Fens 2100+

Great Ouse

Baseline economic appraisal report

2025

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1. Executive Summary

As part of the Environment Agency collaborative delivery framework (CDF), Ove Arup and Partners Ltd (Arup) have been commissioned to present an economic baseline for the Great Ouse catchment, with reference to current and future flood risk management. This report presents an evaluation of key receptors at risk of flooding across the catchment and focuses on defining broad economic impacts. The project focuses on the extents of the River Great Ouse from the Earith Sluice to the outlet of the Tidal River Ouse into The Wash at King's Lynn. The catchment is protected from flooding by a network of drains, embankments, pumping stations and sluice gates. These are operated by the Environment Agency as well as a series of Internal Drainage Boards (IDBs), including the Middle Level Commissioners, Ely Group of IDBs, Downham Market Group of IDBs, the Whittlesey Consortium of IDBs, Ramsay IDB and the King's Lynn IDB.

This economic assessment has focused on quantitively defining high-level impacts to a series of the key receptors at risk, including:

- Residential Properties;
- Non-residential Properties;
- Agriculture;
- Environment & recreational sites;
- Highways;
- Rail;
- Gas;
- Electricity;
- Water;
- Isolated Properties; and,
- Local losses to the economy as Gross Value Added.

The Do Nothing baseline scenario identifies present value damages of up to £20,655 million (£27,272 million with GVA) across the catchment extents over a 100-year period. This is compared to the estimated damages associated with existing flood risk management arrangements of £559 million. Based upon the analysis, the present FRM arrangements and activities across the catchment are estimated to afford a benefit of £20,097 million (£26,713 millio with GVA) to the Great Ouse catchment. Without these activities to reduce flood risk and manage water levels in the catchment, the study area is at risk of permanent inundation – impacting across the natural, social, economic, human, intellectual and manufacturing capitals. The analysis demonstrates that there is a case for flood risk management in the long term, but the optimal flood risk management regime has not yet been determined.

With a benefit cost ratio of 7.12, maintaining the flood defences in the Great Ouse catchment has a Partnership Funding score of 45% and is eligible for £1.2 billion in Grant in Aid, which leaves a funding gap of £1.5 billion.

1.1 Glossary

Table 1-1: Glossary of economic terminology

Terminology	Summary Definition
Scenario	A scenario is defined as a representation of what flood risk could be based on an explicit set of assumptions. This can include multiple flood mechanisms. For example, in a Do Nothing scenario all risk management authorities would walk away from operation and maintenance of their flood risk management assets leading to more extensive flooding of communities beyond the status quo. This could be made up of a combination of overtopping of defences, breach, or other flood mechanisms.
Standard of Protection (SoP)	At a given point in time, the Annual Exceedance Probability (AEP) of a flood event which an asset is able to withstand. SoP will vary over time.
Standard of Service	The physical attributes or output of an FCERM asset or service usually set out in a design specification. For example, the height of a wall or barrier, the pumping capacity of a pump, the scale, extent and frequency of a service. The standard of service does not change over time as a result of impacts such as climate change whereas the SoP does.
Receptor	A receptor is defined as something that is affected by a flood. For example, a residential property in the floodplain would be a receptor.
Appraisal period	The appraisal period is the length of time where damages, benefits, and costs are calculated for a particular intervention.
Present Value	Values expressed in today's terms following relevant discounting.
Cash	Values expressed in today's terms not discounted.
Damages	The value of negative social, economic and environmental impacts caused by flooding.
Benefits	The positive quantifiable and unquantifiable changes that a flood risk management scheme is expected to produce, e.g. damages avoided
Write off	Write-off is losses to an asset deemed unrecoverable
Discounting	Discounting is a method of converting future costs and benefits with different time spans to a common "present value" basis using a discount rate. HM Treasury discount rates are used, which adjust for social time preference, defined as the value society attaches to present, as opposed to future consumption. The rates are based on comparisons of utility across different points in time or different generations.

2. Introduction

2.1 Aim and purpose of this document

This document presents a catchment-scale economic baseline for the Great Ouse catchment as part of the Fens 2100+ Project 3 baselining, with reference to the current flood risk management regime. This report details the baseline scenarios assessed, the methodology utilised in the economic appraisal, costs associated with maintaining the status quo within the catchment, as well as a summary of the results.

The appraisal is based upon the previous work undertaken by Capita AECOM in 2020[1]. The results from this appraisal are uplifted to 2025 values along with some changes to approach implemented following subsequent reviews and work on the Lower Witham[2].

Along with the suite of Fens 2100+ documents, this report aims to build the evidence required to support investment certainty in the short term, clarity of actions in the medium term, and shared confidence for the long term. This will support RMAs and partners in securing the essential national and regional investment to ensure future flood resilience through delivery of the right projects, in the right places, at the right time.

This project has sought only to produce a baseline economic appraisal. At this stage, no Do Something options have been considered.

2.2 Catchment context

The Great Ouse catchment (hereafter referred to as “the catchment”) covers 2,196km^2 stretching across Cambridgeshire, Norfolk and parts of Lincolnshire, Suffolk and Huntingdonshire. It is the most southerly of all the catchments in the Fens 2100+ study area (see Figure 1). The catchment is bordered by the low clay hills of the Huntingdonshire Uplands to the south-east while to the west the catchment is bounded by the Whittlesey Washes and the River Nene. It is noted that this is not necessarily a hydrological catchment but is defined as a catchment for the purposes of the Fens 2100+ work.

The catchment topography is flat and low lying with 32% of the study area lying below mean sea level, and 62% lying below 2.5m AOD (above Ordnance Datum). The lowest area in the catchment is in the south at Holme Fen, where the land surface is 2.75m below sea level, making it the lowest point in Britain. The Great Ouse Fens is a highly productive agricultural area with approximately 41.8% of the land classified as Grade 1 (the best and most versatile). The landscape of the catchment includes small settlements as well as the cathedral city of Ely, the historic market town of March and the port and market town of King’s Lynn. This catchment supports a total population of approximately 326,000. Connectivity between settlements in the catchment and beyond is facilitated by main roads including the A10, A47, A141, and A142, as well as railway links with stations at King’s Lynn, Watlington, Downham Market, Littleport, Ely, Soham, March, Manea, Shippea Hill and Lakenheath.

The whole catchment has been affected, including March and Ely, by recent flooding including three red flood warnings issued in October 2023 during Storm Babet. Storm Henk caused further flooding in the catchment in January 2024, prompting amber flood

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[1] Environment Agency (May 2020). Future Fens Flood Risk Management Economic Appraisal Report

[2] Arup (September 2024). Lower Witham Flood Resilience Project Economic Appraisal Baseline Report

warnings on the River Great Ouse, Lower River Cam and the Hundred Foot Washes. Sustainably managing flood risk within these areas is crucial to maintaining agricultural productivity and ensuring long term resilience in the face of climate change.

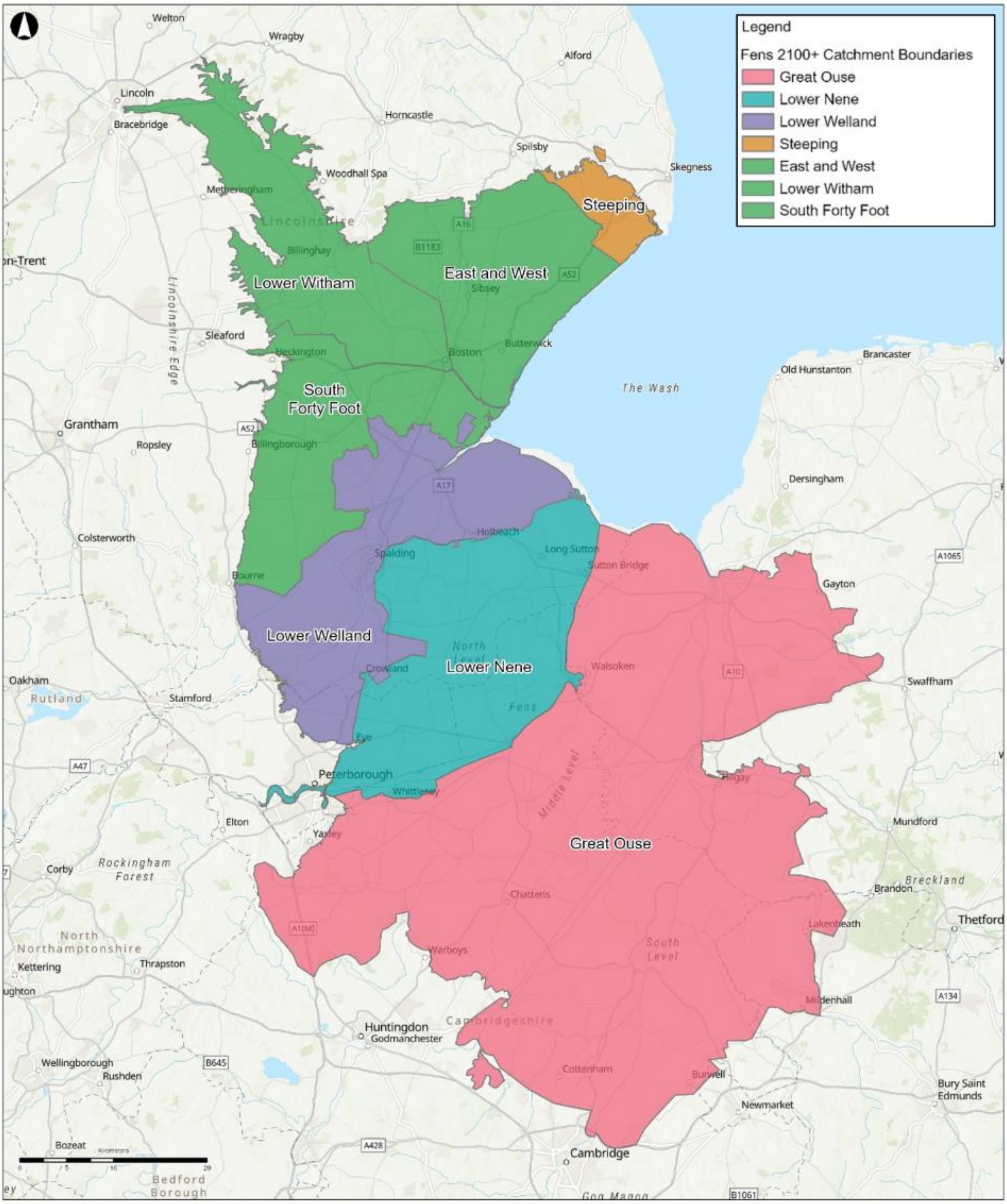


Figure 1: Catchments covered within the Fens 2100+ economic appraisal

2.2.1 Drainage network

The primary watercourse within the catchment is the River Great Ouse, which is the fourth longest river in the UK. As the river enters the catchment study area at Earith it splits, with much of the flow diverted over 31km through the Ouse Washes, and some directed through the adjacent tidal Hundred Foot River which runs parallel to the Washes. From Earith, the course of the Great Ouse continues in a wide loop down the Old West, becoming the Ely Ouse and then finally the Ten Mile bank. It re-joins the tidal River Ouse at Denver just below the outfall of the Ouse Washes at Welmore Sluice on the tidal Hundred Foot River. The Tidal River Ouse eventually discharges past King’s Lynn into The Wash.

Alongside the Main Rivers, the Great Ouse catchment also contains a branched network of drainage channels with numerous water level management structures which allow the water levels in the low-lying catchment to managed. A series of IDBs are responsible for managing this complex network of ditches that drain the farmland within the catchment and discharge to the Main River System. These IDBs are grouped into consortiums within the catchment including the Middle Level Commissioners, Ely Group of IDBs, Downham Market Group of IDBs, the Whittlesey Consortium of IDBs, Ramsay IDB and the King’s Lynn IDB.

2.2.2 Asset schematisation

Three graphical schematisations of the catchment have been produced to provide additional context to this section. These are shown on Figure 2 to Figure 4.

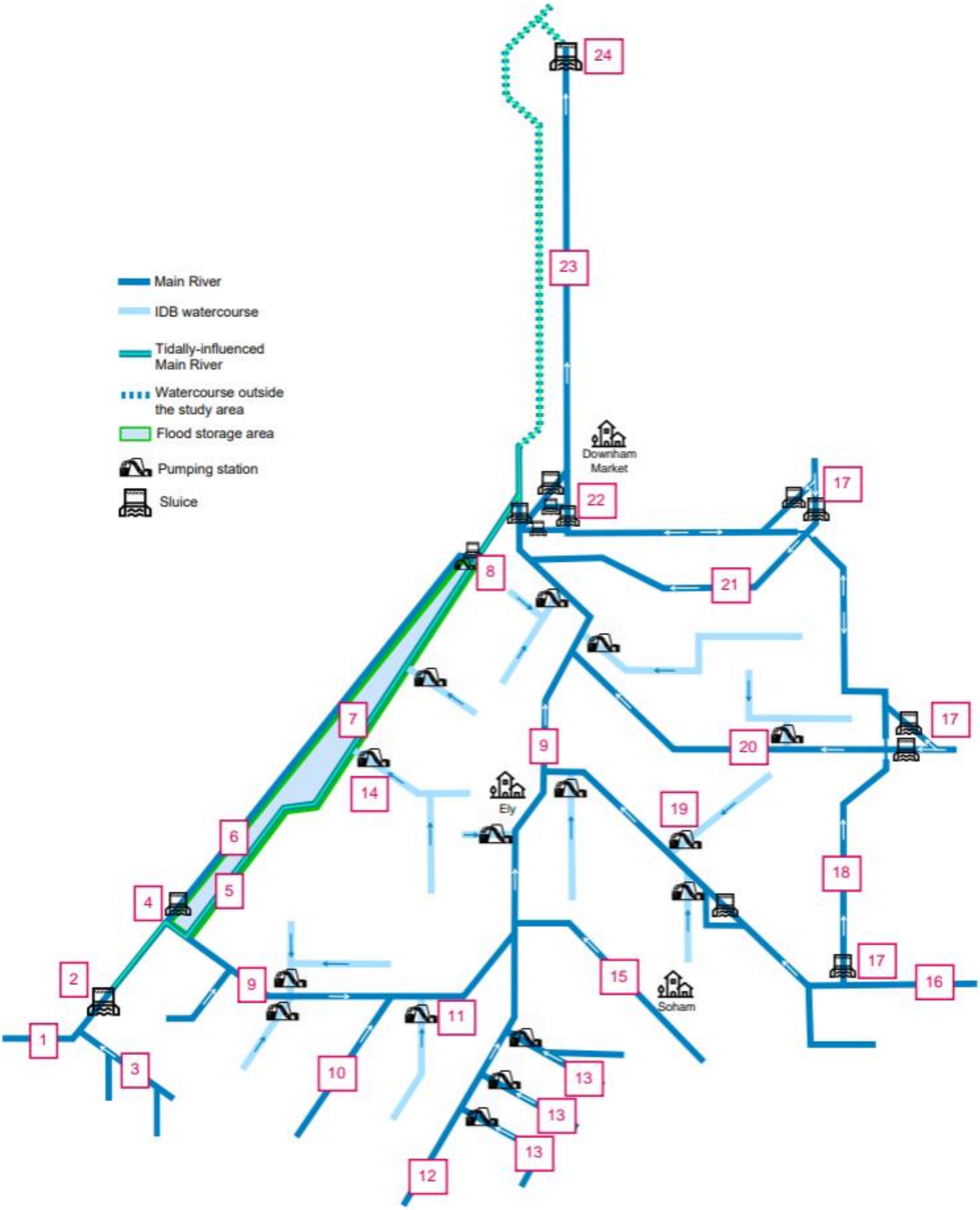


Figure 2: Schematisation of the flood risk assets in the Great Ouse catchment (King's Lynn, East of Ouse and West of Ouse)

1 **River Great Ouse**
Main River
At 200km long, it is the fourth longest river in England.

2 **Brownshill Staunch**
Environment Agency
The tidal limit on the Great Ouse system, which is tidal on the Hundred Foot River.

3 **Swavesey Drain**
Main River
Drains the area between Swavesy, Over and Longstanton.

4 **Earith Sluice**
Environment Agency
Opens automatically when there are high flows in the Bedford Great Ouse to let some water into the River Delph/ Old Bedford River.

5 **Hundred Foot River/ New Bedford River**
Main River
The usual route for water from the River Great Ouse under normal conditions. It is tidal here and as far inland as Brownshill Staunch.

6 **River Delph/ Old Bedford River**
Main River

7 **Ouse Washes**
Environment Agency & Partners
When Earith Sluice opens, high flows are diverted into the Old Bedford River and once its capacity is exceeded, water spills into the Ouse Washes. Overtopping of the Cradge Bank from the Hundred Foot River may also occur. Water is stored in the Washes until flows subside and it can be discharged through Welmore Lake Sluice.

8 **Welmore Lake Sluice & Pumping Station**
Environment Agency
Used to release water from the Ouse Washes back into the Hundred Foot River.

9 **Old West River / Ely Ouse / Ten Mile River**
Main River
The Great Ouse River is known as the Old West River (between Hermitage Lock and the River Cam), the Ely Ouse (downstream of the River Cam), and the Ten Mile River (downstream of Littleport).

10 **Cottenham Lode**
Main River
A high level carrier with raised embankments on either side.

11 **Chear Fen Pumping Station**
Old West IDB
Pumps water into the Old West River from Chear Fen to the south.

12 **River Cam**
Main River
Brings water from a large upland catchment to its confluence with the Old West River. In the Fens it is a high level carrier with raised embankments on either side.

13 **Cambridgeshire Lodes**
Main Rivers
Bottisham Lode, Swaffham Lode, Reach Lode and Burwell Lode are all high-level carriers with raised embankments on either side. They mostly discharge into the River Cam by gravity but pumping stations can boost the flow of water during periods of high flow.

14 **Oxlode Pumping Station**
Littleport & Downham IDB
Pumps water from the area west of Ely into the Hundred Foot River.

15 **Soham Lode**
Main River
Beginning north of Newmarket, it carries water from Soham to the Ely Ouse.

16 **River Lark**
Main River
Rising south of Bury St Edmunds it is one of several tributaries of the Ely Ouse.

17 **Diversion Sluices**
Environment Agency
The Lark Head Sluice (on the River Lark), the Hockwold Diversion Sluices (on the Little Ouse River) and the Stoke Ferry Diversion Sluices (on the River Wissey) allow water to be diverted from these watercourses into the Cut-Off Channel. This relieves pressure on the Ten Mile River. Syphons allow the Cut-Off Channel to flow beneath the Wissey and Little Ouse.

18 **Cut-Off Channel**
Main River
Under flood conditions, water from the River Lark, Wissey and Little Ouse can be diverted into the Cut-Off Channel to relieve pressure on the rest of the South Level system. When required, the Cut-Off Channel's flow can be reversed (via sluices at Denver) to transfer excess water to the Blackdyke Intake north of Hockwold, where it can be transferred to reservoirs in Essex.

19 **Lark Pumping Station**
Burnt Fen IDB
Pumps water from the area between the Little Ouse River and the River Lark.

20 **Little Ouse River**
Main River
Downstream of the Hockwold Diversion Sluices, the river is a high-level carrier with raised embankments on either side of the channel.

21 **River Wissey**
Main River
Joins the Ten Mile River just south of Denver.

22 **Denver Sluice Complex**
Environment Agency
The system of sluices here hold water levels throughout the South Level system and release flows into the River Great Ouse.

23 **Great Ouse Relief Channel**
Main River
Can be used to store more than 9.5 million cubic metres of water arriving from the South Level, to reduce flood risk to King's Lynn.

24 **Tail Sluice**
Environment Agency
Opened in 1959, it sets the tidal limit of the Great Ouse Relief Channel. It is formed of seven sluices, each 9m wide.

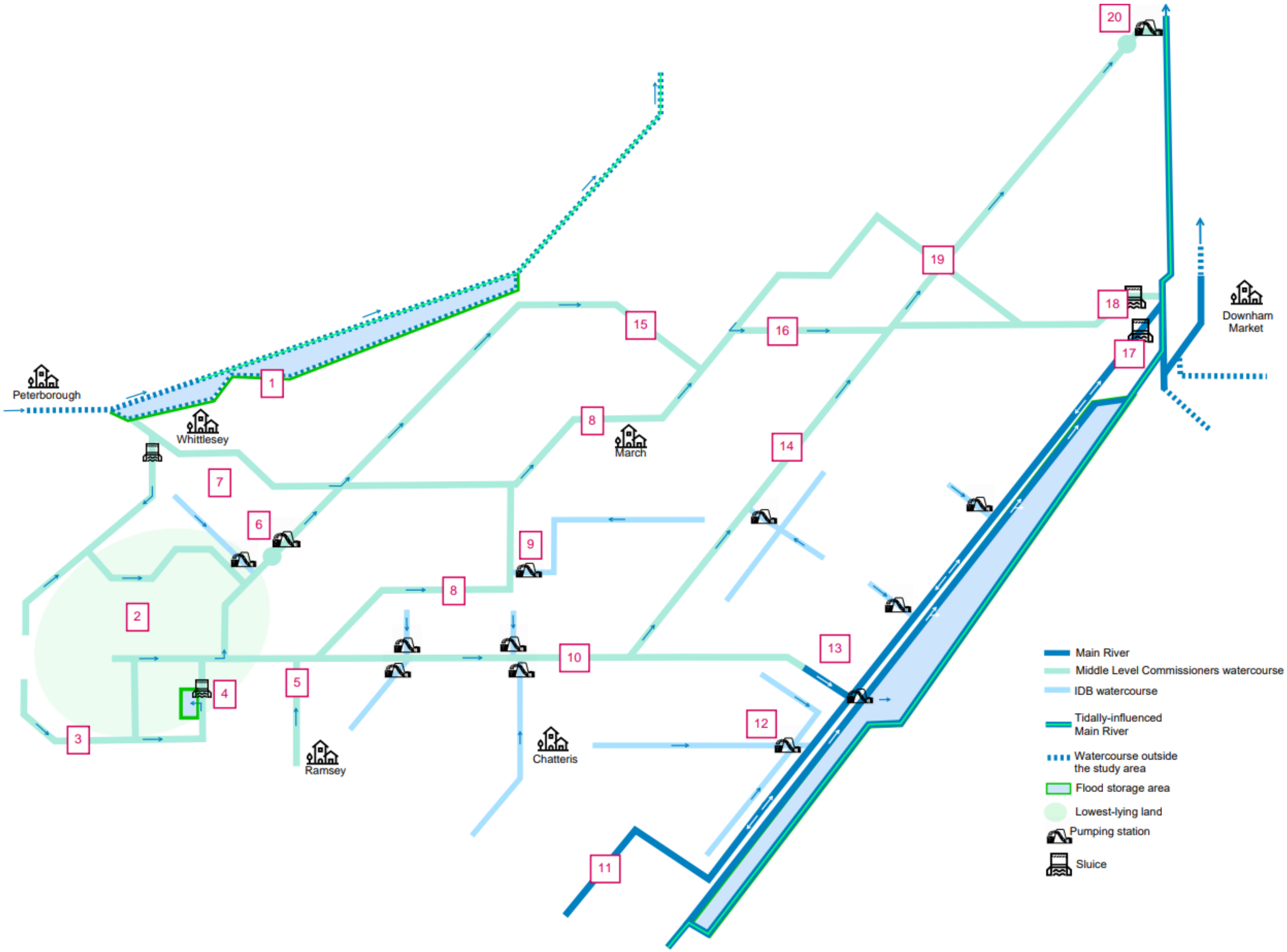


Figure 3: Schematisation of the flood risk assets in the Great Ouse catchment (Middle Level)

1 **South Barrier Bank**
Environment Agency
As undertaker of the Whittlesey (Nene) Washes flood storage area, the Environment Agency are responsible for maintaining the South Barrier Bank which prevents water from spilling into the Middle Level.

2 **Triple pumping**
Middle Level Commissioners
The south-western area of the Middle Level contains the lowest land levels and the deepest peat, which will continue to shrink into the future. The area is vulnerable, being the first area to receive flood water from the higher ground to the south, whilst being located furthest from St. German's Pumping Station. Water in this area is pumped three times to reach the North Sea: at an IDB 'booster' pump, then at Bevills Leam, and finally at St. German's.

3 **Middle Level Catchwater Drain**
Middle Level Commissioners
Designed to minimise the amount of water entering the low-lying Middle Level district, it intercepts run-off from higher ground to the south and directing it to Bevills Leam.

4 **Control Sluice & Woodwalton Fen Flood Storage Area**
Middle Level Commissioners
In times of high flows from the catchwater drain, the control sluice can be closed to divert water into Woodwalton Fen National Nature Reserve, as a back-up measure. Water can be stored here and discharged into the river system at a controlled rate.

5 **Ramsey High Lode**
Middle Level Commissioners
Ramsey High Lode receives and conveys water towards St Germans Pumping Station from the Bury Brook sub-catchment. This sub-catchment is within the Middle Level Commissioners' highland area - which although lying mostly beyond the Fens 2100+ study area boundary, accounts for 10% of the Commissioners' overall catchment.

6 **Bevills Leam Pumping Station**
Middle Level Commissioners
Constructed to boost the flow from the lowest lying area of the Middle Level into Bevills Leam, to flow northwards to St. German's. Bevills Leam pond upstream of the pumping station provides temporary storage of flood water from the Catchwater Drain.

7 **Whittlesey Dyke**
Middle Level Commissioners
Known as King's Dyke upstream of Whittlesey, it carries water eastwards to the Twenty Foot River and the Old River Nene.

8 **Old River Nene**
Middle Level Commissioners
The previous meandering course of the River Nene before the new straightened channel was dug.

9 **Ransonmoor Pumping Station**
Ransonmoor District Drainage Commissioners
One of the 56 IDB pumping stations which outfall directly into the Middle Level Commissioners' watercourses.

10 **Forty Foot Drain**
Middle Level Commissioners
A straightened channel which links the Old River Nene with the Main River system via Horseway Lock.

11 **Ouse Washes Counter Drain**
Main River
Normally discharges water into the River Great Ouse through the Old Bedford Sluice, but also pumps backwards to maintain water resources in Summer.

12 **Mepal Pumping Station**
Sutton & Mepal IDB
Originally built in 1840, it is typical of many fenland pumping stations which started out with coal fired steam operated pumps, then diesel and eventually electric. It discharges water into the Ouse Washes Counter Drain.

13 **Welches Dam Pumping Station**
Environment Agency
Moves water from the Ouse Washes Counter Drain into the Ouse Washes flood storage area.

14 **Sixteen Foot Drain**
Middle Level Commissioners
IDB pumping stations pump water from surrounding land into the channel.

15 **Twenty Foot River**
Middle Level Commissioners
A continuation of Bevills Leam after its junction with Whittlesey Dyke, it eventually connects to the Old River Nene north-east of March.

16 **New Popham's Eau**
Middle Level Commissioners
Water in this drain is pulled eastwards by St German's Pumping Station.

17 **Old Bedford Sluice & Lock**
Environment Agency
Used to release water from the River Delph/ Old Bedford River into the River Great Ouse.

18 **Salters Lode Lock**
Middle Level Commissioners
The guillotine gate at Salters Lode form part of the Great Ouse Tidal Defences. The guillotine gate and the lock gate enables access for watercraft between the Great Ouse and the MLC systems, which connects to the River Nene near Peterborough at Stanground Lock.

19 **Middle Level Main Drain**
Middle Level Commissioners
Brings water northwards from the Middle Level area and discharges it to the tidal reach of the River Great Ouse through St German's Pumping Station.

20 **St German's Pumping Station**
Middle Level Commissioners
The largest pumping station in Britain, it is the primary outlet for water from the Middle Level system, and pumps water from an area of 700km^2 into the tidal stretch of the River Great Ouse. A 'pond' or widened section of the channel upstream can store additional water before it is pumped.

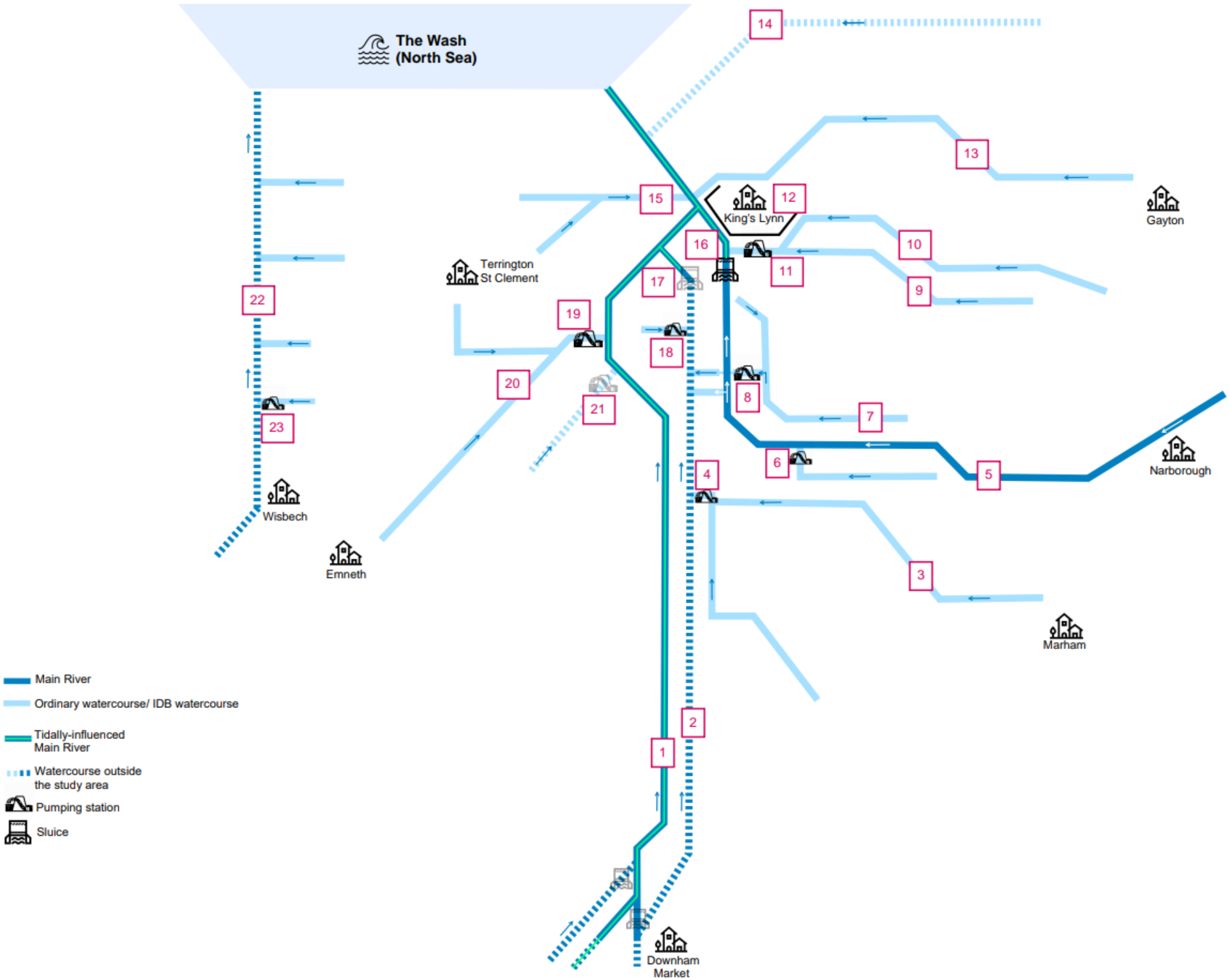


Figure 4: Schematisation of the flood risk assets in the Great Ouse catchment (South Level)

1 **River Great Ouse**
Main River
Downstream of Denver Sluice it is tidal, and is a high-level carrier with raised embankments up to 6m above the surrounding land. Significant lengths of the embankments have erosion protection on the channel sides such as concrete block work.

2 **Great Ouse Relief Channel**
Main River
Part of the South Level System.

3 **Polver Drain/Sandy Drain/Fourteen Foot Drain**
East of Ouse, Polver and Nar IDB
Moves water from Marham Fen to the Great Ouse Relief Channel.

4 **Polver Pumping Station**
East of Ouse, Polver and Nar IDB
Pumps water from the Polver Drain into the Great Ouse Relief Channel.

5 **River Nar**
Main River
The river is a biological Site of Special Scientific Interest. As Main River, the Nar is maintained by the Environment Agency and downstream of Narborough is a high-level carrier.

6 **Mill Fen Pumping Station**
East of Ouse, Polver and Nar IDB
Pumps water from the Mill Fen Drain into the River Nar.

7 **Puny Drain**
East of Ouse, Polver and Nar IDB
Carries water in the Nar Valley towards Puny Pumping Station.

8 **Puny Pumping Station**
East of Ouse, Polver and Nar IDB
Located on a diversion channel, it can pump water out to the Great Ouse Relief Channel during high flows in the Puny Drain, to protect King's Lynn from additional water. There is a similar diversion channel between the River Nar and the Great Ouse Relief Channel for the same purpose.

9 **Pierrepoint Drain**
King's Lynn IDB
Carries water to Pierrepoint Pumping Station.

10 **Middleton Stop Drain**
King's Lynn IDB
Carries water to the Pierrepoint Drain.

11 **Pierrepoint Pumping Station**
King's Lynn IDB
Pumps water out of Pierpoint Drain into the River Nar.

12 **King's Lynn defences**
Environment Agency
The 'hard defences' comprise flood walls and 61 sets of flood gates which can be closed to protect King's Lynn from tidal flooding.

13 **Gaywood River**
King's Lynn IDB
Flows by gravity into the River Great Ouse.

14 **River Babingley**
King's Lynn IDB
Drains the coastal area north of the catchment boundary into the River Great Ouse by gravity.

15 **West Lynn Drain**
King's Lynn IDB
Drains the land west of King's Lynn into the River Great Ouse via gravity.

16 **Old Nar Tidal Sluice**
Environment Agency
Sets the tidal limit of the River Nar.

17 **Tail Sluice**
Environment Agency
Part of the South Level system.

18 **Saddlebow Pumping Station**
East of Ouse, Polver and Nar IDB
Pumps out the area between the River Great Ouse and the Great Ouse Relief Channel.

19 **Islington Pumping Station**
King's Lynn IDB
Replaced in 2022, this is the largest pumping station owned by King's Lynn IDB. It drains approximately 65km^2 of land south-west of King's Lynn.

20 **Smeeth Lode**
King's Lynn IDB
Collects water from a network of smaller channels between Emneth and Terrington St Clement.

21 **St German's Pumping Station**
Middle Level Commissioners
Part of the Middle Level system.

22 **River Nene**
Main River
Forms the western boundary of the Great Ouse catchment. The western part of the King's Lynn IDB district discharges into the River Nene.

23 **Ingleborough Pumping Station**
King's Lynn IDB
Most of the King's Lynn IDB outfalls into the Nene drain by gravity, but the Inglebrough catchment is pumped. Ingleborough pumping station is King's Lynn IDB's oldest pumping station, commissioned in 1965.

2.3 Study context

Drainage works and embanked watercourses perched above the surrounding land have enabled highly productive arable land to be farmed and communities to be established in the area. The farmland is some of the highest-grade agricultural land in the country with around 41.8% of land classified as Grade 1.

Topographically, the Great Ouse catchment is flat and low-lying, with much of it lying below 2m AOD, and parts below mean sea level. The area forms a basin, with lower ground on the inner sides of the Middle and South Levels, and higher ground flanking its perimeter, including at The Wash where it is bounded by coastal defences estimated to have crests around 7m AOD. It is characterised by highly organic peat soils and relatively water retentive silt soils, both of which are suited to intensive farming under controlled drainage. Due to its formation, and because the Great Ouse catchment area is home to rich peaty soils and highly productive agricultural land, plus a network of water supply channels and navigation waterways, a complicated system of flood risk and water level management assets has developed, with a number of pumps managed by Internal Drainage Boards and the Environment Agency.

Figure 5: Ouse Washes left of the Norfolk-Cambridgeshire border, with the village of Welney to the right

2.4 Description of flood risks

The main sources of flood risk for the Great Ouse catchment are a combination of risk from infrequent extreme storm, fluvial, and tidal events. The tidal limit of the Great Ouse is at Brownshill Staunch, near Earith.

2.4.1 Historic flooding

There is a history of significant flood events across the Fens 2100+ study extents. Prior to the 1600s, the wider Fens were formed of low-lying marshland with conurbations on islands of higher land. Historic flood events, within living memory, are outlined in Table 2-1. These events highlight the catchment's vulnerability in the absence of effective performance and operation of assets.

Table 2-1: Historic flood events

Date	Source of flooding	Details
1912	Fluvial	In August 1912, four months of rain fell in 24 hours. Much of the South Level was inundated, and it was reported that crops in Ramsey could only be harvested by boat.
March 1947	Fluvial/ Surface water	In March 1947, a combination of an exceptionally cold winter with extreme snowfall, followed by a sudden thaw caused huge volumes of water to be released. The melting snow could not soak into the ground and surface water accumulated, running into rivers and streams. Cottenham Lode overflowed and the River Cam flooded Cambridge and the low lying areas of Waterbeach. The Ouse Washes filled quickly making the causeways at Welney and Earith were impassable. The River Great Ouse overflowed south of Ely, and on March 17th, a huge 90ft breach formed in the banks of the River Ouse near Over, causing severe flooding in Willingham. At Hockwold the banks of the Little Ouse gave way at Wilton Bridge and water poured into Feltwell and Lakenheath Fens[3].
1953	Coastal / tidal	The flood of 1953 is the most devastating natural disaster recorded in the United Kingdom in the 20th Century. A severe north-westerly storm combined with a spring tide caused large parts of Britain's east coast to flood. The tidal surge and waves overwhelmed sea defences and caused extensive flooding. In the Great Ouse catchment, the event prompted the agreement to heighten the banks of the Great Ouse Tidal River.
April 1998	Fluvial	Heavy rainfall caused widespread flooding across the Midlands, including the Great Ouse catchment.
December 2020	Fluvial/ Surface water	In December 2020, many properties flooded across the River Great Ouse catchment. This occurred following several days of heavy rainfall on already saturated ground leading to swollen rivers causing a combination of surface water and fluvial flooding[4].
October 2023	Fluvial	Three red flood warnings were issued in the catchment in October 2023 during Storm Babet.
January 2024	Fluvial	Storm Henk caused further flooding in the catchment in January 2024, prompting amber flood warnings on the River Great Ouse, Lower River Cam and the Hundred Foot Washes.

[3] Ely Standard (2007) 'The Fight to save the Fens'. Available at: FEATURE: The fight to save the Fens | Ely Standard. [Accessed 01/09/2024].

[4] Environment Agency (2022) Increasing flood resilience in the River Great Ouse. Available at: Increasing flood resilience in the River Great Ouse - GOV.UK. [Accessed 01/09/2024].

2.5 Existing flood risk assets, operation, and maintenance

The Great Ouse catchment has been heavily engineered along its course, with hydraulic structures, such as the Denver Sluice. The Great Ouse catchment contains an extensive network of hundreds of flood risk management (FRM) assets including embankments, sluices, pumping stations, and watercourses. These defences are essential, highly engineered assets which are of critical importance to the sustainability of the economy of the catchment and the people that reside within the catchment. Without these defences and the IDB assets (including pumping stations which drain large areas of land), much of the area would be marshland, regularly inundated by the sea. Working together, these assets provide protection against flooding to over 130,000ha of high-grade agricultural land and over 30,000 properties, including 24,895 at risk of periodic flooding from rivers and the sea, and 17,149 which are at risk of permanent inundation (some properties being at risk from both) as described in the 2020 Capita AECOM report.

The Environment Agency undertakes a rolling program of maintenance to protect and maintain the condition of the existing defences along Main Rivers, including grass cutting and other vegetation management, and maintenance of hydraulic structures. However, responsibility for FRM in the Great Ouse catchment is split between the Environment Agency, Local Authorities and IDBs. There are 50 IDBs operating within the Great Ouse Catchment. Figure 6 highlights the general coverage of IDBs in the catchment and the specific operating area of several of the largest.

The catchment is heavily engineered with approximately 95km of coastal defences and 405km of fluvial embankments. One of the key assets is the Ouse Washes which can store 90 million m^3 of attenuated flow and is Britain’s largest washland occupying around 25km^2. Additionally, there are the IDB assets including 138 pumping stations, which are essential to the drainage of large areas of the catchment, as well as 24 sets of sluice gates. The pumping station at St German’s is the largest in the UK, with a third of the catchments area (700km^2) draining through this asset at a capacity of 100m^3/s.

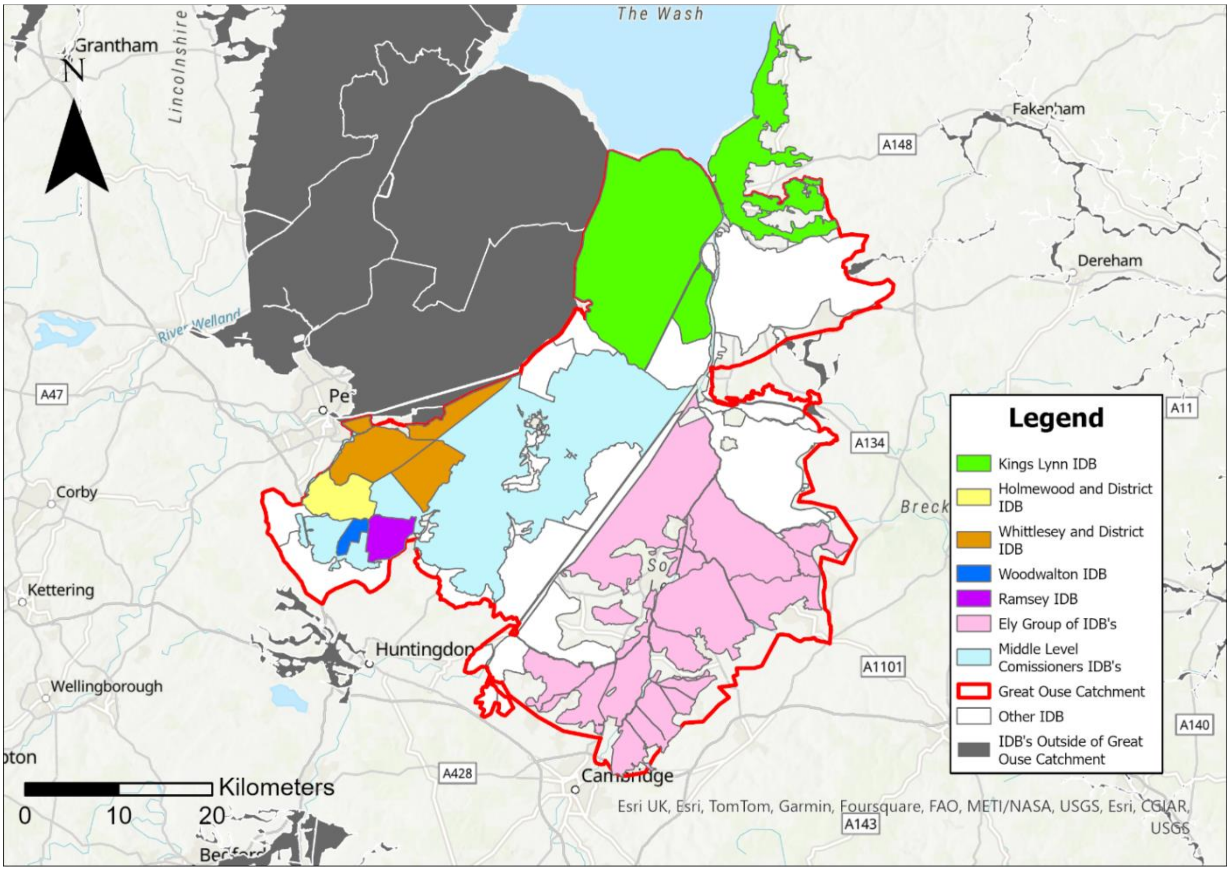


Figure 6: Internal Drainage Boards in the Great Ouse catchment

Figure 7: Denver Sluice

3. Economic Appraisal Baseline Scenarios

The objective of this economic assessment is to provide a broad assessment of key receptors at risk for the Great Ouse catchment. The economic baseline is identified as the Do Nothing scenario. Further analysis of the present flood risk management arrangements (the Maintain scenario) is undertaken to evaluate the existing protection and residual risk with the current flood mitigation measures in place, and the benefits of continuing to maintain the existing asset base. The scenarios to be utilised within this appraisal are described within the following sections.

3.1 Do-Nothing scenario

3.1.1 Definition

Due to interdependent activities in managing flood risk across pumped catchments, the cessation of flood risk management activities will lead to relatively rapid inundation of the catchment from water which is unable to drain to the Main Rivers.

Under the Do Nothing scenario the pumping stations would cease operating resulting in water being unable to drain and the rainfall would start to fill the catchment. In addition, the sluices on the main rivers would cease to operate and cause the rivers to back-up. Extreme flood events on the rivers will cause additional flooding that cannot drain away. There will be some loss of water over summer due to evaporation and transpiration, however the water levels would rise steadily over a few years. Sea defences are assumed to be robust and unlikely to fail in the short term. When the water levels in the catchment are high enough they would spill over the sluices and embankments into neighbouring catchments or main rivers.

A rate of catchment fill of 0.5m every two years is applied for the Great Ouse catchment. This has been taken from the study undertaken by Capita AECOM in 2020 on the Great Ouse catchment. This assumption has been retained to remain consistent with the approach taken previously which involved a large amount of stakeholder engagement and agreement with partners. This estimate was based on the average net rainfall minus an allowance for evapotranspiration and infiltration. It is assumed that water levels in the catchment will increase by the net rainfall per year, and will be unable to drain, therefore, resulting in permanent inundation of land, properties, and infrastructure.

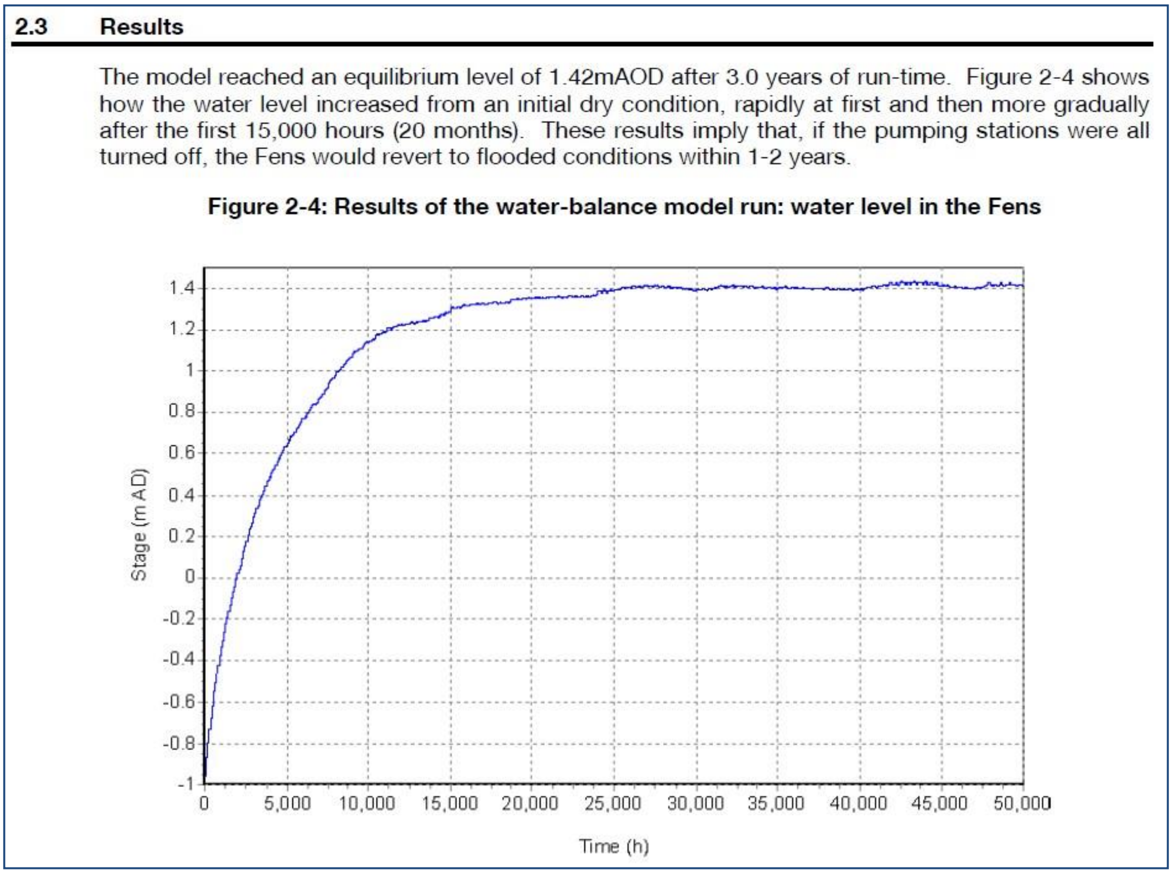
For the Great Ouse catchment, a consistent limiting level is used across all the sub-compartments. This level is based on the anticipated level at which an equilibrium water level would be achieved, where net inflows equal net losses. This is discussed further in section 3.1.2.

3.1.2 Key assumptions

For the purpose of the baseline economic appraisal, the Great Ouse catchment is assumed to be frequently or permanently inundated to the water levels defined by the limiting level, with the rate at which this is achieved based on the rainfall estimates for the catchment. Before properties, land, and infrastructure fall below these water levels, they will be subject to risk from extreme events. This risk is represented using the best available data for the catchment at the time of the Capita AECOM study in 2020, which was Risk of Flooding from Rivers and the Sea data.

Due to the Great Ouse Fens area being an enclosed basin with high ground on all sides, and with water unable to drain to adjacent perched watercourses, the area will begin to fill up with inflows from its river catchments, the Bedford and Ely Ouse and potentially part of the Nene, as well as from direct rainfall, and net groundwater flows. To represent this, assumptions were made around the level at which an equilibrium water level would be achieved, where net inflows equal net losses, and the length of time it would take to achieve this level. Hypothetically, this equilibrium level could be exceeded for short durations as a result of intense rainfall events, and some analysis of potential additional losses has been undertaken as part of a sensitivity test in this regard. This scenario assumes that no tidal defences are breached for the appraisal period. It is anticipated in a true Do Nothing scenario these embankments would breach; however, detailed modelling of tidal inundation and breach analysis is not available at this stage.

A previous Jeremy Benn Associates (JBA) report (Fenlands Flood Zone Improvements, JBA, 2007) for the Great Ouse Fens identifies the long-term equilibrium level of catchment inflows to losses to be 1.42m AOD. The JBA study reported that the basin would reach a 1.42m equilibrium within 3 years, as per Figure 8.



2.3 Results

The model reached an equilibrium level of 1.42mAOD after 3.0 years of run-time. Figure 2-4 shows how the water level increased from an initial dry condition, rapidly at first and then more gradually after the first 15,000 hours (20 months). These results imply that, if the pumping stations were all turned off, the Fens would revert to flooded conditions within 1-2 years.

Figure 2-4: Results of the water-balance model run: water level in the Fens

Figure 8: Water Balance Model Results from the JBA Modelling Report[5]

The JBA assessment is considered to be relatively high level and based on a number of gross assumptions; a period of three years for the equilibrium level at 1.42m AOD to be reached may be overly pessimistic, and there is the potential for a greater long-term equilibrium level to be achieved. The 2020 Future Fens study therefore tested three different long-term equilibrium levels of 1.42m AOD, 2m AOD and 2.5m AOD. It was

[5] JBA (2007). Fenlands Flood Zone Improvements

assumed that in the 1.42m AOD equilibrium level scenario, the level would be achieved by year 7 at which point no further increases in water level occur. In the 2m AOD equilibrium level scenario, the level would be achieved by year 10. No further increases would occur beyond this point. Finally, for the 2.5m AOD scenario, the long-term equilibrium level would be achieved by year 12. If through subsequent modelling it is found that the basin fills at a faster rate, damages will be incurred sooner and for a longer duration across the appraisal period, and benefits of flood risk management will therefore be greater. This appraisal is therefore considered conservative in the assessment of potential Do Nothing damages.

A local model is not available and, thus, a Weighted Annual Average Damages approach is applied for assessment of damages outside of the permanently flooded area. This approach is defined in the Multi-Coloured Manual[6]. These damages are derived from the Risk of Flooding from Rivers and the Sea (RoFRS) dataset representing infrequent flood events. Damages associated with RoFRS are assumed to occur until receptors are written off within the Basin Contours model; for those not falling within the Basin Contour maximum level, damages from infrequent events are assumed to occur throughout the appraisal period.

Due to the use of the national RoFRS dataset climate change will not be represented explicitly. The influence of climate change on sea level rise will also not be accounted for in the Great Ouse catchment because, once a certain threshold is exceeded, any incremental increase in sea level caused by climate change will not change the overall outcome—it remains inundated. Therefore, the impact of climate change on sea level rise will not affect the idea that the area is entirely written off once this threshold is surpassed. This is reinforced in section 6.4.1 where a sensitivity test discusses the impact of a higher overall fill height of 5m for the basin.

3.1.3 Flood extents

Based on the assumptions described above, indicative flood extents are generated for the Great Ouse catchment by GIS analysis. This involves the use of LiDAR data to define a series of flood extents for specific flooded water levels, i.e., elevation levels (m AOD). The flood extents represent the catchment gradually filling up over time. Figure 9 shows the permanent inundation levels based on the outputs from the previous Capita AECOM work in 2020. The time periods assumed for these levels to be achieved are detailed in Table 3-1.

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[6] Flood Hazard Research Centre & Environment Agency. (2013). *Flood and Coastal Erosion Risk Management: A Manual for Economic Appraisal.* Milton Park: Routledge.

Table 3-1: Do Nothing Scenario assumptions regarding water level over time

Appraisal Year (yr)	Water Level (m AOD)
Year 0: Environment Agency and IDB cease maintenance of assets (incl. pumping); fluvial water begins to pond across the catchment	
0	0.0
2	0.5
4	1.0
7	1.42
10	2.0
12	2.5

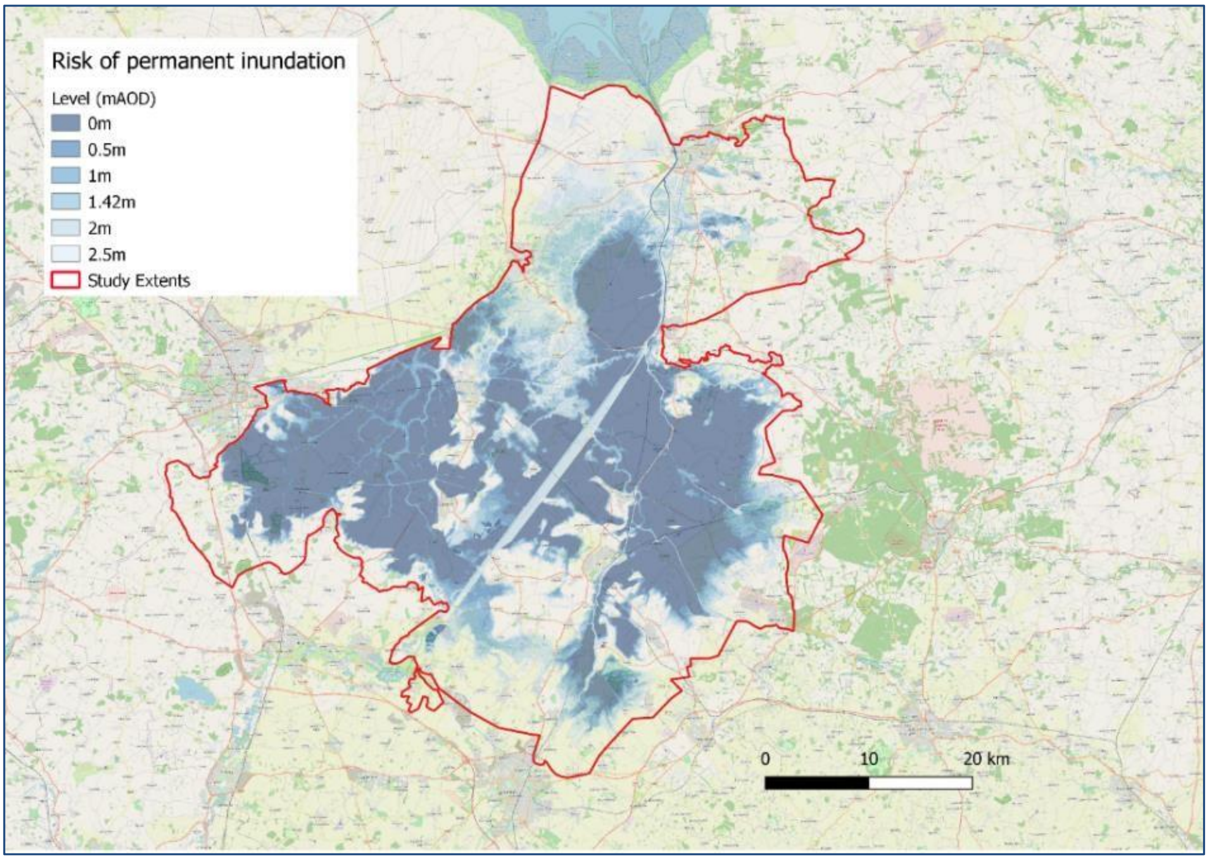

Figure 9: Do Nothing permanent flood extents for the Great Ouse catchment
Source: Future Fens Report 2020

3.1.4 Additional information

It is recognised that under a true Do Nothing scenario, it is likely that localised flood events would result from blockages in watercourses and flood risk management assets, and failure of coastal defences. However, this appraisal is focused on valuing broad economic damages using a simplified approach to the generation of the flood extents. For this reason, localised flood events from degrading assets are not included in this analysis. It is also anticipated that, due to the speed with which the catchment is assumed to fill, these events would have relatively minor impacts on the total damages in the Do Nothing scenario.

Before write-off of land, properties, and infrastructure is going to occur, these receptors will be subject to risk from infrequent extreme storm and tidal events. This risk is represented using RoFRS data. To ensure no double counting of damages occurs, the residual risk associated with infrequent extreme events will be recalculated for the assets at risk above each water level, such that the damages associated with this risk reduce as the permanent water levels in the Do Nothing scenario rise.

3.1.5 Sensitivity tests

Two sensitivity tests are explored for the Do Nothing scenario as part of this appraisal. Firstly, the impact of a higher maximum contour height of 5m for the basin is explored. Secondly, the impact of a faster rate of fill for the contours up to the 2.5m limiting level used in the baseline analysis is explored. This sensitivity test assumes that the same contours will fill up at half a metre per year up to 2.5 m AOD as highlighted in Table 3-2.

The results of these sensitivities are outlined in sections 6.4.1 and 6.4.2.

Table 3-2: Do Nothing catchment fill sensitivity assumptions regarding water level over time

Appraisal Year (yr)	Water Level (m AOD)
Year 0: Environment Agency and IDB cease maintenance of assets (incl. pumping); fluvial water begins to pond across the catchment	
0	0.0
1	0.5
2	1.0
3	1.42
4	2.0
5	2.5

3.2 Maintain scenario

3.2.1 Definition

The baseline economic study will also consider a maintain scenario. This scenario will represent the benefits of existing assets being maintained to continue to provide their existing Standard of Service. There will be no allowance for adaption to climate change. It is assumed that this would form the basis of a short-term approach to protecting the area whilst the longer-term strategy is developed. In a maintain scenario, the study area will remain at risk from infrequent flooding in events exceeding the design standard of the existing Flood Risk Management (FRM) assets.

3.2.2 Description

The Maintain scenario relates to the present “business as usual” (BAU) approach to fluvial and coastal flood mitigation for the Great Ouse catchment. This scenario will be based on nationally available ‘Risk of Flooding from Rivers and the Sea’ (RoFRS) dataset which indicates the flood risk associated with exceedance of the existing flood risk management assets, including from tidal and fluvial sources. This was the best available flood risk data at the time of the Capita AECOM study in 2020. In this scenario it is assumed that the existing flood risk management assts are maintained in serviceable condition and embankments are maintained to their present crest level.

3.2.3 Flood extents

National RoFRS data is used to inform a weighted annual average damage (WAAD) assessment for the catchment as defined in the Multi-Coloured Manual. A range of AEP events from the RoFRS were used to inform the WAAD assessment as shown spatially across the catchment in Figure 10.

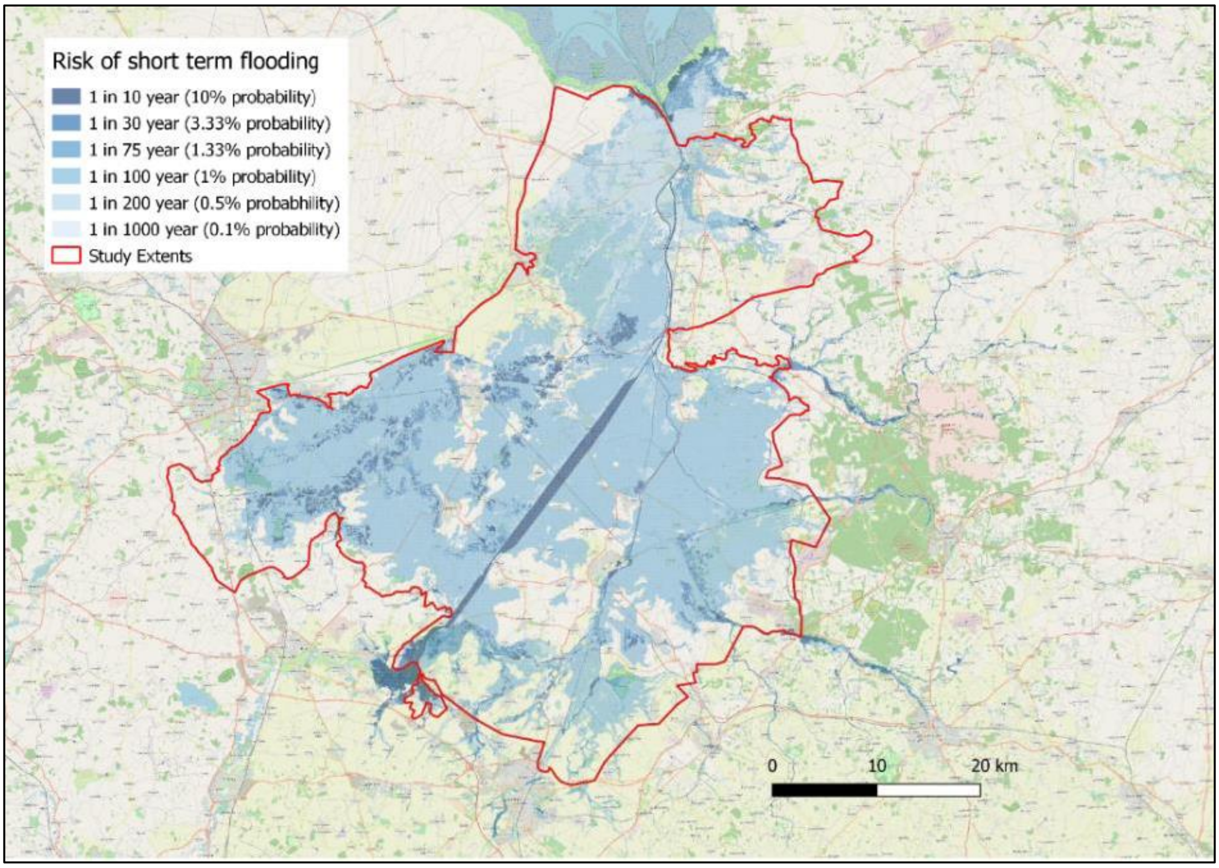

Figure 10: National RoFRS data for the Great Ouse catchment

4. Appraisal Receptors

4.1 Economic appraisal receptors

The Total Impact Framework in Figure 11 identifies a series of common receptors across catchments loosely mapped across the wider determinants of health. The Framework demonstrates that the flood risk across the Great Ouse catchment has the potential to significantly impact the social, cultural, political, economic, commercial and environmental factors that shape the environment in which the local communities live, work and thrive.

Receptors bordered in red are those considered as part of this economic assessment.

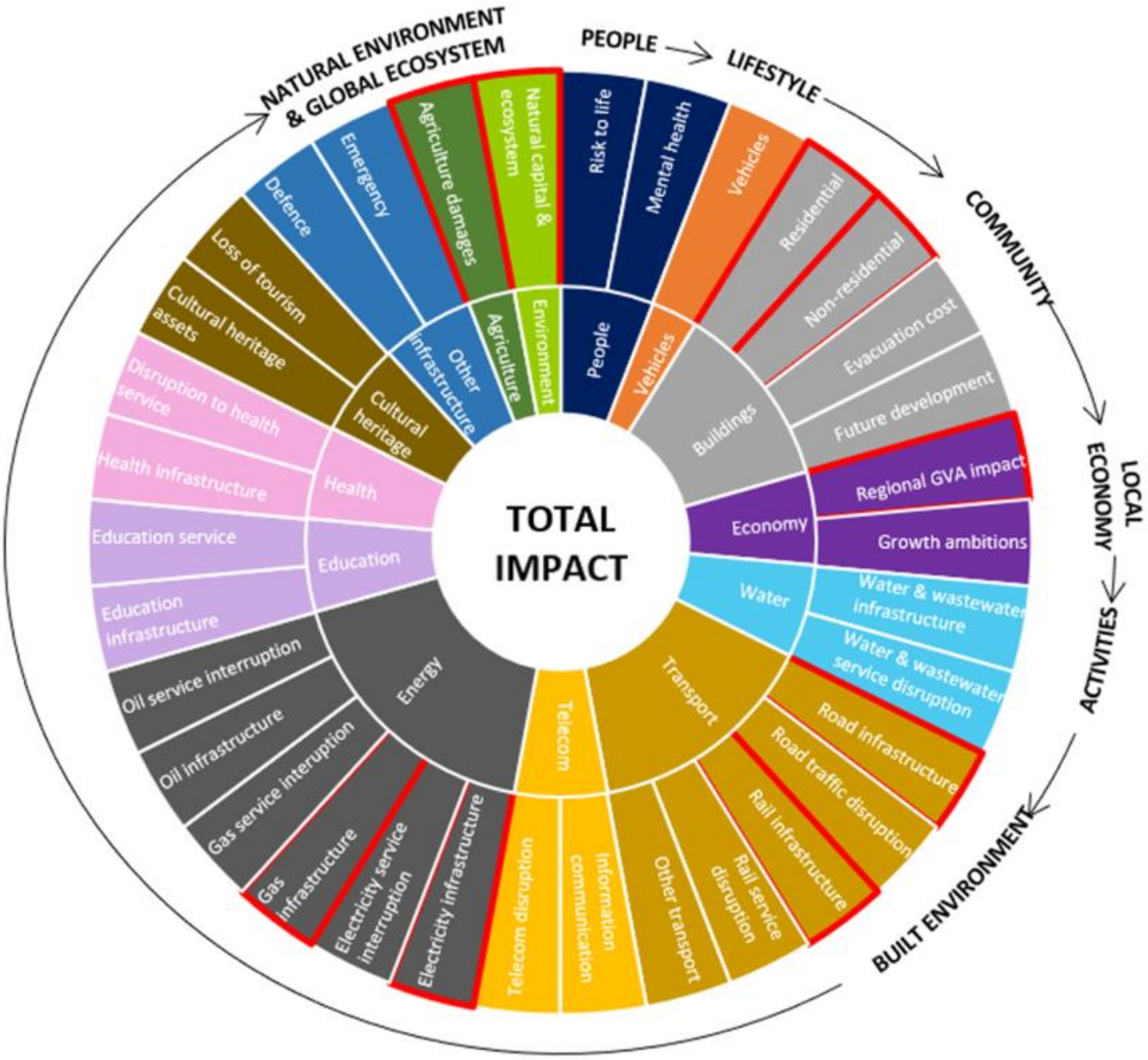

Figure 11: Total Impact Framework

5. Baseline Damages Appraisal

The baseline FCERM economic damages to the nation are based on the study undertaken by Capita AECOM in 2020. These were calculated in line with the standard guidance (FCERM Appraisal Guidance[7] (AG) (2010) and using the Flood Hazard Research Centre's Multi Coloured Manual (MCM) (2013) methodology supplemented by the Multi Coloured Handbook (MCH) and data (2018). A 100-year appraisal period has been assessed.

Due to the nature of the project, the economic approach has focused towards defining 'broad-brush' economic damages for key receptors. Further detailed analysis could be undertaken in line with the needs and requirements of any future stages of the project development and for individual investment business cases.

The following damage streams have been assessed and are described in detail in the following sections:

- Section 5.1 - Residential and non-residential property damages
- Section 5.2 - Agricultural losses
- Section 5.3 - Environmental and recreational losses
- Sections 5.4 - 5.6 - Infrastructure (transport & utilities) damages
- Section 5.7 - Isolated properties and land
- Section 5.8 - Losses to the local economy (as GVA)

All damages have been presented in a 2025 price base, using GDP data from December 2024[8]. Where historic data has been used, this has been uplifted to a 2025 price base using GDP Deflator data.

It should be noted that damages/benefits for a number of benefit streams included on the other catchments within the Fens 2100+ work have not been included for the Great Ouse catchment, given that these were not appraised as part of the 2020 Capita AECOM study. These include:

- heritage losses
- mental health costs
- emergency service costs
- risk to life
- evacuation and temporary accommodation costs
- vehicle damage, and
- healthcare/education disruption costs

[7] FCERM appraisal technical guidance - GOV.UK

[8] GDP deflators at market prices, and money GDP December 2024 (Quarterly National Accounts) - GOV.UK

The omission of these damages/benefits for the Great Ouse catchment is considered unlikely to significantly alter the overall results due to the scale of these damage streams relative to the value of write off of land and property that is already included in this assessment.

5.1 Direct residential and non-residential property damages

Across the Great Ouse catchment, there are several village settlements benefiting from the existing FRM activities as well as some larger conurbations including but not limited to King's Lynn, Ely and March. Flooding to these communities can cause severe disruption to residents and damage to properties, with large financial costs in response and recovery activities and personal expenditure. This remains an area of significant concern for the government and the local communities at risk.

Figure 12: Aerial image of King's Lynn

Direct residential and non-residential property damages are the losses to property owners and residents because of the direct inundation of their property from a flood event and assesses damage to building fabric and structure.

5.1.1 Do Nothing scenario approach

As outlined in section 4.1 of the Economic Appraisal Report from the previous work undertaken by Capita AECOM in 2020 properties at risk have been identified using the 2014 National Receptor Dataset (NRD). All MCM codes of NRD data have been included in the appraisal of damages including unknown '999' data points. Section 5.1.6 discusses the sensitivity analysis undertaken for these catchments and presents the potential impact on benefits when including these data points.

In the Do Nothing scenario write off of property is assumed to occur at the point at which the water level in the catchment exceeds the level of the property such that it becomes permanently inundated or becomes uninhabitable due to frequency of flooding; the property is written off in the year in which this is assumed to occur, as per specific assumptions made per catchment. The value of that property was taken as the loss and discounted to Present Value using HM Treasury discount rates. Residential properties have been valued using UK House Price Index values for the East of England from December 2024, which have been uplifted to 2025 values using GDP deflator data from December 2024. Non-residential property has been valued based on 2024 MCM Chapter 5 Table 5.4 and Chapter 3 Table 3.4, again uplifted to 2025 values using GDP deflator data from December 2024, taking rateable values for the East of England and using floor areas from NRD. Where no floor area is available in the NRD data, MasterMap building polygons have been used to determine an appropriate floor area.

Where properties have not been written off, they may be at risk of flooding due to extreme storm, fluvial and tidal events, in exceedance of the Standard of Service of existing FRM assets. This risk has been assessed using the RoFRS data as shown on Figure 10.

Residential property damages are capped at average market value for the property type. Non-Residential properties are capped based on the rateable value for the property type multiplied by the rental yield factor, and the floor area for the property. Where properties have no floor area, they have been excluded from the analysis – this is recommended as an area for further development as part of any future more detailed appraisals. Damages due to extreme storm events cease to accrue following write-off of the property due to permanent or frequent inundation.

AAD has been reassessed at each flood level as permanent flood levels within the catchment rise to ensure that damages are not double counted, i.e. properties which have been written off by permanent flooding are no longer assessed for AAD. The AAD value has then been forecast across the appraisal period and discounted to understand Present Value (PV) damages for properties.

5.1.2 Maintain scenario approach

For the Maintain scenario, properties are at risk from flooding due to extreme storm and tidal events in exceedance of the Standard of Service for existing FRM assets. Residential and non-residential property damages have been calculated based on the previous Capita AECOM work from 2020.

Return periods from the RoFRS were mapped out to SoPs defined in the WAAD tables in MCM (2013) and using MCH 2018 data. These RoFRS flood extents for different return period events were compared to the NRD data, with the initiation of flood damage at each property estimated and assumed to represent the SoP. The SoP is used to determine the WAAD at each property, and the total AAD are calculated by summing these values. It is assumed that there is no flood warning for all properties across the study extents at this stage of appraisal.

5.1.3 Key assumptions

Table 5-1: Residential and non-residential property data and assumptions

Key assumptions:	
Residential property values	<table><tr><th>Property Type</th><th>Market Value (£)</th></tr><tr><td>Detached</td><td>540,974</td></tr><tr><td>Semi-detached</td><td>359,685</td></tr><tr><td>Terraced</td><td>294,282</td></tr><tr><td>Flat</td><td>200,421</td></tr><tr><td>Other</td><td>347,142</td></tr></table>Source: UKHPI regional values for East of England, December 2024, uplifted to 2025 values using December 2024 GDP Deflator Values.
Non-residential property values	<table><tr><th>Type</th><th>Market Value £/m²</th></tr><tr><td>Retail</td><td>2,081</td></tr><tr><td>Offices</td><td>1,772</td></tr><tr><td>Distribution / logistics</td><td>783</td></tr><tr><td>Leisure</td><td>1,655</td></tr><tr><td>Playing fields</td><td>1,655</td></tr><tr><td>Sports centre</td><td>1,655</td></tr><tr><td>Marina</td><td>1,655</td></tr><tr><td>Sports Stadium</td><td>1,655</td></tr><tr><td>Public buildings</td><td>1722</td></tr><tr><td>Industry</td><td>896</td></tr><tr><td>Car Park</td><td>1,655</td></tr><tr><td>Substation</td><td>1,439</td></tr><tr><td>Unknown</td><td>1,439</td></tr><tr><td colspan="2">Source: Based on 2024 MCM Table 5.4 for East of England; Savills Research uplifted to 2025 values using December 2024 GDP Deflator Values.</td></tr></table>
Key datasets: • RoFRS • National receptor database • OS MasterMap • LIDAR DTM • MCH Chapter 3, 4, 5 data and tables.	

5.1.4 Do Nothing scenario outcomes

Table 5-2: Do Nothing – number of residential properties impacted (non-cumulative)

Appraisal year	South Level	Middle Level	West of Ouse	East of Ouse	King's Lynn	Total
0	685	1,281	466	-	-	2,432
2	286	830	82	1	-	1,199
4	346	756	181	-	-	1,283
7	161	683	298	12	-	1,154
10	429	1,905	1,384	114	-	3,832
12	592	3,061	2,890	468	238	7,249

Table 5-3: Do Nothing - PV residential property write-off (non-cumulative) (£k)

Appraisal year	South Level (£k)	Middle Level (£k)	West of Ouse (£k)	East of Ouse (£k)	King's Lynn (£k)	Total (£k)
0	311,080	584,195	216,885	-	-	1,112,160
2	117,424	343,616	37,871	505	-	499,416
4	135,731	301,404	67,319	-	-	504,454
7	59,734	233,025	101,350	4,370	-	398,480
10	132,569	575,996	426,443	35,411	-	1,170,419
12	176,980	836,314	866,529	130,609	48,715	2,059,145

Table 5-4: Do Nothing – number of non-residential properties impacted (non-cumulative)

Appraisal year	South Level	Middle Level	West of Ouse	East of Ouse	King's Lynn	Total
0	1,831	2,919	832	-	-	5,582
2	482	1,488	102	3	1	2,076
4	713	1,044	174	7	-	1,938
7	426	779	398	43	2	1,648
10	900	1,504	1,121	192	4	3,721
12	895	1,672	1,765	356	93	4,781

Table 5-5: Do Nothing - PV non-residential property write-off (non-cumulative) (£k)

Appraisal year	South Level (£k)	Middle Level (£k)	West of Ouse (£k)	East of Ouse (£k)	King's Lynn (£k)	Total (£k)
0	446,794	588,456	152,401	-	-	1,187,651
2	78,857	337,496	12,429	1,582	90	430,454
4	139,656	163,881	20,519	275	-	324,331
7	95,594	111,441	43,985	12,175	183	263,379
10	141,708	234,792	135,632	45,499	6,146	563,778
12	141,187	262,657	206,220	121,594	55,433	787,092

A total of 17,149 residential and 19,746 non-residential properties are written-off due to inundation in the Do Nothing scenario. When the additional damages, which represent properties at residual risk outside of the contours, are also included this amounts to a total of £5,924,166k and £3,655,529k of PV residential and non-residential property losses respectively over the 100-year appraisal period.

5.1.5 Maintain scenario outcomes

Table 5-6: Maintain scenario – number of residential properties impacted (non-cumulative)

Appraisal year	South Level	Middle Level	West of Ouse	East of Ouse	King's Lynn	Total
10%	441	212	2	-	32	687
3.33%	102	188	9	53	69	421
1.33%	2,065	3,873	1,850	55	274	8,117
1%	445	493	4,394	213	6,025	11,570
0.5%	6	12	2,307	18	1,760	4,103
0.1%	-	-	-	-	-	-

Table 5-7: Maintain scenario – value of residential (non-cumulative) cash property damages (£k)

Appraisal year	South Level (£k)	Middle Level (£k)	West of Ouse (£k)	East of Ouse (£k)	King's Lynn (£k)	Total (£k)
10%	1,529	737	7	-	111	2,384
3.33%	87	160	8	45	59	357
1.33%	739	1,386	662	20	98	2,905
1%	159	176	1,573	76	2,156	4,141
0.5%	1	1	208	2	158	369
0.1%	-	-	-	-	-	-

Table 5-8: Maintain scenario – number of non-residential properties impacted (non-cumulative)

Appraisal year	South Level	Middle Level	West of Ouse	East of Ouse	King's Lynn	Total
10%	192	173	22	4	2	393
3.33%	187	128	11	101	35	462
1.33%	4,626	6,378	2,120	223	288	13,635
1%	536	437	2,663	396	826	4,858
0.5%	11	2	958	17	548	1,536
0.1%	3	-	2	-	-	5

Table 5-9: Maintain scenario – value of non-residential (non-cumulative) cash property damages (£k)

Appraisal year	South Level (£k)	Middle Level (£k)	West of Ouse (£k)	East of Ouse (£k)	King's Lynn (£k)	Total (£k)
10%	151	89	12	0	195	446
3.33%	69	15	1	212	95	393
1.33%	1,099	811	142	254	829	3,135
1%	148	43	380	595	647	1,813
0.5%	0	-	44	2	82	128

The cash values shown in Table 5-7 and Table 5-9 amount to a total of £302,780k and £176,363k of residential and non-residential PV damages respectively when converted to AAD values and discounted over the full 100-year appraisal period.

5.1.6 Impact of NRD 999 Properties

There are large numbers of non-residential properties and receptors classified as unknown (MCM code 999) which are at risk in a Do Nothing scenario. These unknown receptors can constitute a number of property types, including those of high value (e.g. businesses) or minimal value (e.g. post-boxes, sheds). In the interests of proportionality, no attempt has been made to reclassify them at this stage of the appraisal and a sector average damage value for non-residential properties has been used to determine the damages to them. Given the uncertainty in the level of damages which they should contribute, the percentage of non-residential damages coming from 999 code properties for each sub-compartment has been assessed; these are 85% of non-residential damages in the South Level, 81% in the Middle Level, 89% in the West of Ouse, 40% in East of Ouse and 8% in King’s Lynn. Any future individual assessments should therefore consider the suitability of the damages from the 999 classification and whether an additional assessment to more accurately assign these assets is appropriate.

5.2 Agricultural losses

The Great Ouse catchment and the wider Fens 2100+ study area is a region of national agricultural importance due to its fertile soils. The Fens accounts for around half of the most productive (termed “grade 1”) agricultural land in England, which supports a nationally important agricultural industry. The Great Ouse catchment specifically is predominately arable with agricultural land accounting for 88% of the study area. With a significant proportion of agricultural land across the catchment benefiting from the present FRM activities, frequent flooding or long-term inundation of the catchment would have a significant impact on regional and national food production.

“Although it covers less than 4% of England’s farmed area, the Fens produces more than 7% of England’s total agricultural production, worth a staggering £1.23 billion. The whole food chain, from farm to fork employs 80,000 people – equivalent to the population of Peterborough – and generates more than £3 billion a year for the Fens’ economy” (NFU, Farming Food in the Fens, 2020).

Figure 13. Agricultural land in Sedge Fen (north of Littleport, in South Level)

5.2.1 Do Nothing and Maintain scenario approach

As outlined in detail in the 2020 Capita AECOM report on the Great Ouse catchment, two different methods have been used to assess the damages to agricultural land. Section 4.2.2 of the report outlines the 'detailed methodology' which considers land use and crop types in the Fens and the loss in crop and livestock output and associated loss of value-added (profits) due to permanent flooding, infrequent flooding and also reduction in agricultural drainage conditions. However, to be consistent with the methodologies used for the Lower Witham assessment (2024) as well as the rest of the Fens 2100+ study areas and to align with current guidance the 'simple method' outlined in section 4.2.1 using write off of agricultural land based on land valuation data is used to inform the baseline damages reported as part of this study. A sensitivity investigating the impact of using the 'detailed methodology' based on continued productivity losses has been included for comparison.

The results from this study have been uplifted from 2019 values to 2025 values using latest available GDP data from December 2024.

5.2.2 Do Nothing scenario outcomes

Table 5-10: Do Nothing – Area of agricultural write off for the Do Nothing scenario (ha) (non-cumulative)

Appraisal year	South Level (ha)	Middle Level (ha)	West of Ouse (ha)	East of Ouse (ha)	King's Lynn (ha)	Total (ha)
0	28,937	34,625	6,581	113	0	70,256
2	5,002	6,707	494	203	10	12,417
4	5,055	4,330	798	273	80	10,536
7	3,936	4,124	2,039	552	95	10,746
10	7,429	5,605	3,928	1,189	128	18,279
12	4,491	3,026	4,398	865	138	12,918

Table 5-11: Do Nothing – Agricultural write off cash damages for the Do Nothing scenario with basin fill (£k) (non-cumulative)

Appraisal year	South Level (£k) (£k)	Middle Level (£k) (£k)	West of Ouse (£k) (£k)	East of Ouse (£k) (£k)	King's Lynn (£k) (£k)	Total (£k) (£k)
0	755,096	892,123	172,537	2,602	0	1,822,358
2	123,131	174,325	12,962	4,406	170	314,996
4	125,574	110,265	20,934	6,036	1,662	264,471
7	95,414	104,600	53,462	13,215	1,821	268,513
10	159,972	142,887	102,988	27,975	2,262	436,085
12	100,657	75,309	115,297	19,576	2,059	312,899

Table 5-12: Do Nothing – Residual agricultural cash damages in RoFRS with basin fill (£k) (non-cumulative)

Appraisal year	South Level (£k)	Middle Level (£k)	West of Ouse (£k)	East of Ouse (£k)	King's Lynn (£k)	Total (£k)
0	39,404	43,697	7,076	69	-	90,245
2	5,536	7,450	448	105	0	13,539
4	5,245	4,515	700	148	10	10,617
7	3,335	3,920	1,787	360	19	9,422
10	3,752	4,050	3,864	714	25	12,405
12	1,321	482	4,171	349	19	6,343
Above contour fill (12 year +)	2,752	240	6,211	366	195	9,765

Table 5-13: Do Nothing – Total PV Damages (£k)

South Level (£k)	Middle Level (£k)	West of Ouse (£k)	East of Ouse (£k)	King's Lynn (£k)	Total (£k)
1,239,069	1,385,955	396,921	55,511	6,133	3,083,590

5.2.3 Maintain scenario outcomes

Table 5-14: Maintain scenario – Total agricultural cash damages in RoFRS Return Periods (Cumulative) (£k)

RoFRS Return Period	South Level (£k)	Middle Level (£k)	West of Ouse (£k)	East of Ouse (£k)	King's Lynn (£k)	Total (£k)
10%	1,720	3,388	532	121	20	5,780
3.33%	3,502	7,586	912	123	26	12,150
1.33%	5,492	10,103	954	398	30	16,978
1%	57,547	60,168	11,986	1,081	208	130,991
0.5%	61,267	64,344	22,846	2,028	259	150,745
0.1%	61,344	64,353	24,258	2,111	269	5,780

Table 5-15: Maintain scenario – Total PV Damages (£k)

South Level (£k)	Middle Level (£k)	West of Ouse (£k)	East of Ouse (£k)	King's Lynn (£k)	Total (£k)
28,723	38,330	8,725	991	148	76,918

5.2.4 Sensitivity testing

As discussed in section 5.2.1 an alternative method for valuing agricultural write off was also undertaken. This was the original approach used in the Great Ouse Fens project and previously reported as part of the baseline damages and benefits. However, to be consistent with the methodologies used for the Lower Witham assessment as well as the rest of the Fens 2100+ study areas and to align with current guidance this method is now included as a sensitivity.

For this alternative method rather than writing off the land below the Do Nothing 'write off level' based on land market valuations, agricultural land is valued based on lost productivity of the land at field scale. The value of losses if the land is written off is assumed to be the lost productivity of the land for the remainder of the appraisal period rather than the land valuation from Knight Frank or similar. This approach was originally utilised following consultation with the NFU and farmers, where it was found that the process of write off was considered to undervalue the land and did not account for the significance of the agricultural sector in the Fens for national food security. The losses accrued beyond write off of land were based on net margins for good drainage conditions as detailed in section 4.2.2 of the study undertaken by Capita AECOM in 2020 on the Great Ouse catchment. Section 6.4 contains a summary of all the sensitivity analysis exercises undertaken in this assessment.

Table 5-16: Do Nothing – Area of agricultural write off for the Do Nothing scenario (ha) (non-cumulative)

Appraisal year	South Level (ha)	Middle Level (ha)	West of Ouse (ha)	East of Ouse (ha)	King's Lynn (ha)	Total (ha)
0	32,667	41,869	7,126	373	-	82,036
2	4,915	4,610	593	643	54	10,815
4	4,247	3,728	1,430	593	182	10,181
7	3,617	3,016	2,411	950	148	10,142
10	5,104	2,453	4,207	747	104	12,615
12	2,967	980	3,664	301	137	8,050

Table 5-17: Do Nothing – Loss of agricultural productivity per annum for the Do Nothing scenario (£k) (non-cumulative)

Appraisal year	South Level (£k)	Middle Level (£k)	West of Ouse (£k)	East of Ouse (£k)	King's Lynn (£k)	Total (£k)
0	33,264	28,456	5,062	135	-	66,917
2	4,314	4,504	321	278	1	9,418
4	3,162	3,357	668	302	125	7,615
7	2,636	2,340	1,321	782	31	7,109
10	3,664	1,972	2,607	456	44	8,743
12	2,153	840	3,051	206	51	6,301

Table 5-18: Do Nothing – Total PV Damages (£k)

South Level (£k)	Middle Level (£k)	West of Ouse (£k)	East of Ouse (£k)	King's Lynn (£k)	Total (£k)
1,481,712	1,240,421	414,266	73,026	8,318	3,217,743

Table 5-19: Maintain scenario – Areas of agricultural land flooded RoFRS Data (Ha)

RoFRS Return Period	South Level (ha)	Middle Level (ha)	West of Ouse (ha)	East of Ouse (ha)	King's Lynn (ha)	Total (ha)
10%	1,563	2,531	423	133	23	4,673
3.33%	3,219	5,667	698	145	31	9,760
1.33%	5,154	7,570	732	525	37	14,019
1%	44,675	44,599	10,094	1,583	594	101,545
0.5%	48,295	47,717	18,236	2,900	734	117,882
0.1%	48,409	47,727	19,025	42,519	765	158,444

Table 5-20: Maintain scenario – Total agricultural cash damages in RoFRS Return Periods (Cumulative) (£k)

RoFRS Return Period	South Level (£k)	Middle Level (£k)	West of Ouse (£k)	East of Ouse (£k)	King's Lynn (£k)	Total (£k)
10%	858	3,315	435	104	18	4,730
3.33%	3,058	7,340	769	115	23	11,305
1.33%	9,023	15,301	1,341	795	41	26,500
1%	97,141	91,794	18,977	2,685	669	211,265
0.5%	104,351	98,482	34,671	4,932	840	243,276
0.1%	104,527	98,507	36,218	83,343	876	323,471

Table 5-21: Maintain scenario – Total PV Damages (£k)

South Level (£k)	Middle Level (£k)	West of Ouse (£k)	East of Ouse (£k)	King's Lynn (£k)	Total (£k)
44,636	56,464	12,795	9,426	362	123,683

5.3 Environment and recreational losses

The Great Ouse Fens is a distinct, historic and human influenced wetland landscape. The area includes a number of wetland sites of regional and national importance that provide a range of benefits to people and nature. Using data provided by site managers and economic values drawn from research literature, selected ecosystems generated by the main nature reserves in the study area have been valued in economic prices, including carbon storage, recreational benefits, specified target habitat and biodiversity values, and residual flood storage capacity. Permanent inundation could lead to the loss of these habitats and the associated Natural Capital benefits they provide. In addition, these sites plus Public Rights of Way and other open spaces provide significant wellbeing value to local communities and visitors.

The study concentrated on four main nature reserve sites in the study extents, which have been designated sites under Natura 2000, SSSI, Ramsar, WWT and RSPB. The sites are:

- Great Fen
- Wicken Fen
- Lakenheath
- Ouse Washes (plus Welney and Welches Dam Reserves)

It should be noted that the damages and benefits calculated for environmentally designated sites in this section differ from the valuation of ecosystem service presented in the Natural Capital reporting in the baseline report. This is because the Natural Capital reporting provides a total value of ecosystem services currently estimated to be provided across the catchment, whilst this analysis focuses on estimating the impacts and losses of these services, and only for designated sites.

Figure 14: Wicken Fen National Nature Reserve
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5.3.1 Do Nothing and Maintain scenario approach

The methodology for the valuation of environmental and recreational losses is detail in section 4.7 of the 2020 Capita AECOM report on the Great Ouse catchment. Details on the areas of natural land impacted by permanent flooding in the Do Nothing scenario and area of land impacted by RoFRS in the Maintain scenario are outlined in section 5.7 of that report.

The results have been uplifted from 2019 values to 2025 values using GDP data from December 2024 with the PV damages for the Do Nothing and Maintain scenarios shown in section 5.3.2 and 5.3.3 respectively below.

5.3.2 Do Nothing scenario outcomes

Table 5-22: Do Nothing – Environment and recreation Total PV Damages (£k)

South Level (£k)	Middle Level (£k)	West of Ouse (£k)	East of Ouse (£k)	King's Lynn (£k)	Total (£k)
24,794	17,465	-	-	-	42,259

5.3.3 Maintain scenario outcomes

Table 5-23: Maintain scenario – Environment and recreation Total PV Damages (£k)

South Level (£k)	Middle Level (£k)	West of Ouse (£k)	East of Ouse (£k)	King's Lynn (£k)	Total (£k)
2,288	468	-	-	-	2,756

5.4 Infrastructure damages

Connectivity between settlements in the catchment and beyond is facilitated by three main roads, the A10, A47 and A141, as well as railway links with stations at Kings Lynn, Watlington, Downham Market, Littleport, Ely, Soham, March, Manea, Shippea Hill and Lakenheath. Other major infrastructure, such as electrical distribution networks, also cross the catchment.

Whilst infrastructure assets are generally protected to a fairly high standard for infrequent flood events, if the catchment were to become permanently or extensively impacted, vast swathes of infrastructure would be abandoned with alternative capacities or diversions required.

There are localised areas of existing risk, which whilst not primary roads or assets, are key connections between communities. Closures of these connections leads to disruption and local financial losses for businesses such as shops and pubs with customers having to take a longer route to access them or going elsewhere. These localised risks of disruption and financial losses are not captured as part of this assessment.

Figure 15: Littleport bypass level crossing (A10)

Infrastructure assets are assumed to be largely protected to a high standard against short term flooding from infrequent events, and as such only damages associated with the Do Nothing permanent flooding case have been calculated. The following two sections describe impacts to transport and utilities infrastructure.

5.5 Transport damages

5.5.1 Do Nothing scenario approach

As outlined in sections 4.3 and 4.4 of the 2020 Capita AECOM report on the Great Ouse catchment the Do Nothing scenario assumes gradual inundation of the catchment resulting in highways and railway infrastructure being written off as flood levels increase across the catchment. Damages from infrequent flood events, as per MCM guidance, are typically calculated based on disruption to traffic or rail services or damage repair costs (e.g. resurfacing). In this instance, highways and rail are assumed to be permanently inundated resulting in a loss of the asset. The damage value has been defined from the length of highway and railway impacted at each step-change in inundation of the catchment.

The reference values for road and rail infrastructure per metre from the 2020 study have been uplifted from 2020 values to 2025 values using GDP data from December 2024; the uplifted values are shown in Table 5-24.

5.5.2 Key assumptions

Table 5-24: Do Nothing transport assumptions

<table>
<tr><th colspan="2">Key assumptions:</th></tr>
<tr><td>Value of lost highway infrastructure</td><td>The value of lost roads has been based on the Future Fens (Great Ouse) economic analysis, which considered recent data from new build road schemes. No further publicly available information was considered to better the information utilised. Costs expressed in 2025 values.
<table>
<tr><th>Type of Road</th><th>Cost per Metre (£)</th></tr>
<tr><td>Primary Road</td><td>33,072</td></tr>
<tr><td>A Road</td><td>22,122</td></tr>
</table></td></tr>
<tr><td>Value of lost railway infrastructure</td><td>The value of lost railway has been based on the Future Fens (Great Ouse) economic analysis, which considered recent data from new build rail schemes. No further publicly available information was considered to better the information utilised. Costs expressed in 2025 values.
<table>
<tr><th></th><th>Cost per Metre (£)</th></tr>
<tr><td>Railway cost</td><td>15,885</td></tr>
</table></td></tr>
</table>

5.5.3 Do Nothing scenario outcomes

Table 5-25: Do Nothing - length of road network impacted (non-cumulative) (m)

Appraisal year	South Level (m)	Middle Level (m)	West of Ouse (m)	East of Ouse (m)	King's Lynn (m)	Total (m)
0	8,384	5,208	1,526	-	-	15,118
2	7,199	2,693	97	-	-	9,989
4	6,850	6,517	1,716	-	-	15,082
7	2,616	4,179	513	65	-	7,372
10	6,010	9,596	3,940	24	625	20,194
12	6,537	9,341	3,576	350	70	19,873

Table 5-26: Do Nothing – cash road network damages (non-cumulative) (£k)

Appraisal year	South Level (£k)	Middle Level (£k)	West of Ouse (£k)	East of Ouse (£k)	King's Lynn (£k)	Total (£k)
0	211,279	159,645	50,467	-	-	421,391
2	179,633	71,575	3,208	-	-	254,416
4	171,825	165,373	56,734	-	-	393,932
7	66,675	132,561	16,949	2,150	-	218,335
10	168,025	273,441	130,198	706	20,670	593,040
12	176,699	245,359	118,247	11,575	2,315	554,195

Table 5-27: Do Nothing - length of rail network impacted (non-cumulative) (m)

Appraisal year	South Level	Middle Level	West of Ouse	East of Ouse	King's Lynn	Total
0	10,980	897	-	-	-	11,877
2	2,924	4,731	-	-	-	7,655
4	12,432	12,342	-	-	-	24,774
7	5,220	4,854	-	-	-	10,074
10	6,808	2,724	-	2,040	-	11,572
12	13,684	5,576	-	716	13	19,989

Table 5-28: Do Nothing - cash rail network damages (non-cumulative) (£k)

Appraisal year	South Level (£k)	Middle Level (£k)	West of Ouse (£k)	East of Ouse (£k)	King's Lynn (£k)	Total (£k)
0	174,413	14,248	-	-	-	188,661
2	46,447	75,150	-	-	-	121,597
4	197,477	196,048	-	-	-	393,525
7	82,918	77,104	-	-	-	160,021
10	108,142	43,270	-	32,405	-	183,817
12	217,365	88,573	-	11,373	206	317,517

The damages associated with impacted road and rail networks for the Do Nothing scenario are seen in Table 5-26 and Table 5-28. Approximately 87,628m of road network is impacted, resulting in total cash damages of £2,435,308k by the end of the appraisal period. Around 85,941m of rail network is impacted over the same period, leading to an estimated £1,365,138k of cash damages.

When discounted across the 100-year appraisal period, this provides Total PV damages of £1,960,963k and £1,111,321k respectively for road and rail damages.

5.6 Utilities damages

For each of the utilities damage streams, damages are assumed (conservatively) to include only the assets directly impacted by permanent inundation within the Do Nothing scenario. This does not account for the wider impacts and disruption likely to occur as parts of the network become flooded but was considered an appropriate approach at this stage where broad representation of damages is required and the data and effort to assess wider disruption would be disproportionate.

5.6.1 Power networks

Details of the data provided, the assumptions made and the detailed methodology for valuing gas generation assets are outlined in section 4.5.2 of the 2020 Capita AECOM report on the Great Ouse catchment. The reference values from the previous assessment for power generation assets have been uplifted from 2019 values to 2025 values using GDP data from December 2024 and are shown in Table 5-29.

Electrical distribution assets across the catchments have been identified for UK Power Networks and National Grid. Details of the methodology for valuing these assets are outlined in section 4.5.1 of the 2020 report. Damages have been defined by the number of assets within the permanently inundated extents, based upon publicly available GIS asset databases. This primarily relates to substations and pole tower assets. The reference values for the previous assessment have been uplifted from 2019 values to 2025 values using GDP data from December 2024 and are shown in Table 5-29.

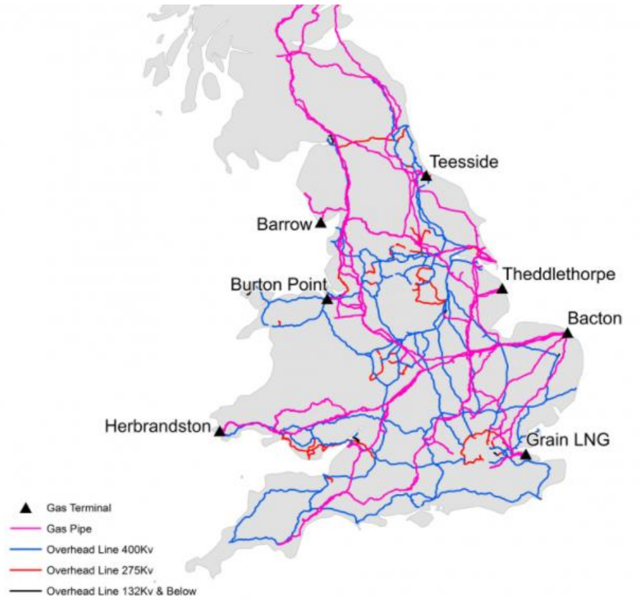

Figure 16: National Grid electricity and gas distribution network
Source: National Grid 2021

5.6.2 Gas

Damages are calculated for the loss of National Grid gas distribution assets based on the length (km) of gas main impacted at the permanently inundated water level, with geographically referenced data for the location of the pipeline being obtained from National Grid. For this assessment we have updated the reference value used to value the national gas distribution pipeline compared to the value used by Capita AECOM in 2020 on the Great Ouse catchment. The value now used is from the Lower Witham catchment study as part of the Fens 2100+ assessment as this value is based on a more recent collection of

30” gas pipeline projects in the US for large gas transmission pipeline and provides a significant increase in value per meter compared to the 2020 appraisal. Details of the reference value, uplifted to 2025 values using GDP data from December 2024, are shown in Table 5-29.

5.6.3 Water

The methodology of the valuation of water utility assets are detailed in the section 4.6 of the 2020 Capita AECOM report on the Great Ouse catchment. The results from this study have been uplifted from 2019 values to 2025 values using GDP data from December 2024 with the PV damages for the Do Nothing scenario shown in section 5.6.3 below.

5.6.4 Ely Ouse Water Transfer

As outlined in section 4.9 of the 2020 Capita AECOM report on the Great Ouse catchment the value to replace the Ely Ouse – Essex Water Transfer Scheme has been included in the appraisal. A valuation of £910 million was used in this previous study. This value has been uplifted from a 2019 value to 2025 value using GDP data from December 2024 which gives a 2025 value of £1,049 million. When discounted to year 12 of the appraisal period, when it is anticipated to be inundated, this gives a PV damages value of £695 million in the Do Nothing scenario.

5.6.5 Key assumptions

Table 5-29: Do Nothing utilities assumptions

<table>
<tr><th colspan="2">Key assumptions:</th></tr>
<tr><td>Power generation assets replacement costs</td><td>Assumed Costs and Efficiency for Power Stations. All costs are expressed as 2025 values.
<table>
<tr><th>Technology</th><th>Capital Cost $/kW</th><th>Conversion to £/kW</th></tr>
<tr><td>CCGT</td><td>1223</td><td>954</td></tr>
<tr><td>Biomass (dedicated)</td><td>-</td><td>2153</td></tr>
<tr><td>Wind Onshore</td><td>-</td><td>1887</td></tr>
<tr><td>Solar Photovoltaics</td><td>3169</td><td>2472</td></tr>
<tr><td>Storage</td><td>3518</td><td>2744</td></tr>
<tr><td>Anaerobic Digestion</td><td>6235</td><td>4863</td></tr>
<tr><td>Landfill Gas</td><td>6235</td><td>4863</td></tr>
</table></td></tr>
<tr><td>Electrical distribution asset replacement costs</td><td>Electrical distribution asset replacement costs for UK Power Network Poles and Substations as well as National Grid Towers and National Grid Substations. All costs are expressed as 2025 values.
<table>
<tr><th>Asset (UKPN & WPD)</th><th>Replacement cost (2025)</th></tr>
<tr><td>Pole Tower (33kV)</td><td>£3,752</td></tr>
<tr><td>Pole Tower (11kV)</td><td>£3,752</td></tr>
<tr><td>Substation (132kV)</td><td>£3,877,438</td></tr>
<tr><td>Substation (33kV)</td><td>£93,809</td></tr>
<tr><td>Substation (11kV)</td><td>£31,270</td></tr>
<tr><td>National Grid Towers</td><td>£375,236</td></tr>
<tr><td>National Grid Substations</td><td>£7,129,482</td></tr>
</table></td></tr>
</table>

Key assumptions:	
Electricity assumptions	Costs relating to safe clearance of temporarily and permanently flooded assets have not been provided, nor have costs for a new submarine power network. Should the network become permanently inundated, the assets will be abandoned. Indirect damages from power outages outside the study area are not captured as part of this appraisal.
Gas pipeline replacement costs	In the absence of UK specific data, losses associated with the gas replacement costs have been based on a collection of 30" gas pipeline projects in the US for large gas transmission pipeline. The cost of the reference pipeline is seen below, with £/m in 2025 values.

Valuation	Cost	Comments
Construction 30" pipeline ($ per mile (2017))	5,340,000	Source: Oil and Gas Pipeline Construction Costs - Global Energy Monitor (gem.wiki)
£ / m	3,327	Conversion to present day £ and meters. Source: 1 USD to GBP - US Dollars to British Pounds Exchange Rate (xe.com) (Conversion date used- 01/07/2017) Uplifted to 2025 price

Key datasets:

- Electricity: Western Power Distribution and National Grid geographical datasets of their assets
- How close does an energy scheme need to be to an electricity network? | Roadnight Taylor
- Typical constructions of overhead lines (electrical-engineering-portal.com)
- Gas: National Grid Gas Distribution Network

5.6.6 Do Nothing outcomes

Table 5-30: Do Nothing – number of electrical assets impacted

Asset Type	Do nothing count
Power Stations	25
UK PN Substations	2,762
UK PN Pole Towers	2,984
National Grid Towers	185
National Grid Substations	2

Table 5-31: Do Nothing – Total PV Damages of electrical assets impacted (non-cumulative) (£k)

Appraisal year	South Level (£k)	Middle Level (£k)	West of Ouse (£k)	East of Ouse (£k)	King's Lynn (£k)	Total (£k)
0	54,141	187,348	-	-	9,596	251,084
2	104,050	114,489	-	1,157	1,044	220,740
4	75,792	15,584	76	822	1,171	93,444
7	3,184	4,338	65	2,971	4,538	15,097
10	24,057	6,844	155	4,465	19,393	54,915
12	6,913	38,753	293,835	9,828	791,872	1,141,202

Table 5-32: Do Nothing - length of gas network impacted (non-cumulative) (m)

Appraisal year	South Level (m)	Middle Level (m)	West of Ouse (m)	East of Ouse (m)	King's Lynn (m)	Total (m)
0	1,075	44,091	-	181	-	45,347
2	1,045	9,552	-	13	-	10,610
4	1,619	12,414	15	42	-	14,090
7	867	3,886	217	201	-	5,171
10	613	3,586	13,260	2,727	362	20,548
12	1,329	3,258	8,958	2,481	415	16,441

Table 5-33: Do Nothing – Total PV Damages of gas network impacted (non-cumulative) (£k)

Appraisal year	South Level (£k)	Middle Level (£k)	West of Ouse (£k)	East of Ouse (£k)	King's Lynn (£k)	Total (£k)
0	3,576	146,671	-	602	-	150,849
2	3,245	29,662	-	40	-	32,948
4	4,693	35,987	43	122	-	40,845
7	2,267	10,160	567	526	-	13,520
10	1,446	8,457	31,270	6,431	854	48,457
12	2,926	7,172	19,721	5,462	914	36,194

Table 5-34: Do Nothing – Total PV Damages of water utilities impacted (non-cumulative) (£k)

Appraisal year	South Level (£k)	Middle Level (£k)	West of Ouse (£k)	East of Ouse (£k)	King's Lynn (£k)	Total (£k)
0	147,495	150,542	-	478	75,998	374,513
2	44,635	64,727	-	1,187	10,045	120,593
4	31,248	53,946	509	577	19,873	106,153
7	18,698	43,532	277	3,172	23,246	88,924
10	31,978	70,043	1,023	16,943	52,666	172,653
12	35,977	66,438	7,517	17,098	81,136	208,166

The total count of electrical utilities impacted for the Do Nothing scenario can be found in Table 5-30 with total PV damage shown in Table 5-31. The total length of gas pipeline impacted for the Do Nothing scenario is shown in Table 5-32 with total PV damage shown in Table 5-33.

By the end of the appraisal period, around 25 power stations, 3169 pole towers and 2764 substations are impacted during the final inundation level. This results in total PV power network damages of £1,346,404k.

By the end of the appraisal period, 112,207m of gas pipeline is impacted during the final inundation level. This results in total PV gas network damages of £322,814k.

Water utilities damages give total PV damages of £1,071,002k across the appraisal period with an additional £694,486k PV damages from the Ely Ouse Water Transfer.

5.7 Isolated land and properties

The consideration of isolated land and properties is unique to the Do Nothing scenario which considers permanent inundation of the catchment, rather than infrequent extreme flood events. This aspect looks to account for the notion that areas of elevated land may not be directly flooded, but if surrounded by water are likely to be abandoned - with similar impacts to that of the damage streams described prior.

5.7.1 Do Nothing scenario approach

In accordance with HM Treasury Green Book[9] guidance (2022), the analysis looks to define the "lowest cost to the nation". As such, the approach considered damages associated with isolated areas (at the point of permanent inundation) which are assumed to be abandoned; these costs were compared to cost of re-provision of services and to reconnect the isolated communities to the 'mainland'.

Whilst abandonment is considered to be the most likely scenario or outcome if a Do Nothing event were to occur, recognising that the community would have no wider flood defence measures and be extremely vulnerable to coastal storm events, the approach taken provides a conservative estimate of potential losses where there is uncertainty.

The analysis has focused towards identifying isolated populated communities. Each settlement's residential and non-residential properties have been identified and values associated with their abandonment defined. Recognising the high-level nature of this assessment, it is assumed the majority of the losses associated with isolated agricultural land have been captured as part of the agricultural land assessment, and due to the small spatial extents, it is not considered to be proportionate to define isolated agricultural land losses. This logic also applies to the analysis of wider isolated infrastructure and environmental designations.

The detailed methodology of the valuation of isolated land and properties is reported in section 4.10 of the 2020 Capita AECOM report on the Great Ouse catchment.

The results from this study have been uplifted from 2019 values to 2025 values using GDP data from December 2024 with the PV damages for the Do Nothing scenario shown in section 5.7.2 below.

5.7.2 Do Nothing scenario outcomes

Table 5-35: Do Nothing – Isolated Land Total PV Damages (£k)

South Level (£k)	Middle Level (£k)	West of Ouse (£k)	East of Ouse (£k)	King's Lynn (£k)	Total (£k)
219,719	517,317	0	11,715	1,451	750,202

[9] The Green Book: appraisal and evaluation in central government - GOV.UK

5.8 Losses to the local economy

The Fens has a diverse economy, to which agriculture contributes significantly, as previously highlighted within the agriculture section. In addition, there are a range of retail, industrial and manufacturing businesses across the catchments which would be impacted by flooding in the Do Nothing scenario.

5.8.1 Do Nothing scenario approach

Losses to the local economy can be expressed in terms of Gross Value Added (GVA). GVA measures the contribution made to an economy by one individual producer, industry, sector or region. As per the HM Treasury Green Book (2022), local or regional benefits cannot be included in applications for Grant in Aid funding (only those identified as losses to the nation are eligible). As such, only a high-level analysis of GVA has been undertaken to understand the regional impacts, particularly in terms of the number of jobs at risk under a Do Nothing scenario (and thus benefiting from the existing FCERM arrangements).

The methodology for calculating GVA losses is outlined in section 5.11 of the 2020 Capita AECOM report on the Great Ouse catchment. Details on the number of jobs impacted by permanent flooding in the Do Nothing scenario and area of land impacted by RoFRS in the Maintain scenario are outlined in section 5.8.2 below.

The results from the 2020 Great Ouse study have been uplifted from 2019 values to 2025 values using GDP data from December 2024 with the PV damages for the Do Nothing scenario shown in section 5.8.2 below.

5.8.2 Do Nothing scenario outcomes

Table 5-36: Do Nothing high-level estimates of number of jobs impacted (GVA - direct and indirect) (non-cumulative)

Appraisal year	South Level	Middle Level	West of Ouse	East of Ouse	King's Lynn	Total
0	5,323	9,724	560	-	-	15,606
2	1,226	5,344	29	-	-	6,599
4	2,190	3,705	219	58	-	6,171
7	1,046	2,404	322	140	-	3,913
10	4,631	5,247	1,608	1,551	284	13,323
12	5,365	9,511	2,666	4,402	2,419	24,363

Table 5-37: Do Nothing - high-level estimates of GVA cash losses (direct and indirect) (non-cumulative) (£k)

Appraisal year	South Level (£k)	Middle Level (£k)	West of Ouse (£k)	East of Ouse (£k)	King's Lynn (£k)	Total (£k)
0	162,481	296,832	17,087	-	-	476,400
2	37,420	163,137	886	-	-	201,443
4	66,848	113,096	6,674	1,772	-	188,389
7	31,932	73,400	9,827	4,282	-	119,442
10	141,377	160,184	49,097	47,360	8,681	406,700
12	163,786	290,337	81,370	134,374	73,854	743,721

Table 5-38: Do Nothing – GVA Total PV Damages (£k)

South Level (£k)	Middle Level (£k)	West of Ouse (£k)	East of Ouse (£k)	King's Lynn (£k)	Total (£k)
2,041,163	4,349,346	-	18,275	207,431	6,616,215

Based on the number and area of non-residential properties impacted during the first 10 years of the appraisal period for the Do Nothing scenario, a high-level estimate of the number of jobs and associated GVA losses can be seen in Table 5-36. During this period an estimated 69,975 jobs are impacted whilst total PV GVA losses in excess of £6.5 billion are accrued.

6. Economic Damages and Benefits Summary

A summary of the Do Nothing and Maintain scenario economic damages, and Maintain scenario benefits, are provided in the tables below.

6.1 Summary of Do Nothing Damages

Table 6-1: Summary of PV Do Nothing damages (£k)

Type	Do Nothing Damages (£k)					
	South	Middle	West of Ouse	East of Ouse	King's Lynn	Total
Residential properties	978,774	2,888,744	1,757,554	173,748	125,346	5,924,166
Non-residential properties	1,061,587	1,703,872	583,003	200,312	106,755	3,655,529
Agricultural losses	1,239,069	1,385,955	396,921	55,511	6,133	3,083,589
Transport - road	817,161	830,988	286,778	9,850	16,185	1,960,963
Transport - rail	675,546	405,139	0	30,499	137	1,111,321
Water	310,031	449,227	9,326	39,455	262,963	1,071,002
Power network	241,453	341,713	552,954	13,802	194,682	1,344,603
Gas	712,639	238,110	51,602	13,183	1,767	1,017,300
Ely Ouse water transfer	694,486	-	-	-	-	694,486
Environment and recreation	24,794	17,465	-	-	-	42,259
Isolated properties	219,719	517,317	1,451	11,715	-	750,202
Total PV damages (excludes losses to the local economy)	**6,975,258**	**8,778,531**	**3,639,590**	**548,073**	**713,968**	**20,655,420**
Losses to the local economy (GVA)	2,041,164	4,349,346	207,431	18,275	-	6,616,216
Total PV damages (Incl. GVA)	**9,016,422**	**13,127,877**	**3,847,021**	**566,348**	**713,968**	**27,271,637**

6.2 Summary of Maintain Damages

Table 6-2: Summary of PV Maintain damages (£k)

Type	Maintain Damages (£k)					
	South	Middle	West of Ouse	East of Ouse	King's Lynn	Total
Residential properties	74,960	73,334	73,249	4,249	76,988	302,780
Non-residential properties	43,713	28,576	17,267	31,694	55,113	176,363
Agricultural losses	28,723	38,330	8,725	991	148	76,917
Environment and recreation	2,288	468	-	-	-	2,755
Total PV damages	**149,684**	**140,709**	**99,242**	**36,933**	**132,248**	**558,816**

6.3 Summary of Maintain Benefits

Table 6-3: Summary of PV benefits (£k)

Type	Maintain Benefits (£k)					
	South	Middle	West of Ouse	East of Ouse	King's Lynn	Total
Residential properties	903,813	2,815,410	1,684,305	169,500	48,358	5,621,386
Non-residential properties	1,017,874	1,675,296	565,736	168,617	51,642	3,479,166
Agricultural benefits	1,210,346	1,347,625	388,195	54,521	5,985	3,006,671
Transport - road	817,161	830,988	286,778	9,850	16,185	1,960,963
Transport - rail	675,546	405,139	0	30,499	137	1,111,321
Water	310,031	449,227	9,326	39,455	262,963	1,071,002
Power network	241,453	341,713	552,954	13,802	194,682	1,344,603
Gas	712,639	238,110	51,602	13,183	1,767	1,017,300
Ely Ouse water transfer	694,486	0	0	0	0	694,486
Environment and recreation	22,506	16,997	0	0	0	39,504
Isolated properties	219,719	517,317	1,451	11,715	0	750,202
Total PV benefits (excludes benefits to the local economy)	**6,825,574**	**8,637,822**	**3,540,348**	**511,140**	**581,720**	**20,096,605**
Benefits to the local economy (GVA)	2,041,164	4,349,346	207,431	18,275	0	6,616,216
Total PV benefits (Incl. GVA)	**8,866,738**	**12,987,168**	**3,747,779**	**529,415**	**581,720**	**26,712,821**

6.4 Sensitivity Testing

The impacts of changes to assumptions have largely been reported under the individual damage sections in Section 5. However, the impact of three of the more uncertain elements of the appraisal, with larger impacts on the overall damage figures, are summarised below for context and comparison with the baseline values reported in section 6.6.3. This includes the impact of the two sensitivity tests for the Do Nothing scenario outlined in section 3.1.5 as well as the impact of the different approaches to valuing agricultural losses.

6.4.1 Maximum Basin Contour Height Sensitivity

The impact of a higher maximum basin contour height of 5m is shown in Table 6-4 below. In our assessment of the damages in this scenario, we have assumed the same uplift in damages occurs when moving from the 2.5m basin contour scenario to the 5m basin contour scenario as was observed in the study undertaken by Capita AECOM in 2020 on the Great Ouse catchment.

Table 6-4: PV Damages in the Maximum Basin Contour Scenario (£k)

Damage Stream	2.5m Contour Scenario (£k)	5m 'Max Contour' Scenario (£k)	Increase in Damage (£k)
Residential properties	5,924,166	5,936,615	12,449
Non-residential properties	3,655,529	3,657,827	2,299
Agricultural losses	3,083,589	3,086,098	2,509
Transport - road	1,960,963	1,960,963	-
Transport - rail	1,111,321	1,111,321	-
Water	1,071,002	1,071,651	649
Power network	1,344,603	1,345,697	1,094
Gas	1,005,408	1,005,408	-
Ely Ouse water transfer	694,486	694486.0133	-
Environment and recreation	42,259	42,259	-
Isolated properties	750,202	750,202	-
Losses to the local economy (GVA)	6,616,216	6,616,216	-

These changes represent an overall increase in damages of significantly less than 1%. The largest increase in damages is from Residential Properties at over £12m. However, as noted in the assumptions within section 10.1 of the 2020 Capita AECOM report, the damages are likely to be overestimated here. As such, it is not considered that the appraisal is sensitive to flood risk above the 2.5m AOD basin contour scenario.

6.4.2 Faster contour fill rate of 0.5m per year

The impact of a faster contour basin fill rate as outlined in section 3.1.5 is shown in Table 6-5.

Table 6-5: PV Damages in the Faster Basin Contour Fill Rate Scenario (£k)

Damage Stream	Original Contour Fill Rate Scenario (£k)	Faster Contour Fill Rate Scenario (£k)	Increase in Damage (£k)
Residential properties	5,924,166	6,848,292	924,126
Non-residential properties	3,655,529	4,065,276	409,747
Agricultural losses	3,083,589	3,259,246	175,657
Transport - road	1,960,963	2,215,286	254,323
Transport - rail	1,111,321	1,245,362	134,041
Water	1,071,002	1,192,163	121,161
Power network	1,344,603	1,573,924	229,321
Gas	1,005,408	1,218,561	213,154
Ely Ouse water transfer	694,486	883,580	189,094
Environment and recreation	42,259	47,476	5,217
Isolated properties	750,202	954,472	204,270
Losses to the local economy (GVA)	6,616,216	6,616,216	-

The observed changes represent an overall increase in damages of 10% with changes seen to be uniform in their percentage magnitude across the damage streams. This sensitivity test suggests that the appraisal is sensitive to catchment fill rate with a faster fill leading to a significant increase in the damages observed.

6.4.3 Agricultural damages – loss of productivity

The results of the two agricultural damage approaches outlined in section 5.2.1 are summarised in Table 6-6.

Table 6-6: Comparison of Total PV agricultural damages using agricultural market prices and land use and crop damage estimates (£k)

Scenario	Agricultural Land Valuation and ALC Grade (£k)	Land Use Data and Crop Damages (£k)
Maintain	76,918	123,683
Do Nothing	3,083,590	3,217,743

A comparison of the agricultural land valuation and land use-based approach shows that the latter estimate is higher by about £134m in the Do Nothing scenario. This constitutes a ~4% increase. However, the land use-based approach also shows significantly more damages than the land valuation approach for the Maintain scenario with an increase of ~£47m which represents a 60% increase.

The results highlight that using agricultural land valuations, relative to a more detailed land use-based approach, may provide an underestimate of damages for the agricultural land in the Fens due to flood impacts in all scenarios. This is because the land use-based approach, with estimates of damage by crop type, allows us to better understand the scale of damages associated with high value crops and the impacts of drainage conditions adjacent to flooded areas. It also better highlights the impacts from residual flood risk.

This sensitivity test shows that the land valuation approach provides a conservative method for valuing the benefits of FCERM defences to agricultural land. The land valuation method provides benefits which are approximately £87m lower than the land use-based approach representing around a 3% difference.

7. Costing

This section sets out the approach to defining the estimated capital cost interventions required for all Flood Risk Management assets in the Great Ouse catchment and the estimated point in time at which interventions are required, along with maintenance and operational expenditures.

This exercise has not considered any limitations on funding or the affordability of the investments needed, rather just examining the total investment requirements to sustain the existing asset base to continue to provide the existing Standard of Service, and to inform the cost benefit analysis for the Maintain scenario. An assessment of eligibility for funding at a catchment scale gives a better indication of the limitations on funding based on current Partnership Funding rules and is included in Section 9.

The exercise has been completed to gain a high-level understanding of the broad investment requirements for sustaining the existing asset base, and to understand the cost benefit ratio and available funding to do so. The results should be treated as indicative and used solely for planning of intervention works. For specific interventions, the costs should be reviewed considering existing knowledge, engineering assessment and site constraints in order to most effectively plan future intervention works, and ensure a robust cost is developed at business case development stage for individual investments.

A single “best estimate” cost has been produced based on best available data and standard approaches to estimation of uplifts for elements such as appraisal, design and risk. This has been used to determine the cost benefit analysis and eligibility for funding. However, noting the high-level nature of the data available at this stage, an additional range of costs has been estimated to demonstrate the uncertainty in the cost estimation at this stage.

Risk has been represented with the application of optimism bias; for the best estimate this has been included at 60% for all costs given the uncertainty in cost information at this stage. For the range estimation, optimism bias was included at 30% for the lower bound and 100% for the upper bound.

7.1 Capital costs

Cost information for assets requiring works have been collated from the Environment Agency and partner RMAs for their respective assets. This included both assets requiring capital interventions in the near term and those assets which will require capital interventions in the future. In order to do this, a spreadsheet template was developed with headings highlighting the key data requirements. This was circulated to partners as part of the development of tactical plans for the 2020 Capita AECOM study, along with an introduction to the data which was required and how it was to be used in the appraisal process.

Optimism bias has been included at 60% as standard for this stage of appraisal. No quantitative risk assessment has been undertaken at this stage of assessment.

No adjustment is made to this approach for the lower and upper bound costs.

Table 7-1: Estimate of capital costs per asset type

Asset type	Asset Information	Assumed capital cost (£k)
Pumping station	0-1 m^3/s capacity	1,097
	1-2 m^3/s capacity	2,275
	2-5 m3/s capacity	3,708
	5-10 m^3/s capacity	3,708
	10+ m^3/s capacity	87,156
Embankments	Per m	2
Walls	Per m	4
Outfalls	Per unit	39
Sluices	Per unit	2,314
Control gates	Per unit	38
Open channels	Per m	-
Simple culvert	Per m	249
Weirs	Per unit	246
Debris screen	Per unit	19

7.2 Appraisal costs

Consultancy fees and Environment Agency staff costs have been estimated using Project Cost Tool (PCT) curves. At this stage, indicative costs have been included for environmental enhancement and survey exercises (including Ground Investigation (GI) and non-intrusive survey including topographic survey). It has been assumed that environmental enhancement will equate to 3% of capital costs, that GI will be 5% and non-intrusive survey will be 3% of capital costs. These uplifts were derived based on outturn costs from similar packages of work.

For the lower bound cost estimate, the minimum percentage uplifts from the PCT curves for consultancy and Environment Agency staff costs have been used, regardless of estimated construction value. Conversely, for the upper bound estimate the maximum percentage uplift has been used.

7.3 Future Costs

Where costs have been provided for short term investments or capital interventions which are not a full asset replacement, these have been assumed as separate to the capital costs of asset replacement as described in Section 7.1. These costs are referred to as future costs, as they are planned interventions on a programme. However, it should be noted that in some cases these are expected to occur before asset replacement and capital costs.

No adjustment is made to this approach for the lower and upper bound costs.

7.4 Maintenance and Operational Costs

Anticipated maintenance and operational costs have also been based on expenditure for similar assets in the Great Ouse and Lower Witham catchments. Where this information is not available the relevant cost estimation guidance has been used[10]. These costs were projected out over the whole appraisal period and a 60% risk applied to represent uncertainty in future maintenance and operational activities.

Maintenance and operational cost estimates were adjusted for the cost range estimation by reducing the 60% risk value to 30% for the lower bound estimate and increasing it to 100% for the upper bound estimate.

7.5 Whole life costs

The cost information received from the Environment Agency and partner RMAs was forecast over the appraisal period to understand the profile of investment required over a 20 year and a 100-year period. These costs were discounted using HM Treasury discount rates to provide Present Value estimates of Whole Life Costs per asset, summed per sub catchment and totalled for the entire Great Ouse catchment.

The best estimate of cost to be used in cost benefit analysis, alongside the lower and upper bound costs accounting for uncertainty in investment needs at this stage, are presented in Table 7-3.

[10] https://www.gov.uk/flood-and-coastal-erosion-risk-management-research-reports/long-term-costing-tool-for-flood-and-coastal-risk-management

Table 7-2: Estimate of whole life costs for the Great Ouse catchment and each subcompartment (£k)

	East of Ouse (£k)	Kings Lynn (£k)	Middle (£k)	South (£k)	West of Ouse (£k)	Great Ouse (£k)
Capital costs	100,277	96,321	122,623	436,553	25,522	781,297
Appraisal costs	48,151	44,970	56,681	223,179	12,072	385,053
Risk contingency	89,057	84,775	107,582	395,840	22,556	699,810
Future costs	3,444	9,656	28,114	20,645	-	61,859
Maintenance and operational costs	139,582	89,588	102,680	539,793	20,017	891,661
Whole life cost	**380,511**	**325,311**	**417,680**	**1,616,010**	**80,168**	**2,819,679**

Table 7-3: Range of whole life costs for the Great Ouse catchment and each subcompartment (£k)

	East of Ouse (£k)	Kings Lynn (£k)	Middle (£k)	South (£k)	West of Ouse (£k)	Great Ouse (£k)
Lower bound cost	322,363	269,534	344,116	1,340,757	65,938	2,342,709
Best estimate cost	380,511	325,311	417,680	1,616,010	80,168	2,819,679
Upper bound cost	479,439	424,174	551,598	2,029,079	105,401	3,589,690

8. Cost Benefit Analysis

Capped PV damages, the net PV benefits of implementing the Maintain scenario, and the project costs are used to calculate the benefit cost ratios, shown in Table 8-1.

Table 8-1: Cost Benefit Analysis

Option	Damages (£k)	Benefits (£k)	Whole life costs (£k)	Benefit Cost Ratio
Total – Great Ouse				
Do Nothing	20,643,428	-	-	-
Maintain	558,816	20,084,712	2,819,679	7.12
East of Ouse				
Do Nothing	536,181	-	-	-
Maintain	36,933	499,247	380,511	1.31
Kings Lynn				
Do Nothing	713,968	-	-	-
Maintain	132,248	581,720	325,311	1.79
Middle				
Do Nothing	8,778,531	-	-	-
Maintain	140,709	8,637,822	417,680	20.68
South				
Do Nothing	6,975,258	-	-	-
Maintain	149,684	6,825,574	1,616,010	4.22
West of Ouse				
Do Nothing	3,639,500	-	-	-
Maintain	99,242	3,540,348	80,168	44.16

9. Partnership Funding

The maximum level of Grant in Aid (GiA) available at a catchment (and sub compartment) level has been calculated using the benefits derived as damages avoided following the methodologies set out in Section 5, and compared with whole life costs for all assets within the catchment (or sub compartment) as derived under Section 7.

Outcome Measure 2 counts follow a simplified approach detailed in Section 9.3 of the Calculate GiA funding for FCERM projects guidance[11]. Outcome Measure 2 properties better protected from flood risk have been defined based on the number of properties at risk in the Maintain scenario, together with those written off in the Do Nothing scenario which are assumed to be at Low Risk in the "after" counts; for the "before" count of properties, these properties are shifted one risk band higher.

No Outcome Measure 4 have been included in the Partnership Funding calculators at this stage of assessment.

Table 9-1 to Table 9-12 detail the number of Outcome Measure 2a properties that are better protected against flood risk by sustaining the existing defences over the 100 years benefits period.

Table 9-1: Outcome Measure 2 – Great Ouse - at risk today

	Low risk	Moderate risk	Intermediate risk	Significant risk	Very significant risk
20% most deprived	-	1,889	4,131	516	93
21% to 40% most deprived	-	1,041	4,625	3,897	105
60% least deprived	-	1,153	2,740	3,604	193
All deprivation bands	-	1,889	4,131	516	93

[11] https://assets.publishing.service.gov.uk/media/66e15a1c44b517b5cc5e2688/LIT_58360__Calculate_GIA_funding.pdf

Table 9-2: Outcome Measure 2 – Great Ouse - at risk after duration of benefits

	Low risk	Moderate risk	Intermediate risk	Significant risk	Very significant risk
20% most deprived	1,889	4,131	516	93	-
21% to 40% most deprived	1,041	4,625	3,897	105	-
60% least deprived	1,153	2,740	3,604	193	-
All deprivation bands	1,889	4,131	516	93	-

Table 9-3: Outcome Measure 2 – East of Ouse - at risk today

	Low risk	Moderate risk	Intermediate risk	Significant risk	Very significant risk
20% most deprived	-	5	17	2	50
21% to 40% most deprived	-	-	7	20	-
60% least deprived	-	13	190	30	-
All deprivation bands	-	5	17	2	50

Table 9-4: Outcome Measure 2 – East of Ouse - at risk after duration of benefits

	Low risk	Moderate risk	Intermediate risk	Significant risk	Very significant risk
20% most deprived	5	17	2	50	-
21% to 40% most deprived	-	7	20	-	-
60% least deprived	13	190	30	-	-
All deprivation bands	5	17	2	50	-

Table 9-5: Outcome Measure 2 – Kings Lynn - at risk today

	Low risk	Moderate risk	Intermediate risk	Significant risk	Very significant risk
20% most deprived	1,695	3,659	16	28	1,695
21% to 40% most deprived	7	1,746	125	42	7
60% least deprived	53	618	137	-	53
All deprivation bands	1,695	3,659	16	28	1,695

Table 9-6: Outcome Measure 2 – Kings Lynn - at risk after duration of benefits

	Low risk	Moderate risk	Intermediate risk	Significant risk	Very significant risk
20% most deprived	1,695	3,659	16	28	-
21% to 40% most deprived	7	1,746	125	42	-
60% least deprived	53	618	137	-	-
All deprivation bands	1,695	3,659	16	28	-

Table 9-7: Outcome Measure 2 – Middle - at risk today

	Low risk	Moderate risk	Intermediate risk	Significant risk	Very significant risk
20% most deprived	-	-	128	404	15
21% to 40% most deprived	-	-	136	1,318	48
60% least deprived	-	7	163	2,039	117
All deprivation bands	-	-	128	404	15

Table 9-8: Outcome Measure 2 – Middle - at risk after duration of benefits

	Low risk	Moderate risk	Intermediate risk	Significant risk	Very significant risk
20% most deprived	-	128	404	15	-
21% to 40% most deprived	-	136	1,318	48	-
60% least deprived	7	163	2,039	117	-
All deprivation bands	-	128	404	15	-

Table 9-9: Outcome Measure 2 – South - at risk today

	Low risk	Moderate risk	Intermediate risk	Significant risk	Very significant risk
20% most deprived	-	-	42	-	-
21% to 40% most deprived	-	22	951	7	-
60% least deprived	-	426	1,078	76	-
All deprivation bands	-	-	42	-	-

Table 9-10: Outcome Measure 2 – South - at risk after duration of benefits

	Low risk	Moderate risk	Intermediate risk	Significant risk	Very significant risk
20% most deprived	-	-	42	-	-
21% to 40% most deprived	-	22	951	7	-
60% least deprived	-	426	1,078	76	-
All deprivation bands	-	-	42	-	-

Table 9-11: Outcome Measure 2 – West of Ouse - at risk today

	Low risk	Moderate risk	Intermediate risk	Significant risk	Very significant risk
20% most deprived	-	189	327	52	-
21% to 40% most deprived	-	1,034	2,714	1,483	8
60% least deprived	-	1,080	1,343	320	-
All deprivation bands	-	189	327	52	-

Table 9-12: Outcome Measure 2 – West of Ouse - at risk after duration of benefits

	Low risk	Moderate risk	Intermediate risk	Significant risk	Very significant risk
20% most deprived	189	327	52	-	-
21% to 40% most deprived	1,034	2,714	1,483	8	-
60% least deprived	1,080	1,343	320	-	-
All deprivation bands	189	327	52	-	-

Table 9-13 details the maximum eligible GiA and the raw PF score for the whole of the Great Ouse catchment and each subcompartment.

Table 9-13: Partnership funding calculator results

	pv maximum eligible FCERM GiA (£k)	raw PF score (%)
Great Ouse	1,265,073	45
East of Ouse	30,756	8
Kings Lynn	51,200	16
Middle	535,614	128
South	418,547	26
West of Ouse	228,957	286

10. Limitations

There are a number of limitations for the work undertaken at this stage of assessment:

- This update of the economic baseline for the Great Ouse catchment has drawn upon the work undertaken previously by Capita AECOM in 2020; subsequent work for the Lower Witham catchment and the work undertaken as part of Fens 2100+ for the other catchments has considered a wider range of damage and benefit streams. It is not considered proportionate to add these to the Great Ouse assessment as the overall impact on total damages and benefits is considered likely to be relatively small.
- The work undertaken by Capita AECOM in 2020 utilised RoFRS data to determine risk in events exceeding the current capacity or standard of FRM assets. This does not capture surface water flood risk and therefore may underestimate damages in the maintain scenario, and to some extent in the Do Nothing scenario for residual risk above the permanently flooded area. Reassessment of damages using Risk of Flooding from Multiple Sources was not considered proportionate for this stage of study given the impact on total damages and benefits is likely to be relatively marginal.
- The costs developed at this stage are considered indicative only and should be reviewed at more detailed stages of appraisal for individual investments.
- Costs and estimated years for interventions have not been provided by all RMAs for all assets and as such there may be assets for which no cost information is included. However, benefits have been allocated across all eligible FRM assets such that these assets do have available benefits. Further to this, standardised costing assumptions have been made for a number of assets which may not be appropriate across all assets. The overall impact of this is not considered likely to change the general outcome of the analysis, and the indication of affordability and value for money.

11. Conclusions

Over the next 100 years, the Do Nothing scenario is projected to result in PV damages exceeding £20 billion, compared to £559 million under the Maintain scenario. By continuing the current FRM approach, the Maintain scenario delivers estimated benefits of around £20 billion. The primary driver of these benefits is the high standard of existing flood protection, which does not lead to considerable flooding from overtopping of defences. In total, 17,149 residential properties as OM2a are protected by the FRM assets maintained under this scenario. Benefits include:

- £9.10 billion of property damages avoided, including 17,149 residential and 19,746 non-residential properties avoiding write off
- £3.01 billion of agricultural losses avoided, and 135,152 ha of land protected
- £39.50m of environmental and recreational losses avoided
- £3.07 billion of transport damages avoided
- £4.13 billion of utilities damages avoided
- £750.20m of land lost to isolation being avoided.

In addition to these economic benefits, there is an estimated £6.62 billion of financial losses to the local economy avoided in the first ten years.

To provide this level of protection, a total of 119 pumping stations, 336 outfalls, 18 weirs, and significant reaches of open channel and linear flood defences will need to be sustained over the next 100 years, with total whole life costs estimated at £2.8 billion to do so.

Based on the analysis, it is clear that the current FRM measures and activities provide substantial benefits across the Great Ouse catchment. However, these benefits are not evenly distributed. The Middle Level and South Level both demonstrate high levels of benefit, with strong returns on investment for the FRM interventions implemented. In contrast, East of Ouse and Kings Lyn both show a less good return on investment, with the lower cost benefit ratios 1.31 and 1.79 respectively of 3.11. This is likely due to the limited amount of benefits generated compared to the high cost of maintaining and replacing the assets that provide these benefits.

Given the high value of benefits and large numbers of residential properties protected, the catchment is eligible for £1.2 billion of GiA funding with a PF score of 45%. Consequently, there is a funding gap of £1.5 billion that needs to be closed when compared to the total whole life cost of sustaining the FRM assets.

Fens 2100+