Strategic Solution Gate One Submission:
Preliminary Feasibility Assessment

# South Lincolnshire Reservoir

5 July 2021

# Contents

# Acronyms

| Acronym | Definition |
|---|---|
| **A2AT** | Anglian to Affinity Transfer |
| **AA** | Appropriate Assessment |
| **ACWG** | All Company Working Group |
| **AIC** | Average Incremental Costs |
| **AMP8** | Asset Management Plan |
| **BNG** | Biodiversity Net Gain |
| **BSA** | Bulk Supply Agreement |
| **CAP** | Competitively Appointed Provider |
| **CCW** | Consumer Council for Water |
| **CDO** | Concept Design Option |
| **CON** | Consultation |
| **CRT** | Canal and River Trust |
| **DBFOM** | Design, Build, Finance, Operate and Maintain |
| **DCO** | Development Consent Order |
| **DO** | Deployable Output |
| **DPC** | Direct Procurement Customer |
| **DWI** | Drinking Water Inspectorate |
| **EA** | Environment Agency |
| **EAR** | Environmental Assessment Report |
| **EIA** | Environmental Impact Assessment |
| **FSA** | Flood Storage Area |
| **HOF** | Hands-off-Flow |
| **HRA** | Habitat Regulations Assessment |
| **IDB** | Internal Drainage Board |
| **INNS** | Invasive Non-Native Species |
| **JV** | Joint Venture |
| **LA** | Local Authority |
| **MCDA** | Multiple-Criteria Decision Analysis |
| **MCM** | Million Cubic Metres |

| Acronym | Definition |
|---|---|
| **MO-RDM** | Multi-Objective Robust Decision Making |
| **NC** | Natural Capital |
| **NFU** | National Farmer's Union |
| **NPV** | Net Present Value |
| **OB** | Optimum Bias |
| **PEI** | Preliminary Environmental Information |
| **PMG** | Programme Management Group |
| **PPA** | Power Purchase Agreement |
| **PWS** | Public Water Supply |
| **REGO** | Renewable Energy Guarantees of Origin |
| **SAC** | Special Area of Conservation |
| **SCP** | Systematic Conservation Planning |
| **SEA** | Strategic Environmental Assessment |
| **SFFD** | South Forty Foot Drain |
| **SLR** | South Lincolnshire Reservoir |
| **SLWP** | South Lincolnshire Water Partnership |
| **SOC** | Strategic Outline Case |
| **SOCC** | Statement of Community Consultation |
| **SPA** | Special Protection Area |
| **SRO** | Strategic Resource Option |
| **TWAS** | Trent-Witham-Ancholme Scheme |
| **UKCP18** | (Met Office) UK Climate Projections |
| **VFM** | Value For Money |
| **WFD** | Water Framework Directive |
| **WQRA** | Water Quality Risk Assessment |
| **WRE** | Water Resources East |
| **WRMP** | Water Resources Management Plan |
| **WRW** | Water Resources West |
| **WRZ** | Water Resources Zone |

# 1. Executive summary

## South Lincolnshire Reservoir

### Solution summary

- The South Lincolnshire Reservoir, or SLR, is a strategic regional water resource solution that is being proposed in the Anglian Water region to support supply to Anglian Water customers and Affinity Water customers via the associated Anglian to Affinity transfer solution.
- Water would be abstracted when river flows allow and transferred to a newly constructed reservoir, expected to be located in Lincolnshire, via pipeline or open water transfer.
- Three potential concept design options have been evaluated at three indicative sites to provide useful characteristics for comparison – these are not the only options being considered and work continues on the site selection and design processes.
- The three concept designs consider the opportunities for providing benefits to other sectors. The designs include a multi-sector reservoir providing for public water supply, flood and agricultural storage, with variations including wetlands, flood storage areas and farm irrigation reservoirs.
- The water resource benefit of the three SLR concept design options presented range from 151Ml/d to 182Ml/d considering Anglian Water as the sole recipient of the reservoir output. The conjunctive benefit would increase if a transfer to Affinity Water is adopted.
- Whole-life costs for each option have been calculated, with costs ranging from £1.1billion to £1.8billion depending on the extent of the design.

### Outline delivery plan

- The SLR programme remains on track to be 'construction-ready' in AMP8, although the required 'into-supply' date is dependent upon the outcome of the regional modelling.
- The workstreams planned for gate two will ensure there is a robust planning and market-engagement process in place to help inform the preferred procurement model.
- The scheme is expected to be promoted as a Nationally Significant Infrastructure Project, requiring a Development Consent Order (DCO).

### Water quality considerations

- Initial water-quality risk assessments have not highlighted any significant issues, although the quality of the raw water sources is known to be complex.
- The output of the initial risk assessment has been used to inform the proposed treatment requirements, with a focus on the need to consider customer perception (taste, odour, hardness) due to a change in water type.

### Key environmental outcomes

- Initial environmental assessments have not identified any significant issues with the SLR concept design options.
- The abstraction licence arrangements will be discussed with the Environment Agency to ensure no likely significant effects on designated sites, and a programme of monitoring has been agreed to gather additional information to inform the ongoing assessments.
- Initial assessments indicate significant wider benefits will be realised, including opportunities for environmental enhancement, positive social outcomes, improved climate-resilience, realisation of low-carbon targets and amenity value.

### Stakeholder engagement

- An extensive programme of customer engagement has been completed, and the overall consensus is that customers agree with the need for regional water resource collaboration.
- Reservoirs are an option widely accepted by customers – with the majority view that the long-term recreational, resilience and environmental benefits outweigh the localised impacts and shorter-term disruption of construction.
- Ongoing stakeholder engagement will include a first phase of community engagement in spring 2022, once the preferred option has been identified.

### Scheme viability

- SLR is a viable solution that has the potential to deliver multiple benefits across sectors and considerable public value. The recommendation is that the solution should progress through gate one, and work should continue to ensure that it is construction ready by AMP8.

### Key risks & assumptions

- The Water Resources East regional system simulator model will be used to select the preferred option. The regional modelling programme is relatively time constrained, and ensuring this stays on programme will be essential to the successful delivery of the SLR programme to gate two.
- The timescales to align the scheme delivery with the planning (DCO) and procurement (Direct Procurement for Customer – DPC) requirements are currently not fully aligned and work is ongoing to mitigate the risks.

# 2. Solution description

## This section sets out a summary of key information and an initial overview of the South Lincolnshire Reservoir Strategic Resource Option (SRO) solution.

### 2.1 Solution outline

- As part of WRMP19, Anglian Water and Affinity Water identified an increasing supply deficit. One option considered to alleviate this shortage was the development of a winter storage reservoir in South Lincolnshire (the SLR) and an associated inter water company transfer (the Anglian to Affinity Transfer or A2AT).
- The initial concept is similar to the WRMP19 solution that consisted of a 50,000Ml reservoir, with an abstraction from the River Witham supported by a transfer from the River Trent.
- The work on the concept design to gate one has built on the WRMP19 solution by considering the wider multi-sector benefits a potential reservoir system could deliver.
- The SLR has the potential to provide many benefits to the area in addition to providing public water supply (PWS). The following multi-sector design features have been considered as part of the preliminary feasibility stage:
    - multi-purpose reservoir system with PWS, flood risk and irrigation storage.
    - a flood storage area (FSA) to capture River Witham or South Forty Foot Drain (SFFD) flows.
    - a network of secondary farming reservoirs.
    - bank storage wetlands to capture and purify winter flows.
    - open water transfer/widening of the SFFD to provide navigation and flood storage.
    - wetlands on (or by) spring-fed streams to allow PWS use, slow the flow and provide a source of irrigation.
    - catchment management to improve water quality on the SFFD to allow PWS use.
- Three initial concept designs have been developed that incorporate multi-sector benefits to compare with the original WRMP19 public-water-supply-only option.
- Water is to be abstracted from the river when flows allow and transferred to the reservoir via pipeline or open water transfer. Local flows from the SFFD will be incorporated into the design where possible.
- A treatment works will be located adjacent to the reservoir to treat the water before it is piped to an existing service reservoir north of Peterborough.
- The final concept design and associated location of the reservoir system will be finalised ahead of gate two.

### 2.2 Options and configurations

The SLR solution has considered three potential concept design options for this gate one submission that have been developed and evaluated, and a baseline option that has been costed to enable comparison. The options represent a combination of design features that are being explored with stakeholders to maximise multi-sector benefits, identify the cost benefit ratios of individual features and to inform the preferred concept design for the gate two submission. The concept design options presented here do not represent a final set of options or sites; the final concept design may comprise a different combination of features.

It should be noted that all of the concept designs include the River Trent as a key source of water for the scheme. This is as a result of the source of water assessment carried out for gate one, which concluded that the deployable output (DO) would be too small without the Trent as a source of water, both on a cost effectiveness basis, and to provide a scheme that was sufficient in size to support regional needs.

**All the dimensions presented in this submission (including volumes, pipeline lengths, etc) and any site-specific information such as geological and environmental conditions are based on indicative sites only and will be subject to change depending on the final preferred site selection and configuration.**

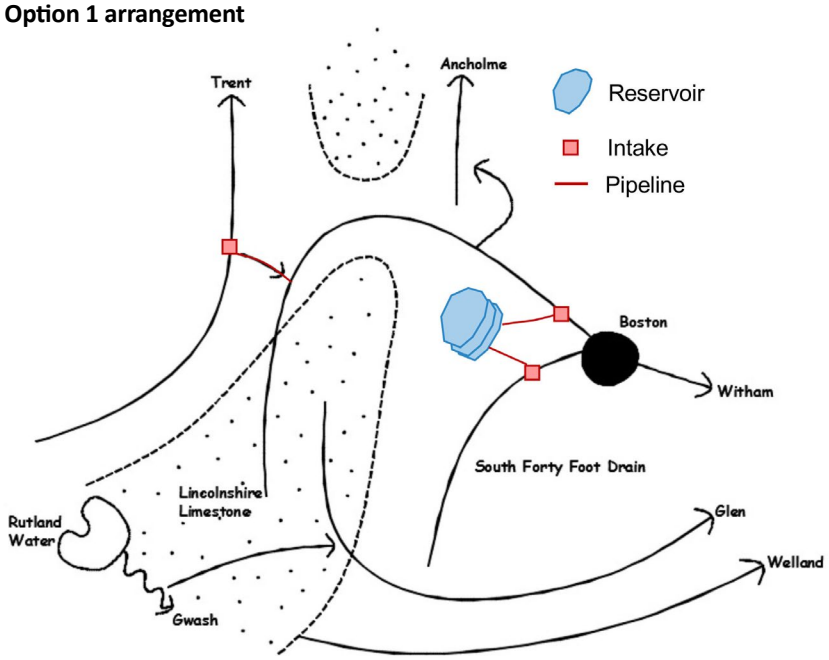
- **Concept Design Option 0** is a baseline option comprising a PWS reservoir and pipeline; there are no multi-sector benefits included. This option has not been developed in as much detail as it does not achieve the multi-sector ambition of the scheme, and is therefore not considered promotable, but costs are provided in Section 4 to enable comparison and evaluation.
- **Concept Design Option 1** considers a single multi-sector reservoir providing for PWS, flood and agricultural water storage.
- **Concept Design Options 2 and 3** include a PWS reservoir with other multi-sector benefits, including wetlands, flood storage and irrigation.

The concept design options are summarised below and presented in more detail in Section 4.1. Each option also includes a 300Ml/d transfer from the River Trent to the River Witham via a 9.3km, 1.7m diameter pipeline. The option to use the existing transfer via the Environment Agency's Trent Witham Ancholme Scheme was considered, but the capacity is not sufficient to incorporate this additional demand in addition to normal operation. This is described further in Section 4.4.

### 2.2.1 Concept Design Option 1 (CDO1)

CDO1 includes the construction of a 52.5million cubic metre (MCM) multi-purpose water storage reservoir, incorporating 50MCM for water storage for PWS and 2.5MCM for irrigation. CDO1 includes an adjacent 2.5MCM for flood storage. Bulk water abstraction points are assumed to be located on the River Witham and the SFFD, with a transfer of 500Ml/d to the reservoir via a 12.5km long, 2.2m diameter pipeline from the River Witham and a direct pipeline transfer from the SFFD of 150Ml/d. The schematic for CDO1 is presented in Figure 1.

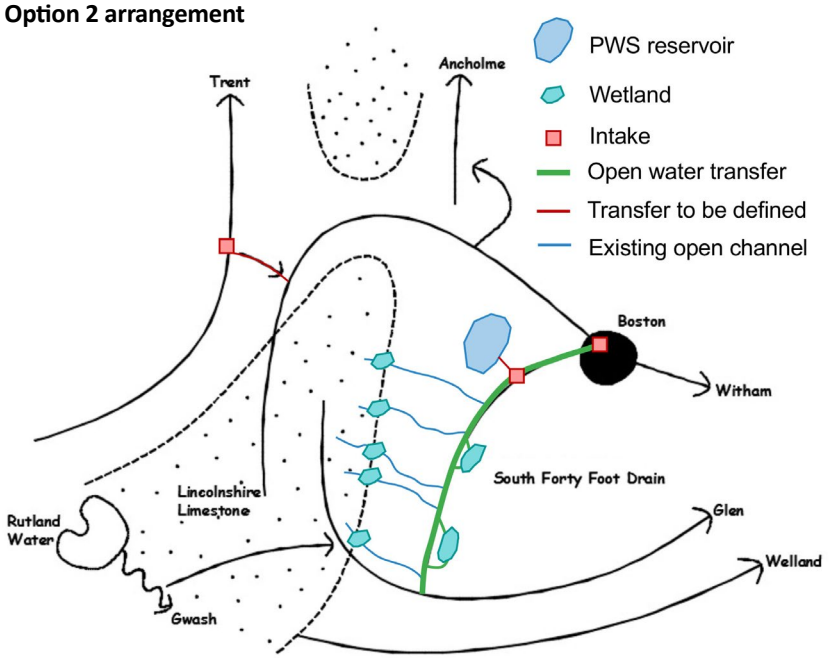
**Figure 1: Concept Design Option 1 arrangement**




### 2.2.2 Concept Design Option 2 (CDO2)

CDO2 includes the construction of a 50MCM PWS reservoir with two separate 0.5MCM bank storage wetlands and five online 0.1MCM spring-fed stream wetlands. Abstraction for this option is from the River Witham with the 500Ml/d transfer of water to the PWS achieved via a new 4km long and 6m wide open water link. Flows would then be transferred along the SFFD for 15.5km and finally to the PWS reservoir via an open water channel extension to the SFFD and a final 3.7km long pipeline with pumped transfer. Open channel transfers are an aspiration of stakeholders as they are considered to bring many benefits to the area, including navigation, flood storage and connected catchments. The schematic for CDO2 is presented in Figure 2.

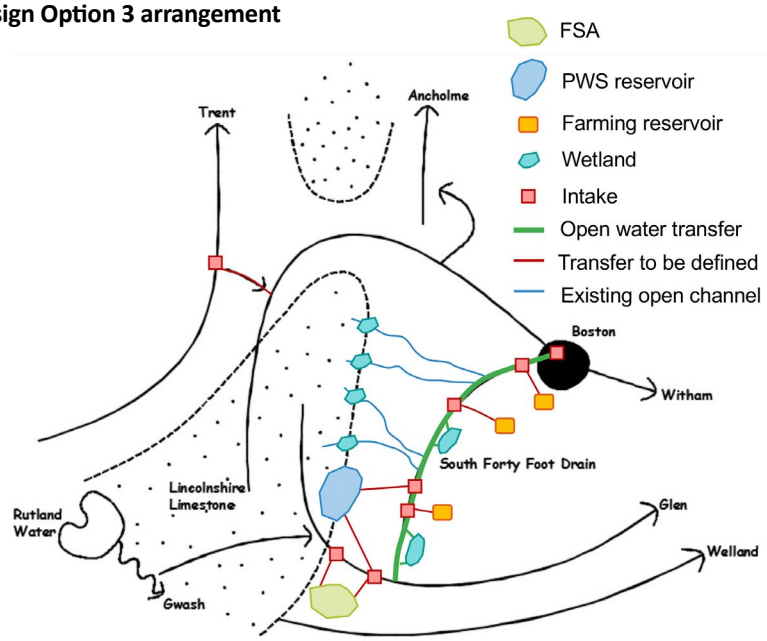
**Figure 2: Concept Design Option 2 arrangement**



### 2.2.3 Concept Design Option 3 (CDO3)

CDO3 includes the construction of a 50MCM PWS reservoir, two 0.5MCM bank storage wetlands, five 0.1MCM spring-fed stream wetlands, an additional 4MCM flood storage reservoir and three 1MCM farming reservoirs. The additional flood storage is designed to provide flood protection along the River Glen and release up to 150Ml/d to the Bourne Eau. This option also includes a 500Ml/d transfer via a newly constructed open water channel between the River Witham and the SFFD, 4km in length and 6m wide, in addition to widening 24.9km of the SFFD by 9.3m to give a total cross-section width of 12.1m and excavating the channel bed to lower the invert by 2m. The schematic for CDO3 is presented in Figure 3.

**Figure 3: Concept Design Option 3 arrangement**




### 2.3 Overall costs

Option costs have been developed for each of the concept design options and range from £1.1billion to £1.8billion. Due to the current level of development at gate one, there is still significant uncertainty embedded into the proposed costs. However, this has been incorporated within the proposed Optimism Bias (OB) and risk approaches, which are consistent with the All Company Working Group (ACWG) methodology. The estimate of the overall cost for each concept design is considered sufficient for gate one. Further detail on the costing approach can be found in Section 10.

### 2.4 Resource benefits

The SLR will increase water resource availability to Anglian Water and Affinity Water by storing medium and high flows from the River Witham, River Trent and potentially the SFFD. The water resource benefit that the scheme could provide has been estimated for the climate conditions in the 2050s and is shown in Table 1 for each of the options. The reduced benefit in CDO2 and CDO3 is due to open water transfer losses.

**Table 1: Summary of elements and benefits for each of the concept designs**

| Scheme element | CDO0 | CDO1 | CDO2 | CDO3 |
|---|---|---|---|---|
| **PWS reservoir** | ✓ | ✓ | ✓ | ✓ |
| **Flood storage** | | ✓ | | ✓ |
| **Irrigation storage/farm reservoirs** | | ✓ | | ✓ |
| **Open channel transfer** | | | ✓ | ✓ |
| **Wetlands** | | | ✓ | ✓ |
| **Total deployable output (Ml/d)*** | **182** | **182** | **151** | **151** |

**based on supply to Anglian Water only.*

It should be noted that the DO reported above only applies if the scheme is used to supply Anglian Water only. If storage is shared between Anglian and Affinity Water then the different requirements on storage and timing of drought stress periods means the effective DO increases as a result of conjunctive use, to as much as 229Ml/d for CD00 and CD01, and 193Ml/d for CD02 and CD03. These enhancements are based on the maximum transfer of 100Ml/d being made available to Affinity Water.

In addition to public water supply, the SLR scheme has the potential to provide significant additional water resource benefits to other users and mitigate flood risk depending on the concept design that is adopted. Modelling has confirmed that the multi-purpose reservoir included in CDO1 results in the most significant yield benefit for PWS and irrigation requirements. The addition of the bank storage wetlands and flood storage area provides a marginal additional resource benefit but provides enhanced biodiversity and flood-risk mitigation.

## 2.5 Environmental outcomes

Initial environmental assessments have been completed for the three concept design options, including a Habitats Regulations Assessment (HRA), Water Framework Directive (WFD) and Strategic Environmental Assessment (SEA). Additional assessments for Invasive Non-Native Species (INNS), Biodiversity Net Gain (BNG), Natural Capital (NC), social outcomes and carbon have also been undertaken.

The abstraction licence arrangement will be agreed with the Environment Agency (EA) and Natural England to ensure no adverse effects on any designated sites. Further work will be required to collate information available to inform the assessments as the design continues to ensure that any WFD compliance risks are considered and addressed. Initial assessments indicate that there will be significant wider benefits realised by three of the options, including opportunities for environmental enhancement, positive social outcomes, improved climate-resilience and realisation of low-carbon targets.

A programme of additional monitoring and environmental assessment is in progress to further develop the environmental assessments for the gate two submission.

## 2.6 Drinking water considerations

A Water Quality Risk Assessment (WQRA)[1] was carried out for the SLR solution in accordance with the guidance developed for the ACWG[2]. The outcome from the WQRA has been used to design the treatment requirements for the elements of the SLR scheme. No significant water quality concerns have been identified at this stage, although the raw water quality in the Trent is understood to be complex. A water quality monitoring programme is underway to provide additional data to enable the WQRAs to be developed to a greater level of detail and confidence for gate two.

## 2.7 Resilience benefits

The SLR solution has been designed to ensure that the scheme is resilient to an extreme drought, which is defined as a one-in-500-year return period, and to account for potential climate change impacts in the 2050s, in accordance with the latest EA Water Resource Planning Guidance. For this stage of assessment, only one medium-range climate change scenario has been adopted corresponding to a temperature rise of 2°C from current conditions. The reported DO benefits for each of the concept design options will contribute to the overall Anglian Water and Affinity Water supply resilience. New climate datasets are being generated by the Met Office covering a wider range of scenarios. These will be tested for gate two to fully explore the uncertainty in climate projections and its impact on the water resource benefit of the scheme.

The Black Sluice flood model has been used to quantify the benefits associated with the proposed flood storage options. Each option provides additional flood resilience benefits by reducing the flood risk for the SFFD, the spring-fed stream wetlands particularly in Swaton and Billingborough, and the Glen downstream towards the Surfleet Reservoir.

## 2.8 Links to other options, schemes and elements

In addition to the SLR, Anglian Water and Cambridge Water are developing Fens Reservoir, a new reservoir in Norfolk/Cambridgeshire. The development of this option is independent to the SLR; it is currently considered that there is a need for both reservoirs to provide regional benefit to the east of England. It is expected that this will be confirmed in the regional plan.

Each of the three SLR concept design options is linked with the Anglian to Affinity Transfer (A2AT) SRO and the associated supporting downstream infrastructure that will require construction to distribute the flow to where it is required in the Affinity Water supply area. The A2AT SRO is considering alternative sources for the transfer, including the Fens Reservoir and the use of existing capacity at Rutland Water, supported by an intake on the Trent. If the SLR is selected as the source of water for the A2AT, it is assumed the water will be treated initially as part of the SLR scheme before further conditioning prior to connection with the Affinity Water network.

The SLR relies on a transfer of water from the River Trent. There are multiple competing demands for the River Trent, including the Minworth Effluent Reuse SRO and the Grand Union Canal SRO, which are joint schemes between Severn Trent Water and Affinity Water. The ACWG has co-ordinated a River Trent Working Group to monitor developments across these schemes and alternative sources of water will continue to be assessed for SLR as the scheme develops. Initial indications are that there is limited conflict between the SLR and the other SROs, but further investigation is planned for gate two to confirm this, supported by ongoing discussions with the EA.

1 *South Lincolnshire Reservoir (SLR) –Drinking Water Quality Report | 28/05/21 | Mott MacDonald*
2 *ACWG WQ Risk Framework Report – Final (Strategic WQ Risk Framework FINAL Report) | 19/01/21 | Jacobs*

### 2.9 Regional planning

There are complex interdependencies between Water Resources East (WRE), Water Resources South East (WRSE) and Water Resources West (WRW) regional groups and regional plans, and uncertainty exists at this stage around which configuration of SROs offers best value for customers and the environment.

The ambition for the SLR to deliver multi-sector benefits is central to WRE's approach promoting an integrated multi-sector water management plan. WRE is a critical partner in the development of the solution, with particular focus on ensuring stakeholder views are effectively considered and captured. The WRE regional plan will not only confirm if the SLR will be taken forward to delivery post-gate two, but it will also confirm what timescale the resource is required. Early indications from the regional planning suggest it is very likely to be selected due to the scale of the water resources challenges in the WRE region and the relatively limited number of feasible strategic alternatives. It is expected that the SLR will be selected even if it is not the chosen source to meet the Affinity Water deficit; Anglian Water's demand is considered significant enough to justify the need.

The timing for the need and utilisation of the SLR are also dependent on the outputs of the WRSE regional plan, which will determine which of the SROs will be selected to meet the deficit in the Affinity Water area. Even if the A2AT is selected as the preferred solution in the WRSE regional plan, it is not guaranteed that the source of the transfer will be the SLR. This is a decision that will be made via the WRE system simulator in autumn 2021.

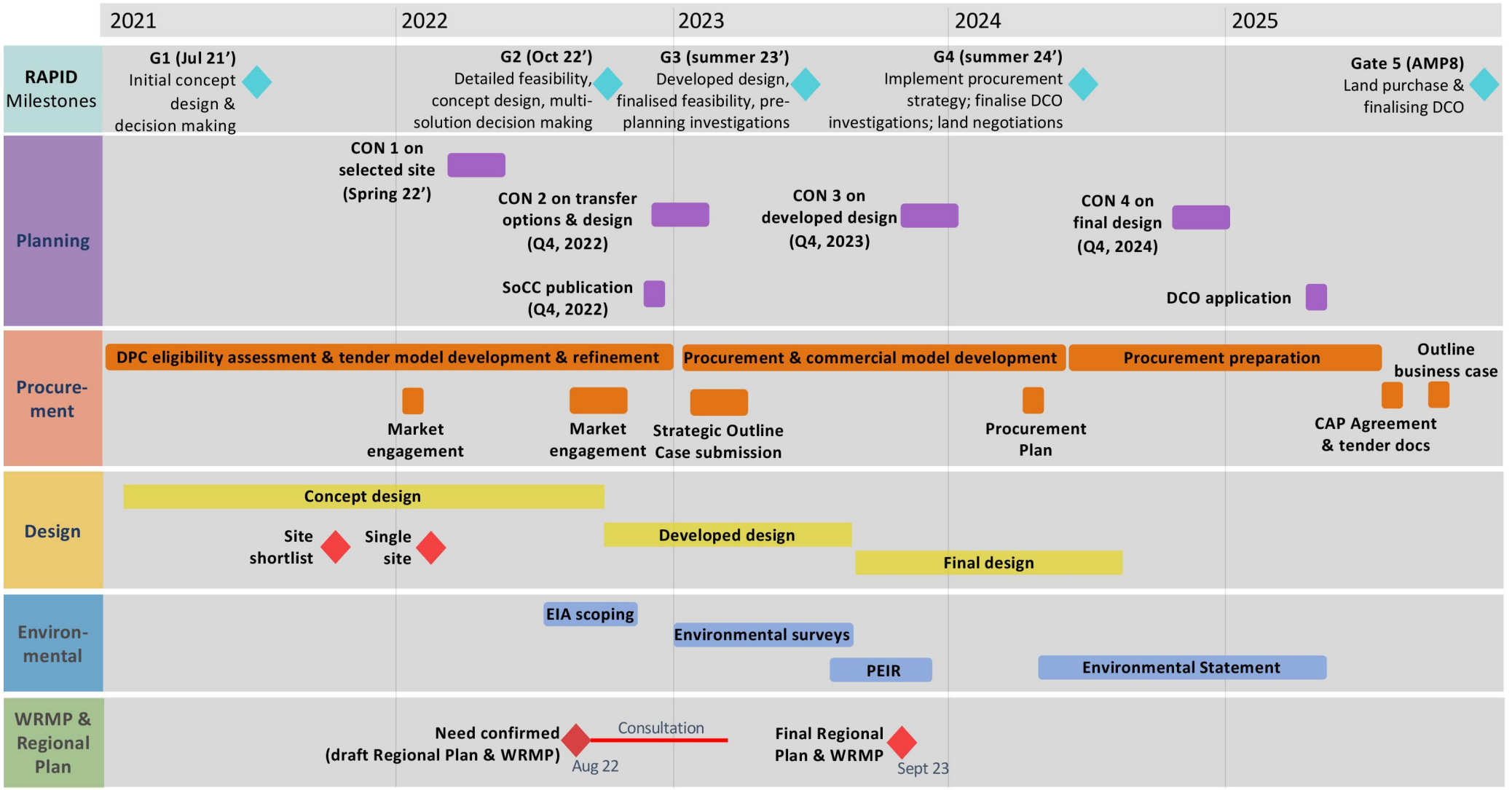
The outputs from the regional planning process will be central to the recommendation as to a) whether to take the SLR forward beyond gate two and b) the timing of the need for the new resource. The project team is therefore working closely with the regional groups to ensure the regional planning and reconciliation processes continue to align with the RAPID process and, critically, that the stakeholder engagement processes are integrated and complementary.

# 3. Outline project plan

This section sets out the key activities and outputs that will ensure successful delivery of the SLR scheme. Substantial work has been undertaken to understand the requirements and interdependencies of the RAPID gates, the WRMP and regional planning process, and the planning and procurement strategies. Baseline studies for ecology, hydrology, hydrogeology and water quality are complete; detailed studies have identified the preferred source of water; the robust site selection process has been mapped out, agreed with stakeholders and assured by an expert advisor; and the initial concepts have been designed. Procurement experts have analysed options and confirmed initial feasibility of Direct Procurement for Customers (DPC), and a planning advisor has produced the strategy for the Development Consent Order (DCO) process. This work has informed the plan and will be further refined during the next stage of the RAPID process.

The programme is currently on track and the plan presented in Figure 4 provides a coherent approach to delivering the necessary outputs for each gate, with integration across the fundamental workstreams of planning, procurement, design and enabling, and construction.

**Figure 4: Project-level plan corresponding to RAPID gates**




**CAP** = competitvely appointed provider; **CON** = public consultation; **DCO** = development consent order; **DPC** = direct procurement for customers; **EIA** = environmental impact assessment; **PEIR** = preliminary environmental information report; **SoCC** = statement of community consultation; **WRMP** = water resources management plan

## 3.1 Key activities and decisions

Figure 4 provides a summary of the key activities required to align the planning, procurement, design and enabling activities with both the RAPID gates and the WRMP and regional planning programme.

- **Planning –** It proposed that the SLR will be promoted as a Nationally Significant Infrastructure Project (NSIP), requiring a DCO (see Section 7 for more detail). As a result, the project will have to comply with the requirements and guidance associated with the Planning Act 2008, such as developing the plans for Fens Reservoir in response to consultation with a range of stakeholders, including statutory consultees, local authorities and the community. Four public consultations (CON1-4) are planned, with the first in spring 2022 (CON1) to consult on the preferred site and help inform the concept design. This comes before the need is confirmed in August 2022 but necessary to ensure sufficient detail is developed prior to gate two. The DCO application is planned for spring 2025 but will be a focus throughout the programme to ensure the process is robust and well documented.

- **Procurement –** work carried out so far has confirmed that SLR is eligible for DPC (see Section 6 for more information). Tender model development and refinement are the next key activities for procurement, with two phases of market engagement planned prior to gate two. The Strategic Outline Case (SOC) will be submitted early 2023 once the concept design is agreed and the need understood, and the Competitively Appointed Provider (CAP) agreement is planned for summer 2025.

- **Design –** the concept design will continue to be refined prior to gate two. It will utilise innovative processes and be driven by our stakeholder engagement. Further information is presented in Section 15, but the key milestone is to identify a preferred site and concept design by February 2022 to provide sufficient time to develop the detail needed for gate two.

- **Environmental –** a programme of ecology, flow and water quality monitoring is in progress to inform the gate two concept design. The Environmental Impact Assessment (EIA) scoping is planned to commence in autumn 2022, with environmental surveys following in 2023 to inform the final design process.

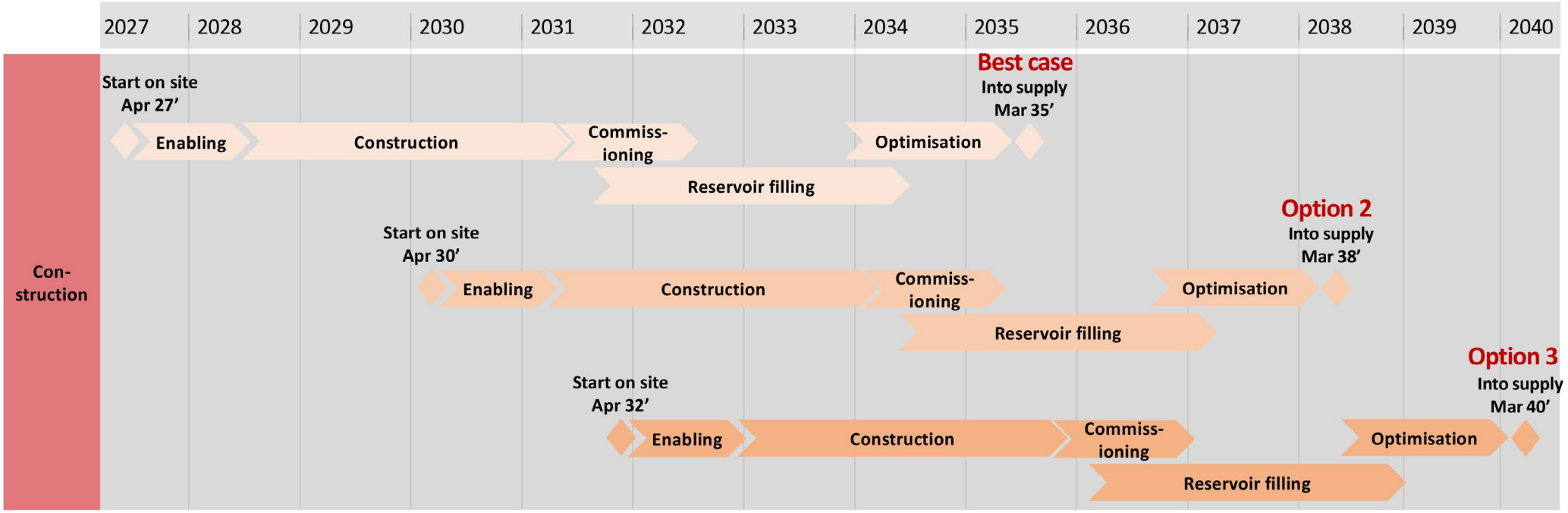
## 3.2 Construction programme

In line with RAPID aspirations, the programme provided in Figure 4 will enable a 'start on site' date in AMP8. Figure 5 presents a potential start date of 2027 and, with an estimated site programme of eight years, suggests the earliest possible deployable output date is 2035. The draft regional plan and WRMP in August 2022 will confirm the need and dictate this programme. Other options are shown to represent what is possible.

## 3.3 Assumptions and dependencies

The programme assumes that the SLR will be selected in WRE's regional plan and the need is confirmed to necessitate starting on site in AMP8, thus remaining in the RAPID standard gated process. It also assumes that the SLR is the selected option to meet the Affinity Water deficit. Although it is expected the need will remain for Anglian Water alone if another option is selected for Affinity Water, the programme is likely to differ.

**Figure 5: Project-level plan showing indicative construction timescales**



# 4. Technical information

## This section sets out the technical information and preliminary feasibility assessment for the options considered for the SLR up to gate one.

### 4.1 Initial configuration of options

Technical details for each of the three CDOs are summarised in Table 2 and detailed below.

**Table 2: Initial configuration of options**

| | CDO1 | CDO2 | CDO3 |
|---|---|---|---|
| **Trent to Witham 300Ml/d raw water transfer** | River intake, pumping station, INNS treatment and 9.5km long, 1.7m diameter pipeline | | |
| **Witham to SLR 500Ml/d raw water transfer** | River intake, pumping station and: | | |
| | 12.5km long, 2.2m diameter pipeline | 4km long, 6m wide new open water channel, 15.5km transfer via SFFD and 3.7km pipeline transfer | 4km long, 6m wide new open water channel, 24.9km transfer via the SFFD |
| **PWS 50MCM reservoir** | 8km long embankment, height between 11m and 16m | 9.2km long embankment, height between 1.6m and 18.6m | 8.2km long embankment, height between 10.3m and 14.3m |
| **Water treatment works** | Located adjacent to the proposed PWS reservoir, to include coagulation, clarification, filtration, pesticide removal, ozonation, GAC adsorption, disinfection with hypochlorite solution and chemical dosing. | | |
| **Flood storage areas** | 2.5MCM SFFD FSA with 3.3km long embankment with a height of between 0.5m and 3.6m | – | 4MCM River Glen FSA with 7km long embankment with a max height of 3.8m |
| **Bank storage wetland** | – | Two bank storage wetlands with 3km long, 0.7m embankment, provision for biodiversity net-gain | |
| **Spring-fed stream wetlands** | – | Five spring-fed stream wetlands with embankment of up to 2.5m height | |
| **Farm reservoirs irrigation supply** | 2.5MCM incorporated into PWS reservoir volume | – | Three 1MCM farm reservoirs |
| **SLR 150Ml/d transfer to existing PWS service reservoir north of Peterborough** | 38.5km long, 1.2m diameter pipeline | 40.5km long, 1.2m diameter pipeline | 21km long, 1.2m diameter pipeline |
| **Amenity features** | For all design options, we would seek to include amenity features for the public, such as cycle routes and water-based activities where appropriate. | | |

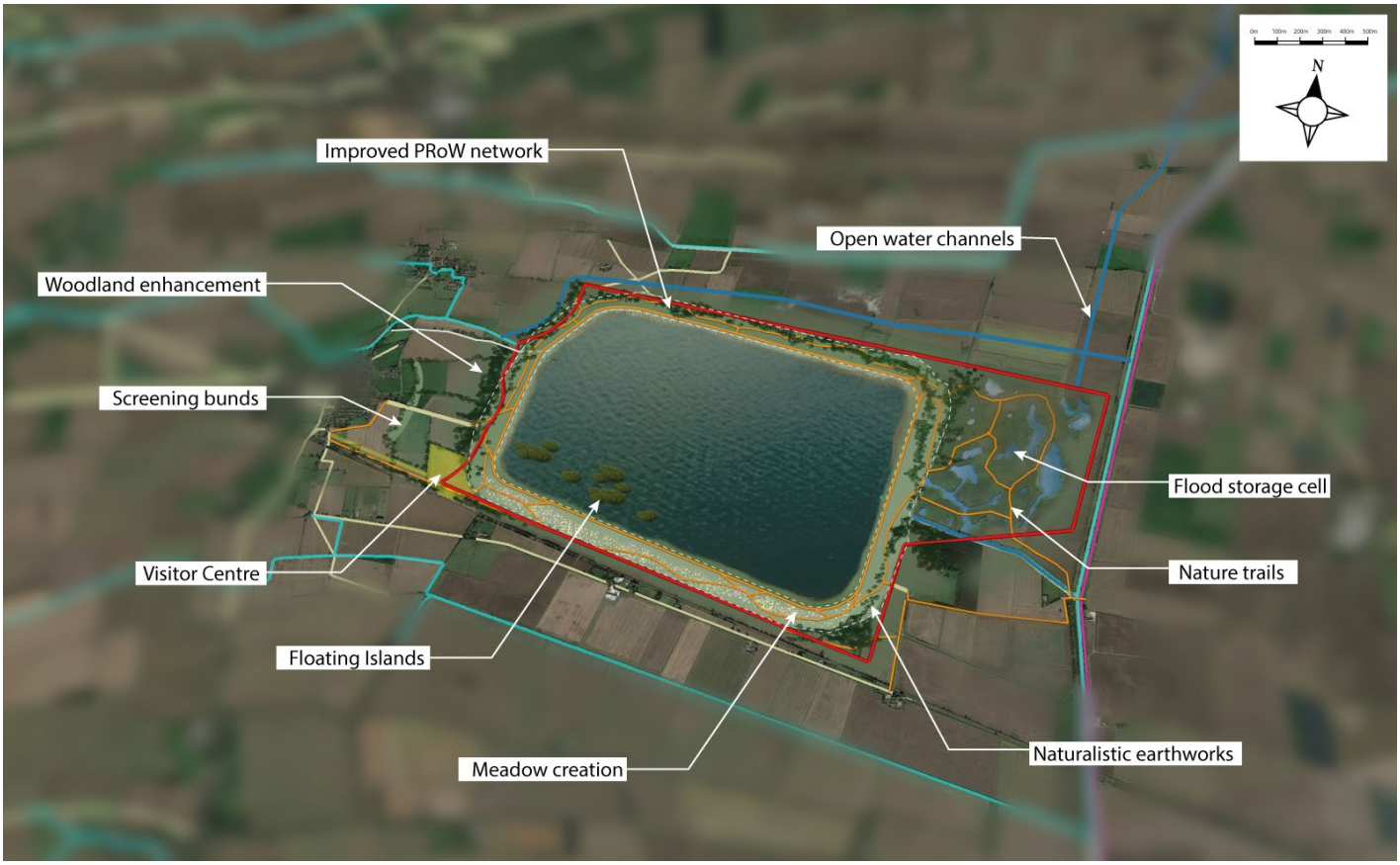
A nominal site has been identified for each of the three concept design options for the purpose of this preliminary feasibility stage. The site locations for each have been selected to inform the provisional concept design options by considering the range of design constraints that could affect the development of the proposed scheme, such as ground conditions and development constraints. In parallel, a robust site selection process is underway in collaboration with stakeholders, and an agreed site will be presented at gate two.

The SLR is expected to be filled principally from the River Witham and the SFFD. A comprehensive study area in the surrounding catchment is being considered for the location of the main large reservoir and additional features included in the concept designs. The geology across the study areas comprises superficial deposits overlying Oxford Clay, Kellaways Sand and Clay, Cornbrash and the Lincolnshire Limestone. The stratigraphy varies considerably across the area and the structural geology will be a fundamental consideration in the site selection process.

### 4.1.1 Concept Design Option 1 (CDO1)

The proposed configuration for the 52.5MCM reservoir in CDO1 includes a large earth-bunded storage reservoir with transfers of water both in and out while including for all appropriate draw-off works. The proposed design includes two direct intakes: the first from the River Witham (500Ml/d) and the second from the SFFD (150Ml/d) with pressurised transfer into the PWS reservoir. A landscape visualisation on the reservoir and associated FSA is presented in Figure 6.

**Figure 6: Visualisation of proposed PWS reservoir (CDO1)**




The earthen bund for CDO1 is 8km in length with an embankment height of between 11m and 16m. The core material is expected to consist of glacial till excavated from an internal borrow area, with the anticipation that works will achieve an appropriate cut fill balance. Water storage for flood control is provided by a separate 2.5MCM flood storage cell located adjacent to the proposed PWS site. This flood storage cell would be formed by an earthen bund 3.3km in length and an embankment height of between 0.5m and 3.6m to enable bulk water transfer by gravity to the main PWS or for subsequent release back to the SFFD as required. Flow control to the flood storage cell would be achieved through a gravity inlet sluice, with flows discharged by pump to the PWS reservoir or back to the SFFD, as required.

### 4.1.2 Concept Design Option 2 (CDO2)

The proposed configuration for the 50MCM reservoir in CDO2 includes a large earth-bunded storage reservoir with transfers of water both in and out while including for all appropriate draw-off works. The PWS reservoir would consist of an earthen bund 9.2km in length and an embankment height of between 1.6m and 18.6m. The core material at this nominal location would consist of Oxford Clay sourced from an internal borrow area located within the reservoir footprint. CDO2 also includes two separate 0.5MCM bank storage wetlands, and a landscape visualisation on the reservoir is presented in Figure 8.

The design includes an open water transfer consisting of a new 4km long, 6m wide canal linking the River Witham to the SFFD. Flows would then be transferred along the SFFD for 15.5km and finally to the PWS reservoir via a new open water channel extension to the SFFD and a final 3.7km long pipeline with a pumped transfer capacity of 500Ml/d. Widening of the SFFD has been incorporated into the design in order to provide the required capacity to enable the transfer of flow upstream. The proposed design intends to maintain the existing drain invert level but would need to extend the cross section by 15.5m for the 11.5km where the transfer would be envisaged to give a total cross-section width of 18.1m. It is also noted that the raw water transfers via the SFFD have been designed to ensure continued navigation within the same watercourse.

**Figure 7: Visualisation of proposed PWS reservoir (CDO2)**


In addition to the main transfer, it is proposed that local water sources are captured for use through two bankside storage wetlands, which would provide additional support for irrigation as well as the PWS reservoir. Diversion into the wetlands is proposed to take place from October to June at a maximum rate of 20Ml/d and when flow in the SFFD is above Q40. Water would then be released back into the SFFD during July to September at a rate of 5Ml/d. The proposed 0.5ha sites are designed to provide a biodiversity net gain with improved water quality through the establishment of 3km long and 0.7m high embankments, with provision for edge water plants, macrophyte beds and potential recreational facilities.

Five online spring-fed stream wetlands have been included to the west of the SFFD to help slow the flow of water, provide additional flood resilience and improve water quality. These stream-fed wetlands have been designed to store 0.1MCM through the construction of small earthen bunds of up to 2.5m in height, providing flow control on the associated watercourses while enabling the storage of water through the flooding of land for up to 1.2km upstream of the proposed embankment locations and allowing release during drier periods. Note, these are not shown in Figure 9 as they are located outside of the image boundary.

### 4.1.3 Concept Design Option 3 (CDO3)

The proposed configuration for the 50MCM reservoir in CDO3 includes a large earth-bunded storage reservoir with transfers of water both in and out while including for all appropriate draw-off works. The PWS reservoir would consist of an earthen bund of 8.2km long and an embankment height of between 10.3m and 14.3m, with abstractions from the River Witham conveyed through an open water transfer via the SFFD. The bund core at this nominal location would be constructed from the underlying Oxford Clay sourced from a borrow pit located within the reservoir footprint. A landscape visualisation of the reservoir is presented in Figure 9.

The open water transfer is proposed to transfer 500Ml/d and would consist of a new open water channel between the River Witham to the SFFD, 4km in length and 6m wide, in addition to widening the SFFD itself for 24.9km by extending the cross section by 9.3m to give total cross-section width of 12.1m and excavations within the channel to lower the invert by 2m.

CDO3 includes a dedicated flood storage area (FSA) adjacent to the River Glen. The proposal is for a 4MCM storage cell consisting of an earthen bund of 7km long and a maximum height of 3.8m designed to capture flood flows from the River Glen, with subsequent transfers made to the PWS reservoir in order to increase yield. Flows up to 150Ml/d would be able to be released either to the SLR or back to the River Glen via the Bourne Eau, with flow transferred from the FSA to the Bourne Eau via a new 1.6km long, 8m wide open water channel and subsequent flow from the Bourne Eau transferred to the SLR via a 2.8km long pipeline.

**Figure 8: Visualisation of proposed PWS reservoir (CDO3)**

In addition to this, local sources would be captured and stored within two 0.5MCM bank storage wetlands to support water supply both for irrigation and the PWS reservoir. The design for these would be the same as for CDO2.

CDO3 also includes five online 0.1MCM spring-fed stream wetlands to the west of the SFFD to help slow the flow of water and provide additional flood resilience. These wetlands are designed to store 0.1MCM through the construction of small earthen bunds of up to 2.5m height, providing flow control on the associated watercourses while enabling the storage of water through the flooding of land for up to 1.2km upstream of the proposed embankment locations and allowing release during drier periods. Note, these are not shown in Figure 9 as they are outside of the image boundary.

This option also includes farm irrigation reservoirs located to the east of the SFFD to further supplement water availability in the local area. Although these irrigation reservoirs would have no direct operational link to the PWS reservoir, they would provide additional benefit to local stakeholders and landscape. Abstraction for the reservoirs would occur from the SFFD.

In all designs, rapid drawdown facilities have been considered to allow for the safe removal of water from the PWS reservoir in an emergency. This is achieved by means of a permanent siphon installed at the site, which discharges into the SFFD by means of a drawdown channel.

## 4.2 Initial costing and estimating report

To ensure consistency in costing, the ACWG guidance[3] has been followed and relevant templates have been used. Recent WRMP guidelines and HM Treasury Green book guidance[4] have both been followed for the valuation of greenhouse gases. The overall estimate of carbon emissions has taken on best practice, using PAS2080 accredited carbon data and tools. The assessments have also taken into account ACWG guidance on consistency of data sources and scope boundaries.

### 4.2.1 Approach to costing and data used

The approach to costing has been driven by the best available data for the concept designs based on their level of development. Where possible, existing costing systems have been used, which have gone through significant assurance and are considered the most representative cost estimates available. Where this has not been possible, due to the size or type of assets being delivered not being covered by existing cost data, unit rates have been used that represent industry norms and have been validated through benchmarking industry data. Costing reflects the early stages of design development for each of the concept designs; more refined costing will be provided following further scheme definition.

Optimism Bias is the tendency to be over optimistic about large infrastructure projects, resulting in the underestimation of project costs, as well as other project parameters such as duration. To account for this, and in line with the ACWG methodology, a percentage uplift has been applied to the scheme costs. As the development of the schemes progress and the associated uncertainty decreases, the percentage uplift will be reviewed and reduced accordingly. A project risk register has been developed and is summarised in Section 9. The risk register has been used to inform the OB assessment to ensure that sufficient allowance has been made for uncertainty in project costs. The risk register will continue to be developed with risks quantified and used to monitor and manage ongoing cost risk as the scheme develops.

Indirect costs vary dependant on the size and type of scheme. The SLR is significantly larger than any scheme delivered by Anglian Water or Affinity Water and therefore consideration will need to be made with respect to whether the typical client indirect cost allowances are suitable for a scheme of this scale. For gate one, the total indirect cost allowance for the concept design options are 78% of base materials Capex cost.

An allowance has been made for capital replacement costs based on the recommendations by the ACWG on asset life for water resources planning. Asset capital replacement costs were calculated after an estimated capital construction period of 10 years. This will need further refinement once a specific capital delivery profile is developed.

### 4.2.1 Capital costs (Capex)

Overall costs for each option, including OB, range from £1.09billion to £1.82billion. The cost for the SLR option included in WRMP19 was £820million (excluding multi-sector benefits or optimism bias). The baseline option (CDO0) is comparable to the WRMP19 option and comprises only the PWS elements of the concept design options. It is costed at £1.09billion. CDO0 has been included for costing comparison purposes only and is not being taken forward as an option for consideration in this scheme.

### 4.2.2 Operational costs (Opex)

The Opex for the reservoir, pipelines and treatment works have been calculated to include power consumption of mechanical scoped elements, such as pumping stations; chemical consumption at the treatment works; and an estimate of maintenance costs. The Opex ranges from £10.67million to £12.20million per year, with CD02 having the smallest Opex and CD03 the greatest.

### 4.2.3 Whole-life costs

The net present value (NPV) has been calculated using the standard Treasury Green book discount rate which starts at 3.5% and drops to 3% and 2.5% after 30 and 60 years, respectively. Capital and operational carbon emissions have also been monetised using the Treasury Green book traded and non-traded price of carbon. PV costs have all been calculated over 100 years and assume a 10-year construction period before operating costs and carbon start.

3 *Mott MacDonald (2020), Cost Consistency Methodology, Technical Note and Methodology*
4 *Green Book supplementary guidance: valuation of energy use and greenhouse gas emissions for appraisal - GOV.UK (www.gov.uk)*

Table 3 shows that the NPV costs for all concept designs, shown including and excluding carbon costs. CDO1 has the lowest whole life NPV costs over 100 years at £1.34billion, and CDO3 has the highest NPV costs at £2.13billion.

**Table 3: Overall estimate of average annual operational costs for each concept design**

| | £million | | | |
|---|---|---|---|---|
| | CDO0 | CDO1 | CDO2 | CDO3 |
| **NPV cost** | 1,240 | 1,340 | 1,550 | 2,130 |
| **NPV carbon** | 40 | 70 | 70 | 80 |
| **Total NPV costs** | 1,280 | 1,410 | 1,620 | 2,080 |

During the next stage of the RAPID process and beyond gate two, the impact of the scheme will be tracked across all six capitals: financial, manufactured, intellectual, human, social and relationship, and natural.

### 4.2.4 Embodied and operational carbon emissions

In addition to the assessment of cost, carbon assessments have been developed for each of the concept design options. Due to the current level of development for gate one, there is still significant uncertainty embedded into the proposed values, and the aim will be to reduce this uncertainty as much as possible as the scheme develops further. An assessment of the opportunities to reduce carbon to meet net-zero commitments are presented in Section 5.9.

The carbon assessments for the river intake and conveyance pipelines were carried out separately to the reservoirs using existing carbon data from Anglian Water's carbon calculator. The carbon calculations have followed best practice from the CESMM4 Carbon & Price Book[5].

A summary of the capital carbon cost is summarised in Table 4. CDO3 has the largest capital carbon footprint at 527kt$CO_2$e. CDO2 has the lowest capital carbon footprint at 380kt$CO_2$e, despite having a higher cost than CDO1. All the concept design capital carbon emissions are dominated by the PWS reservoir construction and the pipelines. Construction of the various flood storage areas also contribute a significant capital carbon emissions source for CDO1 and CDO3.

**Table 4: Overview of capital carbon costs for concept designs by scheme element**

| Scheme element | $tCO_2e$ | | | |
|---|---|---|---|---|
| | CDO0 | CDO1 | CDO2 | CDO3 |
| **PWS reservoir** | 213,000 | 190,500 | 195,300 | 253,200 |
| **SFFD FSA** | – | 33,100 | – | – |
| **Farm reservoirs** | – | – | – | 28,400 |
| **River Glen FSA** | – | – | – | 42,000 |
| **SFFD and open channel transfer** | – | – | 27,400 | 88,100 |
| **Wetlands** | – | – | 16,500 | 16,500 |
| **Pipelines (combined)** | 152,400 | 154,800 | 115,400 | 72,500 |
| **South Lincolnshire Reservoir WTW** | 18,300 | 18,300 | 18,300 | 18,300 |
| **INNS WTW** | 7,500 | 7,500 | 7,500 | 7,500 |
| **Total Carbon** | **391,200** | **404,200** | **380,400** | **526,500** |

Operational carbon has been estimated for each option (maintenance carbon is yet to be completed). This has been based on applying emissions factors from the UKWIR CAW v14[6] and future projects from the Treasury Green book data table 1 (Grid Average EF for the Commercial/ Public sector for 2021)[7]. Table 5 provides a summary of the estimated operational carbon impact of each concept design.

5 *CESMM4: Carbon & Price Book 2013; Mott MacDonald & BRE; ICE Publishing*
6 *Workbook for Operating Operation GHG Emissions – Version 14; UKWIR (08/12/20)*
7 *https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/793632/data-tables-1-19.xlsx (Table3)*

**Table 5: Overview of average annual operational carbon costs for concept designs by scheme element**

| Scheme element | $tCO_2e$/year[A] | | | |
|---|---|---|---|---|
| | CDO0 | CDO1 | CDO2 | CDO3 |
| **Reservoir pumping stations** | 1,879 | 99 | 1,537 | 4,001 |
| **SFFD to SLR** | – | 1,183 | 3,787 | 2,840 |
| **Bourne Eau** | – | – | – | 1,893 |
| **River Witham to SLR** | 4,734 | 4,734 | – | – |
| **SLR to Anglian Water service reservoir** | 4,734 | 4,734 | 3,787 | 3,787 |
| **SLR treatment works** | 5,548 | 5,548 | 5,548 | 5,548 |
| **River Trent to River Witham** | 3,787 | 3,787 | 3,787 | 3,787 |
| **INNS treatment works** | 6,921 | 6,921 | 6,921 | 6,921 |
| **Maintenance** | TBC | TBC | TBC | TBC |
| **Total Carbon** | **27,602** | **27,005** | **25,367** | **28,777** |

*A Assumes running at full capacity*

## 4.3 Data provided to regional groups

To support the WRE regional simulator assessment in advance of completion of the regional modelling, a sub-regional model focusing on the Anglian Water Ruthamford system has been developed. Apart from PWS needs, the WRE simulator incorporates the demand for agriculture and industry, as well as the environmental requirements defined by the Environmental Flow Indicator. A multi-criteria optimisation will define the preferred regional portfolio of supply and demand options to fulfil the needs of all sectors, with the SLR being one of the supply side options considered.

To ensure consistency between the WRE simulator and the DO assessment conducted for the SLR, the updated hydrology assessments completed as part of this work for the Witham, Trent, Black Sluice, Welland and Nene catchments have been shared, as well as the proposed abstraction licence arrangement for potential new intakes. In the WRE simulator, the storage capacity of the SLR is not fixed, allowing the optimisation to select the optimum size considering the wider regional needs and options. However, the configurations to be tested have been defined based on the concept designs presented in this gate one submission, allowing also for a variable Trent transfer capacity (including no transfer).

## 4.4 Initial water resource benefit assessment

Several baseline studies have contributed to the estimation of the water resource benefit of the scheme. A new hydrology assessment has been produced, in close collaboration with the EA, using the most up-to-date climate, hydrometric and artificial influence information. The assessment has adopted innovative rainfall-runoff modelling techniques, involving distributed approaches in areas with limited or unreliable flow data and cross-checking results with EA regional groundwater models to increase the reliability of the results.

Potential extreme droughts have been derived using a weather generator conditioned by climate drivers that represent key aspects of the climate system. Stochastic rainfall and potential evapotranspiration series have also been perturbed to represent conditions in the 2050s using the latest Met Office UK Climate Projections (UKCP18). For this stage of assessment, only one medium-range climate change scenario has been adopted corresponding to the high-emissions pathway.

Different potential sources of water for the reservoir have been tested and compared in terms of the yield they could sustain using Aquator modelling. They included several catchments in the Anglian region, as well as the River Trent either through the existing Trent-Witham-Ancholme Scheme (TWAS) or a new transfer. Potential abstraction licence constraints have been introduced as agreed with the EA, and several reservoir capacities tested. Results evidenced that the River Trent with a new transfer would be the optimal additional source of water in combination with the River Witham to maximise the yield of the SLR. A new abstraction licence at North Muskham would include a Q90 flow condition that would allow this transfer to operate not solely in winter/wet periods but also during dry years, thereby reducing the storage volumes required. It is also the most resilient source of water against climate change. The TWAS could support the SLR under current conditions within the existing licence at Torksey, but in the future, with the expected increase in the Ancholme demand and the reduction in Witham flows, this would not be feasible.

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In addition to the River Trent, the River Witham can also provide significant water to the SLR given that the likely Hands-off Flow (HoF) for a new licence would be around Q60 according to the EA latest review of the Witham abstraction licensing strategy. A review of the EA Lincolnshire Limestone groundwater model confirmed that no significant changes to this HoF would be expected in the future. The abstraction would operate mainly from end of autumn to early spring, even during droughts when flows are above the HoFs.

There are other sources in the Anglian River Basin District that could potentially be used to support the SLR, in particular the Nene and the SFFD. However, to reach the same level of yield as in the option with a new Trent transfer, the SLR storage capacity would need to be doubled. These sources would also be significantly impacted by climate change, reducing the benefits they could provide. Therefore, they were preliminarily discounted at this stage and a Trent transfer in combination with the Witham and potentially the SFFD adopted. As the scheme develops and once the regional plan identifies the preferred portfolio, this decision might be revisited, especially if the availability of water in the Trent decreases due to other potential users or this source is found unsuitable due to water quality issues. Capturing high or excess flows from the Nene and Welland in combination with a larger storage capacity could be an alternative to consider. Likewise, the SLR could progress with a reduced output if other regional options are developed.

The yield assessment concluded then that a 50MCM SLR supported by a new 300Ml/d Trent transfer could provide more than 150Ml/d under climate change conditions if piped transfers are adopted. If open water transfers are adopted instead, yield would still be close to 150Ml/d while making use of the SFFD flows to partially offset the evaporative and seepage losses. The choice of these sources has been supported by a preliminary water quality risk assessment based on available sampling information and land use, which has not identified major concerns, and by a preliminary INNS risk assessment, which has concluded a similar risk for all sources and has initially identified mitigation needs. These studies will be revisited for gate two based on the results of a new monitoring programme. Likewise, a pilot study on the application of hydro-ecological modelling to determine environmental flows in freshwater flowing waterbodies and on the relationship between flow and water quality in level-managed watercourses has been undertaken and discussed with the EA. This will be further developed to inform the proposed abstraction licence arrangement for gate two.

The preferred SLR configurations (sources and storage capacity only) have been modelled for conjunctive use DO to establish the water resource benefit of the scheme when connected to the network. This allowed for infrastructure and licence constraints to limit the supply from the reservoir and for a combined operation of the scheme with other existing sources. The configurations have been added to the WRE sub-regional model for the Ruthamford system to enable testing of a wider set of climate conditions given its quick runtime. The transfer to Affinity Water has been incorporated as a time series of deficit calculated within the Affinity Water's portion

of the WRSE regional system simulator for two levels of maximum demand (50Ml/d and 100Ml/d). The Scottish method for establishing the DO has been implemented, where the system is simulated for the whole set of climate change perturbed stochastics for different values of demand and number of years with a failure (when rota cuts are required) recorded. The DO was then estimated as the maximum demand that can be satisfied without failing more than one in every 500 years.

This has resulted in a final water resource benefit of 182Ml/d for CDO1 and 151Ml/d for both CDO2 and CDO3, with the reduction in DO in the latter due to the impact of evaporative/seepage losses associated with open water transfers. Further work will examine whether the seepage losses could be minimised. These DO estimates assume that Anglian Water is the sole recipient of the reservoir output. If the transfer to Affinity is included, there would be additional conjunctive benefit to DO given the different timing of drought stress periods and storage requirements of the water companies, as described in Section 2.4. The operational management of the scheme will be further developed during gate 2, but the initial water resource modelling carried out for Gate 1 indicates that using the resource conjunctively could improve the overall DO of the scheme by up to 25% (assuming the maximum 100Ml/d take by Affinity Water). This confirms that the SLR would be able to satisfy up to 100Ml/d of Affinity Water demand and at the same time contribute to a significant increase in DO for Anglian Water.

## 4.5 Wider benefits

The South Lincolnshire Water Partnership have been involved in the development of the three concept design options for this preliminary feasibility assessment. The design options are being used as a proof of concept of how the scheme could provide wider benefits beyond PWS. They include different features targeting different sectors and following adopted design principles with the aim of realising synergies and maximising outcomes to provide not only best value for water company customers but also the communities close to the reservoir and the environment.

The concept design options have been modelled in Aquator to establish the benefits to agriculture in terms of irrigation supply, and flood risk benefits in terms of the reduction of maximum flows, while identifying a potential increase in PWS from integrated water resources management. While the concept design options should not be directly compared, the benefits from each element are summarised in Table 6.

**Table 6: Overview of benefits of each concept design option**

| Benefit* | CDO1 | CDO2 | CDO3 |
|---|---|---|---|
| **Public water supply** | +++ | ++ | ++ |
| **Irrigation supply** | +++ | n/a | ++ |
| **Flood level in SFFD (1 in 2-year return period)** | + | +++ | +++ |
| **Flood level in SFFD (1 in 20-year return period)** | +++ | ++ | + |
| **Flood extent** | ++ | ++ | ++ |
| **River Witham flood benefit** | n/a | ++ | + |
| **River Glen flood benefit** | n/a | n/a | + |

** Benefits have been scored qualitatively in relative terms.*

Further benefits are highlighted in Section 5.7.

# 5. Environmental and drinking water quality considerations

**This section summarises the initial environmental assessments and drinking water quality risk assessments that have been completed for the SLR solution.**

## 5.1 Environmental assessment overview

An Environmental Assessment Report (EAR)[8] has been completed for the three concept design options. The EAR was undertaken in-line with the methodology in the ACWG environmental assessment guidance[9] and will align to the regional Integrated Environmental Assessment approach that will be completed by WRE.

Three accompanying regulatory assessments have also been completed: Habitats Regulations Assessment (HRA)[10], Water Framework Directive (WFD) Assessment[11], and Strategic Environmental Assessment (SEA)[12]. The regulatory assessments are summarised in the following sections.

In addition, the risk of spreading INNS associated with the options has been investigated, Biodiversity Net Gain (BNG) and Natural Capital (NC) assessments have been undertaken, the wider benefits of SLR have been reviewed and opportunities for the SLR options to contribute to net-zero carbon emission objectives have been investigated. These studies are summarised in the following sections and the full assessments are provided in the EAR.

## 5.2 Habitats Regulations Assessment (HRA)

The options for the SLR have been subject to a HRA Stage 1 assessment. For all the options, it concluded that one pathway identified during operations linked to water abstraction and reduction in flows had the potential to affect the following designated sites: the Wash Special Protection Area (SPA); the Wash Ramsar; the Wash and North Norfolk Coast Special Area of Conservation (SAC); Humber Estuary SAC; Humber Estuary SPA; and Humber Estuary Ramsar.

The Stage 1 assessment indicated that all options should be subjected to a HRA Stage 2 Appropriate Assessment (AA). The AA has not been undertaken at this stage, as further modelling is being developed to confirm whether the existing flow conditions prescribed by the EA based on the Environmental Flow Indicator at the location of the potential intakes are appropriate to maintain ecological conditions downstream. Once this work is completed, any associated changes to the assumed abstraction licence strategy will be discussed with the EA and Natural England to ensure no likely significant effects on Natura 2000 sites.

## 5.3 Water Framework Directive (WFD) assessment

The WFD assessment provides information on the WFD screening (Level 1 – basic screening) and further assessment (Level 2 – detailed impact screening), where appropriate, for the three concept design options.

The Level 1 WFD assessment indicated that a number of waterbodies would need to be 'screened in' and would require Level 2 assessments for all of the options. These include Black Sluice Internal Drainage Board (IDB) draining to the SFFD; River Trent from Soar to The Beck; River Witham – confluence of Cringle Brook to confluence of the River Brant; Lower Witham.

CDO2 additionally required the transfer to the Anglian Water service reservoir to be screened in, and CDO3 also required the River Glen to be screened in.

## 5.4 Strategic Environmental Assessment (SEA)

The three options are predicted to generally result in similar minor positive, neutral or minor negative effects across all the SEA objectives both for construction and operation. There are major positive effects identified across the options for the wider community if wider benefit features are implemented, such as visitor centres and enhanced public rights of way/cycle routes. In addition to these broader benefits, there are also positive effects identified due to the improved reliable and resilient water supplies.

All the options identify that there could be negative effects on the functionality, quantity and quality of soils due to the reservoirs and pipelines falling within Grade one, two and three agricultural land. The assessments do identify that this soil could be reinstated where the pipelines are buried. However, there will be permanent loss of agricultural land as a result of reservoir construction.

It is noted that the SEA does not at this stage include for any in-combination assessment with other SROs, water company capital investments or third-party development plans or projects. However, there is no specific requirement to undertake a full cumulative effects assessment for gate one, and it is proposed that the SEA will be reviewed at gate two once the solution has progressed and the regional plans have developed further.

*8 Environmental Assessment Report | 21/04/21 | Mott MacDonald*
*9 All Companies Working Group (ACWG) WRMP environmental assessment guidance and applicability with SROs (Mott MacDonald, 2020)*
*10 Habitats Regulations Assessment | 15/04/21 | Mott MacDonald*
*11 Water Framework Directive Assessment | 21/04/21 | Mott MacDonald*
*12 Strategic Environmental Assessment | 21/04/21 | Mott MacDonald*

## 5.5 Invasive Non-Native Species (INNS) risk assessment

An initial INNS risk assessment was undertaken to screen the risk associated with the transfers included in the concept design options. The assessment compared the concept design options against relevant EA guidance and other key legislation.

The assessment area included the WFD operational catchments of the potential abstraction sources (rather than a specific assessment of each option). The assessment highlighted the presence of 26 INNS, which was supplemented by field surveys, which identified a further 16 INNS. Screening against EA guidance highlighted that all waterbodies are connected to Canal and River Trust (CRT) navigable canals. A more detailed risk assessment will need to be completed, which the EA will use to decide whether subsequent mitigation is required.

Key design and operational risks highlighted include the nature of the transfer to the concept design options (eg. open channel or pipeline) and recreation along the transfer or in the reservoir. In the case of an open channel or recreational use within the transfer or reservoir, effective mitigation would need to be applied to reduce the risk of INNS spread. For all options, the water abstracted from the River Trent will need to be treated to minimise the risk of the inter-catchment transfer of INNS into the River Witham. A treatment facility is proposed, located adjacent to the River Trent and is included within all options.

## 5.6 Biodiversity Net Gain (BNG) and Natural Capital (NC) assessments

High-level BNG and NC assessments were undertaken on the proposed pipeline routes and locations for the concept design options. For each option, an assessment of the potential impact of construction and operation of the option on each NC stock was undertaken, using the BNG metric. The NC metrics were then quantified as ecosystem services in order to provide monetised values for NC benefit or loss.

All options will lead to the permanent loss of arable farmland stocks. The provision of new NC stocks, including wetlands, surface water and landscape screening (woodland and grassland), is generating an overall gain in high-value stocks post-construction. There will be an overall gain in BNG habitat units due to the generation of new high-value habitats post-construction.

In terms of ecosystems service, all options are expected to improve the future value, as stocks are expected to be created and improved. However, the permanent loss of arable land would have an impact on food provision. It is too early in the process to confirm the grade of farmland to be impacted. This will be considered as part of the screening criteria for site selection.

## 5.7 Benefits assessment

There is great ambition to ensure this solution brings many benefits to customers, the environment and the local area. An innovative Systematic Conservation Planning project is underway to understand and agree the level of ambition with stakeholders and identify priority areas for natural capital action. More detail is provided in Section 8.4. Benefits being considered include flood control; increased access to water for agriculture; economic benefits such as growth enabled by increased water supply, job creation, and a potential tourist and leisure destination; enhanced biodiversity in the region and habitat creation; carbon sequestration; and navigation. The opportunities identified in the NC assessment have the potential to contribute to Government ambitions for environment net gain; this could take the form of habitat compensation, creation and/or species relocation schemes. Further work is planned to assess these benefits prior to gate two.

## 5.8 Landscape assessment

A Landscape Concept Design has been developed with the aim to assess the landscape sensitivity for the three concept design options. Each of the options has been indicatively visualised to provide a better understanding of how the SLR would integrate into three different locations. As the landscape designs develop, they will aim to minimise the impact of a reservoir embankment in a typically flat landscape. The initial landscape plans are presented in Annex A.

The concept design options share common aspirations and opportunities that are applicable to all sites in addition to more location specific proposals. Shared aims that seek to enhance the existing environment and provide lasting and measurable change to the local communities include:

- **Wetland creation –** creation helps promote ecological benefits, restore wetland landscapes and promote sustainable development.
- **Floating island ecosystems –** riparian ecosystems are critical for many species of fish and aquatic life which can provide a measurable increase towards BNG.
- **Enhanced access and connectivity –** recreational provision of footpaths, cycle paths and nature trails will provide positive opportunities for the local community and other visitors.
- **Species-rich meadow creation and woodland enhancement –** wildflower measures offer a diverse and attractive habitat for invertebrates, birds and mammals. Native shrub and woodland planting will help link existing woodland links and enhance natural wildlife corridors.
- **Visitor centre/outdoor recreation hub –** multi-use venue that can both serve on-site recreational activities, school visits, corporate workshops and serve as a community hub.

## 5.9 Assessment of opportunities for net-zero carbon contributions

A key part of delivering an efficient net-zero strategy is to focus efforts on where the largest and most efficient reductions can be made. As a starting point, it will be important to develop an understanding of the major carbon contributors from a capital and operational perspective for the scheme to help focus efforts on areas with the greatest reduction potential. A more granular baseline will be analysed as the scheme progresses to provide a more detailed understanding of specific carbon emission sources for the scheme.

### 5.9.1 Capital carbon reduction opportunities

- Earth works: the most significant source of carbon emissions during construction in all three concept design options will be associated with the earth works for the reservoirs. To reduce capital carbon, the following key areas have been identified:
  - Minimising earthworks movements and double handling.
  - Minimising the use of imported materials and maximising use of materials on site.
  - Use of low or zero-carbon plant vehicles, an opportunity which may become available as electrical and hydrogen technology matures. This will rely on suitable plant vehicles being available and will require early coordination with the supply chain (contractors and plant manufacturers).
- Materials (reinforced concrete, pipelines): there is also a significant amount of embodied carbon in the reinforced concrete required for elements of the scheme and the material for the pipelines for the transfers. Specification of the lowest-carbon materials and working with the supply chain to reduce the embodied carbon of supplied materials will further reduce the carbon impact.

### 5.9.2 Operational carbon reduction opportunities

The aim for operational carbon is to deliver a net-zero solution by reducing energy use through operational efficiencies in design and providing the resultant energy requirement through renewable sources. Power consumption and the power intensity of the pumping requirements and the treatment processes is the most significant source of operational carbon emissions. Mitigation options include:

- Opportunities for renewable generation: the scheme could look to generate all, or a proportion, of the power requirements through renewables onsite. Alternatively, the scheme could look for commercial arrangements to procure green power through a direct wire Power Purchase Agreement (PPA).
- Procurement of green tariff electricity: Renewable Energy Guarantees of Origin (REGO) backed green energy tariffs would reduce the generation impact of grid power from the grid average to zero but would still incur the associated transmission and distribution losses associated with grid supply.

## 5.10 Initial drinking water quality considerations and risk assessments

### 5.10.1 Water Quality Risk Assessment

A Water Quality Risk Assessment (WQRA) was carried out for the SLR scheme. The purpose of the WQRA at this stage of the scheme development is to provide a high-level review of the risks to drinking water quality associated with each concept design option. The WQRAs were carried out based on guidance developed for the ACWG[13]. The process included workshop sessions attended by representatives from the water quality teams from both Anglian Water and Affinity Water. The Drinking Water Inspectorate (DWI) also attended a meeting prior to the workshop at which the WQRA methodology was outlined and discussed. The DWI will continue to be invited to meetings post-gate one to ensure ongoing discussion at a solution-specific level. The key outcomes from the WQRA for the SLR are as follows:

- 4-log removal of cryptosporidium must be considered in the treatment designs.
- Careful consideration must be given to bromate formation, with changes to the treatment options potentially required post-gate one.
- Careful consideration must be given to disinfection by-product formation, with changes to the treatment options potentially required post-gate one.
- Metaldehyde to be considered despite expectation it will be banned in March 2022.
- Further water quality data must be gathered for the SLR sources.

Following the completion of this preliminary WQRA, a subsequent water quality monitoring programme has been established to gather additional water quality data that will be used to further develop the WQRAs to a greater level of detail and confidence. This programme will include a review of the data against the list of limiting hazards to ensure that the preliminary list is appropriate and to determine whether any additional hazards need to be added.

### 5.10.2 Treatment process

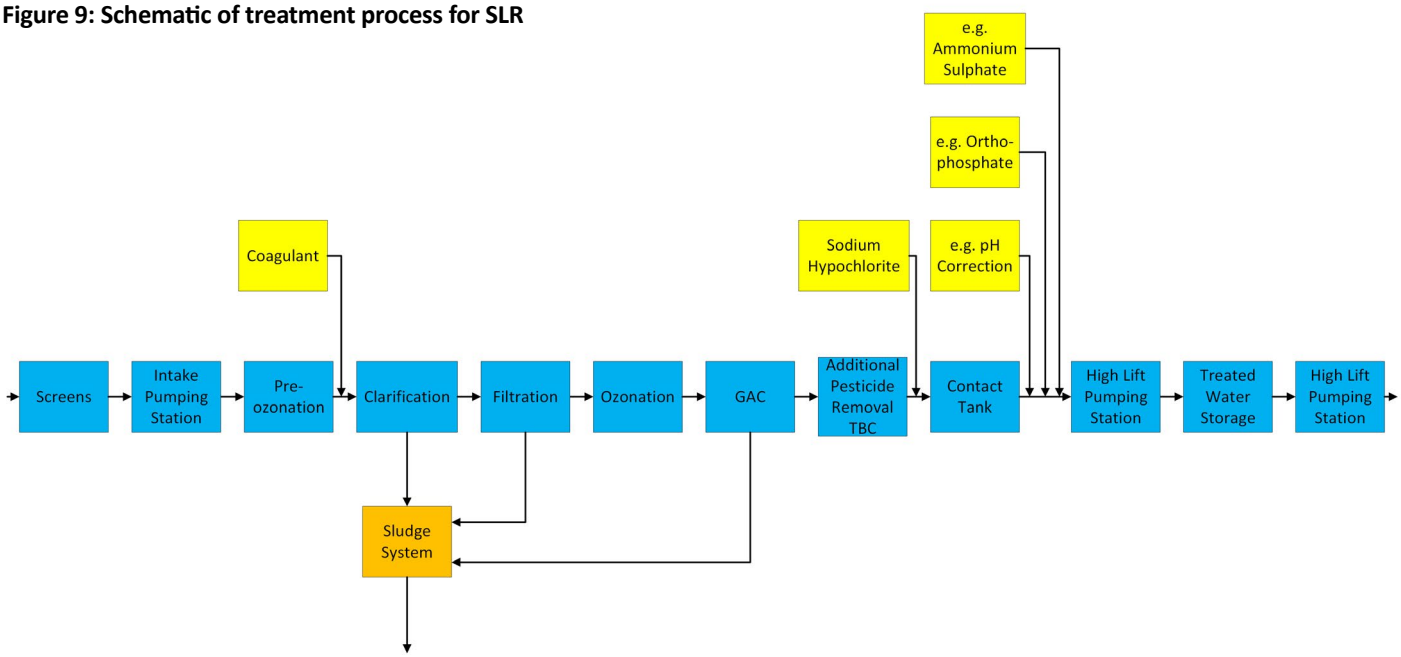
The outputs from the WQRA have been used to inform the development of the treatment requirements for the SLR scheme. As presented in Figure 10, the following treatment processes have been assumed to be required for each of the CDO designs:

- Coagulation.
- Clarification (either by settlement or flotation).
- Filtration (commonly rapid gravity sand filters).
- Pesticide removal.
- Ozonation.
- GAC adsorption.
- Disinfection with sodium hypochlorite solution.
- Other chemical additions such as orthophosphate for lead control, pH adjustment and ammonium sulphate to produce a chloramine residual.

While not included here, further considerations such as the capture, removal and disposal of mussels will need to be considered at later design stages. Bankside storage has not been included at this stage but may be required if water quality sampling indicates unpredictable water quality, notably sediment.

*13 ACWG WQ Risk Framework Report – Final (Strategic WQ Risk Framework FINAL Report) | 19/01/21 | Jacobs*

**Figure 9: Schematic of treatment process for SLR**




In addition, it is likely that the SLR designs will include an aeration system installed within the base of the reservoir to promote circulation and mixing to manage any water quality issues associated with the storage of the impounded water.

### 5.10.3 Water quality catchment management

An assessment of the water quality conditions in the Black Sluice catchment was undertaken and indicated potential issues to be considered in the mitigation and treatment for each of the concept design options. Stakeholders were engaged through a series of participatory system mapping workshops to conceptualise the environmental, social and economic systems in the catchment and help to identify potential root causes and interventions.

In summary, two potential interventions were identified as the most suitable mitigation options for addressing water quality issues observed in the Black Sluice catchment:

- Wetlands to provide a cost-effective alternative water treatment technology, supporting enhanced ecosystems and providing recreational community benefits. CDO2 and CDO3 both incorporate wetlands into the design and have the potential to improve water quality in the catchment.
- Catchment management measures to improve water quality, including increased tree planting, fencing of watercourses, improvement to manure storage and soil management practices.

# 6. Initial outline of procurement and operation strategy

**RAPID has set out the assumption that the SRO solutions will meet the PR19 criteria for Direct Procurement for Customers (DPC) and follow the DPC process route unless an alternative procurement strategy is articulated. This section presents an initial outline of the procurement strategy and describes the anticipated operation of the SLR.**

## 6.1 Procurement strategies

At this stage of the development, DPC has been considered as the preferred route for delivery of the SLR scheme. Under this framework, appointees run a competitive procurement process and award a Design, Build, Finance, Maintain and Operate (DBFMO) type contract to the Competitively Appointed Provider (CAP) for a predefined revenue period. Alternative procurement strategies may be employed at a later stage if the scheme is deemed not suitable for DPC delivery and an alternative approach offers better value for customers. For delivery under the DPC route, three procurement structures have been considered:

- **Single appointee –** One party contracts with CAP and the other receives no supply.
- **Joint Venture (JV) –** Anglian Water and Affinity Water form a JV that contracts with CAP.
- **Single appointee and a Bulk Supply Agreement (BSA) –** Anglian Water contracts with CAP and holds a BSA with Affinity Water.

Following further evaluation, if the solution is deemed not suitable for DPC, there are various alternative procurement strategies such as in-house delivery, in-house delivery with a BSA, through a Regulated Third Party, through a Non-DPC DBFMO contract or other models.

Further work is required to establish the most appropriate procurement, delivery, commercial, legal and funding arrangements for the delivery of a multi-sector reservoir system, as proposed in the three concept designs presented. It is possible that only some aspects of the proposed concept design may form part of a DPC, and others would be procured and delivered through an alternative route. This will form a key part of the work programme to gate two, through joint working with RAPID and other key stakeholders.

## 6.2 Eligibility assessment

The eligibility assessment for DPC is made up of a three-stage test:

1) Is the project greater than £100m whole life Totex?

2) Is the project sufficiently discrete?

3) Will the scheme deliver Value for Money (VfM) for customers if delivered via DPC?

At this stage of development, only the size and discreteness assessments have been considered. The VfM assessment will be completed as part of the gate two submission.

### 6.2.1 Size test

As indicated by the capex totals described previously, all configurations and options clearly pass the size eligibility test.

### 6.2.2 Discreteness assessment

As assessment of the discreteness of the project is summarised in Table 7.

**Table 7: Discreteness eligibility assessment**

| Discreteness criteria | CDO1 | CDO2 | CDO3 |
|---|---|---|---|
| **Stakeholder interactions and statutory obligations** | High/medium (2.5) | High/medium (2.5) | High/medium (2.5) |
| **Interoperability considerations** | Low (1) | Low (1) | Low (1) |
| **Output type and stability** | High (3) | High (3) | High (3) |
| **Asset and operational service failures** | Medium (2) | Medium (2) | Medium (2) |
| **Summary** | Medium (2.125) | Medium (2.125) | Medium (2.125) |

## 6.3 DPC tender model

Under DPC, there are several tender models to split the activities and responsibilities between the appointee and the CAP. This could be at a very early (before the preferred option is selected), early (before the initial design is completed), late (after the consents have been awarded), very late (post-construction) or a split model. Broadly, a late DPC tender model appears to be to be the most appropriate for all of the SLR options. This is the most precedent model in the market and is envisaged to improve financing efficiency with no adverse impact to the overall timelines.

## 6.4 Anticipated operation

The operation of the asset is linked to the procurement strategy; the chosen procurement route will confirm who will be responsible for the operation. If DPC, the CAP could operate the asset, whereas if an alternative procurement strategy is selected such as in-house delivery, the water company would be responsible. Further work will be done prior to gate two to clarify these options.

The SLR will operate continuously adding to the storage capacity of the Ruthamford Water Resource Zone. Therefore, it will operate in combination with Rutland, Pitsford and Grafham reservoirs to supply the demand required during the year, with a peak expected in July and August. On average, more than 50% of the abstraction will come from the River Witham and local sources, mainly from November to April, which will be the typical reservoir refill period, although abstraction will likely continue throughout the year whenever flow is above the licensed HoF condition and reservoir storage is below the target fill level. This will be supplemented by abstraction from the River Trent, with a higher transfer rate between May and December. The stored volume in the reservoir will be above 80% of its capacity on average, being almost full between February to May before drawing down on storage through until October to November. In normal years, the minimum storage volume will not fall below 60% of the storage capacity and will only fall below this during drought years. Once the configuration of the scheme is confirmed at gate two, drought curves for the combined Ruthamford aggregated storage will be developed so that demand saving measures can be activated when required.

The irrigation reservoirs will be operated to meet demand, although this is more difficult to forecast as needs will be directly related to prevailing weather conditions. The flood storage reservoirs will also operate based on weather and flood prediction data in response to catchment hydrological conditions so as to maximise the utility of the storage. Regular maintenance is required to keep the reservoirs and ancillary plant in a safe condition and fully operational. This will encompass clearing, cleaning or operation of structures and replacement of deteriorated or defective materials and equipment as required.

The scheme is being designed to meet future growth demand and is not expected to reach its full design capacity immediately. In addition, the full 100Ml/d supply for Affinity Water is only forecast to be required during periods of summer demand during dry years. It is, therefore, currently envisaged that the operation of the scheme at its full capacity will be intermittent. To maintain operation of the treatment processes and to ensure sufficient sweetening flows in the pipelines, a continuous flow of approximately 20% to 30% of the WTW capacity will be required to prevent any issues with stagnation or the likely maximum turn-down ratio of the WTWs. Initial modelling indicates that this aligns with Affinity Water's operational requirements during non-drought years.

# 7. Planning considerations

**This section summarises the key anticipated features of the likely consenting process for the SLR. The consenting strategy will evolve as the scheme progresses to gate two.**

It is proposed that the SLR will be promoted as a Nationally Significant Infrastructure Project (NSIP), requiring a DCO under the Planning Act 2008. The reservoir's abstraction and transfer infrastructure and related highways and other development would also be consented as part of the DCO, as "associated development" (as defined in the 2008 Act). The associated A2AT transfer infrastructure could be consented either as an integral part of the SLR DCO, as a separate DCO or as a non-DCO project.

The DCO will be delivered through comprehensive community and stakeholder engagement. Four rounds of consultation will take place on the SLR, one round of informal consultation prior to gate two, with three further rounds of consultation taking place between gate two and the DCO submission, one informal and two statutory under Section 42 and 47 of the 2008 Act.

An Environmental Impact Assessment (EIA) will be carried out in accordance with the process mandated by the 2008 Act and relevant guidance. This will commence with EIA scoping, followed by environmental surveys, the production of Preliminary Environmental Information (PEI) and, in support of the DCO application, the delivery of an Environmental Statement. The existing environmental assessments will form the basis for any future EIA and PEI.

The DCO can also provide compulsory acquisition powers. While the Anglian Water and Affinity Water preference is to acquire land by agreement, the project will ensure that these powers can be fully exercised if required. Land referencing and landowner engagement will take place between gate one and gate two to inform this process.

Comprehensive and focused site selection and concept design development will ensure that risks around the EIA and compulsory acquisition will be appropriately managed, particularly in respect of the consideration of alternative locations or designs.

The scheme faces a number of risks or uncertainties in respect of the DCO process, summarised in Section 9, including:

- Uncertainty over the timing of the approval of the National Policy Statement.
- The risk of public inquiry or legal challenge in respect of the WRMP.
- Sustained objector risk, particularly if compulsory acquisition powers are sought, resulting in increased consultation and EIA effort, potential delays and higher risk of legal challenge.

# 8. Stakeholder engagement

This section sets out the customer and stakeholder engagement undertaken to gate one.

A detailed consultation and engagement strategy has been developed that is centred around the three key themes of:

1. **Building understanding, trust and support –** stakeholder, community and customer engagement help to build understanding and trust through a series of iterative consultation phases to engage early, be open, honest and transparent, and bring consultees along the development journey.

2. **Compliance –** central to project acceptance (Section 56 of 2008 Planning Act) is demonstrating that the consultation process has complied with, and gone beyond, standard practice to deliver a compliant and effective consultation that will stand up to scrutiny, clearly evidenced through feedback loops and consultation reporting.

3. **Reducing risk –** programme risks are being managed (see Section 9) and mitigation measures put in place to minimise the delivery risks.

The concept designs have been developed and co-created in collaboration with wide-ranging stakeholders across regions, companies and other SROs. WRE has been at the centre of this process, with key stakeholders including the EA, Lincolnshire County Council and Natural England. This way of working has ensured that development of the scheme concept design has been transparent and, most importantly, informed by the wider stakeholder community. This collaborative approach will help to deliver a scheme that meets the needs of all water users, driving economic development while restoring and enhancing the natural environment.

Key to this collaboration has been working closely with the South Lincolnshire Water Partnership (SLWP), which was formed in 2016 and now includes representatives from:

- Affinity Water.
- Anglian Water.
- Black Sluice Internal Drainage Board.
- Water Resources East.
- Environment Agency.
- Lincolnshire County Council.
- Natural England.
- Greater Lincolnshire Local Enterprise Partnership.
- Fenland Agricultural Water Group.
- Inland Waterways Association.
- Lincolnshire Wildlife Trust.
- National Farmers Union.
- Welland and Deepings Internal Drainage Board.

These organisations all share the common desire of bringing together public water supply, flood risk management, agriculture, environment, business, tourism and leisure sectors in the area to find a multi-sector water resource management solution.

Due to the nature and scale of the scheme, there will be a need for extensive engagement with landowners, local authorities and communities as the designs are developed and preferred sites are identified. The engagement programme and planned activities for gate two are presented in Section 15.

The Fens Reservoir and SLR proposals are also central to the work being led by the Future Fens: Integrated Adaptation Partnership. This ground-breaking partnership, led by Anglian Water, the EA and WRE, is bringing together key partners to address the challenges of climate change in the UK's most exposed area. The partnership will draw on lessons from the Netherlands, bringing together drainage and flood management with water resources. The ambition is for the reservoir systems to form part of a broader overarching strategy that delivers environmental, social and economic prosperity to the Fens.

## 8.1 Regional customer engagement

A programme of customer engagement was commissioned in collaboration with the other Strategic Resource Options (SROs) and involving 10 water companies to examine customers' understanding of water resources and the need for regional solutions. This research programme was an industry first and ensured that feedback was comparable across companies and solutions in addition to being cost efficient. The scope and the approach were agreed in advance with a coalition of representatives from the participating water companies' Customer Challenge Groups, the Consumer Council for Water (CCW) and RAPID. The programme was comprised of three parts:

- An evidence review of over 100 documents across the 10 companies to compile insights from PR19 and WRMP19 research to ensure development on previously available information.

- Qualitative research with both Anglian Water and Affinity Water customers to test broad priorities, including the proposals for sharing water between companies.

- Quantitative research: This was focused on the recipient customers in the Affinity Water area with the engagement of 360 households and 80 non-households. The survey also captured customer views on high-level principles and their support for water sharing via SROs following learnings from the qualitative research, including views on reservoirs.

The key findings from the customer engagement research were:

- The evidence compiled to this point demonstrates that proposals to share water between companies are seen in a positive light by customers. There is a recognition that collaborative planning and options can be efficient and fairer because water is a communal resource. However, schemes like the SLR are not seen by customers as a substitute for demand measures such as reducing leaks, saving water and localised supply options.

- Reservoirs are a widely accepted option by customers – with a majority view that the recreation and environmental benefits outweigh the localised impacts and disruption of construction. It is evident, though, from the qualitative research that the SLR cannot be tested with customers separately from the associated transfer solution(s) or the alternative source(s) and transfer combinations that could be substitute options. A preference to avoid negative environmental impacts strongly underscores customer views on supply options, hence the level of support for the SLR will depend on the combined impacts from source and transfer.

- Customers want to see a clear view on the "choice" that will be faced for the SLR in relation to the need for and timing of other SROs, including comparative costs and the potential impacts that could be avoided, so framing this scheme in the broader strategic planning context for water resources will be important as the scheme develops.

## 8.2 Regional planning group engagement

The SLR is a key component of the WRE regional plan. WRE brings together partners from a wide range of sectors including water, energy, retail, the environment, land management and agriculture, to work in collaboration to manage the region's challenges, building on the area's unique opportunities for sustainable future growth and pioneering a new approach to managing water resources. The SLR will be central to the decisions on the combination and timing of strategic options that will be undertaken through the WRE planning conferences throughout summer and autumn 2021.

As described in Section 2.9, there are also interdependencies between the SLR and the WRSE regional plan. WRSE has an ongoing engagement and consultation programme to support the development of the South East regional plan. In 2020, the focus of the programme was on the building blocks of the plan, including the planning policies and the technical methods. In 2021, the engagement broadened to focus on feasible solutions and the approach and tools to determine the best value plan, with consultation on the draft plan scheduled early in 2022. Although the SLR is not core solution to the WRSE regional plan, the source water and the A2AT transfer have been key in explaining to WRSE stakeholders the wider regional planning approach and coordination.

## 8.3 Targeted SLR technical engagement

Specific stakeholder engagement for the SLR to this stage has focused on the SLWP, statutory consultees and regulators to ensure close alignment on issues of data collection and assessment. A summary of the engagement to date is presented in Table 8.

There is general agreement from stakeholders that they are keen to ensure that the SLR can deliver the desired outcome of a multi-sector solution, set against the WRE ambition of a thriving 'water market' in eastern England. Stakeholders also recognise that the scheme will need to provide a viable public water supply option for inclusion in the WRMP24 and PR24 Business Plans for Anglian Water and Affinity Water.

## 8.4 Systematic conservation planning

A Systematic Conservation Planning (SCP) project is underway to work with stakeholders to collectively identify, discuss and shape the design objectives for the scheme in adherence with the recommended design principles. This stakeholder-led project includes three phases.

**Table 8: SLR specific engagement**

| Stakeholder | Assessment summary | Activity to date |
|---|---|---|
| **Customer Challenge Group (CCG) and Consumer Council for Water (CCW)** | Focus is on protecting customer interests, ensuring plans and schemes are developed with customer engagement and input. | Update session to local CCW representatives.<br>Monthly update on progress to Affinity CCG. Currently, no Anglian CCG in place. |
| **Drinking Water Inspectorate (DWI)** | Regulation of drinking water quality. Interested in the progression of this scheme as an alternative source of water into the region. | Quarterly meetings. |
| **Environment Agency (EA)** | Regulation of water resources (quantity and quality), environmental and hydrological monitoring and assessment. Delivery of wider environmental ambition and objectives. | Active engagement as member of SLWP<br>National Appraisal Unit representation at Programme Management Group (PMG) monthly meetings.<br>Attendance at key workshops. |
| **Highways England** | Long-term planning on road infrastructure. Early engagement to align plans. | Invited to site selection workshop but not available. |
| **Historic England** | To ensure the historic environment is protected but to reconcile that with the economic and social needs and aspirations of the people who live and use the area. | Attended water quality workshop; further follow up with local inspectors needed once site selection more developed. |
| **Local Authorities (LAs)** | Responsible for the planning process regarding location and disruption of any works involving abstraction, transportation and treatment for the scheme. | Regular updates and engagement with Lincolnshire County Council (CC) through SLWP and additional ad hoc meetings.<br>LAs have been invited to regional and company events and forums to gain general awareness of process and schemes. |
| **Natural England** | Legal and regulatory requirements with respect to the natural environment plus landscape and environmental benefits and opportunities for enhancement. | Active engagement as member of SLWP. |
| **Ofwat** | Economic regulation of water industry. Ultimate approval of option progression to business plans. | Scheme updates via the RAPID meetings, plus additional meetings to update on procurement strategy. |
| **RAPID** | Regulatory alliance with responsibility for overseeing the work to examine the SROs and for administering the gated process. | Scheme updates at regular intervals to RAPID team. |
| **South Lincolnshire Water Partnership (SLWP)** | The partnership is aiming to find a multi-sector water resource management solution for the Black Sluice catchment, encompassing the SFFD and surrounding areas and water courses. | Monthly meetings including an agenda item on progress with the SLR and A2AT plus more regular working group meetings |

### 8.4.1 Phase One – Establishing design objectives

In spring 2021, key stakeholders from Lincolnshire County Council, Lincolnshire Wildlife Trust, NFU, EA, Natural England, Black Sluice IDB, Affinity Water and Anglian Water came together to produce an exhaustive list of design objectives that describe the collective vision for both the wider landscape and the design of the reservoir system. The design objectives have been articulated around the Design Principles for National Infrastructure (Climate, People, Places, Values) as developed by the National Infrastructure Commission[14]. Objectives related to these were split into two categories: landscape objectives, which collectively summarise the shared vision for the future of the region, and reservoir system objectives, which detail the specific outcomes desired by stakeholders from the creation of the reservoir and its associated activities.

The emerging design objectives for the SLR are:

- Climate: aim for carbon neutrality and build resilience against future climate change impact.
- People: provide recreation and water security for agri-food, reconnect communities with the environment.
- Places: integrate with landscape habitats, achieve biodiversity net gain, improve water quality and adopt open water transfer where possible.
- Values: deliver a holistic positive outcome and lasting legacy and develop an open and transparent approach to design including all views.

### 8.4.2 Phase Two – Developing a spatial prioritisation analysis and decision support frameworks

The shared vision will be developed further through a spatial prioritisation analysis during summer 2021. This will be used to identify where action would need to take place to deliver the vision over the coming years, providing the reservoir design team with a robust, multidisciplinary understanding of the wider system, allowing them to identify sites that avoid disrupting natural systems, minimise the loss of natural capital and biodiversity while maximising the positive, long-term benefits of the reservoir system. This will ensure that the design of the reservoir system is well integrated into the stakeholders' long-term vision for the landscape. In parallel, decision support frameworks will be developed to help consider and manage non-spatial objectives.

### 8.4.3 Phase Three – Dynamic and iterative decision making

Once the analysis is complete, it will be used to assess the potential implications of different reservoir design concepts. Phase Three will be completed between September 2021 and February 2022. Details of the reservoir system will be input into the spatial prioritisation analysis. The analysis will then be re-run to indicate the potential implications of the reservoir system design with regards to the shared landscape vision. This will identify a range of potential consequences, including whether the proposed reservoir system a) prevents any targets from being met, b) increases or decreases the cost of targets being met, c) contributes to meeting targets and d) provides additional natural capital opportunities. In addition, the non-spatial decision support frameworks will be used to assess other non-spatially explicit aspects of the proposed reservoir system design, such as the steps taken to ensure the destination is accessible to all.

## 8.5 Preparing for community engagement

In preparation for the DCO application for this scheme, an independent specialist communications, PR and public affairs organisation has been engaged to provide additional support on the development of plans for community engagement.

The current plan is to begin the first phase of community engagement in spring 2022 to seek constructive feedback on the preferred site and preliminary concept design. Further engagement and feedback through three further rounds of consultation, with the objective of minimising challenge through the planning process, will take place between gate two and the expected DCO submission. The consultation phases are shown in Figure 4, in Section 3. The approach to community engagement will draw on recent experience from Anglian Water's Cambridge Water Recycling Centre relocation project, which is following the DCO planning route.

*14 Design Principles for National Infrastructure, National Infrastructure Commission (2020)*

# 9. Key risks and mitigation measures

For gate one, a qualitative risk register has been used to manage programme risk. The key risks are summarised in Table 9, alongside the mitigation measures put in place and the latest trend; these risks have been reported in the RAPID quarterly dashboards. There are three notable risks for the SLR from the summary provided:

- Risk ID 21 details the risk associated with the development and delivery of a transparent and robust site selection process to inform the selection of a single preferred site for gate two. This will be critical to avoiding subsequent challenge of the SLR scheme development during subsequent DCO consultation and/or examination phase of the programme. To mitigate this risk, the programme team have proactively engaged with stakeholders, particularly the South Lincolnshire Water Partnership, in the collaborative planning of a mutually acceptable site selection process, which draws upon tailored and innovative approaches to the realisation of a multi-sector SLR scheme, such as SCP and Multiple-Criteria Decision Analysis (MCDA).

- Risk ID 24 captures the challenges associated with the development of an integrated programme, which brings together the different requirements and timescales associated with the RAPID, DCO and DPC workstreams. Detailed programme specific investigations are underway into delivery routes (including DPC) and DCO considerations to provide confidence and ensure a coherent and robust programme.

- Risk ID 56 details the risk associated with the material requirements, specific to the preferred site, for the construction of the SLR embankment. Given the size of the embankment, estimated capital costs are sensitive to the assumed source of the embankment fill material. Costs are currently based on key assumptions relating to assumptions over the underlying ground conditions and opportunity for sourcing fill material from the preferred site itself. However, these assumptions are based on a limited amount of available data. To mitigate this risk relating to uncertainty over ground conditions, the programme team will undertake a targeted and phased ground investigation programme in advance of gate two, which will support the informed selection of a preferred site.

For gate one, costs attributed to programme risk have been estimated using the ACWG Optimism Bias methodology. An enhanced risk management process will be developed for gate two, which will consider programme opportunities in addition to risks, both of which will be costed to produce a Quantified Risk Assessment (QRA).

**Table 9: Programme risk summary**

| Risk ID | Risk details | | Mitigation plan | Trend |
|---|---|---|---|---|
| | Risk (event) | Effect(s) | | |
| **21** | **Site selection programme to define preferred site** | Robustness of site selection methodology, to inform preferred site and option for gate two, challenged as part of DCO consultation or examination process, undermining case for project or compulsory powers. | Comprehensive site selection and consultation programme to ensure project progresses on a robust and proportionate evidence base. | Stable |
| **24** | **RAPID, DCO and DPC inter-dependencies** | All three elements have differing timescales, complexities and requirements that need to be understood. Programme misalignment could result in delays. | Understand and overlay all three processes to enable alignment, with identification of critical path, to deliver a coherent strategy. Further detailed investigation of each workstream ongoing through to gate two. | Decreasing |
| **56** | **Embankment material uncertainty** | Inadequate ground information leading to incorrect assumption of existing material at preferred site, impacting required on-site excavation works and potential requirement for costly material import. | Targeted and phased ground investigation programme to be developed, to run in parallel with process to select a preferred site for gate two, to mitigate risk of uncertain ground conditions. | Stable |
| **43** | **Utilising River Trent as a source of water is unviable** | Multiple competing demands for River Trent water (inc. other SROs) resulting in insufficient surplus water to be used for A2AT, either directly or via SLR. | Concept design to consider alternative sources of water so that there are viable alternative source water options if the River Trent is unavailable as a source. Assumptions to be revisited in preparation for gate two. Proactively contribute to ACWG coordination on River Trent and regular attendance at River Trent Working Group to monitor developments. | Stable |
| **59** | **Multi-sector benefactor funding** | Unable to justify water company customers paying for all potential scheme benefits, resulting in limited incorporation of multi-sector features into scheme design without additional funding sources. | Project team to undertake detailed economic assessment, involving mapping of multi-sector benefits to different parties. Use this information to explore funding opportunities within these organisations and develop a viable financial model, which involved parties are engaged with, for the delivery of a multi-sector SLR scheme | Stable |
| **4** | **WRE and stakeholders oppose options considered** | Lack of stakeholder buy-in to solution resulting in programme delays, particularly from formal DCO consultation requirements. | Mitigation is being undertaken through stakeholder mapping, ongoing engagement and collaborative planning of a mutually acceptable site screening process at a working group level. A Planning Performance Agreement (PPA) is being formalised to improve relations with our key stakeholders. | Stable |
| **9** | **Inter-regional alignment** | Regional plans from WRE and WRSE are not aligned with regard to selection of SROs across the regional plans, resulting in delays. | Inter-regional alignment planned towards end of 2021, where WRE and WRSE will work together alongside SRO teams to overcome any differences in the best value planning process. | Stable |
| **23** | **Delivery route approach** | Uncertainty about potential delivery routes and necessary work required to understand respective programmes | Identification of delivery route options and programme implications for delivery of scheme undertaken for gate one, to be reviewed, and market engagement will take place in preparation for gate two. | Decreasing |
| **42** | **Legal challenge or public inquiry** | External challenge to programme resulting in delays; eg. public inquiry of WRMP resulting in delays in publishing WRMP24 or DCO grant unsuccessful. | DCO programme and approach to consultation to be developed to manage and mitigate this risk. | Stable |

# 10. Option cost/benefits comparison

The cost for each of the concept design options are presented in Section 4.2, which also includes a description of the costing approach and confirmation that the costs have been developed in accordance with relevant methodologies and guidance. At this stage of development, it is not possible to state which concept design option, or combination of options, provides the best value for customers.

Tables 10 and 11 summarise the costs for each of the concept designs at 25% and 100% utilisation. It should be noted that the Average Incremental Costs (AICs) presented are purely for indicative purposes at this stage as they will change as the scheme develops. Further, they do not consider either the additional cost or DO associated with the incorporation of the A2AT transfer element.

**Table 10: Cost summary for SLR concept designs at 25% utilisation**

| Option name | Units | CDO0 - base | CDO1 | CDO2 | CDO3 |
|---|---|---|---|---|---|
| **Option benefit – additional resources or demand saved (based on full implementation)** | **Ml/d** | 182 | 182 | 151 | 151 |
| **Total planning period option benefit (NPV)** | **Ml** | 1,057,500 | 1,057,500 | 887,370 | 887,370 |
| **Total planning period indicative option cost (NPV)** | **£000** | 1,065,051 | 1,109,344 | 1,250,645 | 1,578,766 |
| **Average Incremental Cost (AIC)** | **p/m3** | 101 | 105 | 141 | 178 |

**Table 11: Cost summary for SLR concept designs at 100% utilisation**

| Option name | Units | CDO0 - base | CDO1 | CDO2 | CDO3 |
|---|---|---|---|---|---|
| **Option benefit – additional resources or demand saved (based on full implementation)** | **Ml/d** | 182 | 182 | 151 | 151 |
| **Total planning period option benefit (NPV)** | **Ml** | 1,057,500 | 1,057,500 | 887,370 | 887,370 |
| **Total planning period indicative option cost (NPV)** | **£000** | 1,257,702 | 1,303,692 | 1,486,266 | 1,814,387 |
| **Average Incremental Cost (AIC)** | **p/m3** | 119 | 123 | 167 | 204 |

The SLR will provide wider benefits beyond just public water supply, by adopting concept designs properly integrated in the landscape, utilising existing infrastructure where possible, applying integrated water resource management principles and realising synergies between sectors.

Parallel to the SCP spatial prioritisation analysis (as described in Section 8.4), a Multi Criteria Decision Analysis (MCDA) approach is proposed for identifying the preferred concept design and site that will be presented at gate two. The MCDA process will draw on the concept design work that has been completed to date and combine multi-sector features to deliver best value. In particular, the cost benefit of each feature adopted in the gate one concept designs will inform the options to be tested in the MCDA but a new more detailed assessment will be carried out. Criteria will be mapped to the agreed SCP design objectives, while weights for criteria will be agreed with stakeholders using a facilitation tool and adjusted to reflect a fair representation of sectors. Scoring will be applied based on the results of multi-sector modelling/assessments or on stakeholder feedback when a quantitative assessment is not possible. Additional criteria to be considered in the analysis include: geology and cost, flood risk impact, SCP landscape objective mapping, biodiversity net gain, natural capital, WFD compliance, revenue generated, etc.

The MCDA tool will be used to present stakeholders with the inherent trade-offs of the concept design and site selection and as a way of supporting decision making. It will also provide the best value option that satisfies a certain set of constraints and will allow both promoters and stakeholders to consider the implications of their own selections and choices.

Finally, as part of the regional plan, WRE will select a portfolio of demand management and supply-side options to meet the needs of all of those with an interest in the abstraction and use of water in the region over the period to 2050 and beyond. This process will involve:

- A portfolio selection using the Multi-Objective Robust Decision Making (MO-RDM) process previously developed by WRE. Based on a multi-sector regional water resource simulator, MO-RDM allows the vulnerabilities of the various water resource and water supply systems in the region to be quantified and the performance of different options for meeting agreed targets to be tested. From this, the preferred set of options will be selected.

- A delivery strategy will be agreed, distinguishing between options that should primarily be delivered through water company business plans and options that should be delivered by other sectors. For the water company options, the order in which these should be delivered will be based on a least cost optimiser (EBSD), considering the strategies that are more flexible and adaptive and so better suited for dealing with the uncertainties associated with growth and climate change.

The SLR will form part of this regional assessment as one of the key supply-side options, with the MO-RDM optimisation expected to select the size of the scheme that will be required and the regional EBSD establishing when it should be delivered. The optimisation will consider not only cost (Capex and Opex) and PWS reliability, but also agriculture deficit, energy reliability and deviations from environmental flow requirements to ensure that the best-value option is selected.

# 11. Impacts on current plan

This section describes the impact of the SLR on current delivery plans and places this solution within the wider context of company and regional Water Resource Management Plans (WRMP).

The SLR is being investigated within the context of WRMP and regional planning. The term regional planning refers primarily to WRE and its own plan development but also to the wider regional plan reconciliation process that will ensure that coherence is achieved between different regional plans. This process of alignment between regional plans is important for the SLR, as the current solution may supply Affinity Water, which impacts the WRSE plan.

Anglian Water's WRMP19 highlighted the need for an adaptive plan to enable better management of future uncertainties. A number of strategic options were identified as part of this plan for pre-planning activities this AMP, recognising there could be a need for additional supply-side capacity as early as 2030. The SLR was one of the options included - a 50,000Ml winter storage reservoir to supply Ruthamford North Water Resources Zone (WRZ) supply zone. During the WRMP19 planning process, Affinity Water and Anglian Water discussed a number of strategic options and assessed their feasibility, and a transfer from the SLR (the A2AT) was included in both company option sets. The adaptive plan developed by Affinity Water in its WRMP19 concluded that an import from Anglian Water linked to the SLR would only be required under certain scenarios (high growth and extended sustainability reductions) and as a third stage of development after the other two preferred options (in the 2060s). It would also be required as an alternative if either of the WRMP19 preferred options were not viable, or investigations altered the economics and multi-criteria analysis for the options.

The assumptions made to date are based upon respective WRMP19 plans; no outputs from either WRMP24 or the next WRE plan are expected to be available in time for the gate one submission. One of the key assumptions is that Affinity Water's supply from SLR (up to 100Ml/d) via the A2AT is selected by the WRE system simulator and carried forward by the regional plan reconciliation process. However, there are complex interdependencies between WRE, WRSE and WRW and uncertainty exists around which configuration of SROs offers best value for customers and the environment. Therefore, this assumption will be revisited at gate two once the outputs of the regional plans have become available to confirm that the WRE regional modelling supports the assessment of the costs, benefits and viability. Note that even if the A2AT is not chosen by the regional simulator, the SLR is likely to be to support Anglian Water's demand.

The development of the SLR ties in with both Anglian Water's and Affinity Water's current delivery plans as well as their long-term ambitions and strategies. The solution provides supply resilience for both companies and is aligned with WRE's mission to provide multi-sector solutions that benefit a range of water users.

WRE estimate a regional deficit for public water supply alone of 1,176Ml/d11 by 2050 – the SLR has the potential to supply 19% of this. In WRMP19, Affinity Water estimated a shortfall of 43Ml/d by 2025 rising to 256Ml/d by 2080; the SLR could supply up to 100Ml/d of this deficit. In addition it could supply up to 44% of Anglian Water's WRMP19 estimated deficit of 294Ml/d by 2045.

# 12. Board statement and assurance

A comprehensive assurance plan has been developed and implemented across all activities undertaken leading up to this gate one submission. The assurance process is similar to the standard Anglian Water and Affinity Water risk-based assurance frameworks. It uses the Ofgem data assurance guideline risk assessment method.

The regulatory, environmental and technical risk of each activity has been assessed and a level of assurance assigned based on a 'three lines of defence' model. A third-party assurance provider has been engaged to provide assurance on the elements that are considered high risk or critical. A comprehensive project governance structure is in place to ensure the low and medium-risk activities have been appropriately managed and overseen. All key technical outputs have been delivered by specialist consultants with rigorous quality assurance and control procedures in place.

Both Anglian Water and Affinity Water Boards support this submission and have signed off the Board statement in accordance with the RAPID guidance, based on the above controls and assurance.

# 13. Solution or partner changes

Anglian Water and Affinity Water are currently working in partnership to develop a mutually beneficial solution for the SLR scheme. This partnership arrangement between the two companies is anticipated to remain unchanged through to gate two, at which point the arrangement will be reviewed in light of scheme developments across the other inter-related RAPID SROs.

# 14. Efficient spend of gate allowance

**This section provides supporting information to confirm the efficiency of gate one spend for the SLR SRO.**

## 14.1 Efficient spend

This section outlines the procurement approach and governance process that Affinity Water and Anglian Water have taken to procure services required to deliver the gate one technical work on the SLR SRO, and how efficiency has been driven into the gate one process.

The governance structure between both companies includes a Programme Management Group (PMG). PMG is responsible for the management of the programme and ensuring that all technical activity is closely aligned with RAPID's requirements to minimise any potential for scope creep and inefficient or abortive spend. A procurement approach and governance process were agreed at the start of the SLR SRO programme. The procurement approach has been based on existing company procurement frameworks, with the following procurement options used to select consultants:

- Mini-competition of existing framework suppliers.
- Direct selection of existing framework suppliers when there is a need for consistency or particular skillset.
- Tender for services outside of existing frameworks.
- Direct award to specialist suppliers outside of existing frameworks.

In line with the objectives set out in the SRO Memorandum of Understanding, the PMG is responsible for the efficient delivery of the programme, which includes approving all procurement decisions. A standard proforma has been developed to facilitate this and is signed by the PMG prior to procuring any work. This documents the rationale for selecting a particular supplier or contractor, as well as detailing the scope, requirements, costs and expected outputs of each work package. Many work packages have been procured jointly for the SLR and A2AT SROs to bring efficiencies to the programme and, where possible, costs have been benchmarked against other similar work packages. For example, both the planning strategy and consultation strategy were procured jointly for the SLR and A2AT and were benchmarked against work complete for another DCO scheme being delivered by Anglian Water, the relocation of Cambridge Waste Water Treatment Plant. The project management for the programme to gate one has been very lean across both water companies and is within the recognised 10-15% of total spend.

The governance structure and procurement approaches have ensured that all costs are relevant and efficient. This has also been confirmed through external, third-party assurance of the gate one costs.

## 14.2 Gate one costs

The cost allocation for each RAPID solution was provided by Ofwat in the PR19 Final Determination[15]. A comparison between the RAPID gate one allowance and actual costs to gate one is shown in Table 12.

**Table 12: Comparison of RAPID gate one allowance and actual costs**

| Stage | Total RAPID allowance (£m) | Actual or forecast spend (£m) | Difference (£m) |
|---|---|---|---|
| **Gate one** | 3.860 | 2.643 | 1.217 |

The gate one spend is made up of actual costs recorded to the end of June 2021 and committed costs to gate one submission (5 July 2021). Overall, the forecast spend to gate one is £2.64m, with a 50/50 split between Affinity Water and Anglian Water. The difference between gate one spend and the final determination allowance is £1.2m underspend. The cost breakdown is shown in Table 13.

*15 PR19 Final determinations, Strategic regional water resources solutions appendix*

**Table 13: Breakdown of gate one spend**

| | Deliverable | Cost (£k) |
|---|---|---|
| 1 | **Preliminary solution feasibility and data collection:** | – |
| 1.2 | **Source of water**<br>Includes baseline hydrology and hydrogeology studies; detailed feasibility studies; and modelling. | 293 |
| 1.2.1 | **Monitoring**<br>Localised monitoring study; and development of a monitoring strategy. | 210 |
| 1.3 | **Site selection**<br>Includes a regional site screening study; workshops to develop a robust site selection process; coarse screening; the development of a GIS mapping tool and the MCDA project. | 270 |
| 1.4 | **Concept design**<br>Includes early feasibility assessments; analysis of multi-sector design options; workshops with stakeholders; the initial concept designs of the three options; costings; and a proportion of the innovative Systematic Conservation Planning project to develop design principles and develop a spatial mapping tool for natural capital to inform the concept design and site selection process. | 471 |
| 1.5 | **Environmental considerations**<br>Includes baseline studies for environment, ecology and INNS contribution to a joint SLR/A2AT/ Minworth study of Trent ecology; and the initial environmental assessments of the options. | 268 |
| 1.6 | **Flood risk considerations**<br>Includes a flood risk study; contribution towards a pan Fens flood risk strategy report; and flood risk considerations as part of the site selection process. | 83 |
| 1.7 | **Water quality considerations**<br>Includes baseline water quality studies and the production of the water quality risk assessment. | 46 |
| 2 | **Initial outline of the solution procurement strategy**<br>Includes finance consultancy advice, and in-house staff time to produce the procurement strategy, plusreport and confirm feasibility for DPC. | 77 |
| 3 and 6 | **DCO planning advice and customer and stakeholder engagement**<br>Includes independent expert advice to produce Consenting Strategy and ensure the programme is robust for DCO; the development of a stakeholder engagement plan; the creation of a storybook; ongoing support from an engagement consultancy; and initial customer research. | 111 |
| 4 | **Contribution to regional planning**<br>Includes contribution to the customisation of the WRE regional simulator (currently in development) to specifically determine DO of each option. Also includes project management support to ensure alignment between the SRO programme with the regional planning timeframe. | 197 |
| 5 | **External assurance**<br>Includes production of an assurance plan to gate two, and an independent consultant to assure the process and outputs. | 29 |
| 7 | **Environment Agency and Natural England support**<br>Includes agreed contribution to the newly established National Appraisal Unit to coordinate EA input centrally; valued local support to shape the process including input at workshops and reviewing documentation; and a funded SLWP Officer role to drive the vision of the stakeholders. Also includes small contribution to cover Natural England's time at workshops. | 254 |
| 8 | **Contribution to ACWG consistency studies**<br>Includes proportion of costs for the environmental framework and a framework for climate change. | 60 |
| 9 | **Project management**<br>Includes staff time from both companies and a consultant project manager. | 274 |
| | | **2,643** |

## 14.3 Gate two costs

A comparison between the RAPID gate two allowance and estimated costs to gate two is shown in Table 14. Overall, the forecast spend to gate two is £5.819m excluding gate one costs, with a 50/50 split between Affinity Water and Anglian Water. The difference between gate two estimated costs and the final determination allowance is £19k. The full cost breakdown for the planned gate two activities is provided in Table 15. With careful risk management it is expected that gate two will be delivered within the allowance; there is no expectation that the allowance will be increased.

**Table 14: Comparison of RAPID gate two allowance and forecast spend**

| Stage | Total RAPID allowance (£m) | Forecast spend (£m) | Difference (£m) |
|---|---|---|---|
| **Gate two** | 5.800 | 5.819 | 0.019 |

**Table 15: Breakdown of gate two budget**

| | Deliverable | Budget (£k) |
|---|---|---|
| **1** | Solution feasibility and data collection: | - |
| **1.1** | Hydrology (inc flow monitoring) | 258 |
| **1.2** | Site selection | 425 |
| **1.3** | Concept design | 550 |
| **1.4** | Site surveys (inc ecology monitoring, topo surveys and ground investigations) | 375 |
| **1.5** | Environmental considerations (inc Environmental Assessments) | 463 |
| **1.6** | Flood risk considerations | 55 |
| **1.7** | Water quality considerations (inc water quality monitoring surveys) | 491 |
| **2** | Procurement strategy | 232 |
| **3** | Considerations of planning application route | 99 |
| **4** | Contribution to regional planning | 150 |
| **5** | External assurance | 41 |
| **6** | Customer and stakeholder engagement | 278 |
| **7** | EA and Natural England contribution (NAU and local) | 538 |
| **8** | Contribution to ACWG consistency studies | 30 |
| **9** | Project management | 595 |
| **10** | Specialist consultants (legal support, land agents, design council, landscape architect) | 369 |
| | Risk (@15%) | **870** |
| | | **5,819** |

# 15. Proposed gate two activities and outcomes

The project-level plan for gate two is provided in Figure 11 and detailed in Table 16. There are two key decisions to make between gate one and spring 2022: the preferred site location and the preferred concept, which will then be developed in detail for gate two.

The site selection process is ongoing and the coarse screening stage is near completion; sites with unfavourable geology or that pose a risk to achieving DCO consent have been discounted. The fine screening stage will follow and will rank the suitability of the remaining sites against a set of criteria agreed with stakeholders through the SCP process, and structured around MCDA. Weightings for criteria will be agreed with stakeholders using a facilitation tool and adjusted to reflect a fair representation of sectors. Some criteria will be quantifiable through modelling (eg. flood risk benefits and impacts), assessments (eg. SCP landscape objectives, BNG, NC, etc) or engineering (eg. cost and carbon informed by preliminary ground investigation etc), while others will require stakeholder feedback. Consideration will be given to monetisation of costs and benefits based on Anglian Water and Affinity Water value frameworks. It is anticipated that affordability will be the main constraint during this process and consideration will be given to customer choices in this regard. To ensure costs are reliably integrated in the process, a desk-top geological review of each site will be conducted and a high-level design of a reservoir sitting in each site undertaken.

Once a reduced number of sites are identified, another iteration of the MCDA optimisation to select the integrated preferred site and concept design will follow. There will be an opportunity to review criteria, weighting and scoring agreed during the fine screening stage. Ground investigations will offer better information on the geological implications of each site and a more detailed flood risk analysis will be conducted. The SCP will support the process by establishing how well sites and concept designs would fulfil stakeholder aspirations and how they could be shaped to maximise outcomes. Once a single preferred site and concept design are selected, engineering design will be carried out to confirm feasibility and estimate costs for gate two submission. Environmental assessments, a preliminary flood risk assessment and a drinking water quality risk assessment will also form part of the preferred concept design development.

Alongside site and concept design selection, flow, water quality and ecology monitoring will take place to confirm the hydrology and environmental flows, verify the suitability of the proposed sources and serve as the basis of the environmental assessments including the INNS risk assessment. Water quality modelling will investigate the potential benefits of catchment management and wetlands, while also establishing the reservoir mixed water quality condition to inform the drinking water quality risk assessment and treatment needs. Water resources modelling will evaluate the water resource benefit of the scheme and quantify the potential multi-sector benefits. The following table details the activities proposed for gate two. These activities are summarised and mapped out in the project plan, presented in Section 3. The programme team have developed a comprehensive set of activities, accommodating feedback from stakeholders, which will deliver a robust process from which a preferred SLR concept design can be developed for gate two.

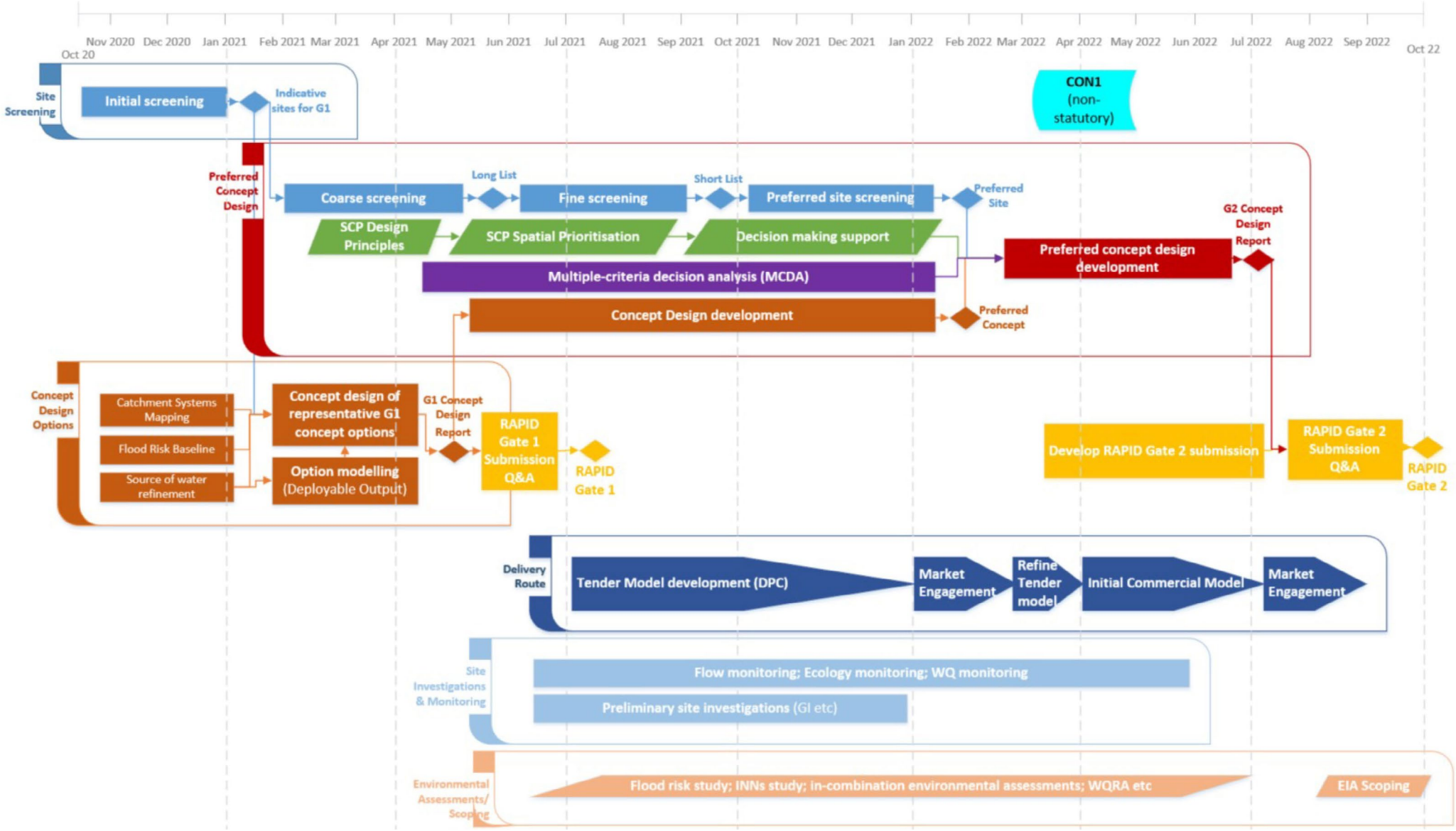
The National Infrastructure Commission (NIC) published guidance on its design principles for national infrastructure in 2020, which was the first of its kind in the UK. The ACWG is in the process of developing a set of design principles that can be applied across all nationally significant water infrastructure projects. The four NIC pillars of Climate, People, Places and Value will be used to develop a set of principles specific to the water industry that can guide the SRO designs as they develop. This work is due to be complete by the end of 2021 so that it can influence the gate two concept designs.

The Delivery Incentives Framework detailed in the Final Determination states that a penalty of up to 30% of each company's total efficient spend will be applied for late submissions or poor-quality deliverables. It is proposed that this framework be applied for gate two submissions, but reviewed post-gate two to reflect the increase in allowance.

**Table 16: Proposed activities for gate two**

| | May 21 -> Oct | | Nov -> Jan 22 | | Feb 22 -> Oct 22 |
|---|---|---|---|---|---|
| **Planning and procurement** | • Planning and procurement for DCO application<br>• Consider potential regional model outputs to inform DO and source of water<br>• Update and convert existing qualitative risk assessment into quantitative assessment<br>• Continue with storybook initiative for education and comms<br>• Procurement: tender model development<br>• Legal advice on DCO process | **Regional model output** | • Land referencing of shortlist of sites<br>• Analyse regional modelling outcome to amend/inform preferred concept design<br>• Assess interaction with other SROs<br>• Consideration of consents and licences required<br>• Procurement – DPC market engagement<br>• Engage landscape architect to challenge thinking | **Single option selection** | • Public consultation (non-statutory)<br>• External assurance of high/critical gate two activities<br>• Procurement – refine tender model and develop initial commercial model<br>• Procurement – DPC market engagement (2) |
| **Engineering** | • Commence monitoring programme (flow, ecology, water quality)<br>• Site selection: fine screening to determine shortlist of sites<br>• Multi-criteria decision analysis tool development to determine preferred site and concept design<br>• Costing analysis of long list of sites<br>• Economic modelling<br>• Stochastics and climate change study<br>• Regional ground investigation<br>• SFFD survey | | • Site selection: preferred site screening<br>• Concept designs for WTW<br>• Develop operational philosophy<br>• Preliminary ground investigation on shortlist of sites<br>• Topographical survey on shortlist of sites | | • Finalise water quality risk assessment<br>• Engineering concept design of preferred option – possible ECI<br>• Develop layouts |
| **Environmental** | • SCP - spatial mapping tool to inform concept design and site selection<br>• Ecology monitoring programme<br>• Hydro ecological modelling<br>• INNs study to inform concept design | | • Update HRA to include an in-combination assessment.<br>• Further investigation into the potential BNG and NC effects | | • Update SEA and WFD<br>• Prelim. Flood Risk Assessment<br>• Field work and desk studies for EIA for DCO process<br>• Quantify soil movements and develop landscaping plans to minimise waste transfer<br>• Quantify impact of construction vehicles<br>• Commence EIA scoping |
| **Engagement** | • Club project across SROs to explore customer preferences for recreational benefit on reservoirs<br>• Utilise learning from regional engagement to inform communication plans<br>• Continue programme of stakeholder engagement. | | • Regional consultation on WRE and WRSE plans.<br>• Begin early engagement with landowners, highways/rail regarding construction. | | • Phase 1 consultation on preferred site<br>• WRMP public consultation<br>• A Statement of Community Consultation (SoCC) for SLR (Q3)<br>• Ongoing engagement with stakeholders, landowners and wider community |

**Figure 10: Project-level plan for gate two**



# 16. Conclusions and recommendations

The SLR solution has progressed well to gate one and the programme has delivered against key objectives, including developing a set of initial concept designs, undertaking comprehensive hydrological analysis on sources of water and progressing with preliminary site selection. Some critical milestone decisions have been made: establishing the design ambition for the solution to be multi-sector and recommending the most appropriate sources of water for supporting the reservoir system.

Significant work has been delivered on developing and implementing innovative processes that support our collective ambition to co-create solutions with our stakeholders, working in partnership with WRE to develop a design that adopts a fully integrated multi-sector approach and will deliver significant wider benefits and public amenity value. Our programme is also fully integrated with the regional planning process.

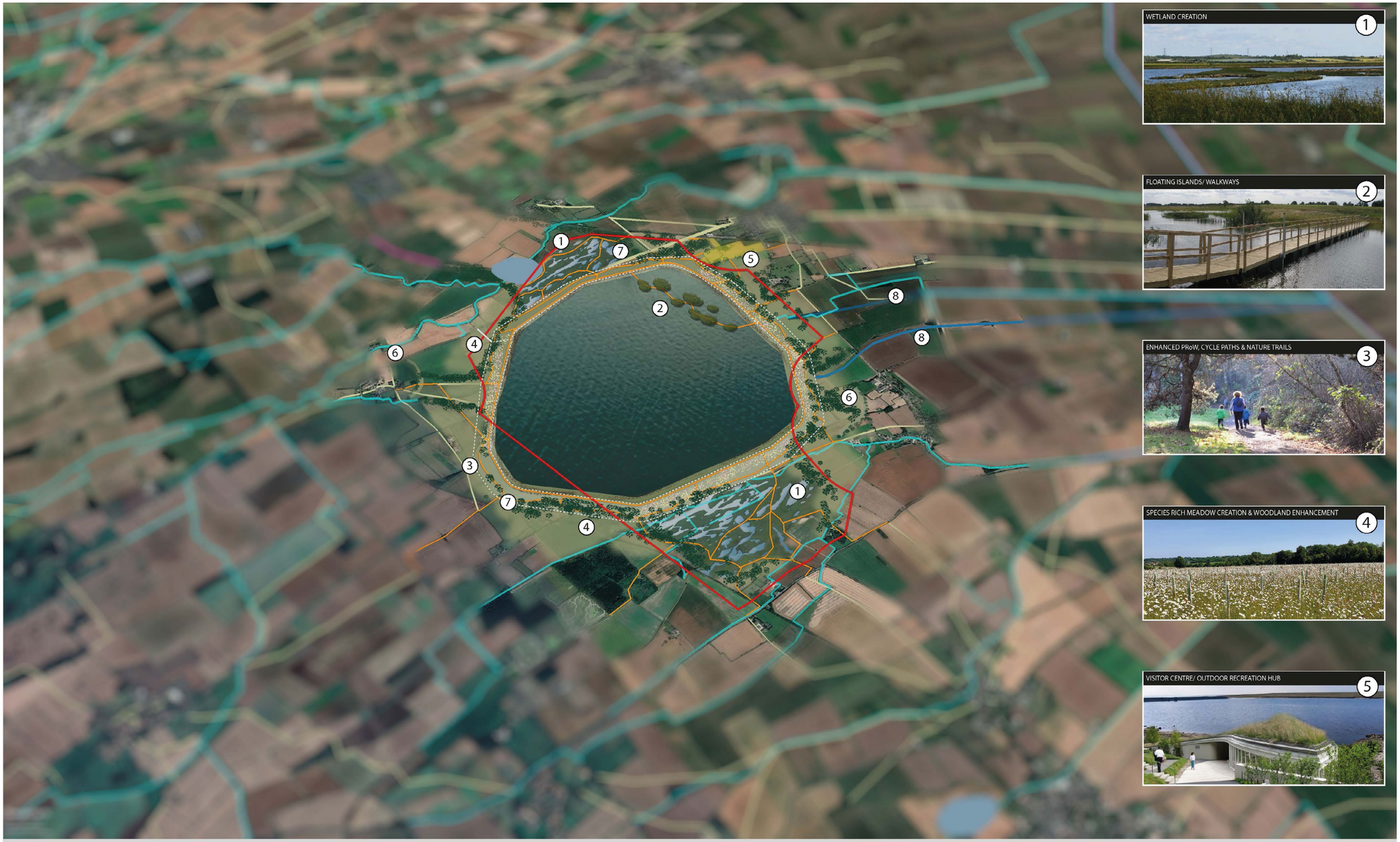
Spend is considered to be efficient and within budget and programme risks are understood. A more robust process for risk and opportunity management is in development for gate two.

The work completed to date has not identified any reason why the solution should not progress to gate two, and it is recommended that this solution continue on the RAPID standard gated process. Anglian Water and Affinity Water look forward to continuing to work in partnership with RAPID, WRE and stakeholders to progress an innovative solution that will bring multiple benefits to the region, customers, and the environment.

# Annex A: Landscape plans for concept design options

**Concept Design 01**

**Concept Design 02**




WETLAND CREATION 1



FLOATING ISLANDS/ WALKWAYS 2



ENHANCED PRoW, CYCLE PATHS & NATURE TRAILS 3



SPECIES RICH MEADOW CREATION & WOODLAND ENHANCEMENT 4



VISITOR CENTRE/ OUTDOOR RECREATION HUB 5



Existing footpath (PRoW)
Existing watercouses (Rivers, drainage)
Existing bridleway
Red line boundary
Access road/ maintenance

Proposed water transfer (open channels, pipes)
Online wetland ponds
Proposed wetland areas

Proposed islands (floating vegetated pontoons)
Proposed planting (Trees, shrubs)
Proposed wildflower meadows

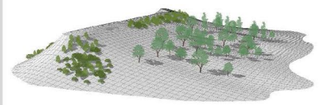
Proposed footpaths (cycle paths, nature trails and footpaths)
Visitor centre/ Outdoor recreational hub

0m 100m 200m 300m 400m 500m

N

6 SCREENING BUNDS

7 NATURALISTIC EARTHWORK SHAPING



8 OPEN WATER CHANNELS

**Concept Design 03**

















Existing footpath (PRoW)
Existing watercouses (Rivers, drainage)
Existing bridleway
Red line boundary
Access road/ maintenance

Proposed water transfer (open channels, pipes)
Online wetland ponds
Proposed wetland areas

Proposed islands (floating vegetated pontoons)
Proposed planting (Trees, shrubs)
Proposed wildflower meadows

Proposed footpaths (cycle paths, nature trails and footpaths)
Visitor centre/ Outdoor recreational hub

0m 100m 200m 300m 400m 500m

N



**Cover photo –** Taverham Mill