1 General

The *Consultant* is

Ove Arup & Partners Ltd	Name and address etc. of *Consultant*
[redacted]	Enter email address
	Insert the relevant framework tendered *fee percentage*

The *key persons* are

[redacted]	Name the *key persons* to be working on the contract
insert name	Name (3)
insert job	Job
insert responsibilities	Responsibilities
insert qualifications	Qualifications
insert experience	Experience
insert name	Name (4)
insert job	Job
insert responsibilities	Responsibilities
insert qualifications	Qualifications
insert experience	Experience
insert name	Name (5)
insert job	Job
insert responsibilities	Responsibilities
insert qualifications	Qualifications
insert experience	Experience
insert name	Name (6)
insert job	Job
insert responsibilities	Responsibilities
insert qualifications	Qualifications
insert experience	Experience
insert name	Name (7)
insert job	Job
insert responsibilities	Responsibilities
insert qualifications	Qualifications
insert experience	Experience

The following matters will be included in the Early Warning Register;

insert details	These are items which could affect the total of the Prices or delay Completion, which are known about at the time of completing this Contract Data
insert details	
insert details	
insert details	
insert details	
insert details	
insert details	
insert details	

3 Time

to be provided within two weeks of the Contract Date	The programme identified in the Contract Data is;	This is optional and is inserted if a programme is being initially provided
[redacted]	precast of the total Defined Cost plus the Fee	

Resolving and avoiding disputes

[redacted]		Enter postal address
		Enter email address
insert name	Name (2)	
insert address	address Line 1	Enter postal address
insert address	address Line 2	
insert address	address Line 3	
insert address	address Line 4	
insert address	address Line 5	
insert address	address Line 6	
insert email address	Email address for communications	Enter email address

X10: Information modelling;

The *information execution plan* identified in the Contract Data is;	If an *information execution plan* is to be identified in the Contract Data	X10 is always used
to be provided within two weeks of the Contract Date.		

Framework: Collaborative Delivery Framework
Supplier: Ove Arup & Partners Ltd
Company Number: 01312453

Geographical Area:
Project Name: TWA Strategic Future Asset Investment Needs study
Project Number: ENV0003341C

Contract Type: Professional Service Contract
Option: Option E

Contract Number: 32355

Revision	Status		Originator		Reviewer		Date

PROFESSIONAL SERVICE CONTRACT under the Collaborative Delivery Framework
CONTRACT DATA

Project Name TWA Strategic Future Asset Investment Needs study

Project Number ENV0003341C

This contract is made on 01 February 2021
between the *Client* and the *Consultant*

- This contract is made pursuant to the Framework Agreement (the "Agreement") dated 01st day of April 2019 between the *Client* and the *Consultant* in relation to the Collaborative Delivery Framework. The entire agreement and the following Schedules are incorporated into this Contract by reference
- Schedules 1 to 22 inclusive of the Framework schedules are relied upon within this contract.
- The following documents are incorporated into this contract by reference
  2021-05-12 Strategic Needs Study - Scope - v0.6_Final. Dated 12th May 2021.

Part One - Data provided by the *Client*

Statements given in all Contracts

1 General

The *conditions of contract* are the core clauses and the clauses for the following main Option, the Option for resolving and avoiding disputes and secondary Options of the NEC4 Professional Service Contract June 2017.

Main Option	Option E	Option for resolving and avoiding disputes	W2

Secondary Options

X2: Changes in the law

X9: Transfer of rights

X10: Information modelling

X11: Termination by the *Client*

X18: Limitation of liability

X20: Key Performance Indicators

Y(UK)2: The Housing Grants, Construction and Regeneration Act 1996

Y(UK)3: The Contracts (Rights of Third Parties) Act 1999

Z: *Additional conditions of contract*

The *service* is Assess the current system-wide resilience of the system (i.e. define assets, confirm asset condition, confirm risk of failure and review suitability of contingency plans where available) and propose measures to enhance future resilience.

The *Client* is Environment Agency

Address for communications [redacted]

Address for electronic communications

The *Service Manager* is
Address for communications

Address for electronic communications

The Scope is in
2021-05-12 Strategic Needs Study - Scope - v0.6_Final. Dated 12th May 2021.

The *partner contract* is

The *language of the contract* is English

The *law of the contract* is
the law of England and Wales, subject to the jurisdiction of the courts of England and Wales

The period for reply is 2 weeks

The *period for retention* is
6 years following Completion or earlier termination

The following matters will be included in the Early Warning Register

Early warning meetings are to be held at intervals no longer than 2 weeks

2 The *Consultant's* main responsibilities

The *key dates* and *conditions* to be met are

conditions to be met	*key date*
'none set'	'none set'
'none set'	'none set'
'none set'	'none set'

The *Consultant* prepares forecasts of the total Defined Cost plus Fee and *expenses* at intervals no longer than 4 weeks

3 Time

The *starting date* is 01 February 2021

The *Client* provides access to the following persons, places and things

access	*access date*

The *Consultant* submits revised programmes at intervals no longer than 4 weeks

The *completion date* for the whole of the *service* is 25th October 2021

The period after the Contract Date within which the *Consultant* is to submit a first programme for acceptance is 4 weeks

4 Quality management

The period after the Contract Date within which the *Consultant* is to submit a quality policy statement and quality plan is 4 weeks

The period between Completion of the whole of the *service* and the *defects date* is 26 weeks

5 Payment

The *currency of the contract* is the £ sterling

The *assessment interval* is Monthly

The *expenses* stated by the *Client* are as stated in Schedule 9

The *interest rate* is 2.00% per annum (not less than 2) above the Base rate of the Bank of England

The locations for which the *Consultant* provides a charge for the cost of support people and office overhead are All UK Offices

6 Compensation events

These are additional compensation events

1. Managing and mitigating the impact of Covid 19 and working in accordance with Public Health England guidance, as may vary from time to time, between 1st July 2021 and 31st August 2021
2. 'not used'
3. 'not used'
4. 'not used'
5. 'not used'

8 Liabilities and insurance

These are additional *Client's* liabilities

1. 'not used'
2. 'not used'
3. 'not used'

The minimum amount of cover and the periods for which the *Consultant* maintains insurance are

EVENT	MINIMUM AMOUNT OF COVER	PERIOD FOLLOWING COMPLETION OF THE WHOLE OF THE *SERVICE* OR TERMINATION
The *Consultant's* failure to use the skill and care normally used by professionals providing services similar to the *service*	**£5,000,000** in respect of each claim, without limit to the number of claims	12 years after Completion
Loss of or damage to property and liability for bodily injury to or death of a person (not an employee of the *Consultant)* arising from or in connection with the *Consultant* Providing the Service	**£15,000,000** in respect of each claim, without limit to the number of claims	12 years after Completion
Death of or bodily injury to the employees of the *Consultant* arising out of and in the course of their employment in connection with the contract	*Legal minimum* in respect of each claim, without limit to the number of claims	*For the period required by law*
The *Consultant's* total liability to the *Client* for all matters arising under or in connection with the contract, other than the excluded matters is limited to	**£5,000,000**	

Resolving and avoiding disputes

The *tribunal* is litigation in the courts

The *Adjudicator* is	'to be confirmed'
Address for communications	'to be confirmed'
Address for electronic communications	'to be confirmed'
The *Adjudicator nominating body* is	The Institution of Civil Engineers

Z Clauses

Z1 Disputes
Delete existing clause W2.1

Z2 Prevention
The text of clause 18 Prevention is deleted.
Delete the text of clause 60.1(12) and replaced by:
The *service* is affected by any of the following events
• War, civil war, rebellion, revolution, insurrection, military or usurped power;
• Strikes, riots and civil commotion not confined to the employees of the *Consultant* and sub consultants,
• Ionising radiation or radioactive contamination from nuclear fuel or nuclear waste resulting from the combustion of nuclear fuel,
• Radioactive, toxic, explosive or other hazardous properties of an explosive nuclear device,
• Natural disaster,
• Fire and explosion,
• Impact by aircraft or other aerial device or thing dropped from them.

Z3 Disallowed Costs

Add the following in second bullet of 11.2 (18) add:
(including compensation events with the Subcontractor, i.e. payment for work that should not have been undertaken).
Add the following additional bullets after 'and the cost of ' :
• Mistakes or delays caused by the *Consultant's* failure to follow standards in Scopes/quality plans
• Reorganisation of the *Consultant's* project team
• Additional costs or delays incurred due to *Consultant's* failure to comply with published and known guidance or document formats
• Exceeding the Scope without prior instruction that leads to abortive cost
• Re-working of documents due to inadequate QA prior to submission, i.e. grammatical, factual arithmetical or design errors
• Production or preparation of self-promotional material
• Excessive charges for project management time on a commission for secondments or full time appointments (greater than 5% of commission value)
• Any hours exceeding 8 per day unless with prior written agreement of the *Service Manager*
• Any hours for travel beyond the location of the nearest consultant office to the project unless previously agreed with the *Service Manager*
• Attendance of additional individuals to meetings/ workshops etc who have not been previously invited by the *Service Manager*
• Costs associated with the attendance at additional meetings after programmed Completion, if delay is due to *Consultant* performance
• Costs associated with rectifications that are due to *Consultant* error or omission
• Costs associated with the identification of opportunities to improve our processes and procedures for project delivery through the *Consultant's* involvement
• Was incurred due to a breach of safety requirements, or due additional work to comply with safety requirements
• Was incurred as a result of the *Client* issuing a Yellow or Red Card to prepare a Performance Improvement Plan
• Was incurred as a resulting of rectifying a non-compliance with the Framework Agreement and/or any call off contracts following an audit

Z6 The Schedule of Cost Components

The Schedule of Cost Components are as detailed in the Framework Schedule 9.

Z23 Linked contracts

Issues requiring redesign or rework on this contract due to a fault or error of the *Consultant* will neither be an allowable cost under this contract or any subsequent contract, nor will it be a Compensation event under this contract or any subsequent contract under this project or programme.

Z24 Requirement for Invoice

Add the following sentence to the end of clause 51.1:
The Party to which payment is due submits an invoice to the other Party for the amount to be paid within one week of the *Service Manager's* certificate.
Delete existing clause 51.2 and replace with:
51.2 Each certified payment is made by the later of
• one week after the paying Party receives an invoice from the other Party and
• three weeks after the assessment date, or, if a different period is stated in the Contract Data, within the period stated.
If a certified payment is late, or if a payment is late because the *Service Manager* has not issued a certificate which should be issued, interest is paid on the late payment. Interest is assessed from the date by which the late payment should have been made until the date when the late payment is made, and is included in the first assessment after the late payment is made

Z25 Risks and insurance

The *Consultant* is required to submit insurances annually as Clause Z4 of the Framework Agreement

Secondary Options

OPTION X2: Changes in the law

The *law of the project* is the law of England and Wales, subject to the jurisdiction of the courts of England and Wales

OPTION X10: Information modelling

The period after the Contract Date within which the *Consultant* is to submit a first Information Execution Plan for acceptance is 2 weeks

OPTION X18: Limitation of liability

The *Consultant's* liability to the *Client* for indirect or consequential loss is limited to

£1,000,000

The *Consultant's* liability to the *Client* for Defects that are not found until after the *defects date* is limited to

£5,000,000

The *end of liability* date is 6 years after the Completion of the whole of the *service*

OPTION X20: Key Performance Indicators (not used with Option X12)

The *incentive schedule* for Key Performance Indicators is in Schedule 17

A report of performance against each Key Performance Indicator is provided at intervals of

3 months

Y(UK)2: The Housing Grants, Construction and Regeneration Act 1996

The period for payment is 14 days after the date on which payment becomes due

Y(UK)3: The Contracts (Rights of Third Parties Act) 1999

term *beneficiary*

Part Two - Data provided by the *Consultant*

Completion of the data in full, according to the Options chosen, is essential to create a complete contract.

1 General

The *Consultant* is

Name Ove Arup & Partners Ltd

Address for communications [redacted]

Address for electronic communications [redacted]

The *fee percentage* is

The *key persons* are [redacted]

Name (1)
Job
Responsibilities
Qualifications
Experience

Name (2)
Job
Responsibilities
Qualifications
Experience

Name (3)
Job
Responsibilities
Qualifications
Experience

Name (4)
Job
Responsibilities
Qualifications
Experience

Name (5)
Job
Responsibilities
Qualifications
Experience

Name (6)
Job
Responsibilities

Qualifications
Experience

Name (7)
Job
Responsibilities
Qualifications
Experience

The following matters will be included in the Early Warning Register

3 Time

The programme identified in the Contract Data is

to be provided within two weeks of the Contract Date

Resolving and avoiding disputes

Address for communications

Address for electronic communications

X10: Information Modelling

The *information execution plan* identified
in the Contract Data is

to be provided within two weeks of the Contract Date.

Contract Execution

Client **execution**

Consultant **execution**

Environment Agency

NEC4 Professional Service Contract (PSC) Scope

Project / contract information

Project name	TWA Scheme Strategic Future Asset Investment Needs Study
Project SOP code	ENV0003341C
Contract number	32355
Date	12/5/2021

Assurance

Reviewed	Project Manager	Date: 2/2/2021
Reviewed	Senior User	Date: 5/2/2021
Reviewed	Project Sponsor	Date: 1/2/2021
Consulted (if required)	Add others (if required)	Date (if required)

Revision History

Revision date	Summary of changes	Version number
17/12/20	Arup first issue to EA project team for comment	0.1
19/01/21	Updated by Arup based on comments from EA project team, and newly provided Project Brief and Product Description	0.2
22/01/21	Flowchart added by Arup as per Amrik's request on 20/01/21 to summarise approach. Alignment of language with contract (removal of 'we' and 'our').	0.3
10/02/21	Minor changes to text to reflect further EA comments received on 08/02/21. Summary graphic of proposed approach moved to before detailed descriptions of scoped activities. Reference to soft-start to project added to Section 6 to describe how some limited scoped activities will commence prior to the contract for the work being awarded.	0.4
26/2/21	Minor changes as recommended by the EA procurement team.	0.5
12/5/21	Amendments following discussion with [redacted] on 10/5/21	0.6

1 Background

The Trent Witham Ancholme (TWA) River Transfer Scheme is a significant water transfer system south of the River Humber, commissioned in the mid-1970s, primarily to serve the increasing water demand associated with the South Humber bank industrial area. The TWA system transfers flows from the River Trent to the River Witham and onto the River Ancholme at Toft Newton.

The TWA system comprises:

- Two pumping stations (Torksey and Short Ferry);
- Over 12 miles of pipeline;
- A storage reservoir at Toft Newton;
- Scabcroft weir on the West Drain, and
- South Ferriby Sluice and Lock, where the Ancholme drains into the Humber Estuary, is vital to the success of TWA, although does not form part of the TWA asset base (asset managed by FCRM and Waterways). Boston Grand Sluice is similar as levels in the lower Witham impact on the operation of TWA.

The TWA system supports more than 100 abstraction licence holders across the agricultural and industrial sectors[1] and is a Category A Strategically Important Asset[2]. TWA also supports navigation in the River Ancholme and River Witham and protects water quality and the environment. The water transferred by TWA is key for several nationally-important industrial sites to the south of the Humber estuary. There are also flood and coastal risk management (FCRM) and navigation interests associated with the scheme (Environment Agency, EA, and Canal & Rivers Trust, CRT, respectively). As such, the TWA system is of national strategic importance to industrial use, public water supply, power generation, agriculture, navigation, recreation and environmental needs within the Ancholme, Witham and Humberside catchments.

The Lincolnshire and Northamptonshire Area (LNA) Hydrology & Operations (H&O) team manage the system and the Monitoring AEM holds the delegated responsibility for it under the EA Scheme of Delegation. The H&O team also provides services to the west of East Anglia (EAN) Area. The Area MEICA team provide the on-site day-to-day operation, funded by the H&O team.

2 Business Case

The TWA system operation is funded through charges from Anglian Water Services and other abstractors on the Ancholme. EA investment into the asset has followed funding availability over the past 5 years with approximately £3 million capital invested during that period.

In relation to the condition and resilience of the assets forming the TWA system:

- There has been no known internal inspection of the transfer mains.
- The reservoir has not been operated to its lower levels in over 20 years.
- The frequency of asset failure e.g. pump failures has increased in recent times.
- There are currently no effective bypass mechanisms for the pumping stations should they fail.
- Toft Newton reservoir provides between 4- and 16-days storage depending on the demand levels.

The H&O team is very stretched with a current total affordability of 7 Full Time Equivalent staff. The affordability can be exacerbated by dry weather operational pumping costs, further impacting on revenue headroom. There is very limited capacity within the H&O team to assess asset management needs or manage capital projects.

Historically on average Short Ferry pumping station pumps circa 6,000 ML and Torksey pumping station circa 2,170 ML of water each year. With increasingly drier summers and associated impacts upon water resources, the system is being operated more. In addition, the TWA System has been identified as a possible source of water for the South Lincs Reservoir (RAPID) project[3]. This would most likely mean that the TWA system is run in both winter and summer months, potentially exposing further underlying asset issues.

This study will underpin development of strategic risk mitigation, a long-term investment plan and an operational management model aligned to Environment Agency ambition for the TWA system.

3 Previous studies

In undertaking the *service* the *Consultant* shall take account of the previous studies detailed in the table below and produce a short technical summary explaining how best use will be made of historical data. These shall be provided by the *Client.*

Report	**Date**
Witham Catchment Abstraction Management Study	February 2013
Lower Trent and Erewash Catchment Abstraction Licensing Strategy	September 2020
River Anchome Catchment Management Plan	December 2000
Grimsby, Anchome and Louth Abstraction Licensing Strategy	March 2020
River Witham Abstraction Licensing Strategy	December 2020

The *Client* has advised that a 'Water Sources' report has been completed by Mott McDonald for the South Lincs Reservoir for Anglian Water. This will be used to help understand potential future demand requirements (as the *Client* advises there is likely to be some overlap between that study and the Strategic Needs Study). A data sharing licence will be generated by the *Client*.

The previous studies have been undertaken by or for the *Client* using reasonable skill and care and have been accepted. The *Consultant* shall review the information provided and notify the *Client* of any deficiencies in its adequacy. Following this review, and completion of any work required to rectify the deficiencies identified, the *Consultant* shall take the risk of any deficiencies in existing data quality and quantity which have not been notified to the *Client*.

All available information relating to the TWA system will be shared by the *Client*, but it is recognised that there will be more information likely available from the EA systems. This will be requested by the *Consultant* and obtained in the first phase of the study.

The TWA Maintenance Reliability Study will be carried out concurrently. The Consultant will ensure close coordination to ensure that all necessary information to allow decision making on the Strategy is provided when it is required.

4 Objectives

The Project Brief (version 2.2 dated 07/01/21) identifies the following three objectives for the study.

The study is required to:

1. Assess the current system-wide resilience of the system (i.e. define assets, confirm asset condition, confirm risk of failure and review suitability of contingency plans where available) and propose measures to enhance future resilience.
2. Identify and quantify the major factors that will impact on the system over the next 50-year period (2021 – 2070) e.g. climate change, South Lincs Reservoir (Regulators Alliance for Progressing Infrastructure Development - RAPID scheme), supply and demand changes, lifespan of assets and ownership.
3. Define the strategic asset investment plan that will be needed to ensure the future resilience and reliability of the system, aligned to climate adaptation and mitigation goals.

5 Study extent

The study is to include the following assets:

Asset	Location
Torksey Pumping Station	SK 83342 78046
Torksey to Foss Dyke Canal Pipeline	
Torksey Outfall	SK 83955 77959
Short Ferry Pumping Station	TF 09112 71806
Short Ferry to Toft Pipeline	
Toft Newton Outfall	TF 03246 87485
Toft Newton Reservoir	TF 03540 87488
Scabcroft Weir	SE 96806 18120
South Ferriby Sluice	SE 97514 21061
Boston Grand Sluice	TF 32367 44503
Monitoring sites that influence TWA (e.g. gauging stations, raingauges)	

Although not directly linked to the TWA system, the Consultant will review a further two assets.. These assets control water levels and are associated with flood risk management rather than water supply, but the interaction of them with the TWA system must be understood:

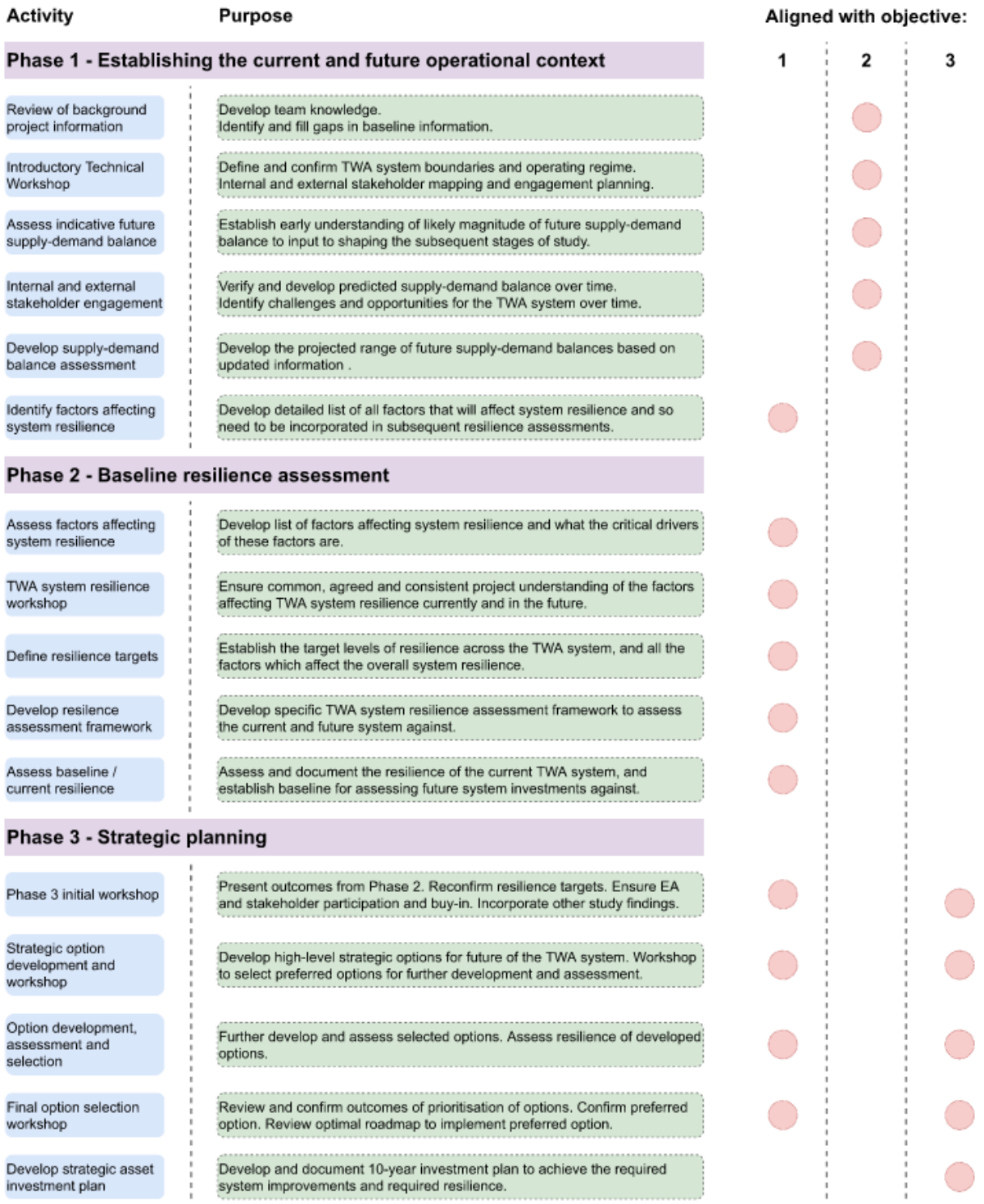
- Bardney Sluice and Lock on the Ancholme.
- Stamp End Sluice and Lock on the Witham.

6 Scoped activities and outputs

The principal activities scoped below are not envisaged to change during the course of the study, but as the study progresses and more information is known, the specific week-by-week activities being undertaken will be planned and resourced within the overall direction of travel explained below. Regular look-ahead and progress reporting will be provided by the Consultant to the EA PM to provide assurance on the progress towards achieving the project objectives.

6.1 Summary graphic of proposed approach

A summary graphic illustrating the principal components of the proposed approach by the Consutlant is shown below.



6.2 Phase 1: Establishing the current and future operational context

Phase 1 addresses Objective 2, and identifies the relevant factors affecting the resilience of the system to be determined (which will then enable Objective 1).

The strategy is **primarily** related to water resources. The fundamental purpose of the TWA system is to supply the required volumes of water to the River Ancholme in the future with sufficient resilience. Phase 1 of this study will define the current and future demands. However, there are also a range of **secondary** considerations which will influence the development and selection of the optimal overall strategy and ensure the necessary overall resilience. Phase 1 will identify these so that they can be sufficiently defined and understood during Phase 2 to feed into the development of the strategy in Phase 3.

The *Consultant* will commence Phase 1 by collating, reviewing and assessing for adequacy for inclusion in the study all the available information detailed above, and through relevant other external sources. This review will include the outputs of the internal EA stakeholder questionnaire which has been circulated by the *Client*. A summary document will be produced by the *Consultant* and presented back to the *Client.*

The review of the existing data will then lead into a single half-day Introductory Technical Workshop. The Arup Jacobs team anticipate this being a virtual workshop between the Arup Jacobs team and the EA to discuss, understand and confirm a mutual baseline understanding of the current assets forming the TWA system and the current operating regime of the system. The people with specific expert knowledge of the TWA system will be identified and mapped to ensure that the relevant expertise is drawn into the study as needed. Any future requirements of the system's operation which differ from current requirements will be defined. The responsibilities for operating and maintaining the various aspects of the system will also be mapped. Any known future challenges and opportunities for the system will be discussed and documented as basis for further investigation through the study[4]. The known external stakeholders will be listed, along with identification of existing communication and engagement channels with them. Any long-term aspirations for the EA in relation to the TWA System within the current water resource and supply framework will be investigated and documented.

The workshop will enable the main Phase 1 work to be undertaken – that of investigating and defining the current and future operational context for the TWA system. The first stage of this will focus on the water supply and demand balance. This will be achieved through assessing the:

- Water availability. Data on the available water resources for this catchment / area will be compiled including interannual and seasonal variability (high flows and low flows). This will draw on CAMS Ledgers (owned by the Integrated Environmental Planning IEP team) and the previous studies referenced in Section 2.
- Water demand: The demand data will be compiled and reviewed. This will include the original demands at scheme inception, the current demands (including seasonal variability and sensitivity) and assessed future demands (based on available sources at this stage). Water demands are primarily from the agriculture, industry and water sectors, as well as environmental needs.
- The supply-demand balance: Based on the water availability and demand data the Arup Jacobs team will identify potential deficits or surpluses, compile the current and future water supply-demand balance and identify opportunities to plug deficits or utilise surpluses.

The purpose of this first stage is to develop an early understanding of the magnitude of the likely changes in the system requirements over the assessment period being considered in the Strategy. This early understanding is required as the magnitude of the difference of the future supply-demand balance from the existing will shape the focus of the ongoing strategy development. At this stage the approach to the study may need to be reconsidered. For example, if the assessment at this stage identified that the existing rising main from the Short Ferry pumping station was likely to have insufficient capacity for the flows required in the future this would steer the study towards options where the capacity of this could be enhanced. However, if the existing assets are indicated at this stage to likely have sufficient capacity

for the required demands, then the focus of the strategy will be more on how these can be optimised or incrementally supplemented as needed.

The second stage of Phase 1 will be to engage with the internal EA and external stakeholders[5]. The purpose of this will be to verify and confirm the future water demand data which has been collated and quantify the extent of any uncertainty and risk of change in this data. The *Consultant* must anticipate this being primarily done through existing communication and engagement channels but culminating in a virtual workshop with both EA and external stakeholders to discuss the developed resource-demand balance and outline implications arising for TWA system, both challenges and opportunities.

In parallel with the stakeholder engagement exercise, a more detailed assessment of the potential future changes to the water availability and water demand will be undertaken. This will ensure that the estimates of both and the overall supply-demand balance are more robust, and with better defined ranges of uncertainty / sensitivity. This more detailed assessment will include a thorough review of major factors that will affect the operation of the system in the next 10 – 50 years including climate change of 2°C and 4°C (positive temperature changes), changing regulation / policy frameworks, and changing water quality requirements. The Arup Jacobs team have not allowed for specific local climate change modelling but will base the work on WRE and Anglian Water climate change assumptions, along with any other projections that Arup, Jacobs or the EA may have access to, such as those presented at the November 2020 Climate Adaptation Workshop for the TWA scheme. Climate change could affect water availability in the River Trent, water availability in the River Witham, environmental requirements for flows in the River Ancholme, and abstraction volumes and timings from the River Ancholme due to changes in agriculture and industry.

The **secondary** considerations which will affect and need to be considered as part of (a) the overall system-wide resilience and (b) the strategy will be identified in Phase 1. These are expected to include the items listed in the table below. This this list may be supplemented or changed depending on the findings of the team during the investigations undertaken in Phase 1.

Aspect	**Affects:**	
	TWA System Resilience	**Overall Strategy**
Climate change adaptation measures required for existing assets on the TWA system – protection from flood water inundation, increased scour in rivers, higher retained water levels, dryer ground leading to subsistence, etc	✓	
Existing asset condition and residual design life	✓	
Existing contingency plans	✓	
Mitigating greenhouse gas emissions associated with the operation of the TWA system in alignment with the EA's corporate commitment to achieve carbon net zero by 2030 (eMission2030)		✓
Operational costs from grid electricity, standby generation, planned maintenance, reactive maintenance etc. and other factors identified.		✓
TWA system ownership, responsibility and accountability - a RACI analysis[6] for the system to define system stakeholders and governance of the system of both its assets and performance.	✓	✓
Historic failure patterns. TWA asset maintenance is being considered in another study, but this review is to identify any significant potential future asset weaknesses which may affect the strategy and system resilience.	✓	✓

Although achieving carbon net-zero by 2030 is only one of the secondary considerations of this strategy, the *Consultant* must note the importance of this as part of the overall strategy. Determining the optimal strategy and investment plan requires consideration of energy use. This may affect aspects such as the types of pumps used, options for energy recovery, options for reducing pumping and increasing gravity flows, lining pipes to reduce friction to flows, investigating potential for solar photovoltaic installation etc. The *Consultant* will engage with the teams in the EA that have already been considering what net-zero could look like in the context of the TWA system and seek to incorporate that work into the strategy development, building on it through the strategic options developed. It will be important to define the boundaries within which net-zero is considered. As the strategy relates to the TWA system assets, and primarily the two pumping stations, the net-zero assessment will only include the TWA system assets. Wider assessment on the greenhouse gas emissions that result from or are saved by the water which is used by industry, agriculture and other extractors from the River Ancholme will not be included in this study. Taking this approach will target the net-zero considerations to the extent of the TWA system which the EA have direct control of.

6.3 Phase 2: Baseline resilience assessment

Phase 2 partially addresses Objective 1 and enables development of the framework to assess strategic options for the TWA system.

Identify system resilience drivers.

The Consultant will identify from the outset what 'system resilience' means in the context of the TWA and all the elements involved: asset operation and maintenance, water supply and demand variation, stakeholder commitments in the short, medium and long-term, external factors which affect the system, etc. In order to correctly identify what system resilience means, it is important to understand what the critical factors in each instance are; these are the drivers of system resilience needs and expectation.

The *Consultant* will identify these drivers using a combination of the information gathered in Phase 1 and a desktop review of additional information (to be confirmed if gaps are identified following Phase 1). This information will be assessed within the context of the Environment Agency's policy and strategic ambitions for the TWA i.e. that by 2030 it will be carbon neutral (eMission 2030), resilient to climate change and play an effective and integrated role in meeting the water resource demands of agriculture, navigation, public water supply and industry. This will require the *Consultant* to work with the EA team to consult on and identify how internal stakeholders would like to see the TWA managed in the future.

The *Consultant* will plan and host a single day-long virtual workshop with TWA stakeholders, identified from the TWA stakeholder mind map shared by the Client. The discussion will focus on identifying key resilience parameters, which would be expected to vary by stakeholder, as well as external factors such as planning horizons and regulatory requirements. In order to frame and aid the discussions, the *Consultant* shall produce a proforma which will be circulated sufficiently in advance of the workshop to enable responses to be written, collated and compiled for discussion.

The assessment, proforma development, workshop and outcome compilation will be carried led by team members with experience of developing resilience strategies and plans for the water industry in the latest Price Review 2019, including Yorkshire Water, Welsh Water and Anglian Water.

Develop resilience objectives and assessment framework

Following identification of the drivers of resilience, the *Consultant* will develop resilience objectives to confirm the ideal target/best practice for the system. These will be aligned with the Project Brief requirements and informed by the findings of the 'resilience drivers' task above. The *Consultant* will follow this up by developing a suitable assessment framework which can be used to carry out the subsequent resilience baseline assessment of each of the TWA systems elements identified in the previous task.

The *Consultant* will draw on experience of developing resilience frameworks, specifically the following pieces of work:

- Yorkshire Water Resilience Maturity Assessment and Framework
- Anglian Water Resilience Maturity Assessment
- Arup/Rockefeller City Water Resilience Framework (Hull City Assessment)

The framework will take into account key information including: TWA system supply-demand balance assessed in Phase 1; climate change resilience; carbon neutrality; integrated water resource management, multi-stakeholder involvement and contingency plans. The framework will also seek to identify, understand and take account of the TWA system and service boundaries and service requirements.

Resilience baseline assessment

Finally, the *Consultant* will use the resilience framework developed in the above task to carry out the baseline resilience assessment of the TWA system. The baseline assessment will assess the maturity of the TWA system from a resilience perspective, using the categories/elements identified in the framework. For each category or element, a score ranging from 1 (worst/weakest/least developed/ furthest from best practice) to 5 (best/strongest/most developed/meets best practice) is allocated, which indicates how that category scores based on assessments by resilience specialists.

The baseline maturity assessment provides a starting point for identifying priorities for improvement and, over the long-term, provides a record of improvements in system resilience over time.

6.4 Phase 3: Strategic planning

Phase 3 addresses Objective 3 and will draw the study to its conclusion building on the assessments and engagement in Phases 1 and 2.

Ambition setting

The *Consultant* will plan and hold a virtual workshop with the *Client* project team to agree resilience ambition and targets. The discussion will be informed primarily by the findings of Phase 2, particularly the resilience drivers, the baseline resilience maturity assessment and the asset criticality assessment. The workshop will review the review the resilience assessment, reconfirm the resilience ambition, and identify any areas where the *Client* may seek to build on the original ambition. This will set the necessary foundation for the asset resilience strategy, bringing the *Client* and other stakeholder priorities to the fore.

The task will also provide an opportunity for the EA and study team to reconfirm what is required of asset resilience strategy, with the benefit of this study findings so far, as well as those of the TWA Maintenance Reliability Study and Transfer Scheme Pipeline Improvements Study. This will require coordination with the respective study teams from Arup and Jacobs. However, it is not anticipated that the other two study teams will attend this workshop.

Option development

The *Consultant* will develop an initial shortlist of high-level strategy options which address the key resilience priority areas identified through the baseline maturity assessment and confirmed through the ambition-setting workshop. No more than five high-level initial strategies will be developed for discussion with the EA team. For ease of reference, each high-level strategy will be presented as a flow chart / infographic with supporting narrative slides.

A virtual workshop with TWA stakeholders will be held to discuss the high-level options and identify three options to be taken forward for appraisal (development of option detail) and prioritisation.

Option prioritisation, costing and investment plan development

Following confirmation by the EA, the three strategies identified at the workshop will be further developed, appraised, and taken through a prioritisation exercise, with a view to identifying a single preferred strategy.

The *Consultant* will utilise their asset management and resilience experience to develop a methodology for prioritisation and appraisal of options. This will be informed by and build on approaches used in a variety of sectors, particularly the water sector and flood risk sector in the UK. The methodology will take account of wider benefits provided by natural capital approaches, through water sector and flood risk sector experience, while addressing climate change and carbon neutrality (eMission 2030). The *Consultant* will consult with the EA before applying the methodology.

Each option will be presented as a flow chart/infographic on a slide with supporting narrative slides, to be shared with the EA for review following prioritisation.

The *Consultant* will host a final workshop to discuss the three prioritised options. The objectives of the workshop will be:

- To review and confirm the prioritisation exercise.
- To confirm the preferred option.
- To develop a high-level 'best value' roadmap of interventions to ensure resilience of the system over the planning horizon.

Develop proposed asset resilience strategy

Finally, the *Consultant* will develop the preferred asset resilience strategy, incorporating the best value interventions and indicative order of magnitude costs of implementing the strategy.

A 10-year investment plan will be developed to support the strategy and ensure that the TWA is fit for the future (to 2070), aligned with other stakeholders and meets the Environment Agency's environmental sustainability commitments.

In order to do this strategy, the *Consultant* will provide answers to the following questions:

- Which assets make up the TWA system?
- How does the EA best ensure long-term operational resilience?
- How could the TWA system meet the EA Net Zero initiative?
- How could the EA adapt the TWA system to meet the future climate change risks?
- How does the TWA system relate to neighbouring catchments / systems?
- What changes in agriculture, PWS, industry abstraction etc, does the EA need to factor into plans?
- How does the EA ensure they do not adversely impact on the WFD status of the affected water bodies and continue to meet other regulatory requirements?
- Who are the primary stakeholders / who is the audience and what is their stake? How do they affect the system or other stakeholders and how are they affected by it?
- How does the EA best build a modern stakeholder partnership approach to the renewal, modernisation and adaptation of the assets?
- What is the right investment plan to meet the TWA system's strategic goals?
- How should the EA achieve best value from the TWA system.

The Strategy will be supported by operational-level strategies. The *Consultant* will answer the following questions:

- What is the condition of the assets?
- Could enhanced levels of automation and monitoring help optimise the system?
- What resources will be required to support effective and efficient operation?
- What assets and operating regimes support eMission 2030?

7 Outputs and deliverables

The Consultant shall produce a single project report which will be developed through the course of the study. This will be updated and issued at the end of each phase. Indicative structure and contents are summarised in the table below.

Content		Included in report issued at end of:		
		Phase 1	**Phase 2**	**Phase 3**
1	Definition of and summary of existing TWA system: • Assets comprising the TWA system • Operating regime • Capacity	✓	✓	✓
2	Current operational context	✓	✓	✓
3	Future operational context and drivers of change • Operating regime	✓	✓	✓
4	Current and future supply-demand balances • Current system supply-demand requirements • Demand profiles and resource range provided by system • Climate change impact on demand and supply • High-level future supply-demand balance visualization, including impact of climate change	✓	✓	✓
5	Stakeholders and Governance • EA stakeholders (internal only) • TWA stakeholders (all) • TWA governance • Gap analysis	✓	✓	✓
6	Resilience Assessment • Summary of resilience drivers • Resilience assessment objectives and framework • Asset criticality analysis • Resilience baseline analysis (maturity assessment)		✓	✓
7	Asset Resilience Strategy • Summary of resilience ambition • Summary of high-level asset resilience strategy options • Option appraisal and prioritization methodology • Preferred (proposed) asset resilience strategy • Asset resilience strategy costs • Governance (how to bring the strategy to fruition)			✓
8	Asset Resilience Strategy Implementation Plan • Future timescales and actions required • Programme and costs • Stakeholders and roles • Long-term commitments and anticipated outcomes (carbon, sustainability, adaptation)			✓
	Appendix – Information log of all input and reference information supporting the study.	✓	✓	✓
	Appendices - Outputs from the Introductory Technical Workshop and stakeholder supply-demand balance workshop.	✓	✓	✓
	Appendices - Outputs from the Asset Resilience Drivers Workshop		✓	✓

	Appendices - Outputs from the Ambition Setting Workshop, the Option Development Workshop and Option Prioritisation Workshop.			✓

8 Relevant guidance

The *Consultant* shall deliver the service using the following guidance:

Ref	Report Name	Where used
LIT 16559	Safety, health environment and wellbeing (SHEW) Code of Practice	Throughout
OI 120_16	Whole-life Carbon Planning Tool	Option development
LIT 14284	Whole Life (Construction) Carbon Planning Tool User Guide	Option development
	Project Cost Carbon Tool	Costs
LIT 12982	Working with Others: A guide for staff	Consultation & Engagement
OI 1334_16	Benefits management Framework	OBC
Gov.uk	Partnership Funding Calculator Guidance	OBC
LIT 15030	The Investment Journey	OBC
LIT 55124	Write a Business Case	OBC
LIT 12280	Lessons Log template	OBC

9 Services and other things provided by the *Client*

The *Consultant* will be provided with the necessary access to Environment Agency systems and resources required to enable the work including Asite, FastDraft, and the Collaborative Delivery Community SharePoint.

If required for site access, site access authorisation letter(s) will be provided.

The *Client* will provide the previous studies listed in Section 1.2 within two weeks of contract award, and any other available information within 2 weeks of the request.

10 COVID-19 related considerations

In relation to the ongoing COVID-19 pandemic, the *Consultant* note the following requirements in relation to the delivery of the Scope defined in this document.

The *Consultant* is not liable for any delay or failure to fulfil any obligation under the Agreement to the extent any such delay or failure caused by, or is a consequence of:

(a) cancellation, postponement or restriction of any domestic or international travel, meetings or visits to site which the *Consultant,* in its absolute discretion, considers is necessary for the health and safety and welfare of its employees, advisers, contractors and/or subcontractors; and

(b) any event or circumstance outside the reasonable control of the *Consultant* including, without limitation, issues relating to the novel coronavirus (COVID-19) outbreak, whether or not those issues were known at the date of the Agreement.

The Parties agree that, notwithstanding requirements specified elsewhere in the contract, persons engaged in the performance of this contract shall not be required to travel contrary to travel advice or where it is reasonably deemed that to do so would prejudice their health, safety or wellbeing. The Parties will use reasonable endeavours to facilitate the diligent performance of their obligations. However, should the Parties be constrained from doing so for matters outside their reasonable control, the Parties shall not be liable for any delay or disruption to the performance of the Services.

In the event that performance of the Services is disrupted due to matters beyond the *Consultant's* reasonable control, the time for performance shall be adjusted by such periods as is fair and reasonable in the circumstances. In the event of such disruption, should additional resources be necessarily expended in order to diligently proceed with the Services, the *Consultant* shall (i) give notice to the *Client* that additional resources shall be expended and (ii) be entitled to a fair and reasonable additional fee.

11 Constraints

- This study will be iterative. It is not possible to define exactly the activities which will be undertaken to achieve the project objectives. This is partially as the scope is being compiled prior to the magnitude of future changes to the system being investigated and understood, and those will significantly influence the investment plan needed.
- That all applicable data and information is not readily available.
- A multitude of stakeholders to appease.

12 BIM

Outputs to be produced in accordance with the BIM Protocol – Production and Delivery Table.