

Appendix E Preliminary and detailed WFD compliance reports

E1 Preliminary WFD assessment report



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

Water Framework Directive Assessment

Version 1.3

February 2020



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1 Introduction

This Water Framework Directive (WFD) assessment report has been prepared for Sowy/KSD Enhanced Capacity Proposed Scheme Phase 1 (the Proposed Scheme).

1.1 Purpose of this report

The WFD needs to be taken into account in the planning of all new activities in the water environment. The Environment Agency (EA), as competent authority in England and Wales are responsible for delivering the Directive through the Environment (Water Framework Directive) (England and Wales) Regulations 2017.

Member states must meet the conditions of the WFD unless they meet the criteria laid out in Article 4.7. Any new activity must be reviewed against Article 4.7 for compliance. To be compliant, the following condition must be met: "the beneficial objectives served by the modifications or alterations of the water body cannot, for reasons of technical feasibility or disproportionate cost be achieved by other means, which are a significantly better environmental option."

1.2 Background

The WFD requires that environmental objectives (as shown in Table 1 below) are set for all surface and groundwater bodies.

Specific mitigation measures have been set for each River Basin District (RBD) to achieve the environmental objectives of the WFD. These measures are to mitigate impacts that have been or are being caused by human activity and to enhance and restore the quality of the existing Preventing Deterioration in Ecological Status or Potential. These measures are to mitigate impacts that have been or are being caused by human activity and to enhance and restore the quality of the existing environment. These mitigation measures will be delivered through the River Basin Management Plan (RBMP) through different organisations.

Table 1: Environmental Objectives of the Water Framework Directive

Objectives
Member States shall implement the necessary measures to prevent deterioration of the status of all bodies of surface water.
Member States shall protect, enhance and restore all bodies of surface water, subject to the application of subparagraph (iii) for artificial and heavily modified bodies of water, with the aim of achieving good surface water status by 2015.
Member States shall protect and enhance all artificial and heavily modified bodies of water, with the aim of achieving good ecological potential and good surface water chemical status by 2015. Where this is not possible and subject to the criteria set out in the Directive, aim to achieve good status by 2021 or 2027.
Progressively reduce pollution from priority substances and cease or phase out emissions, discharges and losses of priority hazardous substances.
Prevent Deterioration in Status and prevent or limit input of pollutants to groundwater.

The WFD stipulates that all water bodies should meet good ecological status (GES) (or good ecological potential (GEP) if an artificial or heavily modified water body) by a set timeframe. Overall ecological status (or potential) is made up of a number of biological, hydromorphological

and chemical quality characteristics called elements. The overall status is determined by the lowest element status.

Any activity which has the potential to have an impact on ecology will need consideration in terms of whether it could cause deterioration in the ecological status or potential of a water body. It is, therefore, necessary to consider the possible changes associated with the proposed options for the Proposed Scheme.

Where there are sites protected under European Union (EU) legislation, the WFD aims for compliance with any relevant standards or objectives for these sites. For this Proposed Scheme, this relates to designated sites that are within the Study Area and designated under Habitats Directives. The nearest protected site is Somerset Levels and Moors Special Protection Area (SPA).

1.3 Preventing Deterioration in Ecological Status or Potential

The WFD stipulates that all water bodies should meet good ecological status (GES) (or good ecological Potential (GEP) if an artificial or heavily modified water body) by a set timeframe. Overall ecological status (or potential) is made up of a number of biological, hydromorphological and chemical quality characteristics called elements. The overall status is determined by the lowest element status.

Any activity which has the potential to have an impact on ecology will need consideration in terms of whether it could cause deterioration in the ecological status or potential of a water body. It is, therefore, necessary to consider the possible changes associated with the proposed options for the Proposed Scheme.

Where there are sites protected under EU legislation, the Directive aims for compliance with any relevant standards or objectives for these sites. For the Proposed Scheme, this relates to designated sites that are within the Study Area and designated under Habitats Directives. The nearest protected site is Somerset Levels and Moors Special Protection Area (SPA).

1.4 Environmental Objectives

The generic environmental objectives set out below (based on Article 4.1 of the WFD and as described in Table 1) will be used for the assessment of the Proposed Scheme in relation to the WFD:

- no changes affecting high status sites
- no changes that will cause failure to meet surface water Good Ecological Status or Potential or result in a deterioration of surface water Ecological Status or Potential
- no changes which will permanently prevent or compromise the Environmental Objectives being met in other water bodies
- no changes that will cause failure to meet good groundwater status or result in a deterioration groundwater status

1.5 Assessment Stages

The following three discrete stages need to be followed to complete the WFD assessments:

- **Screening:** excludes any activities that do not need to go through the scoping or impact assessment stages
- **Scoping:** identifies the receptors that are potentially at risk from an activity and need impact assessment

- **Impact Assessment:** considers the potential impacts of an activity, identifies ways to avoid or minimise impacts, and indicates if an activity may cause deterioration or jeopardise the water body achieving Good Ecological Status or Potential (GES or GEP)

2 Outline of Proposed Scheme

In the Somerset Levels and Moors the flooding problem is caused by insufficient discharge capacity from the rivers to the sea, perpetuated by tide-locking. The River Parrett and its main tributary rivers flow through flat lower moors, where they are embanked and, in some places, perched above the surrounding floodplain. The rivers overflow and floodwater is stored in the moors before it can discharge to sea.

The Proposed Scheme is being promoted under the Somerset Levels and Moors 20-year Flood Action Plan, produced by a range of organisations with the involvement of the community.

The objective is to develop an enhanced capacity Proposed 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-Kings Sedgemoor Drain (KSD system to accommodate more floodwater from uncontrolled overtopping of the Parrett spillways

The Proposed Scheme lies within an area that is subject to several statutory designations: Somerset Levels and Moors Special Protection Area (SPA) and Ramsar site (which share footprints) and Somerset Levels and Moors and King’s Sedgemoor Sites of Special Scientific Interest (SSSI). These are designated for invertebrates, plant communities and populations of waterfowl and over-wintering birds.

2.1.1 Scheme design

Phase 1 of the River Sowy and King Sedgemoor’s Drain Enhancements Scheme focusses on capacity enhancements between Monks Leaze Clyce on the Sowy and Parchey Bridge on the KSD as shown in Figure 3, Appendix J of the PEIR. Table 1 provides the outline design for capacity enhancement works within each section of the Proposed Scheme, working downstream from Monk’s Leaze Clyce.

It should be noted that at this current early stage of design it is uncertain whether the full programme of works set out in Table 1 can be undertaken within the currently available funding. Raising of the existing informal flood embankments between the Sowy/KSD confluence to Parchey Bridge and channel widening works proposed between Beer Wall and Parchey Bridge will be prioritised first within the detailed design. Second priority will be raising of the existing informal flood embankments between Monk’s Leaze Clyce and Beer Wall, followed by raising of existing flood embankments within the Beer Wall to Sowy/KSD confluence section and then channel widening works between Beer Wall and Monk’s Leaze Clyce.

Table 1: Proposed capacity enhancement works, by location

Location		Bank raising	Channel widening
Upper Sowy	Sow between Monk’s Leaze Clyce and Beer Wall	Raising of existing informal flood embankments on left and right bank by up to 0.7m (allowing for 0.2m settlement, final level of 0.5m). This would ensure that the channel in this section has a capacity of 17m ³ throughout.	Where works will be required in this area to raise the embankments, we will look for opportunities to create embayments and lengths of two-stage channel on the right bank. Up to 15 potential locations have been identified for these features, with the number created likely to be dependent on the location and

Location		Bank raising	Channel widening
			extent of bank raising work. This will be looked at in more detail as part of detailed design.
Lower Sowy	Sowy between Beer Wall and A361	Raising of existing informal flood embankments on left and right bank by up to 0.5m (allowing for 0.2m settlement, final level of 0.3m). This would increase the capacity of the channel in this section from 17m ³ /s (assumed) to 24m ³ /s.	Creation of embayments lengths of two-stage channel and backwaters (KSD only) on the right bank in at least seven and up to 14 locations. Potential locations as indicated on the Indicative Landscape Plans (ILPs) provided in Appendix G of the PEIR.
	Sowy between A361 and Sowy/KSD confluence	Raising of existing informal flood embankments on left bank by up to 0.5m (allowing for 0.2m settlement, final level of 0.3m) on the left bank. No bank raising on the right bank. This would increase the capacity of the channel in this section from 17m ³ /s (assumed) to 24m ³ /s. whilst still allowing periodic overtopping of the right bank near Greylake.	
KSD	KSD between Sowy/KSD confluence and Parchey Bridge	Raising of existing informal flood embankments on left and right bank by up to 0.7m (allowing for 0.2m settlement, final level of 0.5m). This would increase the capacity of the channel in this section from 17m ³ /s (assumed) to 27m ³ /s..	

2.1.2 Raising of existing informal flood embankments

Where existing informal flood embankments are to be reprofiled or raised, the crest width will be maintained at a minimum of 4m or increased to 4m, with formed battered embankment sides of 1 in 5 slopes on the landward side (see Figure 1 below). Material required for raising of the existing informal flood embankments on the KSD and Upper Sowy would be won through reprofiling of the existing informal flood embankments in these sections, in accordance with the process shown in Figure 1 below.

Material required for raising of the existing informal flood embankments on the Lower Sowy would be either:

- (i) won through reprofiling of the existing informal flood embankments on the Lower Sowy and KSD and transferred by road to the Lower Sowy using either tipper trucks with 13m³ capacity or tractor and trailer using the routes shown in Figure 15, Appendix J of the PEIR
- (ii) imported under CL:AIRE Code of Practice (COP) (source and road transfer routes currently unknown)

Material won through creation of channel widening structures would be placed on the landward side of the existing informal flood embankments.

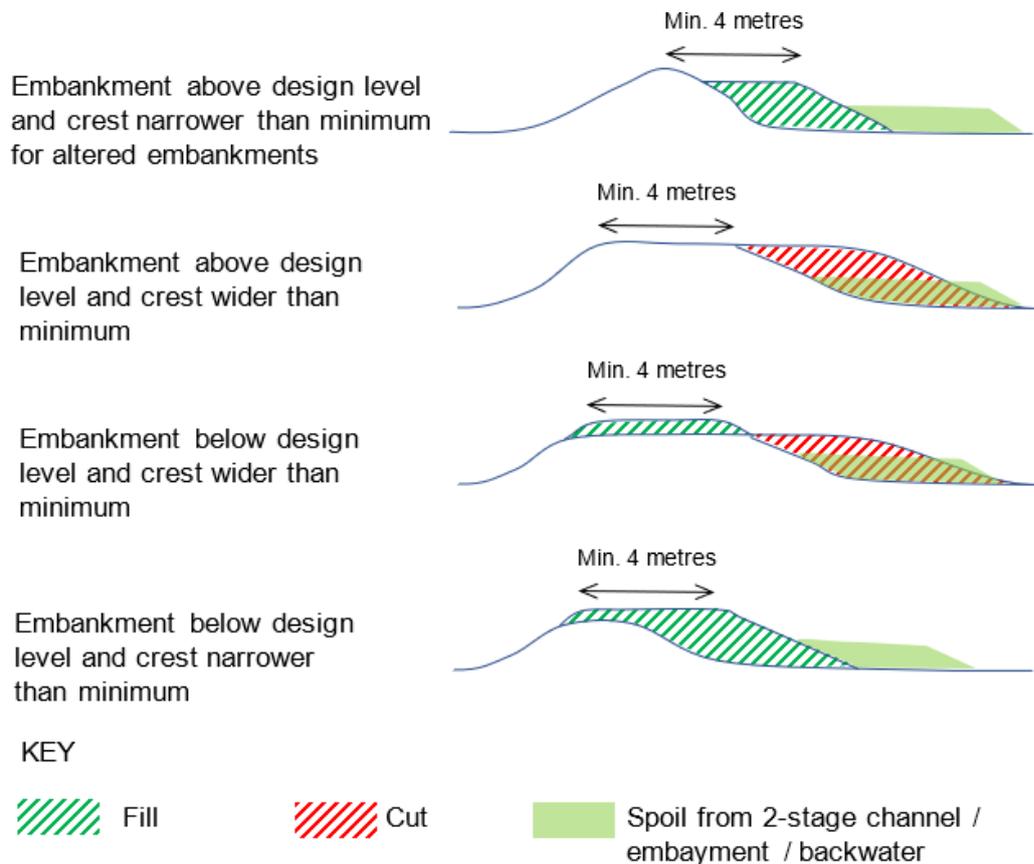


Figure 1: Illustration of bank reprofiling process

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

Channel widening works will only take place on the right bank of the Sowy and KSD, within land currently owned the Environment Agency. Embayments, two stage channels and backwaters would be designed to offer ecological and geomorphological benefit. Individual embayments, backwaters or stretches of two-stage channel created on the right bank would not exceed 150m in length and would be spaced by at least 300m. Exact locations and dimensions of these features will be identified at the detailed design stage, where the following principles will apply:

- two-stage channels: widening of between 1-2m, with a minimum of 3-5m marginal shelf and shelf level of 300mm below summer pen¹
- embayments: up to 6m in width, with shelf level of 300m below summer pen
- backwaters: back channel of between 8-10m wide and 100m in length, with a “planted island” of 5-6m width. Provision of structures to support recreational usage such as bridges and/or fishing platforms will be considered.

The detailed design will also consider planting of small areas of wet woodland and/or willow bed planting on the right bank of the Sowy and KSD (indicative locations shown on ILPs, Appendix G of the PEIR) to improve channel shading.

2.1.4 Additional works

Minor works to two structures on the KSD, Cossington Right Outfall and Chilton Right Outfall structures, will likely be required. This will involve raising of the existing concrete headwalls by 0.3-0.4m.

2.1.5 Construction process

The overall programme will be driven by the need to minimise potential impacts on the designated site features. It is recognised that direct impacts on overwintering bird species could be avoided by programming construction outside the period when they will be present at the designated sites and off-site supporting areas, i.e. 1st October to 31st March. However, other environmental constraints also operate in particular related to water quality and risks to fish related to summer working (because of the higher water temperatures and risk of impacting on dissolved oxygen levels). Therefore, subject to obtaining the necessary consents the aim is to commence work in August 2020. The end date for construction activities will be determined by

¹ The level to which water levels within the channel are maintained during the summer. Winter pen level is lower than summer pen level to allow better drainage.

ground / weather conditions as well as any timing constraints for avoiding disturbance to wintering birds.

If the option to transport material won from the KSD to the Lower Sowy is taken forward, then material would be transported by either tipper truck with 13m³ capacity or tractor with trailer via the routes shown in Figure 15, Appendix J of the PEIR. The exact routes required to transport material from an as yet unidentified remote resource under CL:AIRE COP are not yet known, but the last part of the journey through minor roads would likely be the same as shown in Figure 15, Appendix J of the PEIR.

Works to existing informal flood embankments will be undertaken from the landward side wherever practicable. The requirement for use of haul routes on site will be minimised by the use of existing tracks where practicable, and a potential opportunity to barge material between the KSD and Sowy between A361 and Beer Wall will also be considered (especially where ground conditions are not favourable).

All work will be undertaken following liaison with the landowners and the local community to minimise disruption to local people and infrastructure. Where portable satellite compounds are required, these will be located within 100m of the KSD and Sowy channel. A permanent compound may be required, and this would be located on hardstanding within an agricultural yard or industrial site in close proximity to site.

All site activities with potential to cause disturbance and measures required to protect and enhance the environment will be managed and/or implemented in accordance with an Environmental Action Plan (EAP) which will outline the key mitigation measures that have been identified in the Environmental Statement, and a Construction Environmental Management Plan (CEMP) which will detail the contractor's standard precautions to be taken to minimise the risk of environmental impact. An outline EAP is provided in Appendix D. This outline EAP will be further updated as the scheme design and environmental assessment process progresses and will inform the development of the contractor's CEMP.

Traffic generated (including the movement of materials on the road network and on site) will be managed in accordance with a Traffic Management Plan (TMP) and waste will be managed in accordance with a Site Waste Management Plan (SWMP). These will each be prepared in consultation with our relevant internal specialist teams before the start of construction and the appointed contractor will be required to adhere to the specifications.

3 Assessment Screening

3.1 Data Collection

The Proposed Scheme is located within the South West River Basin which is managed by the South and West Somerset River Basin Management Plan (Environment Agency, 2015).

The EA's Catchment Data Explorer (<https://environment.data.gov.uk/catchment-planning/>) was used to assess water bodies present within the Proposed Scheme's Study Area. The WFD compliance mapping for groundwater risk and status assessment was also reviewed.

The Proposed Scheme lies within the waterbody: King's Sedgemoor Drain – Henley Sluice to mouth (water body ID GB108052021150). The extent of this water body is shown on Figure 2.

The connected upstream water bodies are:

- Cary - source to confluence with KSD (water body GB108052015140) (Figure 3);
- Eighteen Feet Rhyne (water body GB108052021100); and
- Parrett - River Isle to River Yeo (GB108052015370)– upstream of Monksleaze.

The downstream water bodies are:

- Parrett (water body GB540805210900). This is a transitional water body; and
- Bridgwater Bay (GB670807410000). This is a coastal water body. The groundwater body is Tone and North Somerset Streams Groundwater (GB40802G806400).

Figures 2 to 6 illustrate the water body maps. Tables 3 to 6 summarise the quality element data.

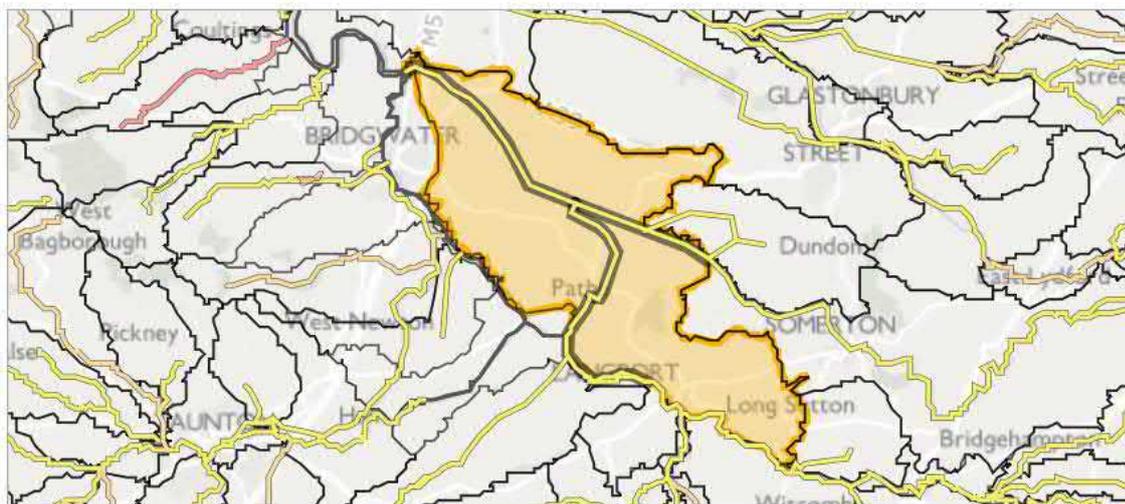


Figure 2: King's Sedgemoor Drain – Henley sluice to mouth water body (Source: <https://environment.data.gov.uk>)

Table 3: Water body WFD parameters – King’s Sedgemoor Drain – Henley sluice to mouth (<https://environment.data.gov.uk>)

Water body ID	GB108052021150
Water body name	King’s Sedgemoor Drain – Henley Sluice to mouth
NGR	ST4081234025
Catchment area	11560.058 ha
Length	27.917 km
Hydromorphological designation	Artificial
Current overall potential (2016 data)	Moderate
Status objective (overall)	Good (2027)
Reasons for not achieving good potential	Mitigation measures assessment: physical modification (Urbanisation, land drainage, flood protection) Phosphates – Diffuse source (livestock); point source (sewage discharge) Dissolved oxygen – Physical modification (land drainage structures; flood protection); Point source (sewage discharge); Diffuse source (livestock) Fish – suspect data
Protected area designation	Conservation of Wild Birds Directive – Somerset Levels and Moors
Hydromorphological supporting elements	Supports Good
Current ecological potential (and status objective)	Moderate (Good 2027)
Biological quality elements	Fish – Moderate Invertebrates – Good Macrophytes and Phytobenthos combined - High
Physico-chemical quality elements	Moderate
Chemical quality elements	Good

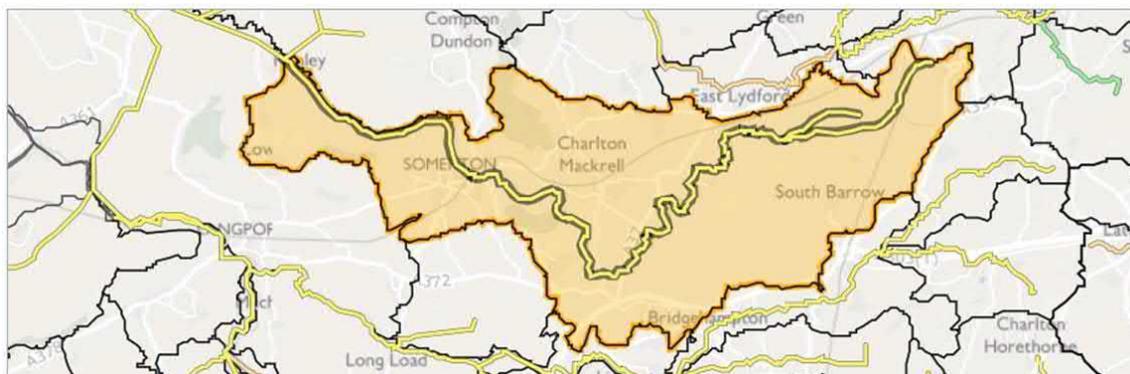


Figure 3: Cary (source to confluence with King’s Sedgemoor Drain) water body (Source: <https://environment.data.gov.uk>)

Table 4: Water body WFD parameters – Cary (source to confluence with King’s Sedgemoor Drain) (<https://environment.data.gov.uk>)

Water body ID	GB108052015140
Water body name	Cary (source to confluence with KSD)
NGR	ST6166230430
Catchment area	9978.079 ha
Length	35.84 km
Hydromorphological designation	River - not designated artificial or heavily modified
Current overall status (2016 data)	Moderate
Status objective (overall)	Good (2027)
Reasons for not achieving good status:	Phosphates – Diffuse source (livestock); point source (sewage discharge); flow (surface water abstraction); point source (sewage discharge – continuous). Macrophytes and phytobenthos - Diffuse source (livestock); point source (sewage discharge); flow (surface water abstraction); point source (sewage discharge – continuous); point source (farm/site infrastructure).
Protected area designation	Nitrates Directive
Hydromorphological supporting elements	Supports Good
Current ecological status (and status objective)	Moderate (Good 2027)
Biological quality elements	Moderate

Physico-chemical quality elements	Moderate
Chemical quality elements	Good

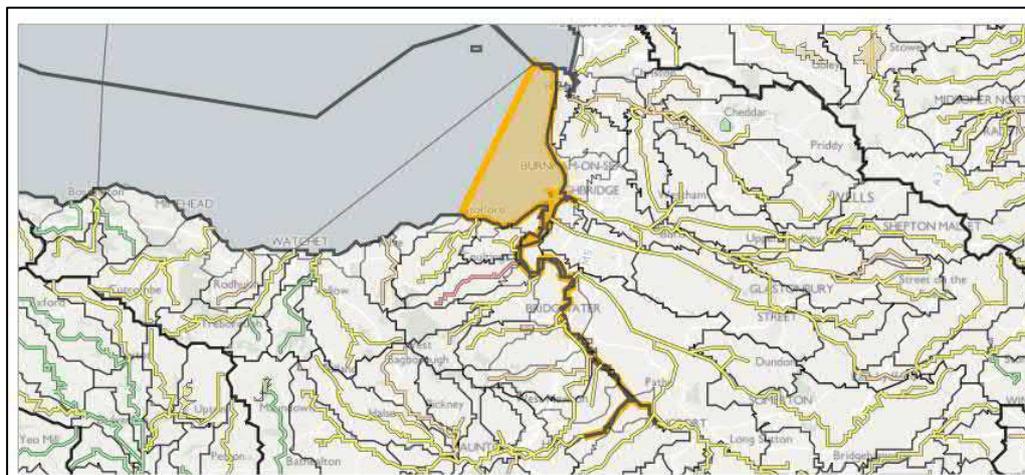


Figure 4: Parrett water body map (<https://environment.data.gov.uk>)

Table 5: Water body WFD parameters – Bridgwater Bay

Water body ID	GB670807410000
Water body name	Bridgwater Bay
NGR	ST2039451216
Surface area	9181.258 ha
Surface area (km²)	91.813
Hydromorphological designation	Coastal – not designated artificial or heavily modified
Current overall status (2016 data)	Moderate
Status objective (overall)	Good (2027)
Reasons for not achieving good status:	Invertebrates – suspect data; Macroalgae – suspect data
Protected area designation	Severn Estuary SPA; Severn Estuary SAC
Hydromorphological supporting elements	High
Current ecological status (and status objective)	Moderate (Moderate)
Biological quality elements	Moderate Invertebrates – Moderate;

	Macroalgae – Moderate: Phytoplankton – Moderate
Physico-chemical quality elements	Good
Chemical quality elements	Good

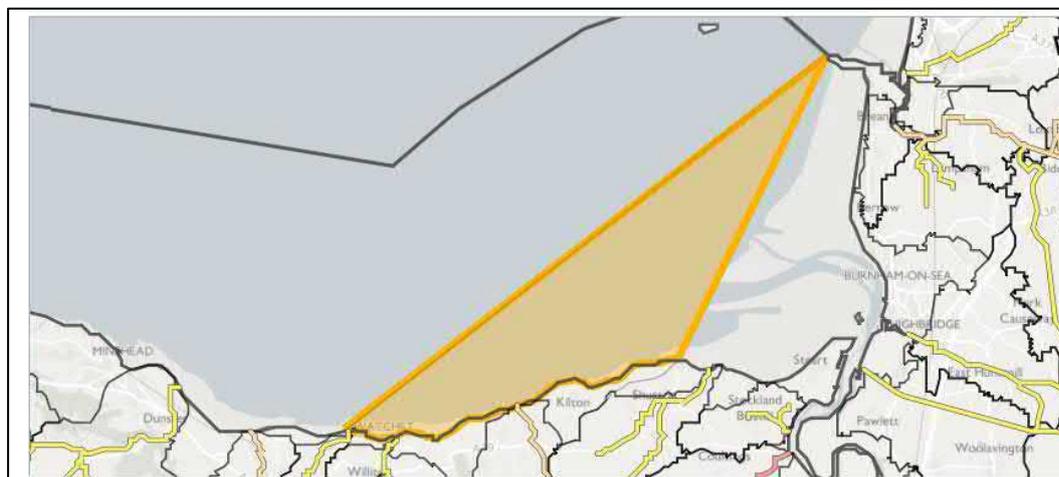


Figure 5: Bridgwater Bay water body map (Source: <https://environment.data.gov.uk>)

Table 6: Water body WFD parameters – Tone and North Somerset Streams Groundwater

Water body ID	GB40802G806400
Water body name	Tone and North Somerset Streams Groundwater
NGR	ST2433728592
Groundwater area	105630.135 ha
Surface area (km²)	1056.301
Hydromorphological designation	-
Current overall status (2016 data)	Poor
Reason for not achieving Good	Diffuse source – agriculture and rural land management
Quantitative	Good
Quantitative status element	Good
Chemical	Poor
Chemical status element	Poor

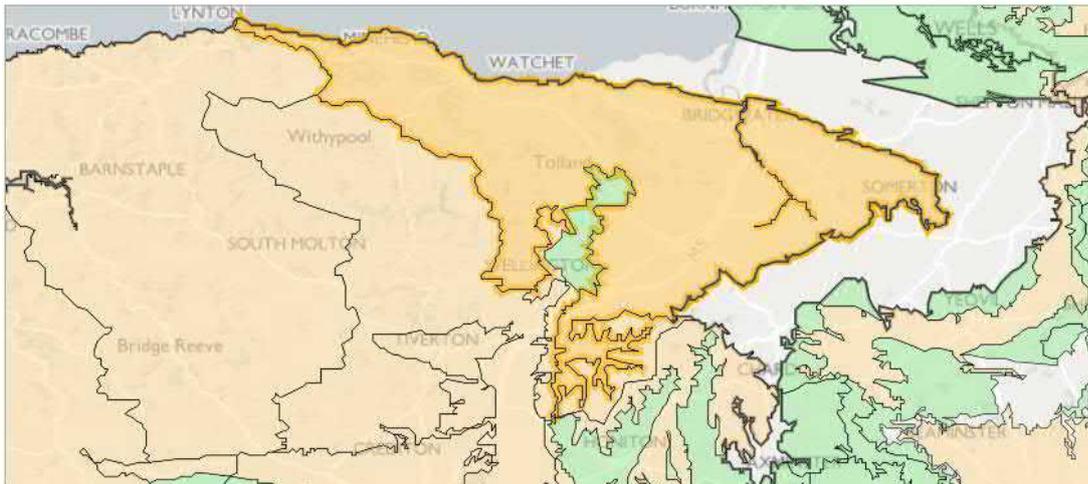


Figure 6: Tone and North Somerset groundwater water body map (Source: Table 3: Water body WFD parameters – King’s Sedgemoor Drain – Henley sluice to mouth (<https://environment.data.gov.uk>))

3.2 Upstream Waterbodies

None of the proposed actions will have any effects that could propagate as far as upstream as the catchments of the upstream waterbodies (Table 7). Eighteen Feet Rhyne water body is located 3km upstream of the confluence of the River Sowy with KSD. No works will be undertaken on this watercourse and it is sufficiently far upstream that no hydromorphological effects will be propagated as far as the Rhyne. The water body is therefore scoped out of the WFD assessment.

Table 7: Biological and supporting elements for identified water bodies.

Element	Current Status 2016	Overall status objective	Reasons for not achieving good status and reasons for deterioration
Cary (source to confluence with KSD) GB108052015140			
Ecological	Moderate	Good (2027)	Phosphates – Diffuse source (livestock); point source (trade/industry discharge); flow (surface water abstraction); point source (sewage discharge – continuous) Macrophytes and phytobenthos combined - Diffuse source (livestock); point source (farm/site infrastructure); flow (surface water abstraction); point source (sewage discharge – continuous).
Biological quality element	Moderate	Good (2027)	
Hydromorphological Supporting Elements	Supports Good	Supports Good	
Physico-chemical quality elements	Moderate	Good (2027)	
Specific pollutants	High	High	
Chemical	Good	Good	

Element	Current Status 2016	Overall status objective	Reasons for not achieving good status and reasons for deterioration
Eighteen Feet Rhyne (GB108052021100)			
Ecological	Moderate	Good (2027)	<p>Mitigation Measures Assessment – physical modification.</p> <p>Phosphates – point source (farm/site infrastructure); diffuse source (poor nutrient management); point source (trade/industry discharge).</p> <p>Dissolved oxygen – flow (land drainage – operational management); point source (sewage discharge, continuous); diffuse source (livestock).</p> <p>Phys chem – flow (land drainage – operational management); Diffuse source – livestock.</p>

4 Assessment

4.1 Overview and Scope of This Assessment

The purpose of this section is to screen potential impacts for the quality elements of the scoped in water bodies in proximity to the Proposed Scheme, and identify any need for further, more detailed assessment.

Table 8 provides a list of elements that are scoped in and out for the purposes of this assessment.

Table 8:Quality Elements Scoped In/Out of Assessment

Quality element	Scoped in or out
Fish	In
Benthic invertebrates	In
Macrophytes and phytobenthos combined	In
Thermal conditions	In
Oxygenation conditions	In
Nutrient conditions	In
Connection to groundwater	In
Quantity and Dynamics of Flow	In
River Continuity	In
River depth and width variation	In
Structure and substrate of the river bed	In
Riparian zone	In
Chemical elements and Specific pollutants	In - Existing pressure related to phosphate release due to agricultural run off and sewage treatment discharge. Out - No implications in relation to the release, dispersal or persistence of chemical contaminants or waste water and influence on the existing pressures related to pesticides or other pollutants.
INNS	In

4.2 Assessment of Potential for Impacts

4.2.1 Screening of Elements

Summaries of the potential for impacts on the WFD quality elements of various Proposed Scheme components are included in Table 9.

Table 9: Screening of the Proposed Scheme's Options against Status Objectives and Elements

Key to Impact				
Negative		Negligible		Positive

Proposed Scheme element	WFD element likely to be impacted	Description of impact	Possible ways to mitigate impact
<i>Sowy between Monk's Leaze Clyce and Beer Wall</i>			
Bank raising on left and right banks. Works also to include reprofiling of informal embankments and channel widening including two stage channel, channel embayments or backwaters	Macrophytes and phytobenthos	During construction: Potential sediment remobilisation during works resulting in potential deterioration in quantity and quality. Temporary localised potential impact.	Potential indirect impacts from construction stage of the development can be managed and no likely significant effects are anticipated on the water environment. Compile and adhere to an Environmental Action Plan (EAP) and ensure materials do not pollute substrate or water body. All pollution to be controlled under current legislation and best practice.
		During operation, there should be an increased in-stream vegetation habitat due to diverse flow conditions and creation of marginal berms or widening existing marginal berms. Low / backwater flows within the two-stage channel / embayments will allow diverse habitat during operation. Decreased nutrient enrichment due to decreased uncontrolled flooding of agricultural land (by creating two-stage channel/embayments in a number of areas along the channel. There will be no change to water levels on the moors as a result of the lowering of the Sowy levels as these are determined and controlled by the penning structures.	Positive impact. Mitigation not required. Diatom communities' life cycle is of the order of 6 weeks so any change following a major flood event onto agricultural land would be short-term, after which the phytobenthos would return to normal.
	Benthic invertebrate fauna	During construction: Potential sediment remobilisation during works for bank raising with potential for smothering downstream channel bed features or spawning grounds (localised and temporary sediment remobilisation so impact limited).	Potential indirect impacts from construction stage of the development can be managed and no likely significant effects are anticipated on the water environment. Compile and adhere to an Environmental Action Plan (EAP) and ensure materials do not pollute substrate or water body. All pollution to be controlled under current legislation and best practice.

Proposed Scheme element	WFD element likely to be impacted	Description of impact	Possible ways to mitigate impact
		<p>During operation: Decreased sediment load to channel following a major flood event due to more storage in two-stage channel leading to decreased nutrient enrichment caused by major flooding of agricultural land, highways, and developed areas.</p> <p>Creation of additional habitats could be utilised by benthic invertebrates within the two-stage channel/embayments.</p>	<p>Neutral impact. Mitigation not required.</p> <p>Diatom communities' life cycle is of the order of 6 weeks so any change following a major flood event onto agricultural land would be short-term, after which the phytobenthos would return to normal.</p>
	Fish fauna	<p>During construction: Potential disturbance to species within the river at this point, which could include temporary interruption to any migration (if occurring); potential for disturbance or loss of species over a localised and temporary event.</p>	<p>Potential indirect impacts from construction stage of the development can be managed and no likely significant effects are anticipated on the water environment.</p> <p>Compile and adhere to an Environmental Action Plan (EAP) and ensure materials do not pollute substrate or water body. All pollution to be controlled under current legislation and best practice.</p> <p>Ensure electrofishing survey or complete removal of fish prior to works. Timing of works is important and should avoid migration and spawning periods.</p>
		<p>During operation: Potential fish stranding within embayments and/or two-stage channel following high flows and mortality due to inability to get back into the main channel when water levels drop.</p>	<p>Implement a strategy for prevention or have facility to take action if and when this occurs or design it out.</p>
	Quantity and dynamics of water flow	<p>During operation: no change to overall quantity of flow. There will be no change to water levels on the moors as a result of the lowering of the Sowy levels as these are determined and controlled by the penning structures. The creation of embayments and/or two-stage channel will lead to more diverse flow variability and habitat niches. Heterogenous flows improve oxygenation, clarity (reduced silt within the water column) and sediment transport, and therefore overall water quality.</p>	N/A
Connection to groundwater bodies	No change during construction or operation. No potential pathway to groundwater body due to works.	N/A	

Proposed Scheme element	WFD element likely to be impacted	Description of impact	Possible ways to mitigate impact
	River depth and width variation	During construction: Change to river cross section as a result of works during construction will change planform, sediment dynamics, water flow and hydromorphological indicators. Also has the potential has potential to cause temporary deterioration in water quality through increased availability of fine sediments.	EA guidance suggests works affecting more than 100 m are high risk. River width variation is a design feature of the Proposed Scheme (embayments and two stage channels).
		During operation: Improvement to river channel cross-section from current trapezoidal cross-section to diverse channel profiles (two-stage channel, embayments) will increase river width and provide flow and habitat diversity. Habitat diversity improves oxygenation, clarity (reduced silt within the water column) and sediment transport, and therefore overall water quality.	No significant changes to WFD water bodies due to operation. Opportunity for betterment.
	Structure and substrate of the river bed	Sediment remobilisation during works could result in potential deterioration in water quality, and potential for greater concentrations of fines downstream.	Compile and adhere to an Environmental Action Plan (EAP) and ensure materials do not pollute substrate or water body. All pollution to be controlled under current legislation and best practice.
		During construction: Potential change to structure of substrate due to construction of two stage channel. Sediment remobilisation during works could result in potential deterioration in water quality, and potential for greater concentrations of fines downstream. Temporary localised potential impact.	Potential indirect impacts from construction stage of the development can be managed and no likely significant effects are anticipated on the water environment. Compile and adhere to an Environmental Action Plan (EAP) and ensure materials do not pollute substrate or water body. All pollution to be controlled under current legislation and best practice.
		During operation: Potential improved sediment variability improves oxygenation, clarity (reduced silt within the water column) and sediment transport, and therefore overall water quality. Aggregation of fines (potential for) in slacker areas of water.	No significant changes to WFD water bodies due to operation. Opportunity for betterment.
	Structure of the riparian zone	During construction: The creation of embayments, backwaters or lengths of two-stage channel along the KSD and Sowy may require the removal of existing riparian tree and scrub vegetation and other elements of value or interest.	Potential indirect impacts from construction stage of the development can be managed and no likely significant effects are anticipated on the water environment.

Proposed Scheme element	WFD element likely to be impacted	Description of impact	Possible ways to mitigate impact
		Sediment remobilisation during works could result in the potential deterioration of the riparian zone, and risk of materials entering the water course.	Compile and adhere to an Environmental Action Plan (EAP) and ensure materials do not pollute substrate or water body. All pollution to be controlled under current legislation and best practice.
		<p>During operation: Bank profiles will alter due to construction of two-stage channel, with some improvement to overall morphological diversity.</p> <p>Inclusion of embayments will also provide diversity to the overall riparian zone.</p> <p>Embankments will not change structure of riparian zone as already present.</p> <p>Morphological diversity improves habitat by creating a variety of habitat niches for various aquatic species.</p>	N/A
	Nutrient conditions	<p>During construction: Sediment remobilisation during works could result in potential deterioration of nutrient conditions within the water course.</p>	<p>Potential indirect impacts from construction stage of the development can be managed and no likely significant effects are anticipated on the water environment.</p> <p>Compile and adhere to an Environmental Action Plan (EAP) and ensure materials do not pollute substrate or water body. All pollution to be controlled under current legislation and best practice.</p>
		<p>During operation: Decreased uncontrolled flooding of agricultural land due to more water being stored within the two-stage channel leading to potential decreased diffuse pollution into the water body.</p> <p>Localised bank raising may aid in the reduction of phosphate/algal blooms into the channel because of potential interception of contaminants in the riparian zone.</p>	N/A - Any phosphates occurring are due to agricultural/discharge issues outside of the Proposed Scheme and cannot be mitigated for within this Proposed Scheme.
Oxygenation conditions		During operation: Water held in the two-stage channel/embayments is likely to have a negligible impact on dissolved oxygen levels of the overall water body. The widened channel can be operated at higher flows with similar velocities and water depths to pre-Proposed Scheme as a result of summer penning.	N/A

Proposed Scheme element	WFD element likely to be impacted	Description of impact	Possible ways to mitigate impact
		Extra water will only diverted down the Sowy when the Parrett is in high flow and thus the Parrett will not experience reduced flow which could impact its oxygen levels as a result of the Proposed Scheme.	
	Salinity and thermal conditions	During operation: Flood water held in the two-stage channel is likely to have a negligible impact on water temperature of the overall water body.	N/A
	Pollution by other substances identified as being discharged in significant quantities into the body of water	During construction: Potential exposure/displacement of contaminated sediments.	Potential indirect impacts from construction stage of the development can be managed and no likely significant effects are anticipated on the water environment. Compile and adhere to an Environmental Action Plan (EAP) and ensure materials do not pollute substrate or water body. All pollution to be controlled under current legislation and best practice.
	INNS – Invasive species	During construction: Risk of spread of invasive species if present.	With appropriate mitigation these can be managed to ensure no significant effects. If present, report to competent authority.
	Connection to designations	Somerset Level and Moors SPA – no impact to SPA.	With appropriate mitigation, potential impacts can be managed to ensure no significant effects, and in any case their short-term duration is unlikely to give rise to an adverse impact to the site's integrity. Separate Habitats Regulations Assessment being undertaken to support this.
	All other water bodies	No effect	N/A
<i>Sowy between Beer Wall and A361</i>			
Bank raising on left and right banks. Works also to include reprofiling of informal		Same impacts to quality elements as above affecting King's Sedgemoor Drain and Sowy.	Same as above.

Proposed Scheme element	WFD element likely to be impacted	Description of impact	Possible ways to mitigate impact
embankments and channel widening including two stage channel, channel embayments or backwaters			
<i>Sowy between A361 and Sowy/KSD confluence</i>			
Bank raising on left bank. Works also to include reprofiling of informal embankments and channel widening including two stage channel, channel embayments or backwaters.		Same impacts to quality elements to above. Potentially lower localised magnitude of impact as only to left bank.	Same as above.
<i>KSD between Sowy/KSD confluence and Parchey Bridge</i>			
Raising of existing informal flood banks on left and right bank for increasing capacity in the Sowy and the Cary. Works also to include reprofiling of informal embankments and channel widening including two stage channel, channel embayments or backwaters.		Same impacts to quality elements as above affecting King's Sedgemoor Drain and Sowy and Cary.	Same as above.
Additional works: Cossington Right Outfall and Chilton	Macrophytes and phytobenthos	During works potential deterioration in quantity and quality. Temporary localised potential impact.	No significant changes to WFD water bodies due to construction or operation.

Proposed Scheme element	WFD element likely to be impacted	Description of impact	Possible ways to mitigate impact
Right Outfall (raising of the existing concrete headwalls by 300-400mm)			<p>Potential indirect impacts from construction stage of the development can be managed and no likely significant effects are anticipated on the water environment.</p> <p>Compile and adhere to an Environmental Action Plan (EAP) and ensure materials do not pollute substrate or water body. All pollution to be controlled under current legislation and best practice.</p>
	Benthic invertebrate fauna	Sediment could be remobilised during works with potential for smothering downstream channel bed features or spawning grounds (localised and temporary sediment remobilisation so impact limited).	<p>No significant changes to WFD water bodies due to construction or operation.</p> <p>Potential indirect impacts from construction stage of the development can be managed and no likely significant effects are anticipated on the water environment.</p> <p>Compile and adhere to an Environmental Action Plan (EAP) and ensure materials do not pollute substrate or water body. All pollution to be controlled under current legislation and best practice.</p>
	Fish fauna	During construction: disturbance to species within the river at this point, which could include temporary interruption to any migration (if occurring); potential for disturbance of species over a localised and temporary event.	<p>No significant changes to WFD water bodies due to construction or operation.</p> <p>Potential indirect impacts from construction stage of the development can be managed and no likely significant effects are anticipated on the water environment.</p> <p>Compile and adhere to an Environmental Action Plan (EAP) and ensure materials do not pollute substrate or water body. All pollution to be controlled under current legislation and best practice.</p>
	Quantity and dynamics of water flow	No change as there is a structure already in place, and nothing is changing the integrity of the river dynamics.	<p>Potential indirect impacts from construction stage of the development can be managed and no likely significant effects are anticipated on the water environment.</p> <p>Compile and adhere to an Environmental Action Plan (EAP) and ensure materials do not pollute substrate or water body. All pollution to be controlled under current legislation and best practice.</p>

Proposed Scheme element	WFD element likely to be impacted	Description of impact	Possible ways to mitigate impact
	Connection to groundwater bodies	No change to water body status during construction/operation.	N/A
	River depth and width variation	No change to water body status during construction/operation.	
	Structure and substrate of the river bed	No change to water body status during construction/operation.	
	Structure of the riparian zone	No change to water body status during construction/operation.	
	Oxygenation conditions	No change to water body status during construction/operation.	
	Salinity and thermal conditions	No change to water body status during construction/operation.	
	Acidification status	No change to water body status during construction/operation.	
	Nutrient conditions	No change to water body status during construction/operation.	
	Pollution by all priority substances identified as being discharged into the body of water	No change to water body status during construction/operation.	
	Pollution by other substances identified as being discharged in	Overall no change to water body.	

Proposed Scheme element	WFD element likely to be impacted	Description of impact	Possible ways to mitigate impact
	significant quantities into the body of water		water body. All pollution to be controlled under current legislation and best practice. Do not allow uncured concrete or concrete residue to enter either still or flowing water, either directly or indirectly through runoff.
	INNS – Invasive species	Risk of spread of invasive species if present.	With appropriate mitigation these can be managed to ensure no significant effects, and in any case their short-term duration is unlikely to give rise to an adverse impact. If present, report to competent authority.
	Connection to designations	No impact to integrity of European designations.	N/A
	All other water bodies	No effect to water body status.	N/A

5 Conclusion

The screening exercise presented in Table 9 has demonstrated that there are no identified adverse impacts to the water quality elements measured under the WFD assessment for the River Cary.

However, in contrast, for the King's Sedgemoor Drain - Henley Sluice to Mouth water body, the assessment has shown that there are potentially adverse impacts due to the nature of the works and the length of the works. Environment Agency guidance (Operating Instruction 488-10) for screening thresholds under the traffic light system states that:

- Channel widening, deepening, straightening or realigning is a high risk activity to WFD objectives whatever the length or extent
- Embankment works are high risk where the length of channel affected is greater than 100 metres; lower risk for between 10 and 100 metres; and low risk for less than or equal to 10 metres
- Reprofiling works are high risk where the length of channel affected is greater than 100 metres; lower risk for between 10 and 100 metres; and low risk for less than or equal to 10 metres. The fact that the embankment reprofiling is a distance away from the actual channel negates the risk.

Compliance with the key objectives against which the impacts of proposed works on a water body need to be assessed are outlined below in Table 10, and for the King's Sedgemoor Drain – Henley Sluice to Mouth water body, the Proposed Scheme has potential to cause deterioration to the water body.

Two separate Habitats Regulations Assessments (HRA) are being undertaken for the Proposed Scheme:

- Strategic level Habitat Regulations Assessment (HRA) which considers the potential impacts associated with the full Sowy/KSD Enhanced Capacity Project (as described in section 3.1 of the PEIR) will be undertaken
- Project level HRA which focuses primarily on the construction related effects of the Proposed Scheme (Phase 1 of the River Sowy and King's Sedgemoor Drain Enhancements Scheme)

The strategic and project level HRA screening (Stage 1) assessments are provided in Appendices A and B of the PEIR.

For the reasons stated above, and in Table 10, **a detailed assessment for the Proposed Scheme will be required.**

Table 10: Compliance with the environmental objectives of the WFD

Environmental Objective	Proposed Scheme	Compliance with the WFD Directive
No changes affecting high status sites	None of the options considered will cause a change to the high status sites in the Study Area.	YES
No changes that will cause failure to meet surface water Good Ecological Status or Potential or result in a deterioration of surface water Ecological Status or Potential	The Proposed Scheme options could cause deterioration in the status of the water bodies.	NO – due to the high risk as described above on previous page due to length of works as in EA guidance
No changes which will permanently prevent or compromise the Environmental Objectives being met in other water bodies	The Proposed Scheme options will not cause a permanent exclusion or compromise achieving the WFD objectives in other bodies of water within the same River Basin District (RBD)	YES
No changes that will cause failure to meet good groundwater status or result in a deterioration groundwater status.	The Proposed Scheme options will not cause deterioration in the status of the of the water bodies.	YES
No changes affecting high status sites.	None of the options considered will cause a change to the high status sites in the Study Area.	YES

References

Environment Agency. 2015. South west river basin management district river basin management plan [Online]. [Accessed: 25/10/201]. Available at: [https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/718339/South West RBD Part 1 river basin management plan.pdf](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/718339/South_West_RBD_Part_1_river_basin_management_plan.pdf)

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E2 Detailed WFD assessment report



River Sowy and King's Sedgemoor Drain Enhancements Scheme: Phase 1 Full Water Framework Directive Assessment

ENVRESW001353-CH2-XX-400-RP-EN-1062

V2 July 2020

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

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Quality Assurance

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1. Introduction

This assessment report has been prepared for the River Sowy and King's Sedgemoor Drain Enhancements Scheme: Phase 1 (the Scheme).

A preliminary compliance assessment in respect of the Water Framework Directive (WFD) was undertaken for this Scheme in October 2019. It concluded that the compliance assessment had demonstrated that there are no identified adverse impacts to the water quality elements measured under the WFD assessment for the water bodies associated with the River Cary. However, for those associated with the King's Sedgemoor Drain (KSD), the assessment demonstrated potentially adverse impacts due to the nature of the works and the length of the works. Environment Agency guidance (Operating Instruction 488-10) for screening thresholds under the traffic light system states that:

- Channel widening, deepening, straightening or realigning is a high-risk activity to WFD objectives whatever the length or extent
- Embankment works are high risk where the length of channel affected is greater than 100m; lower risk for between 10 and 100m; and low risk for less than or equal to 10m
- Reprofiling works are high risk where the length of channel affected is greater than 100m; lower risk for between 10 and 100m; and low risk for less than or equal to 10m

It was concluded that the Scheme options could cause deterioration in the status of the water bodies and may cause failure to meet surface water Good Ecological Status (GES) or Potential (GEP) or result in a deterioration of surface water Ecological Status or Potential. This assessment has been undertaken to better understand these risks and to identify if these can be mitigated to ensure compliance with the environmental objectives of the Directive.

1.1. Purpose of Report

The WFD needs to be taken into account in the planning of all new activities in the water environment. The Environment Agency (EA), as competent authority in England and Wales are responsible for delivering the Directive through the Environment (Water Framework Directive) (England and Wales) Regulations 2017¹.

The generic environmental objectives set out below (based on Article 4.1 of the Directive and as described in Table 1) are used for the assessment of the Scheme in relation to the Directive:

- No changes affecting high status sites
- No changes that will cause failure to meet surface water good ecological status or potential or result in a deterioration of surface water ecological status or potential

¹ 2017 SI No. 407 WATER RESOURCES, ENGLAND AND WALES. The Water Environment (Water Framework Directive) (England and Wales) Regulations 2017

- No changes which will permanently prevent or compromise the Environmental Objectives being met in other water bodies
- No changes that will cause failure to meet good groundwater status or result in a deterioration groundwater status

Table 1 Environmental Objectives of the Water Framework Directive

Objectives
Member States shall implement the necessary measures to prevent deterioration of the status of all bodies of surface water.
Member States shall protect, enhance and restore all bodies of surface water, subject to the application of subparagraph (iii) for artificial and heavily modified bodies of water, with the aim of achieving good surface water status by 2015.
Member States shall protect and enhance all artificial and heavily modified bodies of water, with the aim of achieving good ecological potential and good surface water chemical status by 2015. Where this is not possible and subject to the criteria set out in the Directive, aim to achieve good status by 2021 or 2027.
Progressively reduce pollution from priority substances and cease or phase out emissions, discharges and losses of priority hazardous substances.
Prevent Deterioration in Status and prevent or limit input of pollutants to groundwater.

Member states must meet the conditions of the WFD unless they meet the criteria laid out in Article 4.7. To be compliant, the following condition must be met: "the beneficial objectives served by the modifications or alterations of the water body cannot, for reasons of technical feasibility or disproportionate cost be achieved by other means, which are a significantly better environmental option."

Additionally, the Somerset Levels Special Protection Area (SPA) needs to be considered in terms of integrity to the site as a result of the Scheme, in order to comply with Article 4.9.

2. Outline of scheme

2.1. River Sowy and King's Sedgemoor Drain Enhanced Capacity Scheme: Phase 1 (the Scheme) Overview

2.1.1. Overview

The 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 of the Environmental Statement (see Appendix A of the Environmental Statement) and set out in Table 2 below.

Table 2 Capacity enhancements

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: <ul style="list-style-type: none"> • 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: <ul style="list-style-type: none"> • 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: <ul style="list-style-type: none"> • One embayment • One backwater • One section of two-stage channel

2.1.2. Raising and re-profiling of existing informal flood embankments

Where existing informal flood embankments are to be reprofiled 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 1, p4). Material required for raising of the existing informal flood embankments on the KSD would be won through reprofiling of the existing informal flood embankments on the right bank and left bank. Material required for raising of the existing informal flood embankments on the Upper and Lower Sowy would be imported under CL:AIRE Code of Practice (COP) from a soils processing plant located off the A372 near Westonzoyland. Material won through creation of channel widening structures would be placed on the landward side of the existing informal flood embankments.

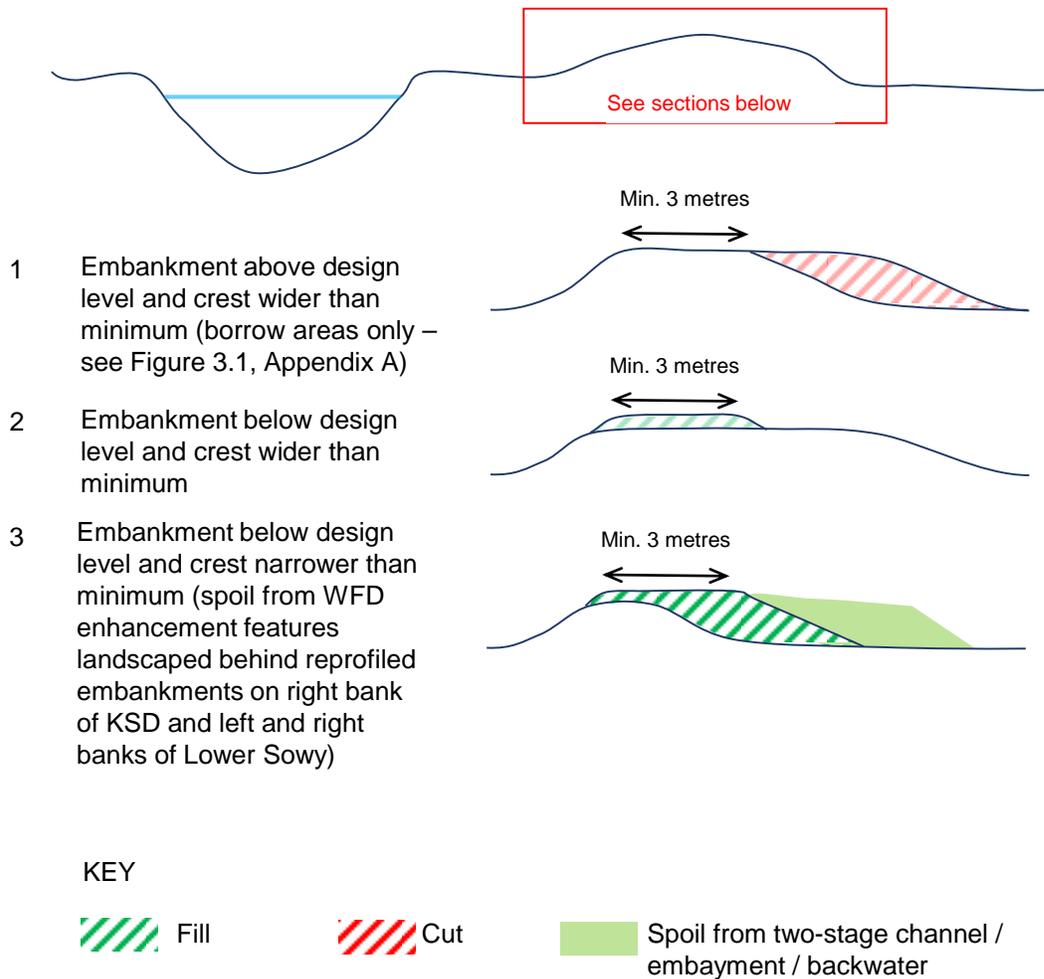


Figure 1 Schematic illustration of bank reprofiling process to achieve a minimum 3m crest width

2.1.3. Channel widening: embayments, two-stage channel and back waters (WFD enhancement features)

The 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 of the ES (see Appendix A of the ES) 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: up to 150m in length, with channel widening of 2m and a 5m marginal shelf with shelf level of 300mm below summer pen
- Embayments: 135-150m in length depending on location and 6m in width, with shelf level of 300mm below summer pen
- Backwater: back channel 9m wide and 100m in length, with a “planted island” of 6m width, with access to island via a bridge provided for maintenance purposes

Proposed locations for the WFD enhancement feature locations, along with a typical plan view layouts and cross sections for each type of enhancement (e.g. embayment, two-stage channel and backwater), are shown in Figure 3.1 of the ES (See Appendix A of the ES). Their placement and dimension have been designed to improve channel form and diversity, maximise benefit to water vole through providing good quality habitat within areas currently identified as sub-optimal and minimise loss of trees.

2.2. Outfall improvements

The Cossington Right and Chilton Right outfalls 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 to provide a continuous defence level when combined with the bank raising works.

2.3. Operation

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 farmland. 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.

The ‘enhanced operation’ proposals outlined in section 3.1 of the ES would not be implemented following completion of the Proposed Scheme, however the measures identified under Mitigation Action Plan (MAP) developed by the EA, IDB and Natural England to counteract potential adverse effects on the Somerset Levels and Moors Special Protection Area (SPA) would be implemented as required. Further detail is provided in section 3.2 of the ES.

2.3.1. Material Management

A Materials Management Plan (MMP) would 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, so excess materials will not present any risk of washing into the water body after any future flood events

2.3.2. Reprofilling of existing informal flood embankments

Light weight bulldozers would be used to reprofile the existing informal flood embankments. Topsoil will be stripped as and when required for construction (rather than in advance) to minimise the duration of weather exposure and associated risk of runoff into the water body.

2.3.3. Outfall improvements

The existing steel sheet piled wing walls at Cossington Right Rhyne and Chilton Right Rhyne will be replaced with new steel sheet piled walls which will extend further into the adjacent informal flood embankments that to tie in with existing areas of high ground. The existing steel will be removed from site. The crest level of the headwall will be raised with the addition of new coping. The new steel sheet piles will be driven to the design level, using a vibro-driven method to reduce noise during installation. WFD enhancement features

Long reach excavators would 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 of water quality (dissolved oxygen). In addition, a Surface Water Management Plan (SWMP) would be developed and agreed with the relevant authorities in advance of the start of construction. This would include measures such as the use of silt curtains, provision for dissolved oxygen monitoring where necessary, and other measures to protect water quality during earthworks. WFD enhancement features would be planted immediately following creation, with riparian tree planting taking place in December 2020 and January 2021.

2.3.4. Site reinstatement

All land within the construction footprint would be fully reinstated with reseeded taking place as soon as construction works are complete within a given area. Livestock would be excluded as needed to allow vegetation to establish.

3. Methodology

The existing preliminary WFD assessment (Jacobs, 2019 – see Appendix E1) concluded that a detailed assessment was needed for the extensive channel modification works on the ‘King’s Sedgemoor Drain – Henley Sluice to mouth’ water body (hereafter referred to as the ‘KSD water body’), and these are therefore screened in to this detailed assessment, whilst all the other elements of the Scheme have been screened out.

The following chapter provides a baseline assessment for the KSD water body and those immediately upstream and downstream (section 4.1), and a scoping of the water body quality elements potentially affected by the works (section 4.2). Inclusion of the up and downstream waterbodies was included in the preliminary assessment, and it was concluded that they should be scoped out of any further assessment, and so are not included here. This is followed by the impact assessment (section 4.3), which considers the potential impacts of an activity, identifies ways to avoid or minimise impacts, and indicates if an activity may cause deterioration or jeopardise the water body achieving good ecological potential (GEP). This is followed by assessment of the Scheme against mitigation measures (section 5); and a cumulative assessment against other proposed schemes (section 6).

4. Assessment

4.1. Baseline data collection

The Scheme is located within the South West River Basin which is managed by the South and West Somerset River Basin Management Plan².

The EA's Catchment Data Explorer³ was used to assess water bodies present within the Scheme's study area. The WFD compliance mapping for groundwater risk and status assessment was also reviewed.

The relevant river bodies were assessed in the preliminary compliance assessment, and it was concluded that further assessment would only be needed for the KSD water body:

- King's Sedgemoor Drain – Henley Sluice to mouth (water body ID GB108052021150) (Table 3).

Table 3 Water body WFD parameters – King's Sedgemoor Drain – Henley sluice to mouth (<https://environment.data.gov.uk>)

Water body ID	GB108052021150
Water body name	King's Sedgemoor Drain – Henley Sluice to mouth
NGR	ST4081234025
Catchment area	11560.058 ha
Length	27.917 km
Hydromorphological designation	Artificial
Current overall potential (2016 data)	Moderate
Status objective (overall)	Good (2027)
Reasons for not achieving good potential	Mitigation measures assessment: physical modification (Urbanisation, land drainage, flood protection) Phosphates – Diffuse source (livestock); point source (sewage discharge) Dissolved oxygen – Physical modification (land drainage structures; flood protection); Point source (sewage discharge); Diffuse source (livestock) Fish – suspect data
Protected area designation	Conservation of Wild Birds Directive – Somerset Levels and Moors

² South and West Somerset RBMP (2015)

³ Catchment Data Explorer, <http://environment.data.gov.uk/catchment-planning/>

Hydromorphological supporting elements	Supports Good
Current ecological potential (and status objective)	Moderate (Good 2027)
Biological quality elements	Fish – Moderate Invertebrates – Good Macrophytes and Phytobenthos combined - High
Physico-chemical quality elements	Moderate
Chemical quality elements	Good

4.2. Scoping

Table 4 provides a list of elements that are scoped in and out for the purposes of this assessment.

Table 4 Quality elements scoped in/out of assessment for each scheme element

Quality element	Raising of existing informal embankments	Channel widening works (WFD enhancements)	Outfall improvements
Fish	In	In	In
Benthic invertebrates	Out due to works being above the channel and unlikely to affect invertebrates in the water body itself.	In	In
Macrophytes and phytobenthos combined	In	In	In
Thermal conditions	Out due to works being above the channel and unlikely to affect thermal conditions in the water body itself.	In	Out due to minimal works within the channel, and unlikely to affect thermal conditions.
Oxygenation conditions	Out due to works being above the channel and unlikely to affect oxygenation in the water body itself.	In	Out. Works are unlikely to have an impact on water body scale due to their nature, and not likely to cause

Quality element	Raising of existing informal embankments	Channel widening works (WFD enhancements)	Outfall improvements
	The embankments are setback.		deterioration/change in oxygenation.
Nutrient conditions	In	In	In
Connection to groundwater		In	
Quantity and Dynamics of Flow	Out due to topping up of existing informal embankments and being away from the main channel; there will be no interruption to channel flow.	In	Out
River Continuity	Out	In	Out
River depth and width variation	Out	In	In
Structure and substrate of the river bed	Out	In	In
Riparian zone	In	In	In
Chemical elements and Specific pollutants	In - Existing pressure related to phosphate release due to agricultural run-off and sewage treatment discharge (already covered by nutrient conditions). Out - No implications in relation to the release, dispersal or persistence of chemical contaminants or waste water and influence on the existing pressures related to	In	In

Quality element	Raising of existing informal embankments	Channel widening works (WFD enhancements)	Outfall improvements
	pesticides or other pollutants.		
INNS	In	In	In

4.3. Assessment against quality elements

Table 5 details a site-specific assessment of the Scheme against quality elements for the scoped in biology, physico-chemical and hydromorphological elements.

Table 5. Screening of the Scheme's Options against Status Objectives and Elements for water quality elements

Key to Impact							
Negative		Negligible		Positive		No change	

Scheme element	WFD element likely to be impacted	Description of impact	Mitigation proposed
KSD between Sowy/KSD confluence and Parchey Bridge			
Bank raising and reprofiling on left and right banks.	Macrophytes and phytobenthos	During construction: Potential sediment remobilisation during works resulting in potential deterioration in quantity and quality of species alongside river channel. Temporary localised potential impacts. Riparian tree planting and retention of existing vegetation.	Potential indirect impacts from construction stage of the development would be managed and no likely significant effects are anticipated on the water environment. This will be managed through implementation of a SWMP and application of other best practice. The SWMP was developed in agreement with our internal technical specialists and will consider measures to manage spoil heap with reference to up to date and applicable guidance. It will include details of managing spoil, managing sediment pathways on the floodplain, in some areas, no works within 10m of the water course because of the potentially large amount of soil potentially available for entrainment. It would also contain information on how vegetation on floodplain will be reinstated following construction., which includes removal of the turf, re-seeding and careful
		During operation, there should be an increased species diversity and abundance and potential for planting between flood bank and channel. Creation of additional habitats on area adjacent to channel could be utilised by benthic invertebrates, and/or other species to improve overall species diversity and abundance.	

Scheme element	WFD element likely to be impacted	Description of impact	Mitigation proposed
			placement of landscape features as supported by landscape planning.
	Fish fauna	<p>During construction: Potential disturbance to species due to noise and to runoff from the working area, which could include temporary interruption to any migration (if occurring); potential for disturbance or loss of species over a localised and temporary event. This is most likely where works are occurring with bank raising and embayment construction, i.e. immediately adjacent to the channel.</p> <p>During operation: No change as a result of bank raising alone.</p>	<p>Potential indirect impacts from construction stage of the development would be managed through sensitive timing and avoiding working in the channel. Timing of works is important and should avoid migration and spawning periods. August to October has been scheduled for works to be undertaken to avoid spawning. Increased sediment availability also needs to be managed as an indirect impact for fish. This will be managed through SWMP and application of other best practice. The SWMP should be agreed with our internal technical specialists and will consider measures to manage spoil heap with reference to up to date and applicable guidance. It will include details of managing spoil, managing sediment pathways on the floodplain, in some areas, no works within 10m of the water course because of the potentially large amount of soil potentially available for entrainment. This would also contain information on how vegetation on floodplain will be reinstated following construction., which includes removal of the turf, re-seeding and careful</p>

Scheme element	WFD element likely to be impacted	Description of impact	Mitigation proposed
			<p>placement of landscape features as supported by landscape planning.</p> <p>All pollution to be controlled under current legislation and best practice.</p>
	Structure of the riparian zone	<p>During construction: The topping up of embankments may require plant tracking/movement along the floodplain corridor, potentially damaging habitat within the riparian channel. Vegetation/turfs will have to be removed during construction, or will at least be removed during construction, and subsequently reinstated, replanted or re-seeded.</p> <p>During operation: Embankments will not change structure of riparian zone as already present.</p>	<p>No plant will track within 5m of the watercourses (except where improvement works to sluices required as discussed above, and where strengthening of culverts on left bank of Sowy and KSD is needed). The SWMP would be developed in agreement with our internal technical specialists and will consider measures to manage spoil heap with reference to up to date and applicable guidance. It will include details of managing spoil, managing sediment pathways on the floodplain, in some areas, no works within 10m of the water course because of the potentially large amount of soil potentially available for entrainment. This would also contain information on how vegetation on floodplain will be reinstated following construction., which includes removal of the turf, re-seeding and careful placement of landscape features as supported by landscape planning. This also needs to contain information on how vegetation on floodplain will be reinstated following the</p>

Scheme element	WFD element likely to be impacted	Description of impact	Mitigation proposed
			<p>construction. No likely significant effects are anticipated on the water environment.</p> <p>Geomorphologist and ECoW to be deployed to provide technical guidance on site</p>
	Floodplain connectivity and continuity	<p>During construction: there will be no overall change during this time.</p> <p>During operation: there will be no overall change. The hydromorphic processes will be more variable due to better heterogeneity but overall there will be no change to continuity. this scheme is going to change the degree of floodplain connectivity though embankment raising and increased conveyance but not sufficiently to alter water body status.</p>	<p>Timing of the works is important. They will be undertaken between August and October when the water levels are lower therefore minimising the need to put in measures to prevent flooding out of works during construction. Overall, potential indirect impacts from construction stage of the development will be managed and no likely significant effects are anticipated on the water environment.</p>
	Nutrient conditions	<p>During construction: Sediment remobilisation during works could result in potential deterioration of nutrient conditions within the water course if there was a direct pathway for transport to the river channel. There is evidence of the potential for algal blooms within the water course. There needs to be assurance that these cannot flare up during the works through disturbance of sediment in the channel during works, or</p>	<p>Potential indirect impacts from construction stage of the development would be managed through sensitive timing and avoiding working in the channel. Timing of works is important and is scheduled between August and October, outside of higher river discharges and wet weather. Therefore, runoff into the KSD from areas stripped of vegetation is less likely than at wetter times of year. The SWMP (as outlined above) will also reduce runoff. As a result, potential indirect impacts from</p>

Scheme element	WFD element likely to be impacted	Description of impact	Mitigation proposed
		<p>by a temporary pathway from the adjacent land to the channel.</p>	<p>construction of the embankments would be managed and no likely significant effects are anticipated on the water environment.</p> <p>The SWMP will establish site-specific measures to ensure nutrient-rich materials do not pollute substrate or water body during the embankment works.</p> <p>All pollution to be controlled under current legislation and best practice.</p>
		<p>Localised bank raising may aid in the reduction of phosphate/algal blooms in the channel because of potential interception of contaminants in agricultural land runoff.</p> <p>There will be no change to water levels on the moors as a result of the lowering of the Sowy levels as these are determined and controlled by the penning structures. There will also be no change in the risk of discharge of farm phosphates. The bank construction will intercept the pathway however where phosphate is not already in the channel.</p>	<p>Mitigation will include application of the SWMP, monitoring of flood levels and flood warnings need to be issued should there be a requirement. There will need to be top soil strip in all areas where raising proposed and also where banks are being reprofiled to win material.</p>
	Connection to designations	Somerset Level and Moors SPA – no anticipated impact to SPA.	A Habitats Regulation Assessment (HRA) has been undertaken which considers potential effects on the Somerset Levels and Moors SPA (see Appendix E of the

Scheme element	WFD element likely to be impacted	Description of impact	Mitigation proposed
			ES). The HRA concludes that, with the identified mitigation in place, no significant effects on the integrity of any European designated sites would occur.
Channel widening including two stage channel	Macrophytes and phytobenthos	<p>During construction: Works will require plant tracking/movement along the floodplain corridor, potentially damaging habitat within the riparian channel. Vegetation/turfs will have to be removed during construction, or will at least be removed during construction, and subsequently reinstated, replanted or re-seeded. Potential sediment remobilisation during works resulting in potential deterioration in quantity and quality. Temporary localised potential impact.</p> <p>During operation, there should be an increased in-stream vegetation habitat due to diverse flow conditions and creation of marginal berms or widening existing marginal berms. The backwaters/embayments are circa 10 metres long at regular intervals so will improve overall habitat diversity and abundance and will ensure a suitable corridor for habitat is put in place without homogenising plant communities. Low/backwater flows will allow diverse</p>	<p>Potential indirect impacts from construction stage of the development would be managed and no likely significant effects are anticipated on the water environment. This will be managed through SWMP and application of other best practice. The SWMP should be agreed with the technical specialists and will consider measures to manage spoil heap with reference to up to date and applicable guidance. It will include details of managing spoil, managing sediment pathways on the floodplain, in some areas, no works within 10m of the water course because of the potentially large amount of soil potentially available for entrainment. This also needs to contain information on how vegetation on floodplain will be reinstated following construction., which includes removal of the turf, re-seeding and careful placement of landscape features as supported by landscape planning.</p> <p>Continuous lengths of pre-vegetated coir rolls would protect the river edge of the berm from erosion and pre-vegetated coir</p>

Scheme element	WFD element likely to be impacted	Description of impact	Mitigation proposed
		habitat during operation. Planting of rhizomes and wet woodland species, including willows will also improve habitat diversity and abundance.	pallets would seed the bank side of the berm with marginal species. Backwater channels would be planted with either/both pre-vegetated coir rolls and pallets.
	Benthic invertebrate fauna	During construction: Potential sediment remobilisation during works with potential for smothering downstream channel bed features (localised and temporary sediment remobilisation so impact limited).	Potential indirect impacts from construction stage of the development would be managed and no likely significant effects are anticipated on the water environment. This will be managed through SWMP and application of other best practice. The SWMP should be agreed with the technical specialists and will consider measures to manage spoil heap with reference to up to date and applicable guidance. It will include details of managing spoil, managing sediment pathways on the floodplain, in some areas, no works within 10m of the water course because of the potentially large amount of soil potentially available for entrainment. This also needs to contain information on how vegetation on floodplain will be reinstated following construction, which includes removal of the turf, re-seeding and careful placement of landscape features as supported by landscape planning. This also needs to contain information on how vegetation on floodplain will be reinstated following construction.
		<p>During operation: Decreased sediment load to channel following a major flood event due to more storage in two-stage channel leading to decreased nutrient enrichment. Habitat niches improve abundance and richness.</p> <p>Creation of additional habitats which can be utilised by benthic invertebrates.</p>	

Scheme element	WFD element likely to be impacted	Description of impact	Mitigation proposed
			<p>In addition, continuous lengths of pre-vegetated coir rolls would protect the river edge of the berm from erosion and pre-vegetated coir pallets would seed the bank side of the berm with marginal species. Backwater channels would be planted with either/both pre-vegetated coir rolls and pallets</p>
	Fish Fauna	<p>During construction: Potential disturbance to species within the river at this point, due to close proximity of works, which could include temporary interruption to any migration (if occurring); potential for disturbance or loss of species over a localised and temporary event.</p> <p>During operation: provision of better habitat to improve conditions for fish during spawning and migration. Embayments/backwaters potentially provide nursery areas. The backwater design allows for sufficient width, in conjunction with the associated island to improve the sustainable function of backwater without it quickly and efficiently silting up or becoming choked by vegetation.</p>	<p>Potential indirect impacts from construction stage of the development would be managed through sensitive timing and avoiding working in the channel. Timing of works is important and should avoid migration and spawning periods. August to October has been scheduled for works to be undertaken to avoid spawning. Increased sediment availability also needs to be managed as an indirect impact for fish. This will be managed through SWMP and application of other best practice. The SWMP has not been produced yet but should include details of managing spoil, managing sediment pathways within the channel and on the floodplain. Construction of the backwaters would offer a direct pathway to the channel. This needs to be controlled by silt traps or other suitable mitigation.</p> <p>ECoW to be used on site.</p>

Scheme element	WFD element likely to be impacted	Description of impact	Mitigation proposed
			All pollution to be controlled under current legislation and best practice.
	Quantity and dynamics of water flow	<p>During construction: Anticipate that the working method to allow formation of new channel features will require some localised coffer-damming and dewatering and/or over-pumping. Any consequences for the dynamics of flow would be temporary and reversible.</p> <p>During operation: Improvement to conveyance and decreasing flood risk. The creation of embayments and/or two-stage channel will lead to more diverse flow variability and habitat niches. The backwater design allows for sufficient width, in conjunction with the associated island, to improve the sustainable function of backwater without it quickly silting up or becoming choked by vegetation.</p>	<p>Timing of the works is important. They will be undertaken between August to October when the water levels are lower therefore minimising the need to put in measures to prevent flooding out of works during construction. As water levels will be lower, the need for pumps and cofferdams will be minimised. Silt traps or silt curtains also need to be put in place during construction to further mitigate any potential entrainment into the channel.</p> <p>Geomorphologist to attend on site during works to provide detailed guidance.</p>
	River depth and width variation:	<p>No change during construction.</p> <p>During operation: Improvement to river channel cross-Section, from current trapezoidal cross-Section to diverse channel profiles, will increase river width and provide flow and habitat diversity.</p>	Potential indirect impacts from construction stage of the development would be managed and no likely significant effects are anticipated on the water environment.
		During construction: Potential change to structure of substrate due to	Sediment mobilisation into the water column will need to be minimised. The

Scheme element	WFD element likely to be impacted	Description of impact	Mitigation proposed
	Structure and substrate of the river bed	<p>construction. Sediment remobilisation during works could result in potential deterioration in water quality, and potential for greater concentrations of fines downstream. Temporary localised potential impact.</p> <p>During operation: Potential improved sediment variability. Aggregation of fines (potential for) in slacker areas of water</p>	SWMP (as outlined above) will include specific measures for in-channel works to minimise the risk of resuspending sediment and of releasing any plumes beyond the working area. Thus, the potential indirect impacts from construction stage of the development would be managed and no likely significant effects are anticipated on the water environment.
	Structure of the riparian zone	<p>During construction: The creation of WFD enhancements will require the removal of existing riparian vegetation. Sediment remobilisation during works could result in the potential deterioration of the riparian zone, and risk of materials entering the water course.</p> <p>During operation: Improvement to overall riparian morphological diversity and species diversity. Morphological diversity improves habitat by creating a variety of habitat niches for various aquatic species. Planting of rhizomes and wet woodland species, including willows will improve habitat diversity and abundance.</p>	Potential indirect impacts from construction stage of the development would be managed. An EAP (see Appendix I of the ES) will refer to site-specific measures to mitigate for effects on the riparian zone, such as translocating areas of vegetation. No likely significant effects are anticipated on the water environment.
	River continuity	During construction: there will be no overall change during this time.	Timing of the works is important. They will be undertaken between August and

Scheme element	WFD element likely to be impacted	Description of impact	Mitigation proposed
		<p>During operation: there will be no overall change in longitudinal continuity. The hydromorphic processes will be more variable due to better heterogeneity but overall there will be no change to continuity. However, the scheme is going to slightly reduce the degree of floodplain connectivity through embankment raising and increased conveyance but not sufficiently to alter water body status.</p>	<p>October when the water levels are lower therefore minimising the need to put in measures to prevent flooding out of works during construction. Overall, potential indirect impacts from construction stage of the development will be managed and no likely significant effects are anticipated on the water environment.</p>
	Nutrient conditions	<p>During construction: Sediment remobilisation during works could result in potential deterioration of nutrient conditions within the water course.</p> <p>During operation: Habitat diversity improves oxygenation, clarity (reduced silt within the water column) and sediment transport, and therefore overall water quality. However, decreased uncontrolled flooding of agricultural land due to more water being stored within the two-stage channel leading to potential decreased diffuse pollution into the water body.</p> <p>Also potential interception of contaminants in the widened riparian</p>	<p>Any phosphates occurring in the existing riparian sediments are due to agricultural/discharge issues outside of the Scheme and cannot be mitigated for within this Scheme. Potential indirect impacts from construction stage of the modified channel will need to be carefully managed to ensure that sediment mobilisation into the water column is minimised, especially under conditions of high light and temperature that could encourage algal blooming.</p> <p>Since the work is scheduled for August to October in order to be outside of higher river discharges and wet weather there is the potential to coincide with sunny and warm spells of weather. The SWMP (as outlined above) will include specific</p>

Scheme element	WFD element likely to be impacted	Description of impact	Mitigation proposed
		zone reducing the load reaching the channel.	<p>measures for in-channel works to minimise the risk of resuspending sediment and of releasing any plumes beyond the working area.</p> <p>The SWMP would be developed in agreement with our internal technical specialists, and would consider measures to manage spoil heap with reference to up to date and applicable guidance. It will include details of managing spoil, managing sediment pathways on the floodplain, in some areas, no works within 10m of the water course because of the potentially large amount of soil potentially available for entrainment. It would also contain information on how vegetation on floodplain will be reinstated following construction., which includes removal of the turf, re-seeding and careful placement of landscape features as supported by landscape planning.</p> <p>All pollution to be controlled under current legislation and best practice.</p>
	Oxygenation conditions	<p>During construction: See 'Nutrient conditions' above.</p> <p>During operation: Habitat diversity improves oxygenation, clarity (reduced silt within the water column) and</p>	See 'Nutrient conditions' above.

Scheme element	WFD element likely to be impacted	Description of impact	Mitigation proposed
		<p>sediment transport, and therefore overall water quality. Water held in the two-stage channel/embayments is likely to have a negligible impact on dissolved oxygen levels of the overall water body. The widened channel can be operated at higher flows with similar velocities and water depths to pre-scheme as a result of summer penning.</p>	
	<p>Invasive Non-Native Species (INNS)</p>	<p>During construction: Risk of spread of invasive species if present.</p> <ul style="list-style-type: none"> • Water fern (<i>Azolla filiculoides</i>) was recorded on a ditch in a field adjacent to the KSD near Westonzoyland. • Himalayan Balsam (<i>Impatiens glandulifera</i>) was recorded in the study area on the Parrett. • Canadian pond weed (<i>Elodea canadensis</i>) was recorded in an agricultural drainage ditch. • Nuttall's waterweed (<i>Elodea nuttallii</i>) was recorded at two locations in the Sowy. <p>Further information on non-native, invasive plant species was also provided by the Somerset Drainage</p>	<p>With appropriate mitigation these will be managed to ensure no significant effects. Invasive Species Management Plan to be put in place. Ensure no spread within the water channel. Given the recorded presence of, and potential for, a number of non-native invasive plant species, an Invasive Species Management Plan would be required. This would 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 would include;</p> <ul style="list-style-type: none"> • Pre-construction survey for non-native invasive plant species.

Scheme element	WFD element likely to be impacted	Description of impact	Mitigation proposed
		<p>Board Consortium stating that parrots feather (<i>Myriophyllum aquaticum</i>) 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 (<i>Pistia stratiotes</i>) and water hyacinth (<i>Eichhornia crassipes</i>) 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 (<i>Hydrocotyle ranunculoides</i>) 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.</p>	<ul style="list-style-type: none"> • 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

Scheme element	WFD element likely to be impacted	Description of impact	Mitigation proposed
			not to not cause harm to the environment. If present, report to competent authority.
	Connection to designations	Somerset Level and Moors SPA – no anticipated impact to SPA.	A Habitats Regulation Assessment (HRA) has been undertaken which considers potential effects on the Somerset Levels and Moors SPA (see Appendix C of the ES). The HRA concludes that, with the identified mitigation in place, no significant effects on the integrity of any European designated sites would occur.
Outfall structure			
Raising of the existing concrete headwalls by 300-400mm.	Macrophytes and phytobenthos	During works potential deterioration in quantity and quality of vegetation through direct impacts of groundworks. Temporary localised potential impact.	Potential indirect impacts from construction stage of the development will be managed and no likely significant effects are anticipated on the water environment. The SWMP should be agreed with the technical specialists, and will consider measures to manage spoil heap with reference to up to date and applicable guidance. It will include details of managing spoil, managing sediment pathways on the floodplain, in some areas, no works within 10m of the water course because of the potentially large amount of soil potentially available for entrainment.
		During operation: no change.	
		Sediment could be remobilised during works with potential for smothering	

Scheme element	WFD element likely to be impacted	Description of impact	Mitigation proposed
	Benthic invertebrate fauna	downstream channel bed features (localised and temporary sediment remobilisation so impact limited.	through sensitive working method and no likely significant effects are anticipated on the water environment.
		During operation: no change.	All pollution to be controlled under current legislation and best practice.
	Fish fauna	During construction: disturbance to species within the river at this point, which could include temporary interruption to any migration (if occurring) between KSD and Cossington Right or Chilton Right rhynes; potential for disturbance of species over a localised and temporary event.	Potential indirect impacts from construction stage of the development will be managed through sensitive timing (to avoid fish migration) and working method and no likely significant effects are anticipated on the water environment.
		No change during operation from current conditions.	
	INNS	<p>Risk of spread of invasive species if present.</p> <ul style="list-style-type: none"> Water fern (<i>Azolla filiculoides</i>) was recorded on a ditch in a field adjacent to the KSD near Westonzoyland. Himalayan Balsam (<i>Impatiens glandulifera</i>) was recorded in the study area on the Parrett. 	<p>With appropriate mitigation these will be managed to ensure no significant effects, and in any case their short-term duration is unlikely to give rise to an adverse impact.</p> <p>If present, report to competent authority.</p>

Scheme element	WFD element likely to be impacted	Description of impact	Mitigation proposed
		<ul style="list-style-type: none"> • Canadian pond weed (<i>Elodea canadensis</i>) was recorded in an agricultural drainage ditch. • Nuttall's waterweed (<i>Elodea nuttallii</i>) was recorded at two locations in the Sowy. <p>Further information on non-native, invasive plant species was also provided by the Somerset Drainage Board Consortium stating that parrots feather (<i>Myriophyllum aquaticum</i>) 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 (<i>Pistia stratiotes</i>) and water hyacinth (<i>Eichhornia crassipes</i>) 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 (<i>Hydrocotyle ranunculoides</i>) 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</p>	

Scheme element	WFD element likely to be impacted	Description of impact	Mitigation proposed
		may become present during the implementation period of the scheme.	
	Connection to designations	Somerset Level and Moors SPA – no anticipated impact to SPA.	A Habitats Regulation Assessment (HRA) has been undertaken which considers potential effects on the Somerset Levels and Moors SPA (see Appendix C of the ES). The HRA concludes that, with the identified mitigation in place, no significant effects on the integrity of any European designated sites would occur.
Installation of sheet piles	Macrophytes and phytobenthos	During construction: Potential sediment remobilisation during works resulting in potential deterioration in quantity and quality, and potential loss in places. Temporary localised potential impact.	Potential indirect impacts from construction stage of the development will be managed and no likely significant effects are anticipated on the water environment. This will be managed through SWMP and application of other best practice.
		During operation, there should be no change from current conditions once the river has returned to normal conditions.	
	Benthic invertebrate fauna	During construction: Potential sediment remobilisation during works with potential for smothering downstream channel bed features (localised and temporary sediment remobilisation so impact limited). During operation, there should be no change	Potential indirect impacts from construction stage of the development will be managed through sensitive working method and no likely significant effects are anticipated on the water environment. Use of ECoW on site.

Scheme element	WFD element likely to be impacted	Description of impact	Mitigation proposed	
	Fish fauna	During construction: Potential disturbance to species within the river at this point, due to close proximity of works, which could include temporary interruption to any migration (if occurring) between KSD and Cossington Right or Chilton Right rhynes; potential for disturbance or loss of species over a localised and temporary event.	<p>Potential indirect impacts from construction stage of the development will be managed through sensitive timing (to avoid fish migration) and working method and no likely significant effects are anticipated on the water environment.</p> <p>Compile and adhere to an EAP and ensure materials do not pollute substrate or water body.</p> <p>Consider ECoW on site during construction.</p> <p>All pollution to be controlled under current legislation and best practice.</p>	
		During operation: no change.		
		During operation: No change and no potential for channel width diversity apart from where sheet piling is absent, and then potential for outflanking.		
	Structure and substrate of the river bed	During construction: Potential change to structure of substrate due to construction. Sediment remobilisation during works could result in potential for greater concentrations of fines downstream. Temporary localised potential impact.		Potential indirect impacts from construction stage of the development will be managed through the SWMP and no likely significant effects are anticipated on the water environment
		During operation: No change. From current conditions.		Any phosphates occurring in the existing sediment are due to agricultural/discharge
		During construction: Sediment remobilisation during works could result		

Scheme element	WFD element likely to be impacted	Description of impact	Mitigation proposed
	Nutrient conditions	<p>in potential deterioration of nutrient conditions within the water course.</p> <p>During operation: No change</p>	<p>issues outside of the Scheme and cannot be mitigated for within this Scheme.</p> <p>Potential indirect impacts from construction of the outfalls will need to be carefully managed to ensure that sediment mobilisation into the water column is minimised, especially under conditions of high light and temperature that could encourage algal blooming.</p> <p>Since the work is scheduled for August to October in order to be outside of higher river discharges and wet weather there is the potential to coincide with sunny and warm spells of weather. The SWMP (as outlined above) will include specific measures for in-channel works to minimise the risk of resuspending sediment and of releasing any plumes beyond the working area.</p> <p>The SWMP will establish site-specific measures to ensure nutrient-rich materials are properly managed. This might include specific weather-dependent limits on working activities.</p> <p>All pollution to be controlled under current legislation and best practice</p>
	INNS	During construction: Risk of spread of invasive species if present.	With appropriate mitigation these will be managed to ensure no significant effects.

Scheme element	WFD element likely to be impacted	Description of impact	Mitigation proposed
		<ul style="list-style-type: none"> • Water fern (<i>Azolla filiculoides</i>) was recorded on a ditch in a field adjacent to the KSD near Westonzoyland. • Himalayan Balsam (<i>Impatiens glandulifera</i>) was recorded in the study area on the Parrett. • Canadian pond weed (<i>Elodea canadensis</i>) was recorded in an agricultural drainage ditch. • Nuttall's waterweed (<i>Elodea nuttallii</i>) was recorded at two locations in the Sowy. <p>Further information on non-native, invasive plant species was also provided by the Somerset Drainage Board Consortium stating that parrots feather (<i>Myriophyllum aquaticum</i>) 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 (<i>Pistia stratiotes</i>) and water hyacinth (<i>Eichhornia crassipes</i>) 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</p>	<p>Invasive Species Management Plan to be put in place. Invasive species are 'reportable' but the operatives need to be provided with this guidance.</p> <p>If present, report to competent authority.</p> <p>Given the recorded presence of, and potential for, a number of non-native invasive plant species, an Invasive Species Management Plan would be required. This would 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 would include;</p> <ul style="list-style-type: none"> • 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.

Scheme element	WFD element likely to be impacted	Description of impact	Mitigation proposed
		<p>records of floating pennywort (<i>Hydrocotyle ranunculoides</i>) 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.</p>	<ul style="list-style-type: none"> • 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.
	Connection to designations	Somerset Level and Moors SPA – no anticipated impact to SPA.	A Habitats Regulation Assessment (HRA) has been undertaken which considers potential effects on the Somerset Levels and Moors SPA (see Appendix C of the ES). The HRA concludes that, with the

Scheme element	WFD element likely to be impacted	Description of impact	Mitigation proposed
			identified mitigation in place, no significant effects on the integrity of any European designated sites would occur.

5. Assessment of the scheme against mitigation measures

Within each RBMP, there is a list of mitigation measures, or environmental improvements, which need to be implemented in order to improve the ecology of water bodies by a specified date in order for the UK to meet the target date set by the WFD. Part of the a WFD compliance assessment is to consider relevant mitigation measures and assess whether a proposed scheme can contribute to them or might obstruct any of them from being delivered.

Table 6 provides a list of all mitigation measures applicable to the Scheme and the KSD water body specifically. There were not any mitigation measures data to contribute to this assessment as they were not readily available, so these are proposed based on experience/knowledge of other mitigation measures for other similar schemes.

Table 6 Mitigation measures put forward to support the RBMP and the Scheme

Mitigation Measure		Will the Scheme help to achieve or contribute to mitigation measure?
Flood protection	Align and attenuate flow to minimise impact on ecology	Yes, through creation of enhancements
	Create habitat	Yes, including backwaters, two stage channels, WFD enhancements, embayments, and improvement to riparian habitat
	Educate landowners impacts to Hydromorphology and Hydromorphological harm	Partially – indirectly through design
	Enhance existing structures to improve ecology	Yes, including backwaters, two stage channels, embayments, WFD enhancements improvement to riparian habitat
	Ensure maintenance minimises habitat impact	Partially – indirectly through design, although maintenance not part of the Scheme objective
	Manage in-channel and riparian vegetation	Yes, through design of enhancements
	Manage realignment of flood defences	Yes
	Preserve or restore habitats	Yes, through design of enhancements
	Remove and prevent further dispersal of invasive non-native species	Partially

Mitigation Measure		Will the Scheme help to achieve or contribute to mitigation measure?
	Remove obsolete structure(s)	No
	Remove or enhance set-back embankments	Yes, including backwaters, two stage channels, improvement to riparian habitat
	Remove or soften hard bank engineering	Yes, partially, including backwaters, two stage channels, improvement to riparian habitat
	Restore or increase floodplain (lateral) connectivity	No
	Restore or Increase In-channel morphological diversity	Yes, including backwaters, two stage channels, improvement to riparian habitat
	Retain habitats	Yes, including backwaters, two stage channels, improvement to riparian habitat
Land drainage	Align and attenuate flow to minimise impact on ecology	Partially through design and improvement of riparian zone
	Create habitat	Yes, including backwaters, two stage channels, improvement to riparian habitat
	Educate landowners impacts to Hydromorphology and Hydromorphological harm	Partially – indirectly through design and tacit understanding of Scheme
	Enhance existing structures to improve ecology	Yes, including backwaters, two stage channels, improvement to riparian habitat
	Ensure maintenance minimises habitat impact	Partially – indirectly through design, although maintenance not part of the Scheme objective
	Preserve or restore habitats	Yes, through design of enhancements
	Remove and prevent further dispersal of invasive non-native species	No
	Restore or increase floodplain (lateral) connectivity	Yes, through design of enhancements

Mitigation Measure		Will the Scheme help to achieve or contribute to mitigation measure?
	Restore or Increase In-channel morphological diversity	Yes, through enhancements
	Retain habitats	Yes, through design

In summary, it is unlikely that the nature of the works would impede any mitigation measures that might be put forward as part of the RBMP or water body specific measures. Further, the nature of the works are unlikely to impede achievement of GEP.

6. Cumulative assessment

None of the other proposed schemes scoped into the cumulative assessment within Chapter 12 of the ES are considered to offer the potential for cumulative effects on the KSD water body, predominantly due to their distance, and scale of development.

7. Compliance conclusions

Referring back to the points raised in Chapter 1, and the assessment in Chapters 4 to 6, the reasoning put forward for the need for a detailed assessment can be put aside for the following reasons:

- Channel widening, deepening, straightening or realigning is a high-risk activity to WFD objectives whatever the length or extent. Reprofilng works are high risk where the length of channel affected is greater than 100 metres. The risks to a number of quality elements have been identified but these can each be mitigated through appropriate working methods and precautionary measures that will be incorporated into a SWMP which will specifically consider risks around sediment control and associated water quality, and an EAP. Once completed, the Scheme will provide a much more tangible benefit in that it will improve the physical condition of the artificial water body, which is currently an oversized trapezoidal drainage channel. The WFD benefits put forward as part of the Scheme, in conjunction with improved hydromorphological condition (for example, improved heterogeneity, improved abundance and variability in species within the channel and riparian corridor) far exceed the implications of channel widening being a high-risk activity.
- Embankment works are high-risk where the length of channel affected is greater than 100 metres. However, the works, including incorporation of enhancements, should benefit the water body. During operation the works will prevent or reduce adverse water quality side-effects from flooding (sewer overflow, arable soil loss). Additionally, they are already on areas of relatively low floodplain value and are being widened on the dry side in all cases, and therefore their adverse consequences are limited.

The overall improvement to the waterbody as a result of this Scheme would suggest that all WFD quality elements will be improved or unaffected.

Taking into consideration the above points, and the anticipated impacts of the Scheme on the biological, physico-chemical and hydromorphological quality elements, it is unlikely to compromise progress towards achieving GEP or cause a deterioration of the overall ecological potential of the King's Sedgemoor Drain – Henley Sluice to mouth water body. The aim of the Scheme is largely to improve the physical condition of an artificial system. This is dependent on the implementation of the design and construction of mitigation measures that are identified in this assessment. The overall design will improve overall WFD elements, and is being designed to specifically includes WFD benefits, such as variable channel widths and depths, two-stage channels and embayments for improved marginal habitat.

Table 8 Compliance of the scheme with the environmental objectives of the WFD

Environmental Objective	Scheme	Compliance with the WFD Directive
No changes affecting high status sites	After consideration as part of the detailed compliance assessment, none of the options considered will cause a	Yes. A HRA has been undertaken in support of the ful Scheme. It concludes that no adverse effects on the

Environmental Objective	Scheme	Compliance with the WFD Directive
	change to the high-status sites in the study area if mitigation is put in place.	integrity of European sites would occur with the identified mitigation in place..
No changes that will cause failure to meet surface water good ecological status or potential or result in a deterioration of surface water ecological status or potential	After consideration as part of the detailed compliance assessment, the Scheme options will not cause deterioration in the status of the water bodies if mitigation is put in place.	Yes
No changes which will permanently prevent or compromise the Environmental Objectives being met in other water bodies	The Scheme options will not cause a permanent exclusion or compromise achieving the WFD objectives in any other bodies of water within the River Basin District.	Yes
No changes that will cause failure to meet good groundwater status or result in a deterioration groundwater status.	The Scheme options will not cause deterioration in the status of the of the groundwater bodies.	Yes