periods, displacement techniques and limitations on the extent of potentially damaging activities. Pre-construction checks for burrows at any locations where a 5m standoff from the main Sowy and KSD channels cannot be maintained. See section 7.6.4 for further details. These measures are required to ensure compliance with the Wildlife and Countryside Act 1981 (as amended).
		Loss of burrows	
	Construction - raising of existing flood embankments/channel widening	Changes in water quality as a result of sedimentation and pollution incidents	Standard construction best practice for drainage / runoff management. See section 7.6.2 and Chapter 6 for further details
Badger	Construction - raising of existing flood embankments/channel widening	Direct loss/injury of species	Works carried out under a badger method statement (see section 7.6.4 for further details).
		Loss of setts	
		Disturbance of species	

Ecological feature	Potential impact	Potential effects	Mitigation measure(s)
			A pre-construction survey should be undertaken to determine if any new badger setts are present on site. Ensure buffer zones around known badger setts. Where active badger setts will lost/disturbed by the works, working under licence may be required to permit activities that will otherwise be unlawful. Cover excavations at night. These measures are required to ensure compliance with the Protection of Badgers Act 1992

7.7. Conclusions and summary of residual effects

Table 7.10 provides a summary of residual effects, where significant effects are predicted in the absence of mitigation

During the construction of the Proposed Scheme, the only predicted significant effect (i.e. an effect of moderate or greater significance) is an adverse effect for water voles, where the potential death and injury to animals, in combination with temporary habitat loss and changes to water quality has the potential to affect the conservation status of a population considered to be of County value. Mitigation is proposed in the form of working under a licence within restricted time periods, using displacement techniques and limiting the extent of potentially damaging activities. Following the implementation of this mitigation, no significant adverse effects are considered likely for water vole.

During operation, significant adverse effects are predicted for some of the qualifying non-breeding bird features of statutory and non-statutory designated sites as a result of a reduction in the extent, frequency and duration of beneficial ‘splash’ conditions provided by small-scale flood events when the Sowy reaches capacity and spills onto the floodplain. Mitigation is proposed to refurbish and install water level control structures across several sites where adverse effects have been identified. The MAP has been designed to ensure there will be no deterioration in SPA habitat availability or quality, including functionally linked land, through a range of general and site specific measures (these are summarised in section 7.6.4).. Following implementation of mitigation, it is considered that there will be a negligible or possible minor beneficial effect for non-breeding bird features of designated sites given the improved management of RWLAs.

The increased capacity of the Sowy/KSD may also represent a beneficial effect for the designated site features. Prolonged and/or deep flooding on the moors can result in damage to vegetation, other supporting features and water level management control structures.

Minor beneficial effects were also identified for aquatic invertebrates and water voles as a result of the creation of embayments, two stage channels and backwaters which will create additional habitats for these features.

Table 7.10 Summary of residual effects where significant effects are predicted in the absence of mitigation

Receptor (sensitivity)	Nature of impact (magnitude)	Significance (pre-mitigation)	Mitigation	Residual effect
Construction				
Water vole (low)	Death/injury to animals, temporary habitat loss/indirect affects via temporary changes in water quality (medium).	Moderate adverse (significant)	Works under licence to include timing of works and displacement techniques.	Minor adverse (not significant)
Operation				
Somerset Levels and Moors SPA/Ramsar and Severn Estuary SPA/Ramsar (non-breeding bird qualifying features only) (high)	Loss of suitable foraging and roosting habitat will put additional pressure on qualifying wintering bird features to find alternative sites, including potential displacement outside of the Somerset Levels. Increase in energy requirements could lead to loss of condition and ultimately death if only sub-optimal sites, subject to disturbance are available. The impact will be permanent (high).	Substantial (significant)	Repair and upgrade of key structures that control levels in the RWLAs at Moorlinch, West Moor and King's Sedgemoor (Othery rhyne). Implementation of the MAP, including updates to WLMPs by 2022.	Negligible/ minor beneficial (not significant)
King's Sedgemoor SSSI/Southlake Moor SSSI/Moorlinch SSSI/West Sedgemoor SSSI/Wet Moor SSSI/West Moor SSSI (non-breeding bird qualifying features only) (medium)		Major adverse (significant)		Negligible/minor beneficial (not significant)
Aller Moor LWS and Greylake RSPB Reserve LWS (non-breeding bird		Moderate adverse (significant)		Negligible/minor beneficial (not significant)

Receptor (sensitivity)	Nature of impact (magnitude)	Significance (pre-mitigation)	Mitigation	Residual effect
qualifying features only) (low)				

8. Cultural heritage

8.1. Introduction

This chapter considers the effects of the Proposed Scheme on cultural heritage.

A heritage asset is defined as a building, monument, site, place or landscape identified as having a degree of significance meriting consideration in planning decisions, because of its heritage interest, and that heritage interest may be archaeological, architectural, artistic or historic',

Heritage assets include designated assets (World Heritage Sites, Scheduled Monuments, Listed Buildings, Conservation Areas, Registered Parks and Gardens, Registered Battlefields and Registered Historic Wrecks) and non-designated assets identified by the Local Planning Authority (for example: locally listed buildings, archaeological sites and monuments and historic landscapes).

8.2. Regulation and policy background

8.2.1. The Ancient Monuments and Archaeological Areas Act 1979

This Act (as amended) provides for the protection of Scheduled Monuments, which are by definition of national importance, but does not afford any protection to their settings. It is a criminal offence to damage a Scheduled Monument, and Scheduled Monument Consent (SMC) is required for any works within a scheduled area in accordance with Section 1 of the Act.

8.2.2. The Planning (Listed Buildings and Conservation Areas) Act 1990

This Act details the statutory protection afforded to Listed Buildings. Under Section 66 (1) of the Act, planning authorities are instructed to have special regard to the desirability of preserving a Listed Building, its setting, or any features of special architectural or historic interest that it possesses.

8.3. Methodology

8.3.1. Scope

The scoping assessment carried out at the formal scoping stage was documented in the PEIR (Jacobs, 2020). Aspects scoped into assessment in the ES are set out below in Table 8.1.

Table 8.1 Scope of assessment

Scoped in	Scoped out
Impacts from construction groundworks to designated archaeological assets (prehistoric trackways (NHLE 1014430) located 670m to the south-east of Parchey Bridge)	Impacts to historic buildings (all assets)
Impacts from construction groundworks to non-designated archaeological assets	Impacts to historic landscape (all assets)

Scoped in	Scoped out
recorded within the footprint of the Proposed Scheme	
Impacts from construction groundworks to unknown archaeological assets	
Impacts from construction groundworks to deposits of paleoenvironmental and geoarchaeological interest. To include as a result of compression and dewatering.	

8.3.2. Study area

The study area for this assessment comprised a 500m radius corridor along the length of the Proposed Scheme, plus two extended areas which covered King's Sedgemoor to the east and Lang Moor in the north-west respectively (see Figures 8.1 and 8.2, Appendix A).

The study area was agreed with the Archaeological Advisor to Sedgemoor District Council.

8.3.3. Establishing the baseline

Data sources

The cultural heritage baseline was established using the following sources of information:

- National Heritage List for England (NHLE) for information on designated heritage assets
- Somerset Historic Environment Record (HER) for information on non-designated archaeological sites, findspots, and archaeological events (updated 2019)
- Portable Antiquities Scheme (PAS) for information on finds of archaeological interest within the study area
- LiDAR data held by the Environment Agency
- Ground Investigation reports and geological information held by the British Geological Survey
- Published and unpublished archaeological reports relating to excavations and observations in the vicinity of the Proposed Scheme
- The South West Research Framework (Webster, 2007) and associated Research Strategy for 2012-2017 (Grove and Croft, 2012)

Supporting studies and investigations

This chapter is also informed by the results of the following studies undertaken in support of the Proposed Scheme:

- A Cultural Heritage Desk-Based Assessment (DBA) included at Appendix O
- A geoarchaeological assessment, including the results of a hand augur survey undertaken along the length of the Proposed Scheme (Appendix O).

Consultation

In order to inform this assessment, consultation has taken place with the following consultees:

- Historic England
- South West Heritage Trust

Further detailed information on consultation is provided in Chapter 4 of this ES.

8.3.4. Determination of significance

Assessment of value

The value of heritage assets was assessed using the criteria shown in Table 8.2 below. The criteria are based on the guidance provided in the Design Manual for Roads and Bridges (DMRB) LA 104 Environmental Assessment and LA 106 Cultural Heritage Assessment (Highways England, 2019).

The term value has been employed here rather than significance, as used in the National Planning Policy Framework (NPPF) (Ministry of Housing, Communities and Local Government (MHCLG, 2019) and local planning policy, or importance, to avoid confusion when describing effects that are significant or not later on in this chapter.

Table 8.2 Criteria for assessing the value of heritage assets

Value	Criteria
High	• Scheduled Monuments • Listed Buildings • Designated historic landscapes of outstanding interest • Non-designated assets of schedulable quality and importance • Assets that can contribute materially to national research objectives • Conservation Areas • Non-designated structures of clear national importance • Non-designated landscapes of outstanding interest, high quality or importance and of demonstrable national value • Well-preserved historic landscapes, exhibiting considerable coherence, time-depth or other critical factors
Medium	• Designated or non-designated assets that contribute to regional research objectives

Value	Criteria
	• Non-designated historic landscapes that will justify special historic landscape designations, or landscapes of regional value • Averagely well-preserved historic landscapes with reasonable coherence, time-depth or other critical factor • Historic Townscape or built-up areas with important historic integrity in their buildings, settings or built settings.
Low	• 'Locally Listed' buildings • Designated and non-designated assets of local importance • Robust non-designated historic landscapes and historic landscapes with importance to local interest groups • Historic landscapes whose value is limited by poor preservation and / or poor survival of contextual associations • Assets compromised by poor preservation and/or poor survival of contextual associations • Assets of limited value, but with potential to contribute to local research objectives • Historic (unlisted) buildings of modest quality in their fabric or historical association • Historic Townscape or built-up areas of limited historic integrity in their buildings or built settings
Negligible	• Heritage assets with very little or no surviving archaeological interest • Buildings of no archaeological or historical note, or buildings of an intrusive character • Landscapes with little or no significant historical interest
Unknown	• The value of the resource has not been ascertained, for example unknown archaeological assets, or buildings with some (hidden) potential for historical significance.

Magnitude of impact

The magnitude of impact is the degree of change that will be experienced by a heritage asset if the Proposed Scheme were completed, as compared with a 'do nothing' scenario. This change to a heritage asset may include physical impacts upon the asset or impacts upon its setting or amenity value. The criteria used for assessing magnitude of impact are shown in Table 8.3 below.

Unless otherwise stated, all identified impacts are adverse.

Table 8.3 Criteria for the assessment of the magnitude of impact

Magnitude of impact	Criteria
High	• Change to most or all key archaeological materials, such that the resource is totally altered • Change to key historic building elements, such that the resource is totally altered • Change to most or all key historic landscape elements, parcels or components; extreme visual effects; gross change of noise or change to sound quality; fundamental changes to use or access; resulting in total change to historic landscape character unit • Comprehensive changes to setting
Medium	• Changes to many key archaeological materials, such that the resource is clearly modified • Change to many key historic building elements, such that the resource is materially modified • Changes to the setting of a cultural heritage asset, such that it is materially modified • Changes to many key historic landscape elements, parcels or components, visual change to many key aspects of the historic landscape, noticeable differences in noise or sound quality, considerable changes to use or access; resulting in moderate changes to historic landscape character
Low	• Changes to key archaeological materials, such that the asset is slightly altered • Change to key historic building elements, such that the asset is slightly different • Change to setting of a cultural heritage asset, such that it is noticeably changed • Changes to few key historic landscape elements, parcels or components, slight visual changes to few key aspects of historic landscape, limited changes to noise levels or sound quality; slight changes to use or access: resulting in limited changes to historic landscape character
Negligible	• Very minor changes to archaeological materials, or setting • Slight changes to historic buildings elements or setting that hardly affect it • Very minor changes to key historic landscape elements, parcels or components, virtually unchanged visual effects, very slight changes in noise levels or sound quality; very

Magnitude of impact	Criteria
	slight changes to use or access; resulting in a very small change to historic landscape character
No Change	• This is where there is no change, loss or alteration to a heritage asset's physical characteristics, features or elements • This is where there is no change to the setting of the heritage asset (visual and/or audible), so it remains unaltered

Significance of effect

The significance of effect is determined as a combination of the assessment of the value of the heritage asset and the magnitude of the impact based on the significance matrix provided at Figure 5.1 (p44) in Chapter 5 of this ES.

For the purpose of this assessment, effects of moderate significance or greater are considered to be significant.

8.3.5. Limitations

The limitations and assumptions for the purposes of this assessment include the following:

- The HER data includes record entries compiled from a range of sources of varying quality and detail and therefore are not seen as definitive. Therefore we do not accept responsibility for the accuracy of the HER data
- Where third party information has been relied upon, DBA and geoarchaeological assessment, it is assumed this is accurate
- The potential for currently unknown archaeological remains to be present within the Proposed Scheme has been assessed, however such an assessment has a degree of uncertainty. In addition, as the extent or sensitivity of any such remains is unknown, further assessment cannot be made.

8.4. Existing environment

For the purposes of this chapter, and to maintain consistency with the PEIR for the Proposed Scheme (Jacobs, 2020), the heritage asset referencing previously used in the PEIR has also been applied in this assessment. Heritage assets are referred to below by their unique NHLE or HER reference numbers.

The locations of the designated heritage assets and non-designated heritage assets are summarised in this chapter and are shown on Figures 8.1 and 8.2 (Appendix A) respectively.

8.4.1. Prehistoric (c. 750,000 BC to AD 42)

There are five heritage assets recorded within the footprint of the Proposed Scheme which date to the prehistoric period, one of which is designated.

There is one Scheduled Monument within the footprint of the Proposed Scheme, this comprises the remains of at least seven prehistoric wooden trackways/structures located approximately 670m to the south-east of Parchey Bridge (NHLE 1014430) on the eastern bank of the KSD.

The monument includes the remains of at least seven well-preserved prehistoric timber trackways/structures, which are located at the base of a spur of higher land at Sutton Hams. The tracks all radiated westwards from the spur of Sutton Hams and were first noted during improvement work to the King's Sedgemoor Back Ditch in the spring of 1979 when they were partly excavated (Norman and Clements, 1979). The scheduled area has more recently been subject to geophysical survey, which due to the ground conditions did not definitively reveal any features associated with the trackway (Davies, 2016). These structures are currently undated; however, evidence has shown they comprise a variety of wood types such as hazel, alder and oak. The construction technique used comprised roundwood and brushwood which in some cases was pegged to spaced transverses and longitudinals. Evidence of axe marks has been identified and a number of flint and bone artefacts have been recovered. The monument is included on the Heritage At Risk Register (Historic England, 2020a) due to the threat of drainage/ dewatering.

These prehistoric wooden trackways/structures were constructed between the Neolithic and Iron Age period and were used as communication and trading routes across wetland areas. In addition, these structure may have functioned as hunting/fishing platforms. These structures were constructed of natural sources, such as brushwood, although some include other features like piles and planks. Trackways provide information not only about the communication and trading routes that were used, but also on the construction techniques that were being practiced and the tools that were used from the woodworking markings on the wood. Furthermore, the waterlogged ground conditions provide ideal conditions for the preservation of organic matter such as pollen, plant remains and beetle, which also provide information on the types of animals and plant species that were present at that time of their use. The NHLE listing states that ‘approximately 75 examples of either trackways or groups of trackways have been recorded in England’ and ‘over half’ are located within the Somerset Moors (Historic England, 2020b). Given this heritage asset’s legal definition as a designated Scheduled Monument, its rarity as a prehistoric trackway/structure and its contribution to Regional Research Aims such as 3, 18, 20 and 39 (Webster, 2007) associated with prehistoric activity and environmental information for the region, this heritage asset has been assessed to be of high value.

It is believed that the structures associated with NHLE 1014430 extend outside the scheduled area (Wessex Archaeology, 2015) and cross the Proposed Scheme in a westerly direction. Timber posts have been identified in the west bank of the KSD (HER 11319) opposite the scheduled area which comprise vertically driven roundwood posts which are 7cm in diameter and may be of prehistoric origin. Due to their location, being opposite the scheduled area, these features may be an extension of the scheduled prehistoric trackways. Given that this heritage asset may

be associated with the Scheduled Monument which is of national importance, this non-designated asset has been assessed to be of high value.

There are three other heritage assets recorded within the Proposed Scheme footprint which date to the prehistoric period and comprise timber features:

- Asset HER 12833 comprises a row of timber piles known as Strangway's Causeway that were identified in the early 20th century crossing the River Sowy to the north-east of Greylake. The HER suggests the orientation of these piles aligns with other timber finds at Langacre Rhyne (Asset HER 12834) which is within the study area
- A late Bronze Age brushwood trackway identified within the Langacre Rhyne (HER 10580) to the east of Greylake
- Asset HER 16137 comprises an alignment of timber piles which were identified in the north bank of the River Sowy and within the river bed 100m east of Church Drove Bridge, Oath. The alignment comprises 13 roundwood piles measuring between 5cm to 12cm in diameter and radiocarbon dating suggest the heritage asset is from the Bronze Age period

Given the above evidence and that these heritage assets likely form part of prehistoric trackways and their potential to contribute to Regional Research Aim 3 (Webster, 2007) associated with prehistoric trackways, Assets HER 12833 and 16137 have been assessed to be of medium value.

Another prehistoric heritage asset found within the footprint of the Proposed Scheme comprises the findspot of a human skull (HER 39230) which was recovered by a dog walker in 2017 from the south bank of the River Sowy downstream from Monk's Leaze Clyce at the southern limit of the Proposed Scheme. The skull was dated to the Iron Age period and has been removed. No other human remains were found at the location although a post structure was also discovered (Brunning *pers. comm*). Given the poor contextual associations of this heritage asset and the limited contribution it can provide to prehistoric burial practices within the area, Asset HER 39230 is considered to be of local importance and has been assessed to be of low value.

There is widespread evidence of prehistoric activity in the study area including both surviving physical remains of prehistoric trackways, field systems and finds. Particular clusters of prehistoric assets of note within the vicinity of the Proposed Scheme include:

- Another scheduled area, comprising two prehistoric timber trackways, is present to the south of Moor Drove (NHLE 1014872) approximately 900m to the south-west of the Proposed Scheme. The two trackways, Moor Drove 1 and 2, were recorded from a drain section when the water level was lowered in the spring of 1980. They were located 45m-50m from the north-west corner of the monument along the south facing section of the ditch to the south of Moor Drove. It is believed that the tracks are contemporary, and that they converge beneath Moor Drove, and extend southwards from the sand island of Chedzoy, across the low lying peat of Lang Moor to the Burtle Sands at Westonzoyland, a distance of approximately 1km

- A number of prehistoric finds (HER 11727, 11734, 11902 and 15025) dating from the Mesolithic through to the Bronze Age found to the south of Parchey Bridge to the east and west of the Proposed Scheme
- A possible prehistoric field system (HER 11861); two possible enclosures (HER 28129); the findspot of a Bronze Age axe (HER 10933); a flint scatter (HER 12109) and the findspot of an Iron Age sword recorded by the PAS to the north-west and west of Westonzoyland approximately 1km to the south-west of the Proposed Scheme
- A cluster of Bronze Age metalwork recorded by the PAS to the north-west of Greylake approximately 300m to the south of the Proposed Scheme
- A group of assets to the east of Greylake including: prehistoric wood finds (HER 11760 and 12132); prehistoric burials and finds recovered during sand quarrying during the early 20th century (HER 10568); and an unstratified chert flake (HER 11761) located either side of the Proposed Scheme. The island at Greylake was also investigated as part of an episode of Time Team in 1998 (HER 24511 and 57102) when Bronze Age human remains and artefacts were recovered. Subsequent dating of the prehistoric burials found in the early 20th century showed them to date to the Mesolithic period (Brunning 2013)
- A group of prehistoric assets including finds and cropmarks (HER 53493, 55012, 55025, 55026 and 55027) on Aller Moor approximately 1.25km to the east of the Proposed Scheme. This area has been subject to geophysical survey (HER 31711) and archaeological evaluation

These assets are reviewed here to highlight the archaeological potential of the Proposed Scheme and are not ascribed a value.

8.4.2. Roman (AD 43 to AD 410)

There are no heritage assets dating to the Roman period recorded within the footprint of the Proposed Scheme.
Recorded non-designated heritage assets of Roman date are less prevalent within the study area, notable groups include:

- A number of possible sunken tracks to the north-west of Westonzoyland (HER 12105) and a cluster of Roman coins recorded by the PAS approximately 750m to the south-west of the Proposed Scheme
- Two cluster of Roman coins recorded by the PAS to the north-west of Greylake approximately 300m to the south of the Proposed Scheme
- Roman finds (HER 4500) recovered from the south-west of Stathe approximately 350m to the west of the Proposed Scheme
- It is noted that there was extensive Roman activity within the Somerset Levels including drainage and land reclamation. Undated field systems recorded by the HER may date to this period.

8.4.3. Early medieval (AD 411 to AD 1065)

There are no heritage assets dating to the early medieval period recorded within the footprint of the Proposed Scheme.

The only early medieval/Saxon heritage asset recorded within the study area comprises the findspot of a strap fitting identified by the PAS to the west of Parchey Bridge approximately 250m to the west of the Proposed Scheme.

8.4.4. Medieval (AD 1066 to AD 1550)

There are three non-designated heritage assets which date to the medieval period within the footprint of the Proposed Scheme. These are summarised below.

One heritage asset comprises a group of linear ditch cropmarks, thought to be field systems and are possibly medieval or prehistoric in date (HER 11278). This heritage asset has been identified on the north-east side of the Langacre Rhyne, east of Greylake and measures over 300m in length in total. The HER suggests the features may have formed part of a more extensive system of land division, however the survival of other associated features is currently unknown. As a result of the frequency of this type of heritage assets and lack of rarity and its non-designated nature this asset has been assessed to be of low value.

Another heritage asset comprises the earthworks of three probable medieval or post medieval stack stands which are visible on aerial photographs (HER 18899) located to the north-east of Othery on King's Sedgemoor. These features sub-square and sub-rectangular in shape and measure between 22m by 9m and 9m by 9m. It is believed stack stands were used to temporarily store harvest hay or corn and *'in wetland areas such as King's Sedgemoor, they include the basic elements of a small platform surrounded by a drainage ditch'* (HER). Given the lack of archaeological contextual evidence of this asset and its local importance to the King's Sedgemoor area this asset has been assessed to be of low value.

Asset HER 54919 comprises the site of a deserted medieval farmstead, comprising an area of extant complex earthworks on a low promontory located on the west bank of the River Sowy to the south of Othery. The features were defined by flooding in the 1940s and is visible on aerial photographs comprising sub-rectangular enclosures defined by banks and ditches. Very few medieval farmsteads have been examined in the South West (Webster 2007, 196) therefore this asset has the potential to provide further information on deserted medieval farmsteads within the Somerset area and contribute to the Regional Research Aims 42 and 47 (Webster, 2007) for the region. Thus, Asset HER 54919 has been assessed to be of medium value.

Medieval assets recorded within the study area most reflect landscape elements such as flood banks, field systems, drains and stack stands. A former farmstead is identified at Othery (HER 11276) to the immediate west of the Proposed Scheme. Deserted medieval villages are also recorded at Oath (HER 53487) approximately 250m to the south of the Proposed Scheme; and east of Aller Court Farm (HER 53488) approximately 700m to the north. The PAS also record 18 finds of medieval date within the study area. The only clear cluster of finds is located to the north-west of Westonzoyland, approximately 1km to the south-west of the Proposed Scheme, where pottery, a spindle whorl and various metal finds have been recovered.

8.4.5. Post medieval (AD 1551 to Present)

The designated Battle of Sedgemoor Registered Battlefield (NHLE 1000032) lies on the left bank of the KSD immediately to the north of Westonzoyland. The designation abuts the drain for approximately 1.1km of its length. The Battle of Sedgemoor dated to 6th July 1685 and was the final engagement of the Monmouth Rebellion against

the Monarchy of James II. It was also the last pitched battle to be fought on English soil. Given its regional and historic importance as a battlefield site and its potential to contribute to the Regional Research Aim 63 (Webster, 2007) on medieval and later conflict sites through the discovery of material remains, this designated asset has been assessed to be of medium value.

Three non-designated post medieval heritage assets relating to roads are recorded within the footprint of the Proposed Scheme including:

- A stone causeway referred to as Greylake Fosse (HER 10567) which is thought to have medieval origins, although this is not proven. This asset is mentioned in the 17th century measuring eight miles long and was named after an Abbot of Glastonbury (HER). The alignment of Asset HER 10567 is now occupied by the modern road, the A361, and crosses the River Sowy to the north-east of Greylake
- Asset HER 10567 coincides with the course of an 18th century turnpike road (HER 26224) which also follows the alignment of the A361, but then deviates south from Greylake
- Another 18th century turnpike road (HER 24693) which crosses the Proposed Scheme at Beer Wall

In consideration of their poor state of preservation, their lack of rarity and limited potential to contribute to Regional Research Aim 48, Assets HER 10567, HER 26224 and HER 24693 are considered to be of local importance and have therefore been assessed to be of low value.

The Proposed Scheme footprint includes part of an area the HER identifies a battle site located to the south-east of Pathe (HER 19451). This battle site is associated with the Battle of Aller Drove, which is thought to have happened after the Battle of Langport (1645) as the Royalists retreated towards Bridgewater (HER), they were stopped by the Parliamentarian army, made a brief stand at Aller Great Drove, before being defeated (Baggs *et al*., 1974). This is not a designated as a Registered Battlefield. Given its regional and historic importance as a battlefield site and its potential to contribute to the Regional Research Aim 63 (Webster, 2007) on medieval and later conflict sites through the discovery of material remains, Asset HER 19451 has been assessed to be of medium value.

The PEIR (Jacobs 2020) acknowledges that the KSD (HER 41612) is a historic feature in its own right. The channel drains the peat moors of King's Sedgemoor and the main channel was constructed between 1791 and 1795. Despite defects, the drain brought some flood relief. It was widened in 1939 and 1944, which led to some of the archaeological data detailed above being generated. In 1972 it was connected with the newly-created River Sowy flood relief channel. Given this asset provides insight into the construction of post-medieval flood relief for the local area, it is considered to be of local importance and has been assessed to be of low value.

Post medieval assets recorded within the study area include the sites of various buildings shown on historic mapping; former sand quarries; withy boilers; roads and Second World War defensive features. The PAS also records 33 post medieval finds within the study area. Of particular note are a cluster of finds within the Registered Battlefield of the Battle of Sedgemoor (NHLE 1000032) which lies on the left bank of

the KSD immediately to the north of Westonzoyland. Finds from this area include shot, buttons, buckles, mounts and coins.
A scheduled duck decoy (NHLE 1014451) is present on Middle Moor at the southern end of the Proposed Scheme. The designation lies 150m north of the Proposed Scheme and dates from the late 17th century.

8.4.6. Undated

There are four heritage assets recorded within the footprint of the Proposed Scheme which are undated including:

- A mound (HER 12086) identified at Cossington Right Drove, Stawell
- Trackways to the north of Westonzoyland Airfield (HER 18916), the north-eastern extent of which partly intersect with the Proposed Scheme close to the River Sowy and KSD confluence
- A cropmark enclosure (HER 29970) through which the Proposed Scheme passes to the north-east of Stathe. This enclosure is visible on aerial photographs and includes an 'annular mark' within its boundary (HER). The feature is different to the other field boundaries and surface drainage systems around it (HER)
- Two groups of similarly oriented ditches (HER 54926) of which the southern ditch is crossed by the Proposed Scheme to the north of Monk's Leaze Clyce. This asset is visible on aerial photographs and may relate to remains of a field system or enclosure (HER)

Given the uncertainty of the origins of Assets HER 22970 and HER 54926 and their lack of secure archaeological context they have been considered to be of local importance and have been assessed to be of low value.
There are also numerous undated non-designated assets recorded within the study area including wooden features and finds, cropmarks, mounds and earthworks. Particular clusters of undated assets of note within the vicinity of the Proposed Scheme include:

- Cropmark enclosures and field systems to the south of Parchey Bridge (HER 11846 and 11847) to the immediate west of the Proposed Scheme
- The findspot of a dugout canoe (HER 28400) at Chedzoy to the immediate west of the Proposed Scheme. The canoe is recorded to have been approximately 12ft in length and was discovered during rhyne widening in the 1950s on the site of the mound adjacent to the KSD
- Trackways (HER 18916) identified to the north of Westonzoyland Airfield at the junction between the KSD and River Sowy
- Various wood and pile finds at Greylake (HER 11762, 11766, 12133, 12134 and 12834) located either side of the Proposed Scheme
- Various wood finds on North Moor (HER 55017, 55028 to 55031) to the east of the Proposed Scheme found during drain clearance works

8.4.7. Paleoenvironment

Previous work

Previous archaeological intervention and eyewitness accounts of excavation and maintenance work along the Sowy and the KSD, in addition to observations during times of low water levels, have borne witness to the buried palaeoenvironment in certain sections of the Proposed Scheme. These interventions have shed light on the nature of the physical environment during the prehistoric period.
A deep band of peat was observed during an archaeological watching brief (HER 28226) to the immediate west of the Proposed Scheme to the south of Aller Drove.

At Beer Wall, Othery, to the east of the Proposed Scheme, an archaeological watching brief (HER 36188) identified peat deposits (6.15-6.22 m below Ordnance Datum (OD)) representing a terrestrial wetland environment dating to the Late Mesolithic period (5300-5070 cal BC). This was subsequently 'choked off' by estuarine alluvial sedimentation associated with rising sea levels. The pollen evidence from this layer showed an on-site mire vegetation of carr woodland (dominated by alder with willow), which may have fringed a wetter zone with sedges and other fen taxa.

At the southern end of the Proposed Scheme, a borehole survey along the River Parrett (HER 26107) was undertaken in 2006. Deposits of the Somerset Levels Formation underlie the entire study area at +5-4m OD. This formed in marsh and river marginal environments during the second half of the Holocene, while carbon dates from the uppermost beds suggest the accretion ceased in the Late Bronze Age/Early Iron Age. Alluvial sediments relating to floodplain processes operating in the River Parrett overlie and form part of the Somerset Levels Formation. These include levee deposits while the whole alluvial sediment bundle dates to the Iron Age. Subsequent embankments were built using silt, clay and sand dredged from the channel and floodplain material.

Part of a geoarchaeological borehole survey (HER 28465) was carried out to the west of Aller Drove, to the west of the Proposed Scheme. The survey identified Late Pleistocene head derived from Barrow Mump and fluvial sands and gravels of Late Glacial/Early Holocene age. A palaeochannel had cut through both these units suggesting that it is a Holocene feature. The fills of the palaeochannel and the intertidal/alluvial deposits that seal it are 10m thick. The earliest channel sediments were carbon dated to the Late Mesolithic period and formed in intertidal conditions, while sedimentological evidence from the upper palaeochannel fills suggests burning activity causing the spread of ash across the wider catchment at this time. A peat dating from the Early Neolithic to the Late Bronze Age/Early Iron Age caps the palaeochannel. The peat formed in an alder carr environment, although pollen studies data demonstrate that the adjacent drylands were occupied by oak, birch and hazel forest. Magnetic susceptibility data suggest human activity on the site during the time that the peat formed. The flood banks were constructed on the peat surface in the medieval period and were built of sediment scraped from the surrounding moor.

Geoarchaeological assessment

A detailed assessment of the geoarchaeological and palaeoenvironmental deposits present within the Proposed Scheme and their archaeological and palaeoenvironmental potential was undertaken by ARCA (University of Winchester)

using the available BGS records and the results of a hand augur transect. The full report on the geoarchaeological assessment is provided at Appendix O and is summarised below.

Augur holes identified in the review below are identified by prefix BH and their locations are shown within the supporting figures at Appendix O.

Stratigraphic sequence

Six stratigraphic units were identified within the Proposed Scheme. These comprised from oldest to youngest:

- Fine clayey gravel (Pleistocene Burtle Beds)
- Unstructured blue grey clay (pre-late Mesolithic)
- Interbedded peat and clays
- Oxidised silt/clay (post-late Bronze Age)
- Topsoil
- Modern Made Ground

Fine gravel was recorded in one borehole only: BH25. It is found at +2.19m OD (1.58m below ground level (bgl)) and is at least 0.72m thick. The borehole was located at Greylake and records the northeast margin of an inlier of the Burtle Beds.

Unstructured blue grey silt/clay deposits were found in two distinct sections of the auger transect and at two different elevations. The first is in two boreholes (BH13 and BH14) on Aller Moor in the Parrett Valley at +3.35m OD (0.96m bgl) and +3.58m OD (0.75m bgl), respectively. The second section includes fifteen boreholes (BH24, BH26 – BH39) from Greylake to Mount Close Batch on King's Sedgemoor, where the deposits lie between -0.37m OD (3.71m bgl) and +0.86m OD 2.25m bgl) in BH37 and BH38, respectively. The lithology of the deposits is the same: namely a structureless and soft, blue grey silt/clay which contained rare black humic spots and sand-sized peat fragments. The high-level deposits in BH13 and 14 may represent silted-up meander cut-offs of the ancient River Parrett. On King's Sedgemoor though, the deposits are probably mid-Holocene (late Mesolithic, sixth millennium) tidal flat mud deposits.

Peat deposits were found in all the boreholes (except BH19 and BH40). From Monk's Leaze Clyce (BH1) to Othery (BH20) peat sub-crops below oxidised silt/clay deposits between +3.64m OD in BH9 (0.79m bgl) and +4.05m (0.23m bgl) in BH16). From Othery (BH21) to Mount Close Batch (BH39) the peat outcrops. The ground surface in this section of the transect lies between +3.85m OD in BH21 and +2.96m OD in BH31. There are three broad peat lithologies: wood peat, reed peat and interbedded peat and clay. Wood peat has been defined as a fibrous peat matrix with >30% composed of clasts of wood, if it has <30% the deposit is a reed peat. Interbedded peat and clay deposits are composed of peat and clay beds with the latter no thicker than 200mm, displaying diffuse or gradual boundaries and containing frequent, poorly sorted peat clasts. The colour of the clay beds is generally a grey to olive brown.

Oxidised silt/clay deposits were found in 18 consecutive boreholes that lie from Monk's Leaze Clyce (BH1) to Othery (BH18). The deposit outcrops with a topsoil developed in the uppermost fraction in BH1 – BH11 and BH7 – BH14. The thickness

of the oxidised silt/clay is a maximum of 1.21m in BH3 and it decreases northwards, away from the influence of the River Parrett. The lithology of the oxidised silt/clay is a firm yellowish-brown silt/clay with 50% iron oxide mottles. There is a gradual boundary to the underlying peat and the colour grades into a dark greyish-brown with occasional peat granules. The unit is bioturbated by roots of grass pasture. It represents flood water alluviation from the River Parrett.

Modern Made Ground was found in BH40 where a turf line covers impenetrable 20th century rubbish, and in BH19 where a topsoil with modern detritus overlies hard deposits that are probably associated with infrastructure works at the site.

Archaeological and palaeoenvironmental potential

The archaeological and palaeoenvironmental potential of the stratigraphic units within the vicinity of the Proposed Scheme was identified to be as follows.

- The palaeoenvironmental potential of the unstructured blue grey silt/clay and the peat deposits is high. The deposits will contain a suite of botanical and faunal remains, for example, diatoms, pollen, plant macrofossils, beetles and molluscs. The archaeological potential of these deposits is moderate to high on the Burtle edge where prehistoric human occupation has been demonstrated, but generally low in the main body of the valley peats. However, prehistoric trackways have been identified, for example: west of Mount Close Batch in King's Sedgemoor Back Ditch (HER 10847); a late Bronze Age brushwood trackway (HER 10580) at Greylake in the west bank of the Langacre Rhyne, which runs parallel to the River Sowy (see Wessex Archaeology 2015, 21:5.1.21); and Bronze Age piles and cut roundwood (>4m bgl) on Aller Moor (HER 15766 and HER 16137). This evidence points to important, local, high archaeological potential.
- The palaeoenvironmental potential of the top fraction of the peat where it is oxidised, and the oxidised silt/clay deposits is moderate to low. In places it is noted that the peat is exposed on the surface due to erosion/plough damage. In such areas, the palaeoenvironmental potential is low to negligible. Archaeological potential for non-organic artefacts and features is high particularly those relating to drainage activities and post-drainage times.

No geological feature was identified in the auger transect that will preclude the presence of buried archaeological remains.

Value

The deposits of geoarchaeological and palaeoenvironmental interest within the area of the Proposed Scheme, comprising unstructured blue grey silt/clay and peat, have the potential to contain well preserved archaeological and environmental evidence that will contribute to Regional Research Aims such as 3, 18 and 20 associated with prehistoric activity and environmental information for the region (Webster, 2007). As such, these deposits are assessed to be of medium value.

8.4.8. Archaeological potential

There is a high potential for previously unknown archaeological assets and deposits of palaeoenvironmental/geoarchaeological interest to be present within the vicinity of the Proposed Scheme. Areas of particular interest, as highlighted by the above review of the known baseline, include:

- To the west of the scheduled trackways south-east of Parchey Bridge (NHLE 1014430). It is highly likely that the previous identified trackways continue from the topographic spur at Sutton Hams to the south-west across the area of the Proposed Scheme. Timber posts have been identified in the west bank of the KSD (HER 11319) opposite the scheduled area and may represent an extension of the scheduled prehistoric trackways. In addition, previously recorded lithic scatters could indicate a potential for preserved in-situ knapping floors or area of activity
- There is a high potential for further evidence of the Battle of Sedgemoor (NHLE 1000032) which lies on the left bank of the KSD immediately to the north of Westonzoyland, in the form of finds and possibly buried remains
- At the topographic island of Greylake, there is evidence for at least three phases of the disposal of human remains including Mesolithic, Early Bronze Age and Late Bronze Age activity (Brunning 2013). In addition, there is also evidence of wooden trackways across King's Sedgemoor from the topographic spur at Briarwood Farm extending to the south-west across the Proposed Scheme towards Greylake and Middlezoy. There are also numerous PAS finds recorded within the Greylake area, including a cluster of Bronze Age metal work which may represent votive offerings. As such, there is a potential for further preserved wooden features to survive within this area and also further unstratified metal finds
- There is a high potential for wooden trackways in the area between Othery and High Ham linking the two areas of higher ground. This is supported by the known presence of wooden finds in this area and analogy with similar natural crossing points in the same valley and the Brue Valley to the north (Brunning pers. comm)
- An undated timber pile alignment (HER 16137) is recorded at Oath in the southern part of the Proposed Scheme. Further evidence of this feature may survive within the Proposed Scheme

The value of any previously unknown archaeological assets is currently unknown. However, if further evidence of prehistoric trackways was identified to the south of Parchey Bridge, it could be considered of equivalent status to the Scheduled Monument (i.e. high value).

8.5. Likely significant effects

Potential impacts to heritage assets as a result of the construction of the Proposed Scheme include:

- Damage to designated assets arising from plant movements
- Damage to designated and non-designated assets as a result of compression from bank raising works
- Partial exposure or damage to designated and non-designated archaeological assets, including unstratified finds related to the Battle of Sedgemoor, during shallow topsoil stripping in advance of embankment raising works

- Partial or complete removal of previously unknown archaeological assets during excavation works for the embayments, two-stage channels and backwaters
- Impacts on deposits of palaeoenvironmental and geoarchaeological interest arising from excavation works for the embayments, two-stage channels and backwaters
- Impacts on deposits of palaeoenvironmental and geoarchaeological interest arising from excavation works and sheet piling for sluice refurbishment works on the right bank of the KSD, fencing removal and reinstatement, and culvert crossing strengthening on left bank of Sowy and KSD
- Impacts to non-designated archaeological assets arising from replacement tree planting

Likely significant effects are detailed in Table 8.4 below.

In terms of impacts to the settings of designated assets, given the nature of the Proposed Scheme, no permanent adverse effects on such assets arising from changes to their settings are identified. The Proposed Scheme will comprise works to existing embankments and creation of new embayments, two stage channels and backwaters within a landscape dominated by drainage features. As such, no harm to the value of any designated assets, or the ability to appreciate this value, is predicted as a consequence of minor changes to their settings. Albeit it is noted that there will be a temporary impact during the construction period arising from the presence of construction machinery within their settings.

The Proposed Scheme will not result in any pathway to change groundwater quality and quantity (see Appendix E). Therefore, no impacts on heritage assets arising from changes to hydrology are predicted to arise from the operation of the Proposed Scheme. This is particularly relevant to the scheduled prehistoric trackway located approximately 670m to the south-east of Parchey Bridge (NHLE 1014430) due to it being included on the Heritage At Risk Register (Historic England, 2020a) due to the threat of drainage/ dewatering.

Modelling of compression impacts arising from plant movements and embankment and land raising indicates that the effect on buried archaeological assets is likely to be negligible. The results of the compression modelling for the works within the area of the scheduled prehistoric trackways 670m to the south-east of Parchey Bridge (NHLE 1014430) and at Greylake are provided at Appendix O.

Table 8.4 Likely significant effects on heritage assets

Asset	Description	Period	Value	Description of impact, phase, and duration	Magnitude	Significance of effect
Prehistoric wooden trackway located approximately 670m to the south-east of Parchey Bridge (NHLE 1014430)	Designated as a Scheduled Monument and comprising at least seven potential wooden trackways radiating across the Proposed Scheme	Prehistoric	High	Compression and rutting from plant movements (direct, construction, temporary). Compression from embankment and land raising (direct, construction, permanent)	Low	Moderate (Significant)
Timber posts identified in the west bank of the KSD (HER 11319)	Non-designated asset, potentially a continuation of the scheduled trackways on the eastern side of the KSD	Prehistoric	High	None identified. No embankment raising works are identified in the vicinity of this asset	No Change	Negligible (Not significant)
Strangway's Causeway (HER 12833)	Non-designated wooden causeway comprising a row of timber piles	Prehistoric	Medium	Topsoil stripping in advance of embankment raising could impact on this asset (direct, construction, permanent) Compression from embankment and land raising (direct,	Medium	Moderate (Significant)

Asset	Description	Period	Value	Description of impact, phase, and duration	Magnitude	Significance of effect
				construction, permanent)		
Bronze Age brushwood trackway at Greylake (HER 10580)	Non-designated brushwood trackway identified within the Langacre Rhyne to the east of the Proposed Scheme	Prehistoric	Medium	Topsoil stripping in advance of embankment raising could impact on this asset (direct, construction, permanent) Replacement tree planting could impact on this asset (direct, construction, permanent)	Medium	Moderate (Significant)
Timber piles identified in the north bank of the River Sowy (HER 16137)	Non-designated alignment of timber piles which were identified in the north bank of the River Sowy and within the river bed 100m east of Church Drove Bridge, Oath	Prehistoric	Medium	None identified.	No Change	Negligible (Not significant)
Human skull find (HER 39230)	Non-designated findspot of a human skull	Prehistoric	Low	None identified. This asset has been removed from the Proposed Scheme	No Change	Negligible (Not significant)

Asset	Description	Period	Value	Description of impact, phase, and duration	Magnitude	Significance of effect
A group of linear ditch cropmarks (HER 11278)	Non-designated linear features representing a field system that spans the Proposed Scheme at Greylake	Medieval	Low	Topsoil stripping in advance of embankment raising could impact on this asset (direct, construction, permanent)	Low	Minor (Not significant)
Stack stands which are visible on aerial photographs (HER 18899)	Non-designated earthworks of three probable stack stands located to the north-east of Othery on King's Sedgemoor	Medieval	Low	Topsoil stripping in advance of embankment raising could impact on this asset (direct, construction, permanent)	Low	Minor (Not significant)
Site of a deserted medieval farmstead (HER 54919)	Non-designated complex of earthworks representing a probable farmstead located on the west bank of the River Sowy to the south of Othery	Medieval	Medium	None identified.	No Change	Negligible (Not significant)
Battle of Sedgemoor Registered Battlefield (NHLE 1000032)	Designated battlefield covering the area of the final engagement of the Monmouth Rebellion against the Monarchy of James II and located on the	Post medieval	Medium	Topsoil stripping in advance of embankment raising could impact on unstratified finds related to this asset and/or other	Low	Minor (Not significant)

Asset	Description	Period	Value	Description of impact, phase, and duration	Magnitude	Significance of effect
	west bank of the KSD at the northern extent of the Proposed Scheme			associated evidence of the battle (direct, construction, permanent) Excavations for culvert strengthening works could impact on unstratified finds related to this asset and/or other associated evidence of the battle (direct, construction, permanent)		
Greylake Fosse (HER 10567)	Non-designated stone causeway	Post medieval	Low	None identified.	No Change	Negligible (Not significant)
18th century turnpike road (HER 26224)	Non-designated road	Post medieval	Low	None identified.	No Change	Negligible (Not significant)
18th century turnpike road (HER 24693)	Non-designated road	Post medieval	Low	None identified.	No Change	Negligible (Not significant)
Battle of Aller Drove (HER 19451) site of	Non-designated site of a skirmish dating from	Post Medieval	Medium	None identified.	No Change	Negligible

Asset	Description	Period	Value	Description of impact, phase, and duration	Magnitude	Significance of effect
	the Battle of Langport (1645)					(Not significant)
Mound (HER 12086)	Non-designated mound identified at Cossington Right Drove on the east bank of the KSD	Undated	Low	Topsoil stripping in advance of embankment raising could impact on this asset (direct, construction, permanent)	Low	Minor (Not significant)
Trackways to the north of Westonzoyland Airfield (HER 18916)	Non-designated trackways identified to intersect with the Proposed Scheme close to the River Sowy and KSD confluence	Undated	Low	Topsoil stripping in advance of embankment raising could impact on this asset (direct, construction, permanent)	Low	Minor (Not significant)
A cropmark enclosure (HER 29970)	Non-designated enclosure visible on aerial photographs and includes an 'annular mark' within its boundary	Undated	Low	None identified.	No Change	Negligible (Not significant)
Two groups of similarly oriented ditches (HER 54926)	Non-designated group of ditches which may represent a former field system or enclosure. Located at the	Undated	Low	None identified.	No Change	Negligible (Not significant)

Asset	Description	Period	Value	Description of impact, phase, and duration	Magnitude	Significance of effect
	southern limit of the Proposed Scheme					
Previously unknown archaeological assets and deposits of paleoenvironmental and geoarchaeological interest	Non-designated	Undated	Unknown – predicted to be high as a worst-case scenario	Excavation for the embayments and two stage channels could result in the partial or complete removal of such remains (direct, construction, permanent) Sheet piling for culvert strengthening works could also impact on such remains	High – predicted	Substantial (Significant)
Previously unknown archaeological assets (prehistoric metalwork and later finds) in the Greylake area	Non-designated	Undated	Unknown – predicted to be low	Topsoil stripping in advance of embankment raising could impact on unstratified finds in the Greylake area as highlighted by the concentration of recorded PAS finds	Medium	Minor (Not significant)

8.6. Mitigation

In accordance with the requirements of the Ancient Monuments and Archaeological Areas Act 1979, SMC will be obtained for the proposed bank raising works within the scheduled area of the prehistoric trackways 670m to the south-east of Parchey Bridge (NHLE 1014430). Compliance with any conditions of the SMC will form part of the mitigation for the Proposed Scheme. To mitigate the impacts of plant movement within the scheduled area, temporary vehicle matts will be utilised.

Where potential impacts to designated and non-designated assets have been identified, these will be mitigated through a programme of archaeological monitoring (watching brief) during construction. For the topsoil stripping within the designated Battle of Sedgemoor Registered Battlefield, and within the area of the Proposed Scheme to the north of Greylake (southern bank of the Sowy), the watching brief will be augmented with a metal detector survey due to the heightened potential for unstratified metal finds within these areas.

During excavation works for the embayments, two stage channels and backwaters archaeological investigation and recording will also be undertaken. Excavation works will be managed to enable the full length of the embayments to be examined to depth prior to breaching. If complex or unexpected archaeological remains are encountered, works will stop and the Archaeological Advisor to Sedgemoor District Council informed. Where possible, the preference will be to preserve any significant archaeological remains *in-situ* through redesign of the embayments, two stage channels and backwaters. Where this is not feasible, further mitigation in the form of detailed archaeological excavation and recording will be required.

All the archaeological investigations will be conducted in accordance with a Written Scheme of Investigation (WSI) submitted to and approved by the Archaeological Advisor to Sedgemoor District Council, and where necessary, Historic England.

Investigation, recording and dissemination of any archaeological assets that cannot be left *in-situ* is in accordance with NPPF (Paragraph 199).

All works will be conducted in accordance with the standards and guidance provided by the Chartered Institute for Archaeologists.

8.7. Conclusions and summary of residual effects

As the Proposed Scheme is located within a landscape of high archaeological potential, with a number of designated and non-designated assets of archaeological interest present within the footprint of the proposed works, there will be a requirement for a programme of archaeological mitigation to be undertaken during the construction period. This will comprise a programme of archaeological monitoring (watching brief) and, if unexpected or complex remains are encountered that cannot be left *in-situ*, detailed archaeological investigation and recording (excavation).

SMC will also be obtained for the works within the area of the scheduled prehistoric trackways 670m to the south-east of Parchey Bridge (NHLE 1014430). Compliance with any conditions attached to the SMC will form part of the mitigation programme.

No impacts are identified arising from changes to hydrology or the settings of any designated assets.

Modelling of compression impacts arising from plant movements and embankment and land raising indicates that the effect on buried archaeological assets is likely to be negligible.

Table 8.5 Residual effects where significant effects are predicted in the absence of mitigation

Receptor (sensitivity/value)	Nature of impact (magnitude)	Significance (pre-mitigation)	Mitigation	Residual effect
Construction				
Prehistoric wooden trackway located approximately 670m to the south-east of Parchey Bridge (NHLE 1014430) (high)	Compression and rutting from plant movements (low, temporary). Compression from embankment and land raising (low, permanent)	Moderate adverse (significant)	Temporary matting for vehicle access Archaeological monitoring of groundworks	Negligible adverse (not significant)
Strangway's Causeway (HER 12833) (medium)	Topsoil stripping in advance of embankment raising could impact on this asset Compression from embankment and land raising (medium, permanent)	Moderate adverse (significant)	Archaeological monitoring of groundworks	Negligible adverse (not significant)
Bronze Age brushwood trackway at Greylake (HER 10580) (medium)	Topsoil stripping in advance of embankment raising could impact on this asset	Moderate adverse (significant)	Archaeological investigation and recording Archaeological excavation and recording	Moderate (significant)

Receptor (sensitivity/value)	Nature of impact (magnitude)	Significance (pre-mitigation)	Mitigation	Residual effect
	Replacement tree planting could impact on this asset (Medium, permanent)		if preservation *in-situ* not achievable	
Previously unknown archaeological assets and deposits of paleoenvironmental and geoarchaeological interest (high – as a worst case)	Excavation for the embayments and two stage channels could result in the partial or complete removal of such remains (high, permanent)	Substantial (significant)	Archaeological investigation and recording Archaeological excavation and recording if preservation *in-situ* not achievable	Negligible adverse (not significant)
Operation				
No significant effects anticipated				

9. Landscape

9.1. Introduction

This chapter identifies and assesses the significance of and the effects of change resulting from the Proposed Scheme on: (a) the landscape as an environmental resource in its own right and (b) on people's views and visual amenity.

9.2. Regulation and policy background

The European Landscape Convention (2000), Council of Europe

The Convention was ratified by the UK Government in 2006. It identifies landscape as …

… an important part of the quality of life for people everywhere; in urban areas and in the countryside, in degraded areas as well as in areas of high-quality, in areas recognised as being of outstanding beauty as well as everyday areas …"

"(Landscape should be protected by) actions to conserve and maintain the significant or characteristic features of a landscape …

9.3. Methodology

9.3.1. Scope of assessment

The scope of the assessment provided in this chapter, as determined through the scoping process presented in the PEIR and clarified during the assessment process, is shown in Table 9.1 below.

Table 9.1 Scope of LVIA

Scoped in	Scoped out
Potential impacts on the Peat Moors, Open Moor and Moor Fringe landscape character areas during construction, the first one to two years of operation and in Year 5 of operation.	Long-term operational impacts on the Peat Moors, Open Moor and Moor Fringe landscape character areas.
Potential impacts on identified visual receptors during construction, the first one to two years of operation and in Year 5 of operation.	Long-term operational impacts on identified visual receptors.

9.3.2. Study area

The study area for the landscape and visual impact assessment (LVIA) includes the flood relief channels of the KSD and Sowy between Monk's Leaze Clyce and Parchey Bridge and the extent of the wider surrounding landscape which the Proposed Scheme may affect. This includes the extent of local Landscape Character Areas (LCA) likely to be affected either directly or indirectly and the area within which visual impacts are likely to be experienced.

The LCAs are single unique geographical areas of a particular landscape type and are commonly defined in the landscape character assessments carried out by local planning authorities. In this case, the LCAs comprise the Peat Moors LCA, the Open Moor LCA and Moor Fringe LCA, which are described in more detail in section 9.4 below and shown on the Baseline Landscape Character plans (Figures 9.1 and 9.2, Appendix A).

The area within which visual impacts are likely to be experienced is referred to as the Zone of Theoretical Visibility (ZTV) and is shown on the Visual Amenity plans (Figures 9.3 and 9.4) in Appendix A. It is considered unlikely, due to the limited scale of the works, that they will be visibly perceptible to a significant degree at a distance greater than one kilometre. The maximum extent of the ZTV, and therefore the study area, has been limited to a corridor of 1km to each side of the channels. The study area boundary is shown on both the Baseline Landscape Character and Visual Amenity plans.

9.3.3. Guidance

The LVIA generally follows the Landscape Institute and Institute of Environmental Management and Assessment Guidelines for Landscape and Visual Impact Assessment (GLVIA) (3rd Edition). The assessment is informed by a site survey undertaken on 27th February 2020. Visual impacts have been assessed from publicly accessible vantage points.

9.3.4. Establishing the baseline

The assessment of impacts on landscape character is undertaken in four stages. The first stage involves the collection of information about the characteristic features of the landscape, its topography, vegetation patterns, settlements, watercourses, land use, cultural aspects, landscape designations and existing pressures likely to lead to change. This provides a baseline against which changes resulting from the proposals can be measured.

The second stage evaluates this information, breaking the landscape down into broadly homogenous landscape character areas. In this case, as described above and in section 9.4 below, the defined Landscape Character Areas (LCA) comprise the Peat Moors LCA, the Open Moor LCA and the Moor Fringe LCA.

9.3.5. Determination of significance

Sensitivity

In the third stage of the landscape assessment, judgements are made on the sensitivity of each receptor (LCA) and the magnitude of the impact on each receptor. Sensitivity is judged by considering the susceptibility of the receptor to the type of change arising from the specific proposals and the value attached to the receptor by society. Each character type is ranked for sensitivity in accordance with the criteria set out in the Table 9.2 below.

Table 9.2 Landscape sensitivity criteria

Sensitivity	Criteria
High	Areas and/or features which have a particularly high value, by nature of their condition, high scenic qualities, strong characteristics such as pattern and land cover, cultural associations, and/or relative position and amenity including level of tranquility. These are likely to be, but not necessarily, within a National Park, Area of Outstanding Natural Beauty, Registered Park and Garden or within a World Heritage Site.
Medium	Areas and/or features which are considered to be of high value by virtue of their beneficial characteristics such as pattern and land cover, sense of place or local or cultural associations and level of tranquility. These areas will be of regional or local importance and are likely to be, but not necessarily, designated by the planning authority as being of landscape value. These may include Areas of Great Landscape Value, Conservation Areas and urban and rural parks.
Low	Landscapes and/or features which retain a beneficial character such as pattern or land cover and a sense of place or local or cultural associations and a degree of tranquility. These areas are unlikely to be designated for their landscape value.
Negligible	Landscapes in fair to poor condition which have undergone change to the extent that they no longer have a distinctive local character such as pattern and/or land cover, or aesthetic quality, or they lack cultural associations or tranquility.

Magnitude

The magnitude of the impact on each receptor is judged by considering the size and scale of the impact, the geographical extent of the area that will be affected, the duration of the impact and its reversibility. This assessment considers whether the proposal fits into the landscape and to what extent it affects the landscape's distinctive quality, local diversity and character, whether it integrates with the natural landform or cuts through it against the grain, whether it removes or avoids features of landscape value, and whether it appears out of scale or inappropriate in its design. The magnitudes of the impacts are ranked in accordance with the criteria in Table 9.3.

Table 9.3 Magnitude of impact criteria for landscape assessment

Magnitude	Criteria
High Adverse	Total loss or large-scale damage to existing character or distinctive features and elements, and/or the addition of new but uncharacteristic conspicuous features and elements.
Medium Adverse	Partial loss or noticeable damage to existing character or distinctive features and elements, and/or the addition of new but uncharacteristic noticeable features and elements.
Low Adverse	Slight loss or damage to existing character or features and elements, and/or the addition of new but uncharacteristic features and elements.
Negligible	No noticeable loss, damage or alteration to existing character or features and elements.
Low Beneficial	Slight improvement of character by the restoration of existing features and elements, and/or the removal of uncharacteristic features and elements, or by the addition of new characteristic elements.
Medium Beneficial	Partial or noticeable improvement of character by the restoration of existing features and elements, and/or the removal of uncharacteristic and noticeable features and elements, or by the addition of new characteristic features.
High Beneficial	Large scale improvement of character by the restoration of features and elements, and/or the removal of uncharacteristic and conspicuous features and elements, or by the addition of new distinctive features.

Significance of effects

The fourth stage considers the significance of the potential effects on the landscape arising as a result of the Proposed Scheme during construction and during operation. The significance of effect is determined by cross-referencing the judgements about the sensitivity/value of the landscape receptors against the magnitude of the impacts and is guided by the matrix provided in Table 9.4.

The significance of effect categories stated in Table 9.4 differ from those stated in Chapter 5, section 5.2.4 in so much as intermediate categories are presented in Table 9.4 to provide a finer gradation of significance classification that accounts more sensitively for differences in magnitude and sensitivity/value of landscape and visual receptors.

Any significance of effect assessed as having a level of moderate or greater is considered ‘significant’ (i.e. major, major-moderate and moderate).

During operation, the significance of effects is reported in Years 1 - 2 following completion of construction and in Year 5 following completion of construction, when any proposed landscape mitigation / vegetation reinstatement will have established

effectively and may have reduced any associated landscape impacts reported in Years 1-2.

Table 9.4 Matrix for the evaluation of significant landscape and visual effects

Magnitude	Value/Sensitivity			
	High	Medium	Low	Negligible
High adverse	Major adverse (significant)	Major adverse – moderate adverse (significant)	Moderate adverse (significant)	Moderate adverse – minor adverse (not significant)
Medium adverse	Major adverse – moderate adverse (significant)	Moderate adverse (significant)	Moderate adverse – minor adverse (Not significant)	Minor adverse (not significant)
Low adverse	Moderate adverse (significant)	Moderate adverse – minor adverse (not significant)	Minor adverse (not significant)	Minor adverse - negligible (not significant)
Negligible	Negligible (Not significant)			
Low beneficial	Moderate beneficial (significant)	Moderate beneficial – minor beneficial (not significant)	Minor beneficial (not significant)	Minor beneficial - negligible (not significant)
Medium beneficial	Major beneficial – moderate beneficial (significant)	Moderate beneficial (significant)	Moderate beneficial – minor beneficial (not significant)	Minor beneficial (not significant)
High beneficial	Major beneficial (significant)	Major beneficial – moderate beneficial (significant)	Moderate beneficial (significant)	Moderate beneficial – minor beneficial (not significant)

9.3.7. Visual impact assessment methodology

The assessment of impacts on visual amenity is undertaken in four stages. The first stage is to establish the area in which the Proposed Scheme may be visible, the different groups of people who may experience views of the Proposed Scheme, the viewpoints where they will be affected and the nature of the views at those points. A preliminary, desk-based identification is made of the potential visual receptors (i.e. people, either as individuals or as groups) that are likely to experience a change in view as a result of the Proposed Scheme, both during construction and on completion of the Proposed Scheme.

Potential visual receptors are defined as: residents, users of recreational areas, PRoW and other areas of public access such as public open space and public sports grounds, users of public roads and railways, workers and public views from within valued landscapes. The areas from where the Proposed Scheme will theoretically be seen, known as the Zone of Theoretical Visibility (ZTV), is defined on a map. In this case, the ZTV has been determined using map interpretation, Google Earth imagery, and visual envelope mapping from an on-site visit. The ZTV informs the identification of a list of potential visual receptors. The ZTV and identified visual receptors are then checked during a site survey to determine the nature of the view, which may be affected by aspects not accounted for by the ZTV such as screening caused by local landform, buildings or by woodland.

The second stage of the visual assessment is to systematically identify the potential likely impacts on the visual receptors. This is undertaken by assessing the extent of the difference between the existing view (i.e. prior to the development) and the view with the proposed development in place, considering several factors: whether the Proposed Scheme is central or peripheral to the view, what proportion of the view alters, the distance between the receptor and the Proposed Scheme, the sensitivity of the receptor to visual changes and how well the Proposed Scheme fits into the existing scene.

In this stage, judgements are made on the sensitivity of each receptor and the magnitude of the impact on each receptor. Sensitivity is judged by considering the susceptibility of the receptor to the type of change arising from the Proposed Scheme and the value attached to the view by people. Each visual receptor is ranked for sensitivity in accordance with the criteria set out in Table 9.5.

Table 9.5 Sensitivity criteria for visual receptors

Sensitivity	Criteria
High	Private dwellings where viewers are familiar with the overall scene. Public views within areas of protected landscapes such as National Parks and Areas of Outstanding Natural Beauty.
Medium	Public Rights of Way and public access areas outside protected landscapes where viewers gain a long view due to slower speed or are likely to experience the views frequently or for long periods.
Low	Commercial premises, public facilities and roadside footways where the viewer may be familiar with the scene but holds it in

Sensitivity	Criteria
	less regard than viewers from residential properties or recreational Public Rights of Way.
Negligible	Surrounding road and rail networks where the viewer gains brief glimpses of the view at speed.

The magnitude of the impact on each receptor is assessed by considering the size and scale of the impact, the geographical extent of the area influenced, the duration of the impact and its reversibility. The magnitudes of the impacts are ranked in accordance with the criteria set out in Table 9.6.

Table 9.6 Magnitude of impact criteria for visual assessment

Magnitude	Definition
High negative	Where the scheme will cause a substantial deterioration in the existing view.
Medium negative	Where the scheme will cause a noticeable deterioration in the existing view.
Low negative	Where the scheme will cause a discernible deterioration in the existing view.
Negligible	No discernible deterioration or improvement in the existing view.
Low positive	Where the scheme will cause a discernible improvement in the existing view.
Medium positive	Where the scheme will cause a noticeable improvement in the existing view.
High positive	Where the scheme will cause a substantial improvement in the existing view.

Stage four considers the significance of the potential effects on the visual receptors arising as a result of the Proposed Scheme during construction and during operation. The significance of effect is determined by cross-referencing the judgements about the sensitivity/value of the visual receptors against the magnitude of the impacts in accordance with Table 9.4.

During operation, the significance of impacts is reported in Years 1-2 following completion of construction and in Year 5 following completion of construction where any proposed mitigation planting will have established effectively and will have reduced any residual landscape impacts reported in Years 1-2.

Any significance of effect assessed as having a level of moderate or greater is considered to be ‘significant’.

9.3.8. Limitations

Access to the site during the site survey was limited to publicly accessible vantage points. Whilst the full length of the KSD section of the Proposed Scheme was accessed via public footpaths, access along the Lower Sowy was restricted to intermittent road and accessible farm track crossing points over the river. South of Beer Wall, the Upper Sowy was accessed along a section of the River Parrett Trail between Stathe and Oath Lock. The proposed bank raising locations along the Upper Sowy upstream of Oath Lock were not surveyed but, as these works comprise discrete lengths of minor bank raising works, this is not considered a significant limitation to the assessment of the resulting impacts.

9.4. Existing environment

A desk study baseline review was carried out in November 2019 and a site survey undertaken on 24 February 2020.

The baseline review has revealed that there are no formal landscape designations within the study area which encompasses the flood relief channels of the Sowy and KSD plus a corridor of 1km to each side of the channel. Due to the limited scale of the works required under the Proposed Scheme it is considered unlikely that changes to the existing landscape resource and visual amenity will be discernible to a significant degree at distances beyond the study area boundary.

9.4.1. Baseline landscape character

At a national level, the Sowy/KSD system is located within Natural England's National Character Area (NCA) 142, Somerset Levels and Moors. A vast area of drained wetland which lies at or below the level of the high tide in the adjacent Bristol Channel, covering a total of about 230 square miles, this flat, open pastoral landscape is drained by the rivers River Parrett, Brue and Axe and their tributaries. Formed mainly by the accumulation of marine and estuarine alluvium as sea levels rose in the post-glacial era, broad valleys have been filled to a depth of up to 30m. This is topped by peat which began forming from wetland vegetation about 6,000 years ago. Continued deposition of marine and estuarine clays created the broad belt of coastal 'Levels' which are slightly higher than the inland 'Moors'. The key characteristics of the NCA, as described in the NCA profile, which are relevant to the study area are summarised as follows:

- A deeply rural, pastoral and flat landscape of rivers and wetlands, artificially drained, irrigated and modified to allow productive farming. The whole area is influenced to some degree by the artificial regulation of water.
- The coastal levels were once mostly saltmarsh and the meandering rhynes and irregular field patterns, defined by intermittent hedgerows, follow the former courses of creeks and rivers. The larger villages are all located on the slightly higher ground within the levels.
- The inland moors are open, often treeless, and have a chequer-board-like pattern of rectilinear fields, ditches, rhynes, drains and engineered rivers, and roads. Occasional hedgerows and lines of pollard willows associated with rhynes and ditches are found towards the edges of the moors, but in the centre field boundaries are frequently defined by ditches and rhynes ('wet fences'). Semi-natural unimproved grasslands, wet meadows, fen, mire and

reed beds underline the area's wetland character. Settlement on the moors is infrequent and generally limited to small farmsteads or hamlets. The complex system of control of water levels is apparent through the hierarchy of diches, rhynes and canalised rivers or cuts, with sluices and pumping stations. Levees or banks, often carrying roads and droves but also containing watercourses, relate to and reinforce the pattern of enclosure, often forming the only upstanding feature of the landscape.

- Reflecting the history of reclamation, roads are often straight droves, causeways and flood embankments, slightly raised and related to the drainage channels of the 18th century landscape of the inland moors.
- The biodiversity of the area is of national and international importance and more than two-thirds of the area is classified as floodplain and coastal grazing marsh priority habitat, the third largest lowland grazing system in Britain. It also has a rich environmental history of human occupation and management of a wetland landscape extending over more than 6,000 years.

The study area closely reflects the key characteristics of the NCA as described above. The study area occupies a small part of the overall NCA and any changes brought about by the Proposed Scheme are considered to be so small in the context of the wide area covered by NCA, any potential effects on the NCA have not be considered further.

With regard to local level landscape character assessments, the KSD and downstream section of the Sowy to the north of Beer Wall lie within Sedgemoor DC's boundary. The upstream section of the Sowy from Beer Wall to its confluence with the River Parrett at Monk's Leaze Clyce lies within South Somerset Council's boundary.

Sedgemoor DC's Sedgemoor Landscape Assessment and Countryside Design Summary (2003) defines one landscape character area (LCA), Peat Moors, (see Figure 9.1 in Appendix A) through which the KSD (from Parchey Bridge to the confluence with the Sowy) and downstream section of the Sowy (from the confluence with the KSD to Beer Wall) pass. The Peat Moors LCA as described therein is summarised as follows:

The Moors comprise the very low-lying areas (3-5m AOD, well below the high tide levels in the Bristol Channel) which were mainly marsh or fenlands until large-scale drainage and enclosure was affected between 1770 and the mid-nineteenth century. The Moors are characterised by a flat landscape with a strong rectilinear pattern of drainage ditches, rhynes and accompanying straight drove roads. Land use is mainly permanent pasture, traditionally for summer grazing and hay, but latterly also arable where water level management allows. Pollarded willows are a locally distinctive but not universal feature, and alder and poplar are common and where hedgerows were planted, hawthorn is the most common species. On some Moors sporadic tree growth alongside drainage ditches forms intermittent lines of scrub rather than continuous hedgerow, elsewhere the Moors landscape may be very open and treeless. Generally, there are very few buildings present other than isolated farmsteads. Views are mostly wide and panoramic other than where restricted by intermittent hedgerows and trees (more common on the Clay Moors) and many areas are prone to winter flooding. It is a particularly distinctive landscape with a very remote feeling strengthened by its lack of buildings and settlement. Most of the

Moors are included within the 'Somerset Levels and Moors Environmentally Sensitive Area' to encourage traditional agricultural practice and conservation. The capacity for development is noted as limited by landscape and nature conservation considerations but also by flood risk and, as a result, very little development is expected. It is noted regarding the potential visual impact of structures in areas where there are hedgerows or woodland, that these features could very effectively screen things from view within this flat landscape but that views to the Moors from the surrounding higher ground must also be considered.

South Somerset District Council's 'The Landscape of South Somerset' (1993) defines the area from Beer Wall to the Sowy throttle as 'Open Moor', a sub-type of the 'Moors and Islands' character zone, and the area from the Sowy throttle to the Sowy's junction with the River Parrett as 'Moor Fringe' (see Figure 9.2 in Appendix A). These LCA's are described as follows:

'Open Moor' has the following key characteristics: 'an overall pattern and wetness created by high water tables, winter flooding and the extensive regular rectilinear network of grassy droves and rhynes as 'wet fences' with their associated herb-rich vegetation'; 'an expansive, visually homogenous open naturalness created by extensive areas of low-intensity grassland and herb-rich pasture with a lack of scrub, woodland or fencing. Traditionally planting restricted to occasional lines of regularly pollarded willows in key places and isolated field junction planting'; 'An isolation and naturalness created by a lack of buildings and artefacts or modern automotive appearances in management'.

'Moor Fringe' lies between the moor and the steeper wooded slopes of the escarpment. Hedges are usually species-rich and fields are sometimes long and thin emphasizing the flow of the slope. Ancient tracks and roads fringe the steep escarpment and link a thin ribbon of farmsteads and cottages. Hedge-trees are usually oak or ash, the latter often pollarded. Willows, often old pollards, are more common on the wetter ground. Overall there is great rural charm is this small-scale domestic landscape which contrasts strongly with the vast unpopulated expanses of the moor and the enclosed secrecy of the wooded scarps'.

The study area closely reflects the similar characteristics of the Peat Moors LCA and the Open Moor LCA, as described above, where it runs through these LCAs. The character of the immediate landscape between the Sowy throttle and the Sowy's confluence with the River Parrett also reflects the open, flat and wet nature of the moors but the less open, hedged landscape of the Moor Fringe LCA is evident to the north of this section of the Sowy.

No national or local landscape designations apply. Sedgemoor DC's Sedgemoor Landscape Assessment and Countryside Design Summary (2003) 'Designated Areas' map notes that the Special Landscape Area local planning designation shown on the map is no longer in force.

At a site-specific level, the KSD comprises a very straight, artificial channel, some 30m in width, with a rectilinear alignment. Between Parchey Bridge and the KSD's confluence with the Sowy, crossings are limited to a footbridge close to the confluence. Vegetation on the left bank of the KSD is generally limited to marginal wetland close to water level bordered by open rectilinear pasture fields, with very sporadic linear strips of scrub and the occasional tree present in places between the fields and KSD. The only exception is a limited area of woodland immediately

upstream of Parchey Bridge. The right bank of the KSD is lined with marginal wetland vegetation which is bordered on the landward side by a strip of rough grazed grassland some 35m wide (in EA ownership) which supports intermittent single and small groups of mature trees at regular intervals along the length of the KSD. To the north of this strip, open rectilinear pasture fields extend away into the distance. The strips of marginal vegetation generally tend to be around 2m to 4m wide with occasional wider areas where silt deposition has locally reduced water depths. It is noted that the KSD has not been subject to any regular vegetation maintenance or desilting for some 20 years, except for some desilting works by Parchey Bridge in 2018. This is likely to have enabled silt deposition to continue and thereby encouraged the development of marginal vegetation along the edges of the KSD.

The existing flood embankments adjacent to the KSD are visually inconspicuous, as gently rounded shallow profiled mounds that barely register as flood defences.

Figure 9.5 Photo Viewpoint 01 - View of KSD from the right bank looking south near Parchey

Figure 9.6 Photo Viewpoint 02 - View of KSD from the right bank looking north-west near confluence with Sowy

The topography along the route of the KSD is level, as is the adjacent corridor except where a low narrow ridge descends from the western edge of Pitt Hill and terminates to the north of the KSD some 700m south-east of Parchey Bridge.

A public footpath runs the length of the KSD on the left bank between Parchey Bridge and the Sowy confluence (public footpath BW 8/6 between Parchey Bridge and Chedzoy New Cut and BW 36/5 between Chedzoy New Cut and the Sowy confluence) and three footpaths (public footpaths BW 8/20, BW 36/8 and BW 31/16) lead from the KSD towards Westonzoyland to the south and Sutton Mallet to the north. Residential and agricultural buildings are substantially absent within a 500m wide corridor either side of the KSD, except for a small number of buildings off Ward Lane to the west of Parchey Bridge.

The Sowy comprises an artificial channel, some 12-15m in width, less rectilinear in alignment than the KSD but generally comprised of a series of straight sections of channel with curved sections at changes in direction. The Langacre Rhyne, a similarly sized channel, runs in a parallel alignment some 35 m to the east of the Sowy between the KSD and Beer Wall. The intervening strip of land comprises treeless, grazed rough grassland and is in EA ownership.

As is the case on the KSD, the existing flood embankments adjacent to the Sowy are visually inconspicuous, gently rounded shallow profiled mounds that barely register as flood defences.

Figure 9.7 Photo Viewpoint 03 - View of the Sowy looking upstream from the A361 road bridge.

Figure 9.8 Photo Viewpoint 04 - View of the Sowy downstream of Beer Wall, illustrating the inconspicuous nature of the existing flood embankments

Figure 9.9 Photo Viewpoint 05 - View of the Sowy looking south-east along the River Parrett Trail towards Oath

The Sowy is crossed by four visually unobtrusive road bridges (the A361, the A372 at Beer Wall and the Aller Drove and Stathe Drove crossings) and nine farm access/footpath bridges. There are no settlements adjacent to the Sowy; the nearest buildings are private properties located on the left (east) side of the Parrett between Stathe and a point some 800m to the east of Oath, at a distance of approximately 100m from the Sowy. The banks of the Sowy support a limited range of riparian marginal wetland vegetation, although the extent of this is limited due to the regular (at least annual) 'weed cutting' regime and flailing of the banks. The principal vegetation cover on the banks is grassland which is grazed for the most part except for limited sections adjacent to fields used for silage where the grass growth is more rank. There are occasional trees (including pollarded willows) and shrubs located adjacent to the channel, mostly associated with adjoining field boundaries and road crossings, but the Sowy is largely free of riparian trees along its entire length. The wider pastoral landscape is populated with intermittent linear belts of trees and scrub hedge associated with the roads, droves and rhynes.

Public access adjacent to the Sowy includes the River Parrett National Trail and Macmillan Way West National Trail which run on the same footpath route at a distance of some 35m from and parallel to the Sowy on its left bank for some 4.6km from Monk's Leaze Clyce to just north of Stathe (public footpath L1/3 between Monk's Leaze Clyce and the Sowy throttle (where L1/3 crosses the Sowy to run north) and L1/8 between the Sowy throttle and where the River Parrett turns west away from the Sowy to the north of Stathe). A public footpath (the continuation of L1/8) continues to run parallel to the Sowy to the north of Stathe but at a distance of 40-200m from the Sowy for approximately 1km until it reaches Pathe. Public footpath L1/1 crosses the Sowy at Oath Bridge from just north of Stathe.

There are newly installed culverts and flow control structures at Beer Wall, which, combined with associated fencing and barriers and areas of hardstanding, are visually detracting features in this rural landscape but the effect is localised. The Langacre Rhyne culvert headwalls, in comparison, comprise low brick walls which are less visually intrusive and integrate more effectively into the landscape. The A372 road is frequently bordered by shrubby, standard and pollarded willow trees which visually filter views of the road from adjacent areas.

In summary, the landscape receptors to be assessed comprise the following:

- LCA 1: The Peat Moors LCA. Due to its distinctive sense of place generated by its expansive, flat, rectilinear drained wetland nature, pastoral land cover, high level of tranquillity and elements of nature conservation value, the character area is deemed to be of medium landscape sensitivity in accordance with Table 9.2.
- LCA 2: The Open Moor LCA. Due to its distinctive sense of place generated by its expansive, flat, rectilinear drained wetland nature, pastoral land cover, high level of tranquillity and elements of nature conservation value, the character area is deemed to be of medium landscape sensitivity in accordance with Table 9.2.
- LCA 3: The Moor Fringe LCA. Due to its sense of place generated by the transition in landscape character from flat, rectilinear drained wetland to wooded escarpment, its rural charm, pastoral land cover and high level of tranquillity, the character area is deemed to be of medium landscape sensitivity in accordance with Table 9.2.

9.4.2. Baseline visual amenity

Visual receptors within the ZTV who may potentially experience visual impacts as a result of the proposed works, the construction compound and material stockpile locations comprise:

- Users of sections of the public footpaths and bridleways to either side of the KSD between Parchey Bridge and the confluence with the Sowy
- Users of sections of the public footpaths to either side of the Sowy between the confluence of the KSD and Beer Wall
- Users of sections of the River Parrett National Trail and Macmillan Way West National Trail (Footpaths L1/8 and L1/3) and other public footpaths to either side of the Sowy between Stathe and Monk's Leaze Clyce
- Residents in properties with views of the proposed works and material stockpile areas, potentially comprising 6 properties with views of the KSD and 10 properties with views of the Sowy. Intervening vegetation and flood embankments are likely to screen views of the KSD and Sowy in many cases.
- Users of Westonzoyland Airfield and Springway Industrial Estate with views of the import material stockpile area at Langmead
- Anglers along the KSD
- Agricultural workers in the farmland adjacent to the KSD and Sowy

- Road users of Ward Lane at Parchey Bridge, A361, A372 and Aller Drove where these routes cross the KSD and Sowy or run past the construction compound and material stockpile locations

With regard to users of the A361 and A372, Sedgemoor DC's Sedgemoor Landscape Assessment and Countryside Design Summary (2003) 'Areas of High Sensitivity' map[8] shows corridors along either side of the A361 and A372 which are designated as 'Areas of high sensitivity' [in terms of visual impact] in relation to road corridors'. These areas are understood to be visually sensitive areas for road users 'within which priority should be given to conservation and enhancement measures'.

There will be a requirement to transport flood embankment fill material from a soil reprocessing plant located off the A372 near Westonzoyland to the Lower Sowy and Upper Sowy by road. Fill material will be transported by 20t HGVs to the A372 and A361 access points where these roads cross the Sowy, or by tractor and trailer (8t) between the soil reprocessing plant and all other site access points (see Figure 3.1, Appendix A). Fill material will be immediately transferred to placement locations along the Sowy using 8t tractor and trailers if ground conditions are suitable, otherwise using light weight tracked dumpers. Average daily wo-way traffic journeys are stated in section 3.3.

Visual receptors within the ZTV who may potentially experience temporary and intermittent visual impacts as a result of these traffic journeys comprise:
Residents in properties adjacent to the proposed haulage routes; approximate numbers of private properties that may experience potential visual impacts are as follows:

- Middlezoy: 14
- Othery: 14
- Aller: 109
- Combe: 11
- Greylake: 7

Commercial / industrial / farm premises:

- approximately 16 to the west of Beer Wall
- approximately 10 to the east of Beer Wall
- Pedestrians on footways and footpaths adjacent to the likely transport routes
- Road users on:
  - A372 between Westonzoyland and Beer Wall.
  - A372 between Beer Wall and Combe
  - Oliver's Road between A372 and A361
  - A361 between A372 and Sowy crossing

[8] Sedgemoor Landscape Assessment and Countryside Design Summary (2003), Map 6, Areas of High Sensitivity.

  - Aller Drove between Aller and Pathe

- Agricultural workers in the farmland adjacent to the likely transport routes

The visual receptors identified, their sensitivity to change, their existing view and the proposed works which will affect existing views are set out in the visual impact table (Table 9.7) below and identified on the baseline visual amenity plans (Figures 9.3 and 9.4 in Appendix A).

9.5. Likely significant effects

This section describes the impacts that the Proposed Scheme (as described in Chapter 3) are likely to have on the baseline landscape character and visual amenity and assesses the likely effects of these impacts on the identified receptors during construction and operation.

9.5.1. Impacts on baseline landscape character and visual amenity

The impacts that the Proposed Scheme proposals are likely to have on the baseline landscape character and visual amenity are described below. The potential effects of these impacts on landscape character and visual amenity are assessed in sections 9.5.2 and 9.5.3.

Impacts during construction phase

The following generic landscape and visual impacts have been identified as likely during the construction phase:

- Temporary adverse impacts detracting from the open, tranquil and natural character and visual amenity of the study area caused by disruption, noise and visual intrusion arising from construction activities and plant (including long reach excavators, tractors and trailers and dumper trucks), topsoil stripping and bank re-profiling and raising works which will expose extended areas of bare earth, the removal of approximately 13 trees and limited areas of scrub/ruderal vegetation required to enable construction access, sluice upgrade works at two locations on the KSD, the excavation of two-stage channels, embayments and backwaters on the right bank of the KSD and lower Sowy, portable and fixed construction compounds and temporary material stockpiles.
- Temporary adverse impacts on the visual amenity and recreational enjoyment of identified receptors arising from disrupted access along adjacent public footpaths and angling locations.
- Short-term, intermittent adverse impacts on the visual amenity of identified receptors along the haulage routes arising from HGV and tractor and trailer journeys during the transportation of fill material from the imported material stockpile near Westonzoyland to the Sowy.

Impacts during operational phase

The following generic landscape and visual impacts have been identified as likely during the operational phase, once the construction of the Proposed Scheme has been completed:
Short-term operational adverse landscape and visual impacts due to the excavation of sections of two-stage channels, embayments and backwaters on the right bank of

the KSD and Sowy before the associated marginal wetland vegetation and habitats and grass cover on deposited spoil material become fully established. Any such works within the KSD and Sowy are likely to temporarily remove the ecologically and visually valuable marginal wetland fringe vegetation along the banks of the channels. This marginal wetland vegetation should be retained in-situ wherever possible but where this is not feasible, it should be temporarily re-located and stored in appropriate conditions conducive to its continuing survival for re-placement once the widening works have been completed.

Short-term operational adverse landscape and visual impacts due to the likely extensive exposure of bare earth and excavated material following the re-profiling and raising of existing embankments and the deposition of excavated peat and sediment onto areas to the landward of the existing embankments, and the short-term installation of fencing to protect seeded areas from grazing stock. Effects will continue but diminish until the reinstated sward and removed marginal vegetation establish sufficiently to withstand grazing and trampling from grazing stock and the protective fencing is removed.

Potential short-term operational adverse landscape and visual impacts should any silty material excavated from the channel banks during the creation of two-stage channels, embayments and backwaters prove to be mobile (liquid) and slurry-like when it is deposited on the landward side of the adjacent flood embankments. There is also a high potential for excessive ruderal weed growth on areas of silt deposition which it will be important to minimise and control following construction.

Maintenance activities during the landscape establishment period, including grass and marginal vegetation cutting, weed control and fence repair and removal, will also give rise to localised, intermittent adverse visual effects.

Medium-term operational adverse landscape and visual impacts due to the removal of approximately 13 trees required to enable bank raising works on the KSD and Lower Sowy and the removal of a limited area of scrub/ruderal vegetation on the left banks of the KSD and Lower Sowy required to enable construction access. Impacts will reduce as replacement trees (planted at a ratio of five replacement trees per one removed tree) and any required replacement scrub grow to a mature size.

Long-term operational adverse landscape and visual impacts due to the raising of the existing flood embankments along the Upper Sowy by up to 0.5m, along the Lower Sowy by up to 0.3m and along the KSD by up to 0.5m (final levels after settlement), incorporating 3m wide crests with 1 in 3 formed side slopes on the riverside and 1 in 5 formed side slopes on the landward side of the flood embankments. Compared to the gently rounded, shallow profiled mounds with varying crest widths and side slope gradients which comprise the existing flood banks, the re-profiled, steeper and higher embankments are likely to form more visually and physically obvious enclosing features in the landscape which, whilst not being entirely uncharacteristic of the local landscape character, will adversely affect the open nature of the moors landscape to a limited degree within the local vicinity of the Sowy and KSD.

Long-term operational beneficial landscape and visual impacts due to the creation of three sections of two-stage channel, three embayments and one backwater on the right bank of the KSD and Sowy and associated enhancement and expansion of

marginal wetland vegetation and habitats, once these become fully established, which may take up to 5 years after completion of the implementation works.

9.5.2. Landscape effects

This section assesses the effects of the impacts of the Proposed Scheme on the identified landscape receptors, comprising LCA1, LCA2 and LCA3, with reference to the construction and operational periods.

LCA 1: Peat Moors

Within LCA 1, the Proposed Scheme elements comprise:

- The re-profiling and raising of a total of up to 4.6 km of existing flood bank on the left and right banks of the KSD between a point 0.46 km south of Parchey Bridge to the KSD/Sowy confluence.
- The re-profiling and raising of a total of up to 6.9 km of existing flood bank on the left and right banks of the Lower Sowy between the KSD/Sowy confluence and Beer Wall.
- On the KSD, the construction of an embayment (135m long), one two-stage channel (150m long) and a backwater (100m long).
- On the Lower Sowy, the construction of two embayments (150m and 100m long) and two two-stage channels (each 150m long).
- The raising of the headwalls and wing walls of Cossington Right and Chilton Right outfalls.

These Proposed Scheme elements are likely to result in the following physical impacts on the existing landscape elements within LCA 1:

- Adjacent to the KSD, the stripping of approximately 2.8ha of existing grassland from the footprint of the bank re-profiling works (excluding any adjacent working area).
- Adjacent to the Lower Sowy, the stripping of approximately 3.9ha of existing grassland from the footprint of the bank re-profiling works (excluding any adjacent working area).
- The excavation of up to approximately 1,800 m^3 of earth material from the right channel bank of the KSD and its deposition on the landward side of the adjacent flood embankments and the associated removal of up to approximately 0.7 km^2 of existing marginal vegetation (required for the creation of the WFD enhancements).
- The excavation of up to approximately 1,950 m^3 of earth material from the right channel bank of the Lower Sowy and its deposition on the landward side of the adjacent flood embankments and on the left bank of the Lower Sowy downstream of the A361 and the associated removal of up to approximately 0.8 km^2 of existing marginal vegetation (required for the creation of the WFD enhancements).

The removal of approximately 13 trees required to enable bank raising works on the KSD and Lower Sowy and the removal of a limited area of scrub/ruderal vegetation on the left banks of the KSD and Lower Sowy required to enable construction access

Minor localised disturbance to ground profiles and grass cover around the Cossington Right Rhyne and Chilton Right Rhyne outfalls and construction culvert crossings at Chedzoy New Cut and Cossington Right Rhyne.

The significance of the effects on the LCA that these impacts are likely to give rise to are as follows:

- During construction (approximately eight weeks), the Proposed Scheme is likely to give rise to temporary, localised effects of moderate adverse significance on LCA 1.
- During the initial operational stage following completion (in Years 1-2 after completion), before landscape mitigation / vegetation reinstatement works have effectively established, the Proposed Scheme is likely to give rise to localised effects of moderate - minor adverse significance on LCA 1.
- In the longer-term (5 years+ after completion), once landscape mitigation / vegetation reinstatement works have effectively established, the Proposed Scheme is likely to result in both adverse and beneficial impacts on LCA 1. Localised adverse impacts are likely to arise from the increased size, angularity and visibility of raised flood embankments which will conflict with the open, topographically level character of the moors landscape. Localised beneficial impacts are likely to arise from the creation of new riparian wetland habitats. These longer-term operational adverse and beneficial impacts are considered likely to balance out and result in an overall negligible significance of effect on LCA 1.

LCA 2: Open Moor

Within LCA 2, the Proposed Scheme elements comprise:

- The raising of two short sections of existing informal flood embankments on the right bank of the Upper Sowy, close to the village of Oath.

These Proposed Scheme elements are likely to result in the following physical impacts on the existing landscape elements within LCA 2:

- The stripping of existing grassland from the footprint of the bank re-profiling works (excluding any adjacent working area).

The significance of the effects on the LCA that these impacts are likely to give rise to are as follows:

- During construction (approximately one week), the Proposed Scheme is likely to give rise to temporary, localised effects of minor adverse significance on LCA 2.
- During the initial operational stage following completion (in Years 1-2 after completion), before landscape mitigation / vegetation reinstatement works have effectively established, the Proposed Scheme is likely to give rise to localised effects of minor adverse significance on LCA 2.
- In the longer-term (five years+ after completion), once landscape mitigation / vegetation reinstatement works have effectively established, the Proposed Scheme is likely to result in a minor adverse - negligible significance of effect on LCA 2.

LCA 3: Moor Fringe

Within LCA 3, the Proposed Scheme elements comprise:

- The raising and re-profiling of two short sections of existing informal flood embankments on the right bank of the Upper Sowy, close to the village of Oath.

These Proposed Scheme elements are likely to result in the following physical impacts on the existing landscape elements within LCA 3:

- The stripping of existing grassland from the footprint of the bank re-profiling works (excluding any adjacent working area).

The significance of the effects on the LCA that these impacts are likely to give rise to are as follows:

- During construction (approximately one week), the Proposed Scheme is likely to give rise to temporary, localised effects of minor adverse significance on LCA 3.
- During the initial operational stage following completion (in Years 1-2 after completion), before landscape mitigation / vegetation reinstatement works have effectively established, the Proposed Scheme is likely to give rise to localised effects of minor adverse - negligible significance on LCA 3.
- In the longer-term (5 years+ after completion), once landscape mitigation / vegetation reinstatement works have effectively established, the Proposed Scheme is likely to result in a negligible significance of effect on LCA 3.

9.5.3. Visual effects

This section assesses the effects of the impacts of the Proposed Scheme on the visual amenity of the identified visual receptors, with reference to the construction and operational periods.

Table 9.8 states the magnitude of impact for each visual receptor and states the significance of effect on each receptor during construction, in Years 1-2 after completion (when landscape mitigation / vegetation reinstatement has been implemented but is not yet established) and in Year 5 (when any landscape mitigation / vegetation reinstatement is reasonably well established). This assessment takes into consideration the mitigation measures embedded within the Proposed Scheme design described in Chapter 3.

Table 9.8 Visual impact assessment - significance of effects during construction and operation
Locations of visual receptors are shown on Figures 9.3 and 9.4 in Appendix A.

Receptor	Sensitivity	Dist (m)	Arc of view	Changes to view as a result of the Proposed Scheme	Magnitude of impact and significance of effect during construction	Magnitude of impact and significance of effect during operation Years 1-2	Magnitude of impact and significance of effect during operation Year 5+
Public Rights of Way							
Footpath BW 8/6 (length of 1.2km)	Medium	0-100	Up to 180º	Path within construction working area. On completion, bank raising and WFD measures will be visible at close quarters. In Year 5+, adverse impacts from bank raising and beneficial impacts from WFD measures likely to balance out to overall negligible effect.	High adverse magnitude Major – Moderate adverse effect	Low adverse magnitude Moderate – Minor adverse effect	Negligible magnitude Negligible effect
Footpath BW 36/5 (length of 2.7km)	Medium	0-100+	Up to 180º	Path within construction working area. On completion, bank raising and WFD measures will be visible at close quarters. In Year 5+, adverse impacts from bank raising and beneficial impacts from WFD measures likely to	High adverse magnitude Major – Moderate adverse effect	Low adverse magnitude Moderate – Minor adverse effect	Negligible magnitude Negligible effect

Receptor	Sensitivity	Dist (m)	Arc of view	Changes to view as a result of the Proposed Scheme	Magnitude of impact and significance of effect during construction	Magnitude of impact and significance of effect during operation Years 1-2	Magnitude of impact and significance of effect during operation Year 5+
				balance out to overall negligible effect.			
Bridleway BW 8/16 (length of 1.1km)	Medium	380+	Up to 90°	Path runs parallel to KSD for 650m with little intervening screening.	Low adverse magnitude Minor adverse effect	Negligible magnitude Negligible effect	Negligible magnitude Negligible effect
Footpath BW 8/20 (length of 650m)	Medium	0-380	Up to 180°	Path runs perpendicular to KSD with little intervening screening. East end of path adjoins KSD footpath BW 8/6.	Medium adverse magnitude Moderate adverse effect	Negligible magnitude Negligible effect	Negligible magnitude Negligible effect
Footpath BW 8/18 (length of 650m)	Medium	402+	Up to 90°	Path runs diagonally away from KSD with little intervening screening.	Low adverse magnitude Minor adverse effect	Negligible magnitude Negligible effect	Negligible magnitude Negligible effect
Footpath BW 36/8 (length of 1.7 km)	Medium	0-700+	Up to 180°	Path runs perpendicular to KSD with little intervening screening. East end of path adjoins KSD footpath BW 36/5.	Medium adverse magnitude Moderate adverse effect	Negligible magnitude Negligible effect	Negligible magnitude Negligible effect

Receptor	Sensitivity	Dist (m)	Arc of view	Changes to view as a result of the Proposed Scheme	Magnitude of impact and significance of effect during construction	Magnitude of impact and significance of effect during operation Years 1-2	Magnitude of impact and significance of effect during operation Year 5+
Footpath BW 31/16 (length of 570m)	Medium	0-570+	Up to 180º	Path runs perpendicular to KSD with little intervening screening. South end of path adjoins KSD footpath BW 36/5.	Medium adverse magnitude Moderate adverse effect	Negligible magnitude Negligible effect	Negligible magnitude Negligible effect
Bridleway BW 31/11 (length of 350m)	Medium	800+	Up to 50º	Path runs diagonally away from KSD with little intervening screening.	Low adverse magnitude Minor adverse effect	Negligible magnitude Negligible effect	Negligible magnitude Negligible effect
Footpath BW 20/23 (length of 1.8km)	Medium	80-680	Up to 70º	Views of KSD works at west end and more distant views of Lower Sowy works across fields.	Low adverse magnitude Moderate – Minor adverse effect	Negligible magnitude Negligible effect	Negligible magnitude Negligible effect
Footpath BW 21/19 (length of 440m)	Medium	715+	Up to 50º	Distant views south of Lower Sowy works across fields.	Low adverse magnitude Minor adverse effect	Negligible magnitude Negligible effect	Negligible magnitude Negligible effect
Footpath BW 20/13 (length of 255m)	Medium	360+	Up to 50º	Distant partially screened views north of Lower Sowy works across fields.	Low adverse magnitude	Negligible magnitude	Negligible magnitude

Receptor	Sensitivity	Dist (m)	Arc of view	Changes to view as a result of the Proposed Scheme	Magnitude of impact and significance of effect during construction	Magnitude of impact and significance of effect during operation Years 1-2	Magnitude of impact and significance of effect during operation Year 5+
					Minor adverse effect	Negligible effect	Negligible effect
Footpath L1/8 (length of 3.2km)	Medium	50+	Up to 160º	Elevated views from Parrett banks over intermittent bank raising works on Upper Sowy.	Medium adverse magnitude Moderate adverse effect	Low adverse magnitude Minor adverse effect	Negligible magnitude Negligible effect
Footpath L1/3 to north of R. Sowy (length of 940m)	Medium	325+	Up to 60º	Distant views south over fields to intermittent bank raising works on Upper Sowy.	Low adverse magnitude Minor adverse effect	Negligible magnitude Negligible effect	Negligible magnitude Negligible effect
Footways adjacent to fill material haul routes	Low	2+	Up to 180º	Intermittent views of an average 18 HGV and 19 tractor and trailer journeys per day for approximately four weeks.	Low adverse magnitude Minor adverse effect	N/A	N/A
Private properties							
Farmhouse on Sutton Hams	High	790	Up to 110º	Distant elevated views south over fields to intermittent bank raising works on KSD.	Low adverse magnitude	Negligible magnitude Negligible effect	Negligible magnitude Negligible effect

Receptor	Sensitivity	Dist (m)	Arc of view	Changes to view as a result of the Proposed Scheme	Magnitude of impact and significance of effect during construction	Magnitude of impact and significance of effect during operation Years 1-2	Magnitude of impact and significance of effect during operation Year 5+
					Moderate – Minor adverse effect		
4 properties on east edge of Westonzoyland	High	700	Up to 10º	Distant restricted views south over fields to temporary soil reprocessing plant.	Low adverse magnitude Moderate – Minor adverse effect	Negligible magnitude Negligible effect	Negligible magnitude Negligible effect
Manor Farm Greylake	High	450+	Up to 60º	Distant partially filtered views north over fields to intermittent bank raising works and temporary material stockpiles on Lower Sowy.	Low adverse magnitude Moderate – minor adverse effect	Negligible magnitude Negligible effect	Negligible magnitude Negligible effect
Shride Farm nr. Othery	High	475+	Up to 80º	Distant views east over fields to bank raising works on Lower Sowy.	Low adverse magnitude Moderate – minor adverse effect	Negligible magnitude Negligible effect	Negligible magnitude Negligible effect
Bennett's Farm nr. Othery	High	480+	Up to 80º	Distant views east over fields to bank raising works on Lower Sowy.	Low adverse magnitude	Negligible magnitude	Negligible magnitude

Receptor	Sensitivity	Dist (m)	Arc of view	Changes to view as a result of the Proposed Scheme	Magnitude of impact and significance of effect during construction	Magnitude of impact and significance of effect during operation Years 1-2	Magnitude of impact and significance of effect during operation Year 5+
					Moderate – minor adverse effect	Negligible effect	Negligible effect
Riverside Stathe	High	580	Up to 10^{o}	Distant elevated oblique views to bank raising works on Upper Sowy.	Low adverse magnitude Minor adverse effect	Negligible magnitude Negligible effect	Negligible magnitude Negligible effect
Riverside Farm Oath	High	130+	Up to 130^{o}	Elevated views to bank raising works on Upper Sowy.	Low adverse magnitude Moderate adverse effect	Negligible magnitude Negligible effect	Negligible magnitude Negligible effect
The Croft Oath	High	130+	Up to 130^{o}	Elevated views to bank raising works on Upper Sowy.	Low adverse magnitude Moderate adverse effect	Negligible magnitude Negligible effect	Negligible magnitude Negligible effect
Aller Court Farm Aller	High	820+	Up to 30^{o}	Distant, slightly elevated views to bank raising works on Upper Sowy.	Low adverse magnitude Minor adverse effect	Negligible magnitude Negligible effect	Negligible magnitude Negligible effect

Receptor	Sensitivity	Dist (m)	Arc of view	Changes to view as a result of the Proposed Scheme	Magnitude of impact and significance of effect during construction	Magnitude of impact and significance of effect during operation Years 1-2	Magnitude of impact and significance of effect during operation Year 5+
14 properties in Middlezoy	High	5+	Up to 180º	Intermittent views of an average 18 HGV and 19 tractor and trailer journeys per day for approximately four weeks.	Low adverse magnitude Moderate adverse effect	N/A	N/A
14 properties in Othery	High	5+	Up to 180º	Intermittent views of an average 18 HGV and 19 tractor and trailer journeys per day for approximately four weeks.	Low adverse magnitude Moderate adverse effect	N/A	N/A
Seven properties in Greylake	High	5+	Up to 180º	Intermittent views of an average 18 HGV and 19 tractor and trailer movements per day for approximately four weeks.	Low adverse magnitude Moderate adverse effect	N/A	N/A
109 properties in Aller	High	5+	Up to 180º	Intermittent views of an average 2 HGV journeys per day for 1 week.	Low adverse magnitude Minor adverse effect	N/A	N/A
11 properties in Combe	High	5+	Up to 180º	Intermittent views of an average 2 HGV journeys per day for 1 week.	Low adverse magnitude	N/A	N/A

Receptor	Sensitivity	Dist (m)	Arc of view	Changes to view as a result of the Proposed Scheme	Magnitude of impact and significance of effect during construction	Magnitude of impact and significance of effect during operation Years 1-2	Magnitude of impact and significance of effect during operation Year 5+
					Minor adverse effect		
Commercial / industrial / farm premises							
Springway Industrial Estate	Low	30+	Up to 140º	Intermittent views of an average 18 HGV and 19 tractor and trailer journeys per day for approximately four weeks.	Medium adverse magnitude Moderate - minor adverse effect	N/A	N/A
16 premises to the west of Beer Wall	Low	5+	Up to 180º	Intermittent views of an average 18 HGV and 19 tractor and trailer journeys per day for approximately four weeks.	Low adverse magnitude Minor adverse effect	N/A	N/A
10 premises to the east of Beer Wall	Low	5+	Up to 180º	Intermittent views of an average 18 HGV and 19 tractor and trailer movements per day for approximately four weeks.	Low adverse magnitude Minor adverse – negligible effect	N/A	N/A
Other receptors							

Receptor	Sensitivity	Dist (m)	Arc of view	Changes to view as a result of the Proposed Scheme	Magnitude of impact and significance of effect during construction	Magnitude of impact and significance of effect during operation Years 1-2	Magnitude of impact and significance of effect during operation Year 5+
Anglers along the KSD	Medium	0+	Up to 180º	Access along KSD will be closed during construction. On completion, bank raising and WFD measures will be visible at close quarters.	High adverse magnitude Major – moderate adverse effect	Low adverse magnitude Moderate – minor adverse effect	Negligible magnitude Negligible effect
Agricultural workers in fields adjacent to works	Low	10+	Up to 180º	Close views of works, stockpiles and HGV/tractor and trailers during construction and raised flood embankments and WFD measures on completion	Low adverse magnitude Moderate – minor adverse effect	Low adverse magnitude Minor adverse effect	Negligible magnitude Negligible effect
Road users							
A361 adjacent to Lower Sowy crossing (length of 520m)	Low	20+	Up to 180º	Fleeting views of works and stockpiles during construction and raised flood embankments on completion.	Low adverse magnitude Minor adverse effect	Negligible magnitude Negligible effect	Negligible magnitude Negligible effect
A372 adjacent to Beer Wall (length of 500m)	Low	20+	Up to 180º	Fleeting views of works and stockpiles during construction and raised	Low adverse magnitude Minor adverse effect	Negligible magnitude Negligible effect	Negligible magnitude Negligible effect

Receptor	Sensitivity	Dist (m)	Arc of view	Changes to view as a result of the Proposed Scheme	Magnitude of impact and significance of effect during construction	Magnitude of impact and significance of effect during operation Years 1-2	Magnitude of impact and significance of effect during operation Year 5+
				flood embankments on completion.			
Beer Drove	Low	800+	Up to 30º	Distant views of works and stockpiles during construction and raised flood embankments on completion.	Low adverse magnitude Minor adverse – negligible effect	Negligible magnitude Negligible effect	Negligible magnitude Negligible effect
Aller Drove adjacent to Upper Sowy crossing (length of 50m)	Low	120+	Up to 10º	Fleeting views of works during construction and raised flood embankments on completion.	Low adverse magnitude Minor adverse – negligible effect	Negligible magnitude Negligible effect	Negligible magnitude Negligible effect
A372 between Westonzoyland and Beer Wall	Low	3+	Up to 90º	Intermittent views of an average 18 HGV and 19 tractor and trailer journeys per day for approximately four weeks.	Low adverse magnitude Minor adverse effect	N/A	N/A
A372 between Beer Wall and Combe	Low	3+	Up to 90º	Intermittent views of an average 2 HGV journeys per day for 1 week.	Low adverse magnitude Minor adverse – negligible effect	N/A	N/A

Receptor	Sensitivity	Dist (m)	Arc of view	Changes to view as a result of the Proposed Scheme	Magnitude of impact and significance of effect during construction	Magnitude of impact and significance of effect during operation Years 1-2	Magnitude of impact and significance of effect during operation Year 5+
Oliver's Road between A372 and A361	Low	3+	Up to 90°	Intermittent views of an average 18 HGV and 19 tractor and trailer journeys per day for approximately four weeks.	Low adverse magnitude Minor adverse effect	N/A	N/A
A361 between A372 and Lower Sowy crossing	Low	3+	Up to 90°	Intermittent views of an average 18 HGV and 19 tractor and trailer journeys per day for approximately four weeks.	Low adverse magnitude Minor adverse effect	N/A	N/A
Aller Drove between Aller and Pathe	Low	3+	Up to 90°	Intermittent views of an average 2 HGV movements per day for 1 week.	Low adverse magnitude Minor adverse – Negligible effect	N/A	N/A

9.6. Mitigation

On completion of the embankment re-profiling and raising works and the excavation of the WFD enhancements, the following mitigation measures will be implemented to ameliorate the remaining adverse landscape and visual impacts:
The embankment re-profiling and raising works will create approximately 6.7ha of exposed bare earth on completion of the earthworks phase. Additional areas of bare earth may be generated by temporary access routes and working areas. These areas will be subject to pre-seeding preparatory works (weed control and cultivation) and seeded with the following seed mixes

- Along the KSD, the raised flood embankments (totalling maximum of approximately 2.8ha) will be seeded with a bespoke NWG (or other appropriate) seed mix containing 100% grass species with a soil-stabilising function, the majority of which are species listed as present within the King's Sedgemoor SSSI Citation (see the LMP in Appendix I for full details).
- Along the Lower Sowy, the raised flood embankments (totalling a maximum of approximately 3.9ha) will be seeded with a bespoke NWG (or other appropriate) seed mix containing 100% grass species with a soil-stabilising function. A substantial proportion of the proposed species are listed as present within the King's Sedgemoor SSSI Citation (see the LMP in Appendix I for full details).

Any newly created channel banks associated with the WFD enhancements and any maintenance access routes which require creation or reinstatement will be subject to pre-seeding preparatory works (weed control and cultivation) and seeded with a NWG, (or other appropriate) seed mix containing 100% grass species with a soil-stabilising function, the majority of which are species listed as present within the King's Sedgemoor SSSI Citation (see the LMP in Appendix L for full details).

The excavated embayments, two-stage channels and backwater channels and islands will be planted and seeded as follows:

- All newly created marginal shelves on the embayments and two-stage channels and the backwater channels will be planted with appropriate marginal wetland species introduced by installing (a) pre-vegetated coir rolls along the riverside edge of the marginal shelves or edges of the backwater channels; (b) pre-vegetated coir pallets closer to the landward edge of the marginal shelves and (c) re-planting any marginal plants lifted from the channel edges at WFD enhancement feature locations prior to excavation and stored on site in suitable locations.
- The backwater islands will be planted with appropriate wet scrub species (grey willow, goat willow, osier, downy birch, dog rose, elder, hawthorn and bramble) to provide biodiversity habitat value for a range of species and to provide long-term stabilisation of the island banks.
- Trees removed on the right banks of the KSD and Lower Sowy to enable flood embankment raising works will be replaced in suitable adjacent locations at a ratio of five replacement trees for every tree removed. Proposed replacement tree species comprise downy birch, white willow, goat willow and crack willow.

To mitigate the potential adverse impacts should the material excavated from the KSD and Sowy channel banks during the creation of two-stage channels,

embayments and backwaters prove to be mobile (liquid) silt, potential requirements for drying, dewatering or containment measures need to be considered in advance of excavation operations to minimise the potential for adverse landscape and visual amenity impacts associated with the deposition of any 'slurry' on the landward side of the flood embankments. The suitability of any silty material excavated from the channel for seeding following spreading will need to be confirmed by appropriate investigation. It is recommended that the potential risk of excessive ruderal weed growth on areas of silt deposition is mitigated by the implementation of an appropriate weed control and monitoring programme in the first two years following construction.

9.7. Conclusions and summary of residual effects

9.7.1. Residual effects

Following the implementation and establishment of the proposed mitigation measures, the following residual effects on the landscape resource and visual amenity are likely to remain.

Table 9.9 Residual effects where significant effects are predicted in the absence of mitigation

Receptor (sensitivity/ value)	Nature of impact (magnitude)	Significance (pre-mitigation)	Mitigation	Residual effect
LCA 1: Peat Moor (medium)	Adverse impacts from extensive areas of bare ground, raised embankments and excavated WFD features (low, temporary)	Moderate-minor adverse	Seeding and planting. Planted WFD habitats will create beneficial impacts which will offset residual adverse impacts of raised embankments	Minor adverse (embankments) x Minor beneficial (WFD habitats) = Negligible (not significant)

Table 9.10 Residual visual effects where significant effects are predicted in the absence of mitigation

Receptor (sensitivity/ value)	Nature of impact (magnitude)	Significance (pre-mitigation)	Mitigation	Residual effect
Footpaths BW 8/6 and BW 36/5 (medium)	Adverse impacts from extensive areas of bare ground, raised embankments and excavated WFD features (low, temporary)	Moderate-minor adverse	Seeding and planting. Planted WFD habitats will create beneficial impacts which will offset residual adverse impacts of raised embankments	Minor adverse (embankments) x Minor beneficial (WFD habitats) = Negligible (not significant)

9.7.2. Conclusion

During construction, the Proposed Scheme is likely to give rise to:

- Temporary, localised effects of moderate adverse, moderate-minor adverse and minor adverse significance on LCA1, LCA2 and LCA3 respectively.
- Temporary localised effects ranging from major-moderate to minor adverse – negligible on a range of visual receptors.

During the initial operational stage following completion, before landscape mitigation and vegetation reinstatement works have fully established, the Proposed Scheme is likely to give rise to:

- Short-term, localised effects of moderate-minor, minor and minor adverse – negligible significance on LCA1, LCA2 and LCA3 respectively.
- Short-term, localised effects ranging from moderate-minor to minor adverse on a proportion of visual receptors with the remainder experiencing negligible effects.

In the longer-term, once mitigation and vegetation reinstatement works have fully established, the Proposed Scheme is likely to result in both adverse and beneficial effects on landscape character and visual amenity. Localised adverse impacts are likely to remain from the increased size, angularity and visibility of raised flood embankments which will conflict with the open, topographically level character of the moors landscape and its associated visual amenity. Beneficial impacts are likely to arise as the newly created riparian wetland habitats along the KSD and Lower Sowy mature. The combined effects of these adverse and beneficial impacts are likely to balance each other out and the overall longer-term operational impacts of the Proposed Scheme on landscape and visual amenity are considered likely to be neutral.

10. Population and health

10.1. Introduction

This chapter considers the potential effects of the Proposed Scheme on recreational assets and agricultural land holdings during construction and operation.

10.2. Regulation and policy background

There is no specific legislation relevant to this topic area. Although the Proposed Scheme is permitted development, national and local planning policy supports the continuation and improvement of outdoor recreational facilities including areas of open space and PRoWs.

10.3. Methodology

10.3.1. Scope

The scoping assessment carried out at the formal scoping stage was documented in the PEIR for the Proposed Scheme and has since been reviewed before undertaking this assessment. The topics scoped in and out of this assessment are outlined in Table 10.1 below.

Table 10.1 Scope of assessment

Scoped in	Scoped out
Land take during construction and operation.	Impacts on local economy due to construction and operation.
Changes in agricultural practices during construction and operation.	Health impacts associated with noise/air quality and pedestrian/cyclist access and amenity during construction and operation.
Construction impacts on recreation and amenity users of the PRoW and long-distance footpaths.	Health impacts associated with access to greenspace/PRoW during construction and operation.
Operational impacts on recreation and amenity users of the PRoW and long-distance footpaths.	

10.3.2. Study area

The study area for this assessment is outlined in Figure 10.1 in Appendix A. The study area comprises of the construction footprint and the settlements of Langport, Stathe, Sutton Mallett, Pathe, Othery, Middlezoy, Westonzoyland, Chedzoy, Parchey and Stawell which are deemed to be the most sensitive settlements due to their proximity to the Proposed Scheme and the use of some haulage routes through these settlements during the construction phase.

10.3.3. Guidance

For the purposes of this assessment, the baseline data was gathered as a desk-top study using publicly available information from a range of online resources including:

- Sedgemoor District Council's planning policies and associated documents
- South Somerset District Council planning policies and associated documents
- The Somerset Levels and Moor Flood Action Plan 2014
- The 'Multi-Agency Geographic Information for the Countryside' (MAGIC) website
- The 1:250,000 Series Agricultural Land Classification Mapping for South West England 2010 (Natural England)

10.3.4. Determination of significance

There is no recognised methodology for assessing the impacts of a scheme on population and health and therefore the broad assessment of impacts on population receptors follows the broad assessment methodology outlined in Tables 10.2 and 10.3 below based on professional judgement. The significance of effects is determined using value and magnitude using the matrix provided in Figure 5.1 (p44) of Chapter 5. Significant effects are those which are assessed at moderate or above.

Table 10.2 Criteria for assessing the value (sensitivity) of population receptors

Value	Receptor	Criteria
High	Agricultural land holdings	Areas of land which are detrimental for agricultural use and productivity and cannot be replicated within alternative agricultural land (if available). Access between neighbouring land parcels and surrounding land is required on a daily basis often with very high levels of vehicular movements.
	Recreation and amenity users	Footpaths and routes likely to be used for recreational users on a daily basis with no alternative routes likely within the surrounding or wider area. Recreational activities which are highly specific to the area with little or no substitution within the surrounding or wider area.
Medium	Agricultural land holdings	Areas of land which mostly provide important opportunities for agricultural use and productivity. Access between neighbouring land parcels and surrounding land is required on a frequent basis (daily/weekly).
	Recreation and amenity users	Footpaths and routes likely to be used by recreational users on a daily basis but with alternative routes available within the surrounding and wider area. Recreational activities which are frequently undertaken (daily/weekly) within the area, but for

Value	Receptor	Criteria
		which can also be undertaken within the surrounding and wider area.
Low	Agricultural land holdings	Areas of land which provide minimal value for agricultural use and productivity. Access between neighbouring land parcels and surrounding land is required on an infrequent basis (monthly).
	Recreation and amenity users	Footpaths and routes which are not likely to be used by recreational users due to severance issues or due to a lack of connectivity to recreational activities/amenities. Recreational activities which are infrequently undertaken (monthly) within the area, but for which can also be undertaken within the wider area.
Negligible	Agricultural land holdings	Areas of land which are predominantly not used for agricultural purposes or are of very low agricultural value. Access between neighbouring land parcels and surrounding land is required on a highly infrequent basis (monthly/bi-monthly).
	Recreation and amenity users	No footpaths or routes available for recreational users within the local or surrounding area. No recreational activities available within the local or wider surrounding area.

Table 10.3 Criteria for assessing the magnitude of population receptors

Magnitude of impact (change)	Receptor	Criteria
High	Agricultural land holdings	Severe damage or loss to agricultural land/access, thereby significantly reducing productivity and the overall viability of the business (adverse). Substantial improvements to agricultural land, thereby potentially significantly enhancing productivity (beneficial).
	Recreation and amenity users	Routes used by recreational users likely to be significantly severed or become completely inaccessible. Recreational activities likely to cease entirely (adverse). Existing routes used by recreational users likely to be significantly enhanced, with potential new routes leading to enhanced connectivity to the local and wider area. Existing recreational

Magnitude of impact (change)	Receptor	Criteria
		activities likely to be enhanced, often with new recreational activities made available (beneficial).
Medium	Agricultural land holdings	Partial damage or loss to agricultural land/access, thereby partially comprising productivity and the overall viability of the business (adverse). Some moderate improvements to agricultural land/access, potentially enhancing productivity (beneficial).
	Recreation and amenity users	Routes used by recreational users likely to be partially severed or become less accessible. Some recreational activities likely to cease or become difficult to undertake on a frequent basis (adverse). Existing footpaths and routes used by recreational users likely to be improved, with the opportunity to create new routes leading to enhanced connectivity within the local area. Existing recreational activities likely to be enhanced (beneficial).
Low	Agricultural land holdings	Minor damage or loss to agricultural land/access, thereby resulting in changes which do not compromise the overall viability of productivity or the overall business (adverse). Some minor improvements to agricultural land/access, potentially enhancing productivity and the viability of the overall business (beneficial).
	Recreation and amenity users	Some minor routes used by recreational users likely to become less accessible. Some minor recreational activities likely to cease or become difficult to undertake on an infrequent basis (adverse). Existing footpaths and routes used by recreational users likely to be improved. Existing recreational activities likely to be minimally enhanced (beneficial).
Negligible	Agricultural land holdings	Very minor damage or loss to agricultural land/access, thereby resulting in changes which do not compromise the overall viability of productivity or the overall business (adverse). Some very minor improvements to agricultural land/access, potentially enhancing productivity

Magnitude of impact (change)	Receptor	Criteria
		and the viability of the overall business (beneficial).
	Recreation and amenity users	Some very minor routes used by recreational users likely to become less accessible. Some very minor recreational activities likely to cease or become difficult to undertake on an infrequent basis (adverse). Some existing minor footpaths and routes used by recreational users likely to be minimally improved. Some existing recreational activities likely to be minimally enhanced (beneficial).

10.3.5. Limitations

The assessment of effects on population and human health has been undertaken as a desk-based assessment only using publicly available information sources. No site visit has been undertaken, although the assessment has been informed by the extensive knowledge of the site by the wider project team. Given the nature of the site and the scale of the project this approach has been considered proportionate for the assessment of effects on population and human health.

10.4. Existing environment

10.4.1. Socio-economic factors

The study area is located within a semi-rural setting with the fringes of the settlements of Langport, Stathe, Sutton Mallett, Pathe, Othery, Middlezoy, Westonzoyland, Chedzoy, Parchey and Stawell located within the immediate and wider vicinity (see Figure 10.1, Appendix A). The study area is located within the administrative boundaries of South Somerset District Council and Sedgemoor District Council and immediately adjacent to the boundary of Somerset West and Taunton Council. The population living within the district of Sedgemoor is 116,104 (2011 Census) and the population living within the district of South Somerset is 163,277 (2011 Census).

The Sowy passes within approximately 500m of numerous farms and residential properties including Bakers Farm, Chapel Farm, Duck Cottage, Grove Farm, Hancox Farm, Rose Cottage, Little Ham Farm, Aller Court Farm, Oath Farm, Sedgemoor House, Stathe House, Pathe House, Mill Farm, Milton Farm, Bagenham Farm, Bennett's Farm, Shride Farm, Owery Farm, Greylake Farm, Merricks Farm Cottage and Manor Farm. The KSD passes within approximately 500m of East Field Farm, Beech Tree Farm, Beerway Farm, Burdenham Farm, Oakfield Barn, Liney House Farm, Nino's Dairy Farm, Sibley's Farm and Penwood Farm.

Within the settlements of Chedzoy, Othery, Middlezoy and Westonzoyland are various community facilities including convenience stores, bakeries, village halls, churches, primary and secondary schools, care homes and public houses.
The South Somerset Local Plan 2006-2028 states that 'Farming employs a small proportion of the South Somerset workforce and employee numbers have steadily

declined over the years, from approximately 3,189 jobs in 2007 to 3,035 jobs in 2010 (a reduction of 5%). Farming and its associated businesses remain integral to the present and future of South Somerset. Food security, local produce and reducing 'food-miles' remain nationally important, and an increasing onus on a low carbon economy, will provide opportunities for key sectors such as land-based industries and renewable energy'.

The county has varied and complex soils that support a wide range of farming, from intensive cropping (potatoes) and dairying but elsewhere only support extensive grassland systems for beef and sheep (The Somerset Levels and Moors Flood Action Plan, 2014).

Within the study area (and progressing downstream) soils consist of loamy and clayey floodplain soils with naturally high groundwater (National Soil Map of England and Wales, 2013). It includes lightly acid loamy and clayey soils with impeded drainage, very acid loamy upland soils with a wet peaty surface and loamy and clayey soils of coastal flats with naturally high groundwater

Recreation and amenity

The study area is used for a range of recreational activities, such as walking, bird watching and fishing (the KSD is leased to Bridgwater Angling Association). In addition, there are numerous PRoWs (footpaths, bridleways and restricted byways) within the study area used by the local community and recreational users. PRoW located within the study area are shown on Figure 10.1 in Appendix A and outlined below in Table 10.4.

Table 10.4 PRoW located within the study area

Location of PRoW	PRoW Reference
Within and immediately adjacent to the construction footprint	40UC017 BW 8/6, 40UC017 BW 8/25, 40UC017 BW 8/20, 40UC052 BW 36/5, 40UC045 BW 31/16, 40UC052 BW 36/8, 40UD003 L 1/8, 40UD003 L 1/1, 40UD003 L 1/3, 40UD003 L 1/11 and 40UD003 L 1/12.
Immediately adjacent to proposed haulage routes	40UC033 BW 20/14, 40UC033 BW 20/31, 40UC033 BW 20/32, 40UC033 BW 20/33, 40UC033 BW 20/11, 40UC033 BW 20/21, 40UC037 BW 24/7, 40UD003 L 1/1, 40UD003 L 1/2, 40UD003 L 1/3, 40UD003 L 1/4, L 1/2, 40UD003 L 1/14, 40UD003 L 1/15, 40UD003 L 1/7 and 40UD003 L 1/9.
Within the settlement of Chedzoy	40UC017 BW 8/16, 40UC017 BW 8/18, 40UC017 BW 8/7, 40UC017 BW 8/12, 40UC017 BW 8/19, 40UC017 BW 8/2, 40UC017 BW 8/15, 40UC017 BW 8/1, 40UC017 BW 8/5, 40UC017 BW 8/11 and 40UC017 BW 8/23.
Within the settlements of Stawell and Sutton Mallet	40UC045 BW 31/8, 40UC045 BW 31/12, 40UC045 BW 31/11/1 and 40UC045 BW 31/11

Location of PRoW	PRoW Reference
Within the settlement of Westonzoyland	40UC052 BW 36/2, 40UC052 BW 36/4, 40UC052 BW 36/6 and 40UC052 BW 36/1.
Within the settlements of Middlezoy, Othery and Pathe	40UC033 BW 20/30, 40UC033 BW 20/3, 40UC033 BW 20/18, 40UC033 BW 20/1, 40UC033 BW 20/5, 40UC037 BW 24/4, 40UC037 BW 24/3 and 40UC037 BW 24/2.
Within the settlements of Aller, Stathe, Oath and Langport	40UE008 T 25/29, 40UE008 T 25/1, 40UE008 T 25/2 and 40UE008 T 25/29.

The Parrett Trail, a long-distance footpath runs between the Parrett and the Sowy between the settlements of Langport and Stathe (see LMP, Appendix I). In addition, The Macmillan Way West is a long-distance footpath which runs for 164km from Castle Cary in Somerset to Barnstaple in Devon. Within the study area, the Macmillan Way West runs from the settlement of Langport to a point near the settlement of Westonzoyland where the route coincides with the Parrett Trail.

10.5. Likely significant effects

10.5.1. Socio-economic (agricultural holdings)

Construction

The Proposed Scheme is likely to result in temporary adverse impacts to agricultural practices from disturbance activities including use of machinery, delivery of materials, use of farm access tracks, use of agricultural land for construction activities and associated noise as a result of construction activities. In addition, bank raising works are likely to require farmers to temporarily adopt their farming practices during the construction phase such as rotating livestock into different land parcels on a more regular basis and ensuring livestock have available drinking water if livestock were previously dependent on water within the KSD/Sowy channels. Therefore, these construction activities are likely to result in minor adverse (not significant) impacts on agricultural practices during the construction phase based on a low magnitude and a medium value receptor.

The Proposed Scheme will involve a small degree of permanent land take (estimated to be between 5-10m from the KSD/Sowy channels to the back slope of the raised bank) from agricultural holdings located immediately adjacent to the KSD/Sowy channels, predominantly from bank raising works. Farmstead properties to be most impacted by bank raising works are located on the left bank of the KSD between the settlements of Parchey and Westonzoyland, properties situated at the confluence of the KSD and the Sowy, the left bank of the Sowy between the settlements of Westonzoyland and Othery and between Monk's Leaze Clyce and Beer Wall. With only minimal permanent land take required for the bank raising works and no land ownership lost as a result of these works, the Proposed Scheme is likely to result in minor adverse (not significant) impacts on agricultural practices based on a low magnitude and a medium value receptor.

Land parcels located within the construction footprint on the left bank of the KSD and the Sowy will be fenced off for up to two years to allow grassland areas to re-

establish. Fencing will therefore act as a barrier for livestock to obtain drinking water from the KSD/Sowy channels and potentially change some agricultural practices during this period Therefore, these construction activities are likely to result in minor adverse (not significant) impacts on agricultural practices during the construction phase based on a low magnitude and a medium value receptor.

Operation

Once the Proposed Scheme is operational, the frequency of overtopping of banks along the KSD and Sowy within the scheme extents is likely to reduce (although no specific hydraulic modelling for the Phase 1 scheme in isolation has been undertaken) and the Proposed Scheme will contribute towards the flood risk benefits achieved through the full River Sowy and King's Sedgemoor Drain Enhancements Scheme once implemented, in combination with other measures included within the 20 year Flood Action Plan.

Once the full River Sowy and King's Sedgemoor Drain Enhancements Scheme is implemented, the operational procedures for Monk's Leaze Clyce altered to allow more water to be diverted from the Parrett to the Sowy/KSD system when required. There is potential that some areas may experience a slight increase in flood extents as a consequence of the altered operational procedure. These areas include land directly adjacent to the Lower Sowy and the KSD, on the left bank of the KSD between the confluence with the Sowy and the A361, and also in the Lang Moor and Sutton Hams areas may experience a slight increase in flood extents on those occasions when water levels in the Sowy and KSD are sufficient to over top the raised flood embankments. In most areas the increase in flood extent will be associated with raised water levels within the Sowy and KSD impeding drainage from the Sowy, with the exception of the land within the area on the left bank of the Lower Sowy upstream of the confluence and downstream of the A361 (outside of the Proposed Scheme extents) where bank raising is not proposed.

Water levels are very carefully controlled across the Somerset Levels and Moors, and existing water control management procedures provide a mechanism to mitigate any adverse effects realised from these potential slight increases in flood extents. Alternatively, there may be an opportunity for interested landowners to take benefit from their ability to contribute to natural flood management procedures through water storage, captured through environmental management schemes. We are also planning to complete works in the coming years on the KSD downstream of the Proposed Scheme which will help improve discharge from the KSD to the estuary and therefore help address these potential impacts.

It is acknowledged that much of the land surrounding the Proposed Scheme is currently under environmental stewardship agreements, however these are due to cease within the next five years, and measures included within the MAP (see section 3.2.2 and Appendix J for further information) including refurbishment of existing water control structures within Moorlinch, West Moor and King's Sedgemoor (Egypt's Clyce) RWLAs during 2020/2021 and monitoring of water levels within Aller Moor, King's Sedgemoor, West Sedgemoor, Wet Moor, Moorlinch, Huish Level, Currymoor, Southlake Moor and Chedzoy with a view to altering existing WLMPs or establishing new WLMPs over the next five years to ensure 'no change' to existing conditions during winter months.

Further detailed discussions regarding the MAP will take place with landowners in parallel with the ES consultation.

Some agricultural practices directly adjoining the Proposed Scheme may have to be modified in a small way due to increased footprint of the re-profiled flood embankments. The raised banks will comprise of a 1:5 back slope, which will still allow livestock to access the KSD/Sowy for drinking water, thereby not adversely impacting on these agricultural practices.

Overall, it is considered that the Proposed Scheme has the ability to sustain and benefit some agricultural practices and reduce the risk of negative financial implications including crop/livestock losses as a result of flooding. Overall a negligible impact (not significant) is anticipated on agricultural practices based on a negligible magnitude and a medium value receptor practices based on a negligible magnitude and a medium value receptor.

10.5.2. Recreation and amenity

Construction

There are several PRoWs which are located within/cross the construction footprint (BW8/6, BW 36/5, BW31/16 and L1/1) or are partially located immediately adjacent to the construction footprint (L 1/8 and L1/3). Users of these PRoW are likely to be adversely impacted by construction activities from the use of machinery, delivery of materials, noise and HGV movements. Access along PRoW BW 8/6 and 36/5 where they cross the works area will be managed through very localised diversions managed by banksmen, with users segregated from the works area via rope fencing. Users of the PRoW (L 1/3 and L 1/8 which form part of the River Parrett Trail) are less likely to be adversely impacted by these construction activities as these PRoW are predominantly set further away from the construction footprint. All of these PRoW will be accessible during the construction period and no severance or reduced access for users of these PRoW is anticipated. Overall, the Proposed Scheme is therefore likely to result in minor adverse impacts (not significant) to users of the PRoW which are located/cross the construction footprint based on a low magnitude and a medium value receptor.

As outlined in Table 10.5, there are numerous PRoW and footpaths located immediately adjacent to and within the wider area of the proposed haulage routes for the Proposed Scheme (predominantly within and surrounding the settlements of Westonzoyland, Middlezoy and Aller) which are used by the local community and recreational users. The proposed haulage routes will utilise existing roads through the settlements outlined above and the wider study area predominantly via the A372, which is a Class A principal road likely to be used by numerous road and farm vehicles given the rural setting of the study area. Therefore, users of the various PRoW and footpaths through these settlements and the wider study area are likely to be already aware of vehicles using roads such as the A372 when commuting and travelling through the study area. Construction vehicle movements using these haulage routes during the construction period are outlined below:

- Lower Sowy: 36HGV movements per day (i.e. 18 return journeys) over a four week period and 38 tractor and trailer movements per day (i.e. 19 return journeys) over an eight week period

- Upper Sowy: Four tractor and trailer movements per day (i.e. two return journeys per day) during one week

Therefore, during the construction phase it is anticipated that the Proposed Scheme is likely to result in minor adverse impacts (not significant) for recreational and other users of the various PRoW and footpaths located immediately adjacent to the proposed haulage routes based on a low magnitude and a medium value receptor. The increase in HGV movements might deter some recreational users or the local community from using PRoW/footpaths located immediately adjacent to the proposed haulage routes due to safety concerns. No direct adverse impacts to PRoW or footpaths located immediately adjacent to haulage routes or within the wider study area are anticipated as these routes are outside of the construction footprint.

Operation

The beneficial impact of the Proposed Scheme (Phase 1) and full River Sowy and King's Sedgemoor Drain Enhancement Scheme on flood risk discussed above with regards to agricultural land holdings will also apply to PRoWs, thereby improving accessibility and connectivity in the local area. Overall the Proposed Scheme will have a negligible beneficial effect on accessibility of local PRoWs.

10.6. Mitigation

Socio-economic (agricultural holdings)

Mitigation to reduce nuisance impacts on farmstead properties and agricultural practices during construction include following compliance with current regulations including the Environmental Protection Act 1990. Contractors will be required to submit a Construction Environmental Management Plan (CEMP) which meets the requirements of the EAP (see Appendix K). Such documentation is expected to address not only noise, but other nuisance impacts such as the timing of works, dust, visual impacts and contamination risk and traffic disruption among others.

Mitigation will be put in place to address or offset the worst potential disruption/impacts, such as:

- Ensuring effective liaison with agricultural businesses to understand access needs and timings of key agricultural practices
- Ensuring effective liaison with agricultural businesses to discuss land take requirements and any potential financial compensation for landowners
- Provisions made for livestock requiring drinking water from the KSD/Sowy during the construction period
- Sign-posting diversions (if required)
- Provision of clear and accessible public information for agricultural landowners

Recreation and amenity users

Mitigation measures to reduce adverse impacts on recreational and amenity activities/users will include informing local communities within the study area about the proposed haulage routes through signage and webpage updates. In addition, notices should also be placed on PRoW immediately adjacent to the proposed

haulage routes prior and during the construction period to notify users of these PRoW of the proximity of the nearby construction works.

10.7. Conclusions and summary of residual effects

There were no significant (moderate or major) effects on population and health receptors identified in the absence of mitigation. With relevant mitigation implemented as outlined above in section 10.6, residual effects during construction and operation of the Proposed Scheme will be further minimised to negligible adverse (not significant) level, with the exception of a negligible beneficial effect (not significant) during operation on flood risks for agricultural land holdings and users of PRoW.

11. Noise

11.1. Introduction

This chapter considers the assessment of impacts from noise and vibration expected from haulage movements associated with the construction of the Proposed Scheme. The addition of extra vehicles onto the local road network has the potential to increase the noise and vibration at receptors along the routes that are used. Impacts of noise and vibration on ecological receptors are discussed in Chapter 7.

11.2. Regulation and policy background

11.2.1. Noise Policy Statement for England (NPSE) (Defra, 2010)

The government's noise policy is set out in the NPSE. The policy came into force in March 2010. It contains the high-level vision of promoting good health and good quality of life (wellbeing) through the effective management of noise. It is supported by three aims and together they provide the necessary clarity and direction to enable decisions to be made in any particular situation, both nationally and locally, regarding what is an acceptable noise burden to place on society. These three aims are:

- To avoid significant adverse impacts on health and quality of life
- To mitigate and minimise adverse impacts on health and quality of life
- Where possible, contribute to the improvement of health and quality of life

These three aims will be considered when determining whether the construction of the Proposed Scheme will cause significant effects.

11.2.2. Control of Pollution Act (CoPA) 1974

The Control of Pollution Act 1974 grants powers to deal with noise nuisances. Much of CoPA has been replaced and extended by the Environmental Protection Act 1990. CoPA Sections 60 and 61 which relate to noise and vibration from construction sites and will include the transporting of material to site.

Section 60 (S60) of CoPA allows a local authority to serve a notice of its requirements for the control of site noise to the individual or entity carrying out or controlling the works. The notice may stipulate noise limits for work, particular plant or machinery that should be avoided, hours during which construction activities may be carried out and provide for any change in circumstances.

Section 61 (S61) of CoPA concerns the procedures adopted when a contractor or developer approaches the local authority prior to any construction activities taking place, with the intention of agreeing noise and vibration limits in advance of works.

If consent is granted under S61, then this will be considered a valid defence by the Magistrate's court if the local authority was to later reverse its position and pursue an action under S60.

11.2.3. Environmental Protection Act (EPA) 1990

The Environmental Protection Act 1990 Part III, Section 79, defines what activities may constitute a Statutory Nuisance, and what activities are specifically exempt. Section 79 imposes a duty on local authorities to periodically survey environmental noise levels and to investigate noise complaints. The Act requires local authorities to serve notice when noise nuisance exists. Under these statutory nuisance provisions, the operators of a site or facility could be required to adopt best practicable means to abate noise nuisance at any time once operations have commenced. It is essential that potential nuisance effects are properly considered, to ensure that the operators are seen to adopt best practice, and that any potential requirements for mitigation are considered.

11.3. Methodology

11.3.1. Scope

Potential noise and vibration impacts from the construction activities and from the operation of the Proposed Scheme were scoped out in the PEIR. This assessment considers only noise and vibration impacts associated with noise expected from road traffic movements associated with the construction of the Proposed Scheme as shown in Table 11.1. Some of the access routes to be used are unmade or not kept to the standard of a public highways. Any imperfections in the surface (e.g. pot holes) could generate additional noise and vibration. However, these locations are considered to be too far from receptors to cause additional impacts due to the uneven road surface and this factor is therefore not considered. This will include any works associated with any remedial work needed on these routes.

Table 11.1 Scope of assessment

Scoped in	Scoped out
Noise and vibration effects associated with transport of material via the road network during the construction phase	Noise and vibration effects associated with construction works on site
	Noise and vibration effects during operation

11.3.2. Study area

For a road scheme following the guidance published by the government (Highways England, 2020), the study area for examining the impacts from additional traffic during construction will normally be an area 50m either side of the affected route. Therefore, the study area for this assessment has considered the worst-case sensitive receptors directly along the routes that the construction traffic is likely to use when travelling from the stockpile location to the work areas in Upper and Lower Sowy. The haulage routes are indicated in Figure 11.1 in Appendix A.

11.3.3. Guidance

LA 111 Noise and Vibration (Highways England, 2020)

The construction, operation and maintenance of highway projects can lead to changes in noise and vibration levels in the surrounding environment. This document provides a framework for assessing and managing the noise and vibration effects

associated with construction, improvement, use and maintenance of motorways and all-purpose trunk roads. This document sets out the requirements for noise and vibration assessments from road projects, applying a proportionate and consistent approach using best practice and ensuring compliance with relevant legislation.

With regards to construction traffic the document provides guidance on the definition of an appropriate study area and also provides a scale of magnitude to define the impacts.

A guide to measurement and prediction of the Equivalent Continuous Sound Level, L_{eq} (Noise Advisory Council, 1978)

The Noise Advisory Council guide was primarily written to introduce the concept of using the Equivalent Continuous Sound Level, L_{eq}, for noise predictions.

Within the guide there is an equation to predict the noise level at 10m from the edge of the road for a given time period. This method requires:

- The number of vehicles per each type (i.e. light and heavy)
- The average speed of each vehicle category
- The noise level from the passage of an individual vehicle averaged over one second. This is called the Sound Exposure Level (SEL)[9]

Calculation of Road Traffic Noise (Department of Transport and Welsh Office, 1988)

The calculation methods for predicting road traffic noise in the UK are defined within the 'Calculation of Road Traffic Noise' (CRTN) a technical memorandum document produced by the Department of Transport in 1988.

The calculation method consists of an initial Basic Noise Level (BNL) calculation at a reference distance of 10m which depends on the flow, traffic composition and speed of a road segment. Subsequently the method calculates all the corrections related with sound propagation at a receptor location where this includes distance, ground absorption, barrier screening, reflections, angle of view and façade correction.

Given the information available for this assessment and the fact that it is not as such a road scheme, calculations of the BNL only have been considered sufficient to determine potential significant effects. However, the method contained within CRTN does not allow a separate speed for each vehicle category to be considered. Given that for this Proposed Scheme the potential impact will be from an increase in just one type of vehicle (i.e. HGVs or tractors and trailer), this is considered important and hence recourse is made to the method provided within the Noise Advisory Council document (described earlier) within the methodology established in section 11.3.5.

The noise index used within CRTN is the L_{A10} level and that used within the Noise Advisory Council method outlined on page 18 is the L_{Aeq} index (the 'A' is added to indicate A-weighing). An L_{A10} noise level will generally be about 2 to 3 dB(A) above that of an L_{Aeq}. Since this assessment is considering the change in noise from the

[9] Defined as the constant sound level which has the same amount of energy in one second as the original noise event, in this case the car passage.

existing situation and not the absolute level of noise, this difference is not considered to influence the conclusion of the assessment.

Guidelines for Environmental Noise Impact Assessment (Institute of Environmental Management and Assessment, 2014)

The guidelines from the Institute of Environmental Management and Assessment (IEMA) in 2014 provide an overview of the requirements for the assessment of noise impacts. They do not provide guidance for any specific circumstances, for example impacts from additional traffic. Within the guidance document is a generic scale showing the relationship between noise impact and the likely level of significance, which includes descriptors for each impact.

11.3.4. Establishing the baseline

The method described above within Noise Advisory Council guidance has been used to calculate the noise level along each haulage route (at 10m) where base traffic data is available. The construction traffic volumes for the Proposed Scheme has then been added to the base traffic data to calculate a noise level that includes that generated by the additional HGV and/or tractors and trailer movements required to transport material from the source of imported material located near Westonzoyland (see Figure 3.1, Appendix A) to the Upper and Lower Sowy. These two noise levels have then been compared to determine the potential impact from additional traffic during the construction phase of the Proposed Scheme.

11.3.5. Assessment of sensitivity, magnitude and significance

LA 111 does not provide a scale for the value or sensitivity of receptors and people living, working or visiting those receptors. Therefore, the scale described in Table 11.2 has been used for this assessment. The receptor types for each category have been determined based on a number of factors including the time that people are at these receptors and the activities undertaken at/within the receptor.

Table 11.2 Value / Sensitivity of receptors

Value / Sensitivity	Receptor type definition for noise
High	Residential, educational buildings, medical facilities
Medium	Hotel, community facilities and places of worship
Low	Commercial buildings (e.g. offices)
Negligible	Farmland, industrial premises

Although LA 111 is primarily designed for the assessment of impacts from large road projects, it also provides a magnitude of impact scale that can be used to determine the potential impact from the construction traffic. This scale can be used for the roads around Upper and Lower Sowy and is shown in Table 11.3.

Table 11.3 Magnitude of impact at receptors

Magnitude of impact	**Increase in BNL[1] of closest public road used for construction traffic (dB)**
Major	Greater than or equal to 5.0
Moderate	Greater than or equal to 3.0 and less than 5.0
Minor	Greater than or equal to 1.0 and less than 3.0
Negligible	Less than 1.0
[1] The Basic Noise Level (BNL) is explained under the Calculation of Road Traffic Noise.	

The descriptions of magnitude provided in Table 11.3 will relate directly to those being used for the Proposed Scheme (e.g. High = Major, Moderate = Medium and Minor = Low) as described in Chapter 5 Assessment Methodology.

LA 111 states that "Construction noise and construction traffic noise shall constitute a significant effect where it is determined that a major or moderate magnitude of impact will occur for a duration exceeding:

1) 10 or more days or nights in any 15 consecutive days or nights;

2) a total number of days exceeding 40 in any 6 consecutive months."

Between Aller and Church Drove it is not possible to use the method described above since the traffic flow data for that route is unavailable. It is therefore not possible to follow the scale of magnitude provided in Table 11.3, and subsequently the significance matrix in Figure 5.1 of Chapter 5 (p44). A different approach is therefore adopted to define the magnitude of impact and the significance of effect of noise changes upon these receptors. This is based on textural descriptors of the possible effect from different magnitudes of impact and is taken from the IEMA guidelines and shown in Table 11.4. This guidance uses slightly different terminology for magnitude that the Proposed Scheme descriptors presented in Table 11.3. Where different the Proposed Scheme descriptor is shown in brackets to indicate how these will align with the IEMA descriptors. The final column of Table 11.4 indicates the potential for a significant effect, and this varies depending upon the magnitude of impact and other factors. Given that the determination of whether a significant effect has occurred relies on judgement, it is considered that this approach aligns with that presented in Figure 5.1 of Chapter 5 (p44).

Table 11.4 Descriptors for generic noise impacts and significance

Magnitude	Description of effect	Significance
Negligible	No discernible effect on the receptor	Not significant
Slight (Minor)	Receptor perception = Non-intrusive Noise impact can be heard but does not cause any change in behaviour or attitude, e.g. turning up volume of television; speaking more loudly; closing windows. Can slightly affect the character of the area but not such that there is a perceived change in the quality of life.	Less likely to be significant

Magnitude	Description of effect	Significance
Moderate	Receptor perception = Intrusive Noise impact can be heard and causes small changes in behaviour and/or attitude, e.g. turning up volume of television; speaking more loudly; closing windows. Potential for non-awakening sleep disturbance. Affects the character of the area such that there is a perceived change in the quality of life.	
Substantial (Major)	Receptor perception = Disruptive Causes a material change in behaviour and/or attitude, e.g. avoiding certain activities during periods of intrusion. Potential for sleep disturbance resulting in difficulty in getting to sleep, premature awakening and difficulty in getting back to sleep. Quality of life diminished due to change in character of the area.	More likely to be significant
Severe (Major)	Receptor perception = Physically Harmful Significant changes in behaviour and/or an inability to mitigate effect of noise leading to psychological stress or physiological effects, e.g. regular sleep deprivation/awakening; loss of appetite, significant, medically definable harm, e.g. auditory and non-auditory.	Significant

For locations where a quantitative assessment of magnitude of impact is not possible using the method described above, this scale of descriptions has been used to determine the effect qualitatively. The locations where this has been used are those where no traffic data is available to determine the baseline. In determining whether there is a potential significant effect factors such as absolute noise level, duration of event, frequency, time of day and nature of the noise source will be considered. A magnitude of moderate or above will be considered as a significant effect.

11.3.6. Assumptions and limitations

This section describes the limitations encountered during this assessment and lists any assumptions that have been made.

Assumptions

By using the calculation methodology from the Noise Advisory Council document described in section 11.3.2, the noise levels from an example light and heavy vehicle contained in the guidance document are assumed.

The speed of each vehicle category has been taken from paragraph 14.2 contained in the Calculation of Road Traffic Noise (Department of Transport and Welsh Office, 1988) which provides data for certain roads types that can be used when measured / modelled data is not available. For the sections of the road where there is a 30mph speed limit, this has been assumed as the speed for light and heavy vehicles (including the tractor and trailers). For the sections of road where the national speed limit applies, the speed for light vehicles is assumed at 50mph. For heavy vehicles

and the tractor and trailer combination, this has remained at 30mph since many of the roads are narrow with frequent corners.

The existing traffic flow data has been taken from a Department for Transport website (DfT, 2020) where traffic flow data is available for certain sections of the road network. Data for 2018, which is the most recent available, has been obtained for a point on the A361 to the north of Othery (Id: 37042) and for a point on the A372 to the west of the stockpile location (Id: 27031). Although neither of these points are on the routes that the vehicles will take from the source of imported material located near Westonzoyland (see Figure 3.1, Appendix A) to the Upper and Lower Sowy, they are considered to be representative since there are no major junctions between them and the road links of interest. The data presented on the DfT website is the Annual Average Daily Flow (AADF), which is the average over a full year of the number of vehicles passing a point in the road network each day. This will clearly vary day by day, with Sundays probably having a lower flow or certainly a different distribution of vehicles (i.e. less HGVs). Using this data this variation cannot be taken into account.

This traffic data available from the DfT website is for either a 24-hour period or where manual counts have been undertaken during daytime hours. In order to determine what percentage of traffic is within the working hours for the Proposed Scheme (assumed to be 07:00 to 19:00. An 11-hour period as opposed to the 12-hour working day has been used since it is unlikely that there will be vehicle movements within the first or last 30 minutes of any day. The manual counts data has also been examined and this has shown that for the A361 there is 80% of the 24-hour traffic flow within the 11-hour working hour period. For the A372 this figure is 89%. The 24-hour traffic flow has been corrected accordingly to ensure that only traffic in that period is considered for the existing situation. If the 24-hour data has been used it will have diluted the extra traffic being added.

Limitations

This assessment was undertaken during the 2020 Covid-19 pandemic and therefore no baseline surveys have been undertaken. The baseline surveys will have been used to assist with describing the existing noise climate. Also, measurements of individual vehicle passages will have been used as input data for the noise calculations. The existing noise climate has therefore been described using professional judgement.

11.4. Existing environment

A desk-based review of the road network and access routes which comprise the haulage routes for the Proposed Scheme was undertaken using aerial photography from Google Earth. Along some parts of the haulage routes there are groups or individual sensitive receptors in the form of dwellings, with some close to the road. These will be the receptors likely to be impacted the most by the increase in traffic and can be seen in Figure 11.1 (Appendix A).

No baseline noise and vibration monitoring has been undertaken for this assessment. Although the traffic flows along the A361 and A372 will not represent continuous traffic, the road traffic is likely to dominate the noise climate. Further from these roads, and within the villages along the route, the noise climate is likely to be

made up from multiple sources rather than one single source. These will include farming activities, wildlife, construction activities and the movement of people.

On the smaller roads (e.g. Oliver's Road) and those parts of the haulage routes that form part of the actual access routes to the construction site (e.g. Sandy Lane) the noise climate will be quieter but may have other more dominant noise sources such as farming activities and wildlife. Along these routes there are only sensitive receptors on Church Path.

11.5. Likely significant effects

This section describes the potential impacts from the additional construction traffic on the local roads. This is divided into locations that may be affected by the different haulage routes, or more accurately the roads used to reach each access point to the construction site. For this assessment the only receptors considered are those of high value (i.e. dwellings) as if significant effects are identified at these then any mitigation measures will be applicable to receptors of other values.

Figures have been provided by the appointed contractor on the expected total number of deliveries to each work site over the entire construction period. These are shown in Table 11.5.

Table 11.5 Expected total number of deliveries to each work site for the entire construction period

Site	Access route	One-way movements by HGV	One-way movements by tractor and trailer
Lower Sowy	Bimpits		195
	A361	185	
	Sandy Lane		184
	Owery Farm Lane		363
	A372	168	
Upper Sowy	Church Drove		2

For this assessment the figures to be used correspond to the expected average journeys per day. These are provided as follows:

- Lower Sowy daily average HGV – 18 for 4 weeks
- Lower Sowy daily average tractor and trailer – 19 for 8 weeks
- Upper Sowy daily average tractor and trailer – 2 for 1 week

These figures are one-way journeys and have therefore been doubled to be total movements for the purpose of calculating the expected noise levels. It is assumed that the vehicles will use the same route to and from the work sites. Within the assessment of each location, presented in Section 11.5, a description will be given as to the assumed route from the source of imported material (soils reprocessing plant) location to the work site. The number of daily movements provided are an average and will be used for the assessment. In order to examine a worst-case

situation these will be doubled. The assumed additional daily movements for each access route in line with the data in the bullet points above and the assumptions made is presented in Table 11.6.

Table 11.6 Additional daily traffic from deliveries to each work site

Access route	Assumed additional vehicles[1]	Vehicle destination
Bimpits	37	18 HGV to Lower Sowy and 19 tractor and trailer to Lower Sowy
A361	37	18 HGV to Lower Sowy and 19 tractor and trailer to Lower Sowy
Sandy Lane	37	18 HGV to Lower Sowy and 19 tractor and trailer to Lower Sowy
Owery Farm Lane	19	19 tractor and trailer to Lower Sowy
A372	20	18 HGV to Lower Sowy and 2 tractor and trailer to Upper Sowy
Church Drove	2	2 tractor and trailer to Upper Sowy
[1] One-way journeys along the access route which are doubled for the calculations to account for two-way movements. These can include vehicles that will use part of the route to get to another access route.		

The haulage route for the site access point Bimpits is not considered as there are no sensitive receptors along the route from the source of imported material to the construction site access point off Bimpits.

11.5.1. A361 and Sandy Lane site access points

To reach these access points it is assumed the haulage vehicles leave the source of imported material and turn right on to the A372, then along Oliver's Road. At the end of Oliver's Road it is assumed they turn left and then onto the corresponding work site. This route is shown on Figure 11.1 (Appendix A).

For these haulage routes the receptors where potential impacts could occur are along the A361 around the eastern end of Oliver's Road and the A361. Although there are no sensitive receptors along Sandy Lane itself, in order to reach this access point the haulage vehicles pass sensitive receptors along the A361. There are around four sensitive receptors along this route. From the source of imported material to the western end of Oliver's Road it is noted that there are no sensitive receptors.

It is assumed that the HGVs and tractor and trailers could be travelling simultaneously to Lower Sowy and so a passage of 74 vehicles in the 11-hour period is assumed. The speed of the light vehicles is assumed to be 50mph, with HGVs and tractors and trailers assumed to be 30mph. At these speeds the SEL for a light vehicle is 76.0 dB(A) and that of an HGV / tractor and trailer is 78.1 dB(A).

Table 11.7 Impact of vehicles using the A361 and Sandy Lane access routes

	Existing traffic conditions	Traffic conditions during construction phase for Proposed Scheme[1]
Light vehicles	4,200	4,200
HGVs	129	203
%HGV	3.0	4.6
Calculated noise level, L_{Aeq}, dB	66.4	66.6
Difference (dB)		+0.2
[1] Additional construction traffic added to existing traffic using the figures presented in Table 11.6		

From Table 11.7 it can be seen that the predicted increase in noise is 0.2 dB(A). The magnitude of this increase for receptors of high value is negligible and will be Not Significant. This increase in noise could be for up to eight weeks.

The additional traffic shown in Table 11.6 uses the predicted average additional movements per day. A maximum number of additional movements per day are assumed as being double this value (approximately 148 movements per day). Considering 148 movements per day will give an increase of 0.3 dB(A) which will still be a negligible magnitude of change and will be Not Significant.

11.5.2. Owery Farm Lane site access point

To reach this access point it is assumed the vehicles leave the source of imported material and turn right on to the A372, then along Oliver's Road. At the end of Oliver's Road it is assumed they turn right and then shortly afterwards left onto Owery Farm Lane. This route is shown on Figure 11.1 (Appendix A).

For this access route the receptors where potential impacts could occur are along the A361 from the eastern end of Oliver's Road to the entrance to Owery Farm Lane (approximately 450m). Those receptors at the eastern end of Oliver's Road have been excluded from this assessment these have been considered within the assessment of potential impacts from vehicles travelling to Sandy Lane and the A361. Taking this into account, there are two sensitive receptors along this route.

It is assumed that only tractor and trailers will be travelling along this route and a passage of 38 vehicles in the 11-hour period is assumed. The speed of the light vehicles is assumed to be 50mph, with the tractors and trailers assumed to be 30mph. At these speeds the SEL for a light vehicle is 76.0 dB(A) and that of a tractor and trailer is 78.1 dB(A).

Table 11.8 Impact of vehicles using the Owery Farm Lane access route

	Existing traffic conditions	Traffic conditions during construction
Light vehicles	4,200	4,200
HGVs	129	167
%HGV	3.0	3.8

Calculated noise level, L_{Aeq}, dB	66.4	66.5
Difference (dB)		+0.1

From Table 11.8 it can be seen that the predicted increase in noise is 0.1 dB(A). The magnitude of this increase for receptors of high value is negligible and will be Not Significant. This increase in noise could be for up to eight weeks.

The additional traffic shown in Table 11.6 uses the predicted average movements per day. A maximum number of movements per day is assumed as being double this value (76). Considering 76 movements will give an increase of 0.2 dB(A) which will be a negligible magnitude of change for high value receptors and will be Not Significant.

11.5.3. A372 site access point

To reach this site access route it is assumed the vehicles leave the stockpile site and turn right on to the A372 and continue along this road to the construction site. This route is shown on Figure 11.1 (Appendix A).

For this haulage route the receptors where potential impacts could occur are to the north of Middlezoy and the north of Othery. There are also a few scattered receptors along the 4.5km route. It is estimated there are around a total of 20 sensitive receptors directly alongside this route.

It is assumed that HGVs and tractor and trailers will be travelling along this route and a passage of 40 vehicles in the 11-hour period is required. This comprises 36 movements to Lower Sowy and four movements to Upper Sowy, which are assumed to use the same route and could be operating simultaneously. The speed of the light vehicles is assumed to be 50mph, with the HGVs and tractors and trailers assumed to be 30mph. At these speeds the SEL for a light vehicle is 76.0 dB(A) and that of an HGV / tractor and trailer is 78.1 dB(A).

Table 11.9 Impact of vehicles using the A372 access route

	Existing traffic conditions	Traffic conditions during construction
Light vehicles	5,236	5,236
HGVs	195	235
%HGV	3.6	4.3
Calculated noise level, L_{Aeq}, dB	67.4	67.5
Difference (dB)		+0.1

From Table 11.9 it can be seen that the predicted increase in noise is 0.1 dB(A). The magnitude of this increase for receptors of high value is negligible and will be Not Significant. This increase in noise could be for up to four weeks.

The additional traffic shown in the table uses the predicted average movements per day. A maximum is assumed as being double this value at 80 movements per day. Considering 80 movements will give an increase of 0.2 dB(A) which will still be a negligible magnitude of change for high value receptors and will be Not Significant.

11.5.4. Church Drove site access point

To reach this site access point it is assumed the vehicles leave the source of imported material near Westonzoyland and turn right on to the A372, then proceed along the A372 to the village of Aller. From here they turn right onto Church Path and then proceed to the construction site via Church Drove. This route is shown on Figure 11.1 (Appendix A).

For this haulage route the receptors where potential impacts could occur are along the length of the A372 from the source of imported material to Aller. However, those receptors between the source of imported material and the A372 within the construction site have already been considered using a higher number of movements under section 11.5.3, and therefore that part of the route is excluded. Between the A372 access point to the construction site and Church Path in the village of Aller where the vehicles turn off the A372, there are around 20 sensitive receptors directly alongside the route. Once the vehicles turn into Church Path there are around another 20 sensitive receptors before the vehicles turn onto Church Drove. Once on Church Drove there are around five sensitive receptors along the route.

It is assumed that only tractor and trailers will be travelling along this haulage route and a passage of four vehicles in the 11-hour period is assumed. The speed of both types of vehicles (i.e. light and tractor and trailer) is assumed to be 30mph as they pass the majority of sensitive receptors. At these speeds the SEL for a light vehicle is 71.4 dB(A) and that of a tractor and trailer is 78.1 dB(A).

A372 to Aller

From Table 11.10 it can be noted that there is no predicted increase in noise. The magnitude of this increase for receptors along the route to Aller of high value is negligible and will be Not Significant. This increase in traffic will only be for one week.

Table 11.10 Impact of vehicles using the A372 to reach Aller

	Existing traffic conditions	Traffic conditions during construction
Light vehicles	5,236	5,236
HGV's	195	199
%HGV	3.6	3.7
Calculated noise level, L_{Aeq}, dB	63.3	63.3
Difference (dB)		0

The additional traffic shown in Table 11.5 uses the predicted average movements per day. A maximum is assumed as being double this value, at 8 movements per day. Considering 8 movements will give an increase of 0.1 dB(A) which will be a negligible magnitude of change for high value receptors and will be Not Significant.

Church Drove

There are approximately 20 receptors along Church Path and a further five along Church Drove. The traffic flow along these roads will be a lot lower than the A372 traffic and so the calculation methodology used for other areas cannot be used here.

Due to the unknown traffic data along this route and with no knowledge of the existing noise climate in these areas that are away from a dominant noise source such as a main road, a qualitative approach based on the descriptors presented in Table 11.3 has been utilised.
Along this route the noise climate will be quiet and so the passing of any vehicle is likely to be audible for perhaps 15 to 20 seconds. The sound will be gradual and not sudden, and unlikely to be a sound (i.e. the passing of a tractor and trailer) that residents will not have experienced before. With both routes leading to farms and parking for footpaths, these will not be devoid of existing traffic and so a passing vehicle will not be uncommon. Over the 11-hour day there will be an average of 4 such passages, so perhaps a maximum of two per hour although that will only occur for two hours. Given that the Proposed Scheme will be of benefit to those living in the area, the works associated with the construction programme is likely to be more tolerated than something that is not welcome. Taking these points into consideration it is considered that the magnitude will be minor and for receptors of high value this will be Not Significant.

Mitigation

Although no significant effects have been identified from the assessment, it is still considered that measures to control the noise from the vehicles on the road network should be included within the EAP (Appendix K). These include:

- Reducing any rapid braking or accelerating
- Avoiding the use of horns, unless required for safety reasons on some of the narrow tracks
- Briefing of the drivers into the nature (i.e. low background noise at present) of some of the routes

In addition, the residents of Church Drove should be informed of the works, including the nature of the vehicles passing, timescales and durations of the works.

11.6. Conclusions and summary of residual effects

The assessment of additional traffic on the local road network during the construction period has shown that there should be no significant noise effects. This is due to the low number of trips proposed between the source of imported material near Westonzoyland and the sites compared with the existing traffic on the local road network.

Since there are no significant effects the first aim of the NPSE is met. The potential impacts are minimised through the choice of routes and vehicles. Due to the works being temporary there is no opportunity to contribute to the improvement of health and quality of life in relation to noise.

12. Cumulative effects

12.1. Introduction

This section sets out the results of the cumulative impacts assessment (CIA) of the Proposed Scheme.

Cumulative effects can be divided into two broad categories as follows.

- **Intra-project effects**: effects that arise as a result of the combination of topic specific effects defined for a given scheme
- **Inter-project effects:** effects that arise due to the interaction of the Proposed Scheme with other relevant development proposals within the general locality of the scheme area. For example:

– Construction impacts from more than one project at the same time or concurrently, and/or

– Operational impacts from more than one project affecting the same receptor(s)

– How the impacts act together

Intra-project effects between topics are an integral part of the EIA for the Proposed Scheme and have been considered within the various chapters of this ES. Where these occur they are outlined in the introductory sections of each chapter. Intra-project effects are therefore not repeated this assessment.

This chapter therefore focusses on potential inter-project cumulative effects, which are subdivided according to the following categories:

- Additive: where similar impact types from the same or different development affect a receptor at the same time in a similar way
- Synergistic: where different types of impact affect a receptor and interact to increase their combined significance

12.2. Methodology

12.2.1. Guidance

The assessment of cumulative effects for this ES has been informed by the 'Guidelines for the Assessment of Indirect and Cumulative Impacts as well as Impact Interactions' (European Commission, 1999) and professional judgement. DMRB Volume 11 Section 2 (LA 104 Sustainability and Environment. Appraisal. Environmental assessment and monitoring) provides valuable guidance on the assessment of cumulative effects and has been used to determine the methodology for this scheme.

The EIA Regulations state that cumulative effects must be assessed in terms of what is 'reasonably foreseeable'. For the purposes of this assessment, reasonably foreseeable has been defined as:

- Development projects with valid planning permission within 5km of the scheme area featuring ten dwellings or more.
- Development projects at the planning application stage that could be reasonably considered to have a significant cumulative impact, as per professional judgement.
- Major development projects that form part of a formal development plan produced by local planning authorities or government
- Other plans or projects identified as important for consideration by our internal specialists

12.2.2. Study area

The study area for the assessment of cumulative effects is the construction footprint for the Proposed Scheme plus a buffer of 5km and/or watercourses hydrologically linked the Sowy/KSD system and their associated habitats. It should be noted that strategically important projects with planning permission, under design or under construction by SDC were also considered. Information on these projects was obtained via contact with the local planning officer.

12.2.3. Assessment methodology

Identification of relevant projects

The following sources of information were consulted to identify plans and projects relevant to the assessment of inter-project cumulative effects:

- Sedgemoor District Council (SDC) planning portal
- South Somerset District Council planning portal
- Somerset County Council planning portal
- SRA website (www.somersetriversauthority.org.uk)
- SDBC website (https://somersetdrainageboards.gov.uk/)
- Our internal national environmental assessment specialist team

It is noted that minor planning applications of a domestic nature, such as improvement to existing residential properties or garage conversions, have not been considered within this assessment as it is considered that the size/scale of these developments are not significant enough to have a generate any cumulative likely significant effects.

Scope of assessment

Using the sources set out in section 12.2.1 other projects or potential developments were identified that could have a cumulative effect when combined with the Proposed Scheme. Projects were considered if:

- The construction period of the Proposed Scheme and the project overlapped
- The Proposed Scheme and the project were hydrologically linked

Where a potential cumulative effect is identified as above, a project is considered 'scoped in' to further assessment and the significance of the cumulative effect is considered in further detail.

Determination of significance

The DMRB (2019) guidance provides a specific methodology for assessing the significance of cumulative impacts. This has been used as a guide for the purposes of this assessment by considering:

- Which receptors or resources are affected?
- How will the activity or activities affect the condition of the resource?
- What are the probabilities of such effects occurring?
- What ability does the receptor/resource have to absorb further effects before change becomes irreversible?

Identified cumulative impacts are categorised as 'construction' (temporary impacts that will only occur during the construction phase of the project) or 'operational' (permanent effects that will be present during the operation of the Proposed Scheme). The significance of the identified effects is defined in line with DMRB guidance, as set out in Table 12.1.

Table 12.1. Criteria used to determine the significance of cumulative effects

Significance	Impacts
Severe	Effects that the decision-maker must take into account as the receptor/resource is irretrievably compromised.
Major	Effects that may become key decision-making issues.
Moderate	Effects that are unlikely to become issues on whether the project design should be selected, but where future work may be needed to improve on current performance.
Minor	Effects that are locally significant.
Not significant	Effects that are beyond the current forecasting ability or are within the ability of the resource to absorb such change.

12.2.5. Limitations

The following assumptions and limitations apply to this assessment:

- To enable consideration of a worst-case situation, it is assumed where planning permission has been granted or has been applied for, developments could be constructed at the same time as the Proposed Scheme or in the following months, thus giving rise to potential construction-related cumulative effects.
- Professional judgement has been used to assess the potential environmental impacts of and planned mitigation measures for other relevant development proposals where pre-existing environmental assessments are unavailable.
- Although there has be consultation undertaken with the local council (SDC) there is limitations to our knowledge in potential planning applications that may be submitted in the future. Therefore, the assessment of cumulative effects is based on our knowledge of submitted planning applications at the time of writing.
- When considering potential cumulative effects between the Proposed Scheme and other developments, in some cases there is limited environmental information for the other developments outlined. Professional judgement has been used to analyse the potential effects of other developments within the area for the purpose of this assessment, and professional judgement has been used to 'fill in' any gaps in information.

12.3. Likely significant effects

Under the process described in section 12.2 above, the following 12 developments and plans/strategies set out in Table 12.1 were identified which either fall within the study area for assessment of cumulative effects (i.e. are located within the 5km buffer zone) or are linked hydrologically or recognised as a strategically important. These projects have then been considered with respect to potential for cumulative effects during the construction or operation phase of the Proposed Scheme and scoped in or out of further assessment accordingly.

A total of projects have been 'scoped in' through this process meaning that they have the potential to have 'cumulative' effects when combined with the Proposed Scheme. These are:

- Oath to Burrowbridge dredge (Parrett IDB)
- Refurbishment of water control structures within West Moor and Moorlinch RWLAs and of Egypt's Clyce (EA)
- Wessex Small Works – Bridges Improvement Project (EA)

.

Table 12.2 Projects with spatial and temporal overlap and/or hydrologically connected with Proposed Scheme

Name	Brief description	Scoped in or out of assessment
Parrett and Tone maintenance dredging programme (SRA)	Maintenance water injection dredging (WID) takes place annually on the Parrett and Tone in December or January. The locations and volumes of dredged material varies depending on the current need.	Construction – scoped out: Whilst the Proposed Scheme and this scheme are both hydrologically linked to the Parrett TRaC, no impact on the Parrett TRaC is anticipated as a result of the Proposed Scheme. Operation -scoped out. This scheme was included within the baseline for the hydraulic modelling undertaken to inform development of the MAP (see Appendix J) for the combined effects of the Oath to Burrowbridge Dredge and the full River Sowy and King's Sedgemoor Drain Enhancements Scheme.
Parrett M5 to Northmoor Capital Dredge (SRA)	WID on the Parrett between Northmoor Pumping Station and the M5 is planned to take place during 2020. This scheme will help offset identified adverse effects of the Oath to Burrowbridge Dredge (Parrett IDB) scheme on the Tone and at Currymoor (pers comms. John Rowlands, EA).	Construction – scoped out. Whilst the Proposed Scheme and this scheme are both hydrologically linked to the Parrett TRaC, no impact on the Parrett TRaC is anticipated as a result of the Proposed Scheme. Operation – scoped out. This scheme was mitigates adverse effects on flood risk identified for the Oath to Burrowbridge Dredge.
Wessex Small Works - Bridges Improvement Project (Environment Agency)	This is a project that addresses maintenance issues associated with several bridge structures located on the Sowy.	Construction - scoped in: Construction period aligns with the Scheme and therefore this is potential cumulative effects on ecological features, particularly on water voles within the area.

Name	Brief description	Scoped in or out of assessment
		Operation – scoped out: No potential environmental effects during operation as a result of this scheme alone. Therefore no potential for cumulative effects with the Proposed Scheme.
Bridgwater Tidal Barrier (Environment Agency)	This is project that aims to construct a tidal barrier near Bridgwater with some additional modifications to embankments further downstream along the estuary and River Parrett. The tidal barrier will hold back tidal waters in times of high flood water. The defence is situated upstream from Dunball.	Construction – scoped out: This scheme is four years away from construction and therefore will overlap with the construction period of the Proposed Scheme. Operation – scoped out: During operation the tidal barrier could cause changes to water quality and geomorphology however these are considered to be limited as when the barrier is open the flow will continue as 'normal', and geomorphological changes associated with the change in sediment from the barrier closure are thought to be in line with natural variation therefore, no significant effect anticipated.
Oath to Burrowbridge Dredge (Parrett IDB)	This project includes the dredging of the River Parrett from Stathe Bridge to the confluence of the River Parrett and the Tone at Burrowbridge.	Construction - scoped out: Will not have a significant effect during the construction phase as the dredging works were completed in 2019. Operation - scoped in: There is potential for cumulative effects between this project and the Proposed Scheme due to the reduction in the amount of standing water available in designated site which support designated species such as breeding birds.

Name	Brief description	Scoped in or out of assessment
HRA Mitigation Structures Project – (West Moor, Moorlinch, Egypt's Clyce) (EA)	This project forms part of the mitigation proposals for the combined effects of the Oath to Burrowbridge Dredge and the full River Sowy and Kings Sedgemoor Drain Enhancements Scheme (see Appendix J).	Construction - scoped in: May/June 2020 is intended construction period for HRA mitigation structures. Operation - scoped out: These works form part of the MAP (see Appendix J) for the Oath to Burrowbridge Dredge and the full River Sowy and King's Sedgemoor Drain Enhancements Scheme.
Dunball Sluice Refurbishment Project (EA)	Projects aims to refurbish the existing Sluice structure where certain mechanical components are failing.	Construction - scoped out: Construction/work associated with this project will not take place in 2020. Operation – scoped out: This project aims to refurbish the existing sluice with no change to the function of the existing structure and therefore will have no effect on the drainage of the wider area.
West Moor (EA)	This project aims to refurbish or replace the Midelney Siphon and adjacent gravity outfall. The project is currently at the appraisal stage where several options have been considered to address how best to refurbish the existing structures.	Construction - scoped out: Construction period does not overlap with that of the Proposed Scheme. Operation – scoped out: The aim of this project is to replace or refurbish the existing structures to ensure that flow and function of both West Moor and South Moor are maintained. As existing flows will be maintained it is not anticipated that there will be any cumulative effects when combined with the Scheme.

Name	Brief description	Scoped in or out of assessment
Dunball Smoothing (Environment Agency)	This project aims to remove a concrete structure that is currently impeding on the flow of the KSD under the A38 road bridge.	Construction - scoped out: This project is currently on hold and therefore will not have any effect on the construction phase of the project. Operation – scoped out: This project is already partially complete and the removal of the remaining small section of concrete is only likely to have a small effect on the flow regime of the KSD and, as such, is unlikely to act in-combination with the operation of the Proposed Scheme.
Taunton Strategic Flood Alleviation Scheme (Environment Agency and Somerset West and Taunton Council)	The purpose of this scheme is to decrease flood risk within the settlement of Taunton by implementing a series of 'small' works.	Construction- scoped out: Construction programme does not coincide with the Proposed Scheme as this project is currently at detailed design. Operation – scoped out: The aim of the scheme is to reduce flooding within Taunton. During detailed design the implication on downstream flood risk were analysed and found to have no significant impact
Hills to Levels (Farming and Wildlife Advisory Group (FWAG) SouthWest)	This is a 'holistic' catchment management approach project that aims to reduce run off from land so that peak flows are reduced. This project aims to retain water within the upper and mid catchment areas in an attempt to reduce local flooding. It will also aid in reducing soil loss from the upper catchment	Construction - scoped out: Due to the highly localised areas associated with this project, it is not anticipated that there will be any cumulative effects when combined with the Proposed Scheme. Operation - scoped out: During operation this project aims to retain water within the upper and middle catchment areas. This is anticipated to aid

Name	Brief description	Scoped in or out of assessment
	areas and thus reduce the need for de-silting within the lower catchment areas	in the objectives of the Proposed Scheme as peak water flows within the middle and lower catchment areas (like the Sowy and the KSD) will be reduced. Therefore, no significant cumulative effects are anticipated.
Co-Adapt EU Project Somerset (SCC, SRA, Somerset Wildlife Trust, the FWAG SouthWest, the National Trust and Blackdown Hills Area of Outstanding Natural Beauty (AONB) Trust)	This is a project that aims to 'co-create' adaptive management solutions (nature based and natural process solutions), which can demonstrate to the surrounding community how natural flood management measures can deliver cost effective protection as well as their effectiveness in delivering water management.	Construction - scoped out: Due to the highly localised and small-scale nature of this project it is not anticipated that any cumulative effects will occur in combination with the Scheme. Operation - scoped out: During operation this project aims to slow the flow of water throughout the catchment area using natural methods

The following subsections consider in further detail whether there is potential for inter-project cumulative effects between the Proposed Scheme and the three projects scoped into further assessment as per Table 12.2.

12.3.1. Oath to Burrowbridge Dredge

The Oath the Burrowbridge Dredging Project is part of the Somerset Rivers Authority 20 Year Flood Action Plan and aims to reduce flood risk to up to 65km^2 of land. The project involves dredging 2.2km of the River Parrett from Stathe Bridge to the confluence between the River Parrett and River Tone at Burrowbridge. The dredging will allow for more water to flow within the River Parrett and therefore during times of high rainfall will reduce the area of land flooded. The project is hydrologically linked to the Proposed Scheme. Hydraulic modelling undertaken to support the Oath to Burrowbridge ES and HRA identified that both the Oath to Burrowbridge Dredge and the full River Sowy and King's Sedgemoor Drain Enhancement Scheme together will act to reduce the extents and depths of the surface water flooding events which provide winter 'splash' conditions within the Somerset Levels and Moors SPA and associated habitats. As such it is considered that the Oath to Burrowbridge dredge and the Proposed Scheme could have a major adverse significant cumulative effect, in the absence of mitigation.

12.3.2. Refurbishment of water control structures within West Moor and Moorlinch RWLAs and of Egypt's Clyce

Refurbishment of water control structures within West Moor and Moorlinch RWLAs and of Egypt's Clyce could have a cumulative effect when combined with the Proposed Scheme as the construction phases for both developments overlap. These two developments therefore have potential for impacts on ecological receptors. However, due to the temporary nature and duration of the construction phase of both schemes, impacts on sensitive receptors are considered to be not significant.

12.3.3. Wessex Small Works – Bridges Improvement Project

The Wessex Small Works – Bridges Improvement Project aims to address maintenance issues with several bridge structures along the Sowy and will be undertaken in summer/autumn 2020. Therefore, there could be potential effects on certain receptors, with particular attention to ecological receptors such as water voles. However, large areas of undisturbed water vole habitat are to be maintained throughout the construction phase of the Proposed Scheme in order to ensure a safe refuse for the water voles at all times, in accordance with the conditions of our organisational licence under which displacement will be undertaken for both schemes. Therefore, impacts on sensitive receptors associated with the two developments are considered not significant.

12.4. Mitigation

As outlined in further detail in Chapter 7 a MAP (see Appendix J) has been identified and agreed between ourselves, Natural England and the IDB which will provide mitigation for the potential cumulative impacts of the full River Sowy and King's Sedgemoor Drain Enhancements Scheme and the Oath to Burrowbridge Dredging Project. The MAP can be found in Appendix J and includes the refurbishment of water control structures at Moorlinch, West Moor and Egypt's Clyce during summer 2020 in advance of construction of the Proposed Scheme.

The MAP will be managed and facilitated through the existing governance framework established for the current Water Level Management Plans and the SRA Management Group; to agree the outcomes and actions outlined in the MAP, based on results of ongoing monitoring. This will be achieved through their regular meetings, as deemed necessary and managed by a small group of officers from each partner organisation (Natural England, Environment Agency and the SDBC).

Further detail regarding other measures included within the MAP can be found in section 3.2.2 and also in the strategic level HRA Stage 2 report for the Proposed Scheme (see Appendix C).

12.5. Conclusions and summary of residual effects

Table 12.5 sets out the residual effects associated with the cumulative effects of the Proposed Scheme and associated developments within the area. The cumulative effects assessment has considered all relevant, reasonably foreseeable developments following the methodology established in section 12.2. Whilst the assessment has identified some cumulative effects, these are not considered to be significant enough to require any changes to the Proposed Scheme, and it is considered that these can be managed effectively, through the identified mitigation.

Table 12.5 Residual cumulative effects

Project name	Receptor	Nature of cumulative impact	Significant cumulative effect	Mitigation	Residual cumulative effects
Construction					
No likely significant effects identified.					
Operation					
Oath to Burrowbridge Dredge (Parrett IDB)	Flora and fauna	Reduction extents, durations and depth of flooding which provides 'splash' conditions favoured by overwintering birds on the Somerset Levels and Moors SPA and supporting habitats. Further information provided in Chapter 7 and in the Oath to Burrowbridge dredge ES (Johns Associates, 2019)	Moderate adverse	MAP developed by the EA, NE and IDB, which includes the refurbishment of water level control structures within Moorlinch, West Moor and Egypt's Clyce prior to construction of the Proposed Scheme. See Appendix J for and the strategic level HRA AA (Stage 2) report in Appendix C for further information.	Not significant

13. Monitoring

Monitoring is required in order to ensure that the mitigation and enhancement measures identified within Chapters 6 to 12 of this report achieve their objectives. These are summarised below in Table 13.1 for the construction and operational phases of the Proposed Scheme. Monitoring requirements are also specified in the EAP for the Proposed Scheme (see Appendix K).

Table 13.1 Monitoring requirements

Action	Purpose	Frequency and duration
Water vole	Ensure that water vole have been successfully displaced from the works area prior to commencement of construction	As required under our organisational licence (WML OR23) – minimum period of seven days
	Ensure that water vole populations re-establish in areas where displacement undertaken	As required under our organisational licence (WML OR23). Up to three years following displacement or until it is confirmed that water vole are present (whichever is sooner).
Monitoring of planting as recommended in the LIVIA (Chapter 9) and the Landscape Maintenance and Management Plan (LMMP) (Appendix N)	Ensure grassland, marginal wetland habitats, wet scrub and replacement native trees establish successfully post-construction	• Two years for grass seeded areas and marginal planting areas (or one year if our field services teams find planting established sufficiently during this time) • Five years for feathered and standard tree planting
Monitoring of areas cleared of INNS, if identified as necessary within the Invasive Species Management Plan which is identified as required within Chapter 7.	Ensure INNS removal is successful and remediate any signs of renewed growth or spread following completion of works under the Proposed Scheme	As deemed necessary within the Invasive Species Management Plan to be developed for the Proposed Scheme.

Action	Purpose	Frequency and duration
Monitoring measures identified as required within the MAP for the Proposed Scheme and Oath to Burrowbridge dredge developed by NE in conjunction with the EA and SDBC and managed and facilitated through the SRA Management Group.	Ensure no significant adverse effects on nature conservation sites	As deemed necessary within the MAP

14. Summary of residual effects and conclusions

In accordance with the scope identified in the PEIR for the Proposed Scheme (including consultation responses), this EIA has considered the potential impacts of the Proposed Scheme on sensitive receptors across the following topic areas:

- Water (Chapter 6)
- Flora and fauna (Chapter 7)
- Cultural heritage (Chapter 8)
- Landscape and visual amenity (Chapter 9)
- Population and health (Chapter 10)
- Noise and vibration (Chapter 11)

Cumulative effects with other plans and projects have also been considered within Chapter 12.

Table 14.1 provides a summary of the potential significant effects (i.e. moderate or substantial) identified through the assessment process across all topic areas, any additional mitigation required over and above the embedded mitigation described in Chapter 3 to minimise or avoid identified potential adverse effects, and any residual effects of the Proposed Scheme. Table 14.1 also links these mitigation measures to the measures listed within the EAP (see Appendix K).

As set out within the assessment methodology for the Proposed Scheme, only moderate or major residual effects are considered to be significant. With the additional mitigation in place, as shown in the topic specific chapters 6-12 and summarised in Table 14.1, the only significant (i.e. moderate or major) residual effect of the Proposed Scheme is a permanent moderate beneficial effect on the King's Sedgemoor Drain – Henley Sluice to Mouth WFD waterbody. This is as a result of WFD enhancements included within the Proposed Scheme (embayments, two stage channels and backwaters) which will improve aquatic and riparian habitats and flow diversity and also contribute to an improvement in water quality. The Proposed Scheme is considered likely to complement progress towards good ecological potential.

The Proposed Scheme will also make a beneficial contribution towards alleviation of flood risk as part of the full River Sowy and King's Sedgemoor Drain Enhancements Scheme (once implemented) alongside other measures identified and brought forward under the Somerset Levels and Moors 20 year Flood Action Plan.

The EAP (Appendix K) includes mitigation identified through chapters 6 to 12 to further reduce the severity of any adverse effects assessed as non-significant, which principally include temporary adverse effects (minor or negligible) to designated and non-designated habitats and LCAs, protected species (badger, bats, breeding birds and eels) and non-designated archaeological assets, as well as disturbance to agricultural land holdings and users of PRoW adjoining the proposed haulage routes.

The EAP is an iterative document and will be updated as the scheme's construction work methods and consenting processes are progressed to ensure that it captures

all relevant actions and any potential adverse effects of the Proposed Scheme will be minimised.

Table 14.1 Summary of residual effects

Receptor (sensitivity/value)	Nature of impact (magnitude)	Significance (pre-mitigation)	Mitigation	Residual effect	EAP ID for mitigation
Construction					
Water					
WFD water body (King's Sedgemoor Drain) (medium)	Increase in suspended sediments within water column; disturbance to marginal habitat; risk of reduced oxygen levels in-channel (medium, temporary)	Moderate adverse (significant)	Preparation and implementation of a SWMP and EERP Compliance with best practice pollution prevention measures Use of silt curtains/booms or DO monitoring in summer Toolbox talks regarding water quality risks	Minor adverse (not significant)	A2-A7 B1-B8
Non-WFD water bodies (Langacre, and other rhynes) (medium)	Increase in suspended sediments within water column; disturbance to marginal habitat; risk of reduced oxygen levels in-channel (medium, temporary)	Moderate adverse (significant)	Preparation and implementation of a SWMP and EERP Compliance with best practice pollution prevention measures Use of silt curtains/booms or DO monitoring in summer	Minor adverse (not significant)	A2-A7 B1-B8

Receptor (sensitivity/value)	Nature of impact (magnitude)	Significance (pre-mitigation)	Mitigation	Residual effect	EAP ID for mitigation
			Toolbox talks regarding water quality risks		
Communities and infrastructure benefitting from flood risk protection from the full River Sowy and King's Sedgemoor Drain Enhancements Scheme (not defined, qualitative descriptive assessment only)	Construction – no change in flood risk	Not assessed (qualitative descriptive assessment only)	None identified	No change	A1
Flora and fauna					
Water vole (low)	Death/injury to animals, temporary habitat loss/indirect affects via temporary changes in water quality (medium).	Moderate adverse (significant)	Works under licence to include timing of works and displacement techniques.	Minor adverse (not significant)	B20, C3
Cultural heritage					
Prehistoric wooden trackway located approximately 670m to the south-east of Parchey Bridge (NHLE 1014430) (high)	Compression and rutting from plant movements (low, temporary). Compression from embankment and land raising (low, permanent)	Moderate adverse (significant)	• Temporary matting for vehicle access • Archaeological monitoring of groundworks	Negligible adverse (Not significant)	A11, A12, B21

Receptor (sensitivity/value)	Nature of impact (magnitude)	Significance (pre-mitigation)	Mitigation	Residual effect	EAP ID for mitigation
Previously unknown archaeological assets and deposits of paleoenvironmental and geoarchaeological interest (high – as a worst case)	Excavation for the embayments and two stage channels could result in the partial or complete removal of such remains (high, permanent)	Substantial (significant)	• Archaeological investigation and recording • Archaeological excavation and recording if preservation *in-situ* not achievable	Negligible adverse (Not significant)	A11, B24
Operation					
Water					
WFD water body (King's Sedgemoor Drain) (medium)	Overall improvement due to provision of WFD enhancement features (embayments, two stage channels and backwaters) (medium, permanent)	Moderate beneficial (significant)	N/A	Moderate beneficial (significant)	A1
Non-WFD water bodies (Langacre, and other rhynes) (medium)	Overall improvement due to provision of WFD enhancement features (embayments, two stage channels and backwaters) (medium, permanent)	Moderate beneficial (significant)	N/A	Moderate beneficial (significant)	A1, B28-33

Receptor (sensitivity/value)	Nature of impact (magnitude)	Significance (pre-mitigation)	Mitigation	Residual effect	EAP ID for mitigation
Communities and infrastructure benefitting from flood risk protection from the full River Sowy and King's Sedgemoor Drain Enhancements Scheme (not defined, qualitative descriptive assessment only)	Positive contribution towards flood risk alleviation in combination with other measures and future works	Not assessed (qualitative descriptive assessment only)	N/A	Not assessed (qualitative descriptive assessment only)	A1
Flora and fauna					
Somerset Levels and Moors SPA/Ramsar and Severn Estuary SPA/Ramsar (non-breeding bird qualifying features only) (high)	Loss of suitable foraging and roosting habitat will put additional pressure on qualifying wintering bird features to find alternative sites, including potential displacement outside of the Somerset Levels. Increase in energy requirements could lead to loss of condition and ultimately death if only sub-optimal sites, subject to disturbance	Substantial (significant)	MAP developed by the EA, NE and IDB, which includes the refurbishment of water level control structures within Moorlinch, West Moor and Egypt's Clyce prior to construction of the Proposed Scheme. See Strategic level HRA AA (Stage 2) report in Appendix C for further information.	Negligible/ Minor beneficial (not significant)	B7, C4
King's Sedgemoor SSSI/Southlake Moor SSSI/Moorlinch SSSI/West Sedgemoor SSSI (non-breeding bird qualifying features only) (medium)		Major adverse (significant)		Negligible/Minor Beneficial (not significant)	

Receptor (sensitivity/value)	Nature of impact (magnitude)	Significance (pre-mitigation)	Mitigation	Residual effect	EAP ID for mitigation
Aller Moor LWS and Greylake RSPB Reserve LWS (non-breeding bird qualifying features only) (low)	are available. The impact will be permanent (high). Cumulative impact with Oath to Burrowbridge dredge (Parrett IDB)	Moderate adverse (significant)		Negligible/Minor beneficial (not significant)	
Landscape					
LCA 1: Peat Moor (medium)	Adverse impacts from extensive areas of bare ground, raised embankments and excavated WFD features (low, temporary)	Moderate-minor adverse (up to significant)	Seeding and planting. Planted WFD habitats will create beneficial impacts which will offset residual adverse impacts of raised embankments	Minor adverse (embankments) x Minor beneficial (WFD habitats) = Negligible (not significant)	A1, B28 to B35
Footpaths BW 8/6 and BW 36/5 (medium)	Adverse impacts from extensive areas of bare ground, raised embankments and excavated WFD features (low, temporary)	Moderate-minor adverse (up to significant)	Seeding and planting. Planted WFD habitats will create beneficial impacts which will offset residual adverse impacts of raised embankments	Minor adverse (embankments) x Minor beneficial (WFD habitats) = Negligible (not significant)	A1, B28 to B35

References

Baggs, A. P, Bush, R.J. E and Tomlinson, M., 'Parishes: Aller ', in A History of the County of Somerset: Volume 3, ed. R W Dunning (London, 1974), pp. 61-71. [Online]. Available from: British History Online http://www.british-history.ac.uk/vch/som/vol3/pp61-71. Accessed 30 March 2020.

Biggs et al. (2014). Analytical and methodological development for improved surveillance of the great crested newt. Appendix 5. Technical advice note for field and laboratory sampling of great crested newt (*Triturus cristatus*) environmental DNA.

Capita (2015a) Water Vole Survey Report, The Sowy and King Sedgemoor Drain Enhanced Capacity Scheme.

Capita (2015b) Badger Survey Report, Sowy and King Sedgemoor Drain Enhanced Capacity Scheme.
CH2MHill. 2015. Somerset Levels and Moors Appraisal. Sowy-KSD Enhanced Capacity Options Appraisal Report (technical/environmental/economic). Unpublished.

Chartered Institute of Ecology and Environmental Management (CIEEM) (2018) Guidelines for ecological impact assessment in the UK and Ireland, terrestrial, freshwater and marine.

Chown, D.J. (2003). Night-time use of the Somerset Levels and Moors floodplain by waterfowl: final report, winters 2001/02 – 2002/03. Unpublished report to English Nature Somerset Team.

Collins, J. (ed) (2016) Bat surveys for professional ecologists: Good practice guidelines (3rd edn). The Bat Conservation Trust, London.

Cresswell P, Harris S and Jefferies D, J. (1990). The history, distribution status and habitat requirements of the badger in Britain Nature Conservancy Council, Peterborough (*Meles meles*) population. Mammal Review 18, 37-49.

Davies, R., (GSB Prospection Ltd) (2016). GSB Survey Report No. G1656 King's Sedgemoor Drain, Chedzoy, Somerset. [unpublished].

Dean, M., Strachan, R., Gow, D. and Andrews, R. (2016). The Water Vole Mitigation Handbook (The Mammal Society Mitigation Guidance Series). Eds Fiona Mathews and Paul Chanin. The Mammal Society, London.

Defra (2010). National Noise Policy Statement for England (NPSE). [Online]. Available from: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/69533/pb13750-noise-policy.pdf

Defra. (2015). South West River Basin District River Basin Management Plan. [Online]. Available from: https://www.gov.uk/government/publications/south-west-river-basin-district-river-basin-management-plan.

Department for Transport Welsh Office. (1988). Calculation of Road Traffic Noise. London: Her Majesty's Stationery Office.

Department for Transport. (2020). Road traffic statistics. [Online]. Available from: https://roadtraffic.dft.gov.uk/local-authorities/5

Eaton, M.A., Aebischer, N.J., Brown, A., Hearn, R.D., Lock, L., Musgrove, A.J., Noble, D.G., Stroud, D.A., & Gregory, R.D. (2015). Birds of Conservation Concern 4: the population status of birds in the UK, Channel Islands and Isle of Man. British Birds, 108: 708-746. Available from: https://www.bto.org/our-science/publications/psob

Environment Agency. 2016. River Sowy and King's Sedgemoor Drain Enhancements Options 2016. [Online]. Available from: https://www.gov.uk/government/publications/river-sowy-kings-sedgemoor-drain-enhancement-options-2016

Grove, J. and Croft, B. (2012) South West Archaeological Research Framework – Research Strategy 2012 – 2017. [Online]. Available from: https://www.somersetheritage.org.uk/downloads/swarf/swarf_strat.pdf. Accessed 17 March 2020

Gov.UK. Badgers: surveys and mitigation for development project.[Online]. Available from: https://www.gov.uk/guidance/badgers-surveys-and-mitigation-for-development-projects

Her Majesty's Stationery Office. (1978). A Guide to Measurement and Prediction of the Equivalent Continuous Sound Level Leq: Report by a Working Party for the Technical Sub-Committee of the Council.

Highways Agency (2019). DMRB LA108 Biodiversity. [Online]. Available from: http://www.standardsforhighways.co.uk/ha/standards/dmrb/vol11/section3/LA%20108%20Biodiversity-web.pdf

Highways England (2019) Design Manual for Roads and Bridges [Online]. Available from: https://www.standardsforhighways.co.uk/dmrb/search?volume=11&section=3.

Highways England. (2020). LA 111 Noise and Vibration. Design Manual for Roads and Bridges [Online]. Available from: https://www.standardsforhighways.co.uk/dmrb/search?q=noise%20and%20vibration&pageNumber=1

Historic England (2020a) Heritage at Risk Register Listing Entry for 1014430 Prehistoric trackways, 670 metres of Parchey Bridge Stanwell – Sedgemoor. [Online]. Available from: https://historicengland.org.uk/advice/heritage-at-risk/search-register/list-entry/45615.

Historic England (2020b) National Heritage List for England Listing Entry for 1014430 Prehistoric timber trackways, 670m SSE of Parchey Bridge. [Online]. Available from: https://historicengland.org.uk/listing/the-list/list-entry/1014430.

ICUN (2020-1). The IUCN Red List of Threatened Species [Online]. Available from: https://www.iucnredlist.org/

Institute of Environmental Assessment. (1993). Guidelines for the environmental assessment of road traffic. [Online]. Available from: https://www.thenbs.com/PublicationIndex/documents/details?Pub=IEA&DocID=257892

Jacobs (2020) River Sowy and King's Sedgemoor Drain Enhancement Scheme: Phase 1: Preliminary Environmental Information (Environment Agency). Unpublished.

Johns Associates (2019). Oath to Burrowbridge Dredging and Associated Activities. Environmental Statement. [Online]. Available at:

JNCC (2010) Handbook for Phase 1 Habitat Survey – a technique for environmental audit.

McGuire, C and Whitfield D (2017). National Water Vole Database and Mapping Project. [Online]. Available from: https://www.wildlifetrusts.org/sites/default/files/2018-05/water_vole_report_2006-2015_final.pdf

Ministry of Housing, Communities and Local Government. 2019. National Planning Policy Framework. [Online]. Available from: https://www.gov.uk/government/publications/national-planning-policy-framework--2

National Character Area (NCA) Profile:142: Somerset Levels and Moors (NE451). [Online]. Available from: http://publications.naturalengland.org.uk/publication/12320274?category=587130

Natural England, 2009. WML-G16 Interpretation of 'Disturbance' in relation to badgers occupying a sett. [Online]. Available from: http://programmeofficers.co.uk/Preston/CoreDocuments/LCC333.pdf

Natural England (2018) Designated Sites View. [Online]. Available from: https://designatedsites.naturalengland.org.uk/SiteSearch.aspx

Natural England. (2014). Agricultural Land Classification Map - South West Region. [Online]. Available from: (http://publications.naturalengland.org.uk/publication/144017?category=595414853724736)

Norman, C. and Clements, C. F. (1979) Prehistoric Timber Structures on King's Sedgemoor: Some Recent Discoveries, in Somerset Archaeology and Natural History: Volume 123, pp 5-18.

Oldham R.S., Keeble J., Swan M.J.S. & Jeffcote M. (2000). Evaluating the suitability of habitat for the Great Crested Newt (*Triturus cristatus*). Herpetological Journal 10 (4), 143-155.

Online Atlas of the British and Irish Fauna (None dated). [Online]. Available from: https://www.brc.ac.uk/plantatlas/plant/hydrocharis-morsus-ranae

Palmer, M. A., Drake, M. and Stewart, N. (2013) A Manual for the Survey and Evaluation of the Aquatic Plant and Invertebrate Assemblages of Grazing Marsh Systems Version 6. [Online]. Available from: https://www.buglife.org.uk/sites/default/files/2013Manual_0.pdf

Johns Associates. (2019). Oath to Burrowbridge Dredging and Associated Activities Environmental Statement. [Online]. Available at: https://somersetdrainageboards.gov.uk/operations/projects/regulation-10-consultation-on-environmental-statement/Reptile and Amphibian Group for Somerset (2020). Grass snake. Available from: http://www.somersetarg.org.uk/grass_snake.php

Strachan, R., Moorhouse, T. and Gelling, M. (2011). The water vole conservation handbook. Third Edition. Wildlife Conservation Research Unit, Oxford.

Stroh, P.A. Leach, S.J., August, T.A., Walker K.J., Pearman, Rumsey, F/J., Harrower, C.A., Fay, M.F., Martin, J.P., Pankhurst, T., Taylor, I. (2014). A Vascular Plant Red Data List for England.

Sedgemoor District Council. (2003). Sedgemoor Landscape Assessment and Countryside Design Summary. Sedgemoor District Council.

Sedgemoor District Council. (2019). Adopted Local Plan (2011-2032) [Online]. Available from: (https://www.sedgemoor.gov.uk/LocalPlan)

South Somerset District Council. (2003). The Landscape of South Somerset. [Online]. Available from: https://www.southsomerset.gov.uk/media/1297/j-plan_pol-web-site-2018-planning-webpages-the_landscape_of_south_somerset.pdf

Somerset Rivers Authority. (2014). The Somerset Levels and Moor Flood Action Plan [Online]. Available from: https://www.somersetriversauthority.org.uk/

South Somerset District Council. (2015). South Somerset Local Plan 2006-2028 [Online]. Available from: https://www.southsomerset.gov.uk/your-council/your-council-plan-and-strategies/planning-policy/local-plan/

Sedgemoor District Council (2019) Sedgemoor Local Plan 2011-2032 (adopted February 2019). [Online]. Available from: https://www.sedgemoor.gov.uk/LocalPlan. Accessed 20 March 2020.

Webster, C. J. (ed.) (2007) South West Archaeological Research Framework – Resource Assessment and Research Agenda. [Online]. Available from: https://www.somersetheritage.org.uk/downloads/swarf/swarfweb.pdf. Accessed 17 April 2020.

Wessex Archaeology (2015) River Sowy Somerset Heritage Assessment. [unpublished].

Wilson G, Harris S and Mclaren G (1997). Changes in the British badger population, 1988 t 1997. School of Biological Sciences, University of Bristol

List of abbreviations

Artificial Waterbody (AWB)

Basic Noise Level (BNL)

Below Ground Level (bgl)

Chartered Institute of Ecology and Environmental Management (CIEEM)

Construction Environmental Management Plan (CEMP)

Construction Traffic Management Plan (CTMP)

Control of Pollution Act (CoPA)

Countryside and Rights of Way (CRoW)

Environment Agency (EA)

Environmental Action Plan (EAP)

Environmental Clerk of Works (ECoW)

Environmental Impact Assessment (EIA)

Environmental Statement (ES)

Internal Drainage Board (IDB)

Institute of Environmental Management and Assessment (IEMA)

King's Sedgemoor Drain (KSD)

Landscape Masterplan (LMP)

Landscape Maintenance and Management Plan (LMMP)

Natural Character Area (NCA)

Natural England (NE)

Secretary of State (SoS)

Site Waste Management Plan (SWMP)

Somerset Rivers Authority (SRA)

Sound Exposure Level (SEL)

Southwest Heritage Trust (SWHT)

Surface Water Management Plan (SWMP)

Special Area of Conservation (SAC)

Special Protection Area (SPA)

Somerset Rivers Authority (SRA)

River Basin District (RBD)

Water Framework Directive (WFD)

Glossary

Agricultural Land classification	A series of six grades classifying soil in terms of its suitability for agriculture, from 1 (excellent) to 5 (very poor)
Baseline	A description of the present state of the environment with the consideration of how the environment will 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
Basic Noise Level (BNL)	
Birds Directive	Europe is home to more than 500 wild bird species. But at least 32 % of the EU's bird species are currently not in a good conservation status. The Birds Directive aims to protect all of the 500 wild bird species naturally occurring in the European Union.
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.
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.
Conservation Area	An area designated under the Town and Country Planning Act, 1990 to protect its architectural or historic character.
Countryside and Rights of Way (CRoW) Act 2000	This Act applies to England and Wales and has five parts: - Access to the countryside Public rights of way and road traffic Nature conservation and wildlife protection Areas of outstanding natural beauty Miscellaneous and Supplementary This act increases the protection of SSSIs. Environment Agency plans/programmes/projects must gain consent for works in or near SSSIs using a CRoW form.
Countryside Character Areas	Sub-divisions of England into areas with similar landscape character as categorised by the Countryside Agency. These are used when assessing the impact of a plan/programme/project on its local landscape.

Cumulative Impacts	The combined impacts of several projects within an area, which individually are not significant, but together amount to a significant impact.
Department for Environment, Food and Rural Affairs (DEFRA)	The government department responsible for flood management policy in England
Ecological Impact Assessment (EcIA)	An assessment of the potential effects of a proposed development on species, habitats and sites that are of value to conservation or protected by national and/or international legislation.
Historic England	Government statutory advisor on the historic environment, funded jointly by the government and by revenue from properties and members.
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 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
Environmental Statement (ES)	The document produced to describe the environmental impact assessment process where statutory environmental impact assessment is required.
Floodline	Environment Agency flood warning system, accessible by telephone or internet and updated every 15 minutes
Geographical Information Systems (GIS)	A computer-based system for capturing, storing, integrating, manipulating, analysing and displaying data spatially.
General Permitted Development Order (GPDO)	The Town and Country Planning (General Permitted Development) Order 2015 (as amended) sets out what may

	be built without needing planning permission. Part 13 applies specifically to the Environment Agency
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 Natural England Together these sites are referred to as the Natura 2000 network.
Higher level scheme	See ESS
Indicative landscape plan (ILP)	Overlay of existing environment and scheme proposals to highlight environmental constraints and opportunities including designated sites and landscape character.
Land Drainage Regulations	The Environmental Impact Assessment (Land Drainage Improvement Works) Regulations 1999 SI 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 Character Assessments	Landscape character assessment (LCA) is the process of identifying and describing variation in character of the landscape. LCA documents identify and explain the unique combination of elements and features that make landscapes distinctive by mapping and describing character types and areas.
Local Nature Partnerships	Local Nature Partnerships were one of the key proposals made in the June 2011 Natural Environment White Paper. Their purpose is to bring a diverse range of individuals, businesses and organisations together to create a vision and plan of action about how the natural environment can be taken into account in decision making in that area.
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 Natural England
Mitigation measures	Actions that are taken to minimise, prevent or compensate for adverse effects of the development.

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 Natural England
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.
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.
Registered battlefield	Battlefield sites listed on the Register of Historic Battlefields maintained by Historic England. These assets have a high level of protection in planning policy.
River Sowy and King's Sedgemoor Drain Enhancements Scheme: Phase 1	Phase 1 of the full River Sowy and King's Sedgemoor Drain Enhancements Scheme. Works proposed under this Phase 1 are the subject of this ES and will increase the capacity of the KSD between Parchey Bridge and the confluence with the Sowy to up to $27m^3/s$ and the Sowy between the confluence with the KSD and the A372 Beer Wall to up to $24m^3/s$. Minor bank restoration works only are proposed to the Sowy between the A372 Beer Wall and Monk's Leaze Clyce.
Full River Sowy and King's Sedgemoor Drain Enhancements Scheme	The full River Sowy and King's Sedgemoor Drain Enhancements Scheme will increase the capacity of the KSD between Parchey Bridge and the confluence with the Sowy to $27m^3/s$ and the Sowy between Monk's Leaze Clyce and the confluence with the KSD to $24m^3/s$. In addition, the operational procedures for Monk's Leaze Clyce will be altered to allow more water to be diverted from the Parrett into the Sowy/KSD system under certain conditions.
Riparian	Area of land or habitat adjacent to rivers and streams
Scheduled monument	Nationally important historic sites, buildings or monuments identified by Historic England and designated by the Secretary of State for Culture, Media and Sport. Any work affecting a scheduled monument must gain consent from Historic England 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.
Sound Exposure Level *(SEL)	Defined as the constant sound level which has the same amount of energy in one second as the original noise event, in this case the car passage.
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) and proposed Special Protection Area (pSPA)	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. Proposed sites receive the same protection as fully protected sites
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.
Water level management plan (WLMP)	A plan that sets out water level management requirements in a defined floodplain area (usually an SSSI) which is designed to reconcile different needs for drainage.