EASTSUFFOLK COUNCIL

The Lowestoft Tidal Barrier Order

Transport and Works Act 1992

Transport and Works (Applications and Objections Procedure) (England and Wales) Rules 2006

A17: Environmental Statement

Non-Technical Summary

LOWESTOFT FLOOD PROTECTION

October 2023

Contents

1. Introduction

The Lowestoft Tidal Barrier Scheme is being promoted by East Suffolk Council, with the aim of reducing the risk of flooding to the town of Lowestoft. The Scheme is one element of a wider strategy known as the Lowestoft Flood Protection (LFP) project.

Permission (consent) to construct and operate the Scheme is required before any building work or land access can commence. This permission is being sought in two ways:

- A Transport and Works Act Order (TWAO). As the tidal barrier will be built within the navigable channel and therefore interfere with rights of navigation in Lowestoft Harbour, an order is being sought under the Transport and Works Act 1992 to provide statutory authority for this interference. TWAO applications are made to, and determined by, the relevant Secretary of State who for this Scheme is the Secretary of State for the Environment, Food and Rural Affairs.
- A Marine Licence. This is required under the Marine and Coastal Access Act 2009 because works will require to take place below the Mean High Water Springs (MHWS) tide level. Licence applications are made to and determined by the Marine Management Organisation.

Listed Building consent will also be required for elements of work being undertaken in proximity to the Grade II* listed Royal Norfolk and Suffolk Yacht Club building (RN&SYC).

To support the TWAO and Marine Licence applications, an Environmental Impact Assessment (EIA) is required. This is reported in a document called an Environmental Statement (ES).

The aim of EIA is to protect the environment by ensuring that any significant environmental effects which the Scheme is likely to cause are identified and considered by decision makers during the consenting process.

The ES describes in detail the need for the Scheme, the legislative background, the alternatives considered, the consultation undertaken, the technical details of the Scheme and the anticipated environmental impacts in the following areas:

Table 1-1: Technical chapters that comprise the Environmental Statement.

Environmental Impact Area	Description
Chapter 8: Population and Human Health	Impact on the local population and their health and wellbeing.
Chapter 9: Noise and Vibration	Impact to humans, and buildings and infrastructure.
Chapter 10: Biodiversity, Flora and Fauna	Impact on the flora and fauna.
Chapter 11: Landscape and Visual Amenity	Impact on the characteristics of the landscape and on views of the Scheme from various locations.
Chapter 12: Water, Hydromorphology and Ground Conditions	Impact on water and silt and on ground conditions on the land.
Chapter 13: Historic Environment	Impact on historic buildings, landscapes and archaeological remains.

Environmental Impact Area	Description
Chapter 14: Transport	Impacts of construction traffic on the road network and areas of traffic congestion.
Chapter 15: Navigation	Impact on navigational users (both commercial and recreational).
Chapter 16: Air Quality and Climate	Impact of dust generation and on climate (generation of greenhouse gases).
Chapter 17: Cumulative Effects	Whether the Scheme could combine with other known projects to cause a greater environmental impact together than when considered separately.

The EIA has considered carefully which areas to include in the assessment and which areas do not need to be considered ("scoped out") as they are not likely to be affected by the Scheme to a significant degree. The EIA considers the environmental impact of the works that will be required to build the Scheme and when the Scheme is completed and in operation. The EIA also considers how the proposed tidal barrier would operate, both today and in the future.

The EIA recognises that, whether or not the barrier is constructed, the surrounding environment is likely to change in the future due to climate change and other pressures. Many environmental areas will be sensitive to this future change, and the impact of the Scheme needs to be considered in this context of environmental change.

The focus of the EIA is on the likely significant effects of the Scheme. Whether the impact is significant is determined by considering the sensitivity of the environmental feature and the scale of the impact. The effect can be temporary (for example, noise during construction) or permanent (for example, the visual impact of the barrier once constructed).

The environmental effect can be positive or negative depending on the receptor and the impact. Where negative effects may result from the Scheme, mitigation measures have been identified where possible to avoid or mitigate those effects, for example, by changes to the design of the Scheme.

This non-technical summary (NTS) summarises the findings of the EIA which is documented in the ES.

The ES is available from the following website: https://www.eastsuffolk.gov.uk/lowestoft-tidal-barrier-TWAO-application.

Electronic copies are available to view at the following locations:

Table 1-2: Locations of ES electronic copies.

Location	Opening times
East Suffolk Council Riverside, 4 Canning Road, Lowestoft, NR33 0EQ	Mondays to Fridays: 0800 to 1700

Location	Opening times
Marina Centre Marina, Lowestoft, NR32 1HH	Tuesdays and Thursdays: 10:00 to 16:00
Lowestoft Library Clapham Road South Lowestoft, NR32 1DR	Mondays: 09:00 to 18:00 Tuesdays to Fridays: 08:30 to 18:00 Saturday: 09:00 to 17:00 Sunday: 10:00 to 16:00

2. The Lowestoft Tidal Barrier Scheme

2.1 Scheme Background and Location

Lowestoft is a coastal town located on the North Sea within the County of Suffolk in the East of England and has a population of 48,985 (East Suffolk, 2019). Lowestoft is susceptible to flooding from heavy rainfall events (pluvial), river flooding (fluvial) and from the North Sea (tidal). A number of factors can contribute to tidal flooding (eg. spring tides, storm surges, flooding via Oulton Broad during storm surges) however, the greatest events typically occur when spring (high) tides coincide with storm events.

Lowestoft is largely undefended from tidal flooding and is the largest UK coastal town with no formal tidal defences. As such, Lowestoft has been affected by a number of historic tidal flood events. A recent example in 2013 is shown in Plate 2-1where 158 residential and 233 commercial properties were reported to have flooded in the Lowestoft and Oulton Broad area. This included 90 residential and 143 commercial properties in the low-lying central area of Lowestoft. In addition, tidal flooding resulted in the closure of key transportation links including Lowestoft railway station (see Plate 2-2) and the A12 / A47 through Lowestoft.

Plate 2-1: View of station square in December 2013 (credit: Paul Nichols).

Plate 2-2: View of Lowestoft railway station in December 2013.

In January 2017 severe flood warnings were issued for large parts of the east coast, including Lowestoft, when a tidal surge of approximately 2.1m was forecast to coincide with a high tide on 13th January. On that occasion, temporary defences, combined with a surge that was lower than predicted protected the town from serious flooding. It is anticipated that climate change will result in increased sea levels and more intense storms resulting in larger and more frequent extreme tides. This will increase tidal flood risk to Lowestoft in the future; it is estimated that 1,804 residential and 1,019 non-residential properties would suffer flooding if no works were undertaken.

As a result of the historic flooding and future projections, a number of strategic documents (set out in Chapter 2: Background, such as the Waveney District Local Plan) have supported the need for, and subsequent development of, tidal flood risk management in Lowestoft.

Currently a series of flood walls are under construction as part of the LFP project. These offer a level of flood risk protection up to 4.65m (or protection from a 1 in 200 year event in 2117), which is an improvement from current tidal flood events ranging from a 1 in 20 year (5% AEP) to 1 in 1000 year (0.1% AEP). This means that the defences will be capable of holding back high and extreme tides, up to the level of an extreme high tide which is predicted to occur on average, only once in every 200 years. At present, there is a break in the walls in the Inner Harbour Entrance Channel, which connects the Outer Harbour to Lake Lothing. Without completion of these defences with the construction of the tidal barrier, flood water would enter Lake Lothing through the Inner Harbour Entrance Channel and flood the areas surrounding Lake Lothing.

The areas at risk of tidal flooding are shown on Figure 2-2 which presents the tidal flood risk for Lowestoft without the tidal barrier. Figure 2-3 shows the flood extents with the tidal barrier in place.

Once complete, the Scheme will immediately deliver an improved level of tidal flood risk protection to 226 residential properties and 137 non-residential properties, with the number of properties protected increasing in the future, as noted above.

2.2 Description of the Scheme

The Scheme involves construction of a tidal flood barrier across the Inner Harbour Entrance Channel to Lake Lothing and the Inner Harbour of the Port of Lowestoft, approximately 40m downstream (east) of the Bascule Bridge and the long term inspection, operation and maintenance of a short length (approximately 35m) of the new tidal flood walls at the western extent of Hamilton Road. A visualisation of the barrier is shown on Plate 2-3. Short sections of temporary flood barrier known as demountable defences are required to connect the tidal barrier to the flood walls under construction as part of the wider LFP project. In addition to the barrier structure, a series of plant buildings will be constructed on the quayside adjacent to the barrier.

Plate 2-3: The proposed tidal barrier in the gate closed position (view looking east/seaward).

The tidal barrier will complete the tidal flood protection for Lowestoft, providing a 1 in 200 year standard of protection (ie. the probability of a given magnitude flood event or greater occurring in any given year) for overtopping in 2117, as explained in Section 2.1 above.

The Scheme is presented in Plate 2-4. It is designed to be closed at the onset of a tidal flood event and periodically as part of routine maintenance, including a monthly operational deployment check and from time to time to prevent silt from building up against the gate leaves when they are open.

Plate 2-4: Visualisation of the proposed 40m Barrier (note: some of the plant builds to be located on the quaysides are not shown).

The Barrier

The barrier is initially expected to be operated (due to a tidal flood event) on average once every three years , increasing due to sea level rise to once a year in 2070 and more than once a year in 2117.

The tidal barrier structure consists of two abutments on either side of the channel located within the existing inner piers, with two mitre gates which rotate inwards to form a barrier against the incoming tide. Plate 2-3 shows the barrier in the closed position. Each abutment is 37.5m long and 8.5m wide. The barrier elements will predominantly sit within the inner piers, with a high point that is approximately 5.5m above the existing ground level. A cill beam, which is a horizontal beam at the bottom of the tidal barrier, can be seen on Plate 2-4 which sits within the channel bed and spans the Inner Harbour Entrance Channel.

Plant Buildings

Plant buildings will house the main mechanical, electrical and ancillary equipment and the electrical plant room. These will be located on the North Quay and South Quay adjacent to the new north and south abutments. An electrical substation is required to be located on the North Quay within 15.0m of the electrical plant room and a standby diesel generator within an integrated acoustic enclosure and an internal fuel store will also be located on the North Quay close to the electrical plant room and electrical substation.

An emergency hydraulic power unit (used to operate the gates) will be located on top of each barrier abutment. These units will represent the highest point of the barrier, at approximately 5.5m above the existing ground level.

The primary location for the barrier control equipment will be within the Bascule Bridge Control Room. This will be controlled via a human-machine interface. The control panel display will provide all the necessary information regarding the status of the barrier gate and control equipment as well as key water levels across the Inner Harbour Entrance channel and Lake Lothing.

Access

Due to their temporary nature (i.e. they are only deployed when required), the use of demountable defences allows access to be maintained to the North and South Quays for the Royal Norfolk and Suffolk Yacht Club (RN&SYC), Associated British Ports (ABP) and National Highways. During deployment of the defences, access will be maintained to the Bascule Bridge Control Room and tidal barrier control equipment.

The working area and access required during gate operation is relatively limited. On the North Quay, it is confined to the barrier structure, the plant buildings and access between them and the Bascule Bridge Control Room. On the South Quay, it is confined to the barrier structure. It is anticipated that staff will access the North Quay with their vehicles through the port's main entrance off Waveney Road and park within existing parking alongside the Trawl Basin. Access to the South Quay will be via the RN&SYC access.

New Tidal Flood Walls at the Western Extent of Hamilton Road

As part of the operation and maintenance of the section of tidal flood wall at the western end of Hamilton Road a number of activities will need to take place to ensure the defences function as required. For the operation of the wall, a section of demountable flood barrier will be deployed across the entrance to the Kwik Fit Garage site in response to a tidal flood event and periodically as part of training or maintenance activities. Inspections and maintenance of the flood wall will be required periodically to ensure that it remains in the required condition.

The Barrier Construction

The barrier construction timeline has been informed by discussions with the port operator, ABP. The Scheme is to be constructed between 2025-2027:

- **Month 1 to Month 5** – Construction set up activity, including temporary crane platform installation.
- **Month 5 to Month 14** – Inner pier demolition, construction of cofferdams[1], creation of barrier abutment foundations and installation of cross channel piles[2].
- **Month 13 to Month 23** – Pouring of concrete base, walls and top slab for barrier abutments.
- **Month 23 to Month 26** – Completion of barrier abutment top sections, installation of concrete beam across the Inner Harbour Entrance Channel and installation of mitre gate.
- **Month 22 to Month 27** – North Quay and South Quay above ground works and demountable flood defences
- **Month 26 to Month 28** – Hand over.

The contractor appointed to carry out the works will follow good construction practice such as the establishment of working areas, site compounds and access routes. This will include scheduling work activities to minimise disruption to marine users and timing deliveries at less busy times of the day, to avoid congestion and disruption on the main roads through the town centre.

[1] A cofferdam is an enclosure built within a body of water to allow the enclosed area to be pumped out. This pumping creates a dry working environment so that the work can be carried out safely.
[2] Long steel sections driven deep into the ground.

3. Alternatives and Reasons for Choice of the Lowestoft Tidal Barrier Scheme

The need for strategic flood defences in Lowestoft has been recognised and recommended in a number of plans and strategies, since 2008.

East Suffolk is covered by the Suffolk Coastal Local Plan and the East Suffolk Council Waveney Local Plan. The plan covers the period 2014 – 2036. The plan outlines the need for strategic flood defence within Lowestoft and is essential to facilitate a number of other proposals. The Lowestoft area is expected to accommodate the majority of the district's development over the next 20 years. The key focus of the Local Plan is to continue the promotion of regeneration in Central Lowestoft and expand it to include the coastal areas of the town and beyond to Corton. Regeneration in Central and Coastal Lowestoft will deliver a significant amount of new housing as well as new economic development including new industry, retail and leisure.

Studies and analysis that support the need for strategic flood defence in Lowestoft include:

- Broadland Rivers Catchment Flood Risk Management Plan;
- Lowestoft Ness to Felixstowe Landguard Point Shoreline Management Plan;
- Lowestoft Transport Infrastructure Prospectus;
- Gorleston to Lowestoft Coastal Strategy;
- Lowestoft Tidal Barrier Feasibility Study;
- Lowestoft Flood Risk Management Strategy; and
- Lowestoft Flood Risk Management Strategy Strategic Environmental Assessment.

More recently, the Scheme has been identified as integral to the town's economic development and supports the UK Levelling Up agenda. Parts of Lowestoft suffer from high levels of deprivation (eg. the neighbourhood around London Road South and the A12 is the 25th most deprived neighbourhood out of 32,844 neighbourhoods on the English Indices of Deprivation measure[3]). The Scheme will reduce tidal flood risk and this will contribute to reducing social deprivation for those living and working in this and other areas, by providing confidence to local businesses, encouraging investment and growth in the local economy and creating a more viable and resilient coastal community.

3.1 Options Appraisal

The above strategic studies have driven the development of the proposals for the Scheme for which consent is now being sought. This chapter summarises the Scheme's development, options considered and outline design stage.

A number of investment objectives were defined early in the project and are as follows:

- To reduce the risk to residential and commercial properties from the effects of tidal flooding;
- To reduce costs associated with developing and insuring property within areas of Lowestoft susceptible to flooding;
- To provide a minimum standard of protection of a 1 in 200 year probability (0.5% AEP) against tidal flooding in 2117 to residential and commercial areas of Lowestoft;
- To provide businesses with the confidence to grow and invest in areas of the town which are currently not considered suitable for development (planning) due to the risk of tidal flooding;

[3] English Indices of Deprivation 2019 - https://www.gov.uk/government/statistics/english-indices-of-deprivation-2019 (LSOA: Waveney 007D).

- To enable the development of key sites through the alleviation of direct flooding and protection of essential infrastructure; and
- Unlock and enable future investment in Lowestoft.

In response, a number of alternative options to protect Lowestoft were developed, as shown in Table 3-1.

Table 3-1: Options considered in the appraisal process.

Option	Benefits / disbenefits	Selected / rejected
Option 1: Do nothing – a required baseline option.	Included as a required option in the appraisal.	Shortlisted and rejected.
Option 2: Do minimum option - maintain the existing defences (an informal flood defence along the east side of the A47 Waveney Road).	Some flood risk benefit but reducing standard of protection over time as a result of climate change and does not respond to growth of the town.	Shortlisted and rejected.
Option 3: Construction of a flood walls only defence, including the perimeter of Lake Lothing.	Improves standard of protection but walls may restrict access to Lake Lothing. Some risk to unprotected properties at western end of Lake Lothing.	Shortlisted and rejected.
Option 4: Construction of a tidal barrier and flood walls to protect the Outer Harbour.	Improves standard of protection and provides protection to the port area but also restrictions on the use of the port during a surge event. Cost of Scheme would be significant due to size of barrier required improvements to Outer Harbour arms.	Rejected.
Option 5: Construction of flood walls and a 28m barrier at the Inner Harbour Entrance Channel.	Improves standard of protection but increased risk of ship impacts associated with the narrowing of the Inner Harbour Entrance Channel to 28m.	Shortlisted and selected.
Option 6: Construction of flood walls and a barrier at the location of the Gull Wing bridge (third crossing).	Improves standard of protection but cost of scheme would be significant due to size of barrier.	Rejected.
Option 7: Construction of temporary flood defences.	Improves standard of protection but only to 1 in 50 years and to limited areas. Will not enable growth nor significantly increase business confidence. Significant impact on business operations when deployed.	Rejected.
Option 8: Provision of property level resilience measures.	Limited standard of protection to individual properties where depth	Rejected.

Option	Benefits / disbenefits	Selected / rejected
	of flooding does not exceed 0.6m. Will not enable growth or significantly increase business confidence. Will not reduce the impact of flooding on transportation routes or other infrastructure.	

Based on the appraisal undertaken it was determined that the preferred option was the construction of a barrier on the seaward side of the Bascule Bridge combined with flood walls with a 1 in 200 year standard of protection. This was based on the technical, economic, environmental and social appraisal work undertaken.

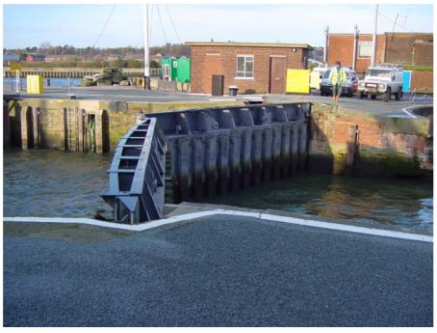
The initial preferred option was for a 28m wide barrier. A series of navigation simulations were undertaken to assess the effect on navigation of the proposed 28m wide tidal barrier opening. This showed that the barrier affected the navigation situation significantly and detrimentally, particularly for larger, conventional ships making inbound/arrival transits through the Bascule Bridge. As a result, the tidal barrier opening was increased to 40m to keep the existing navigable width of the channel unchanged. The effects of this new option were considered, with the conclusion being that impacts would likely be consistent with those of the 28m barrier option. Thus, with a wider channel opening of 40m, a tidal barrier at the Inner Harbour Entrance Channel, together with flood walls, remains the preferred solution for tidal flood risk in Lowestoft.

3.2 Barrier Design

The preferred barrier design was identified during a study commissioned by Waveney District Council in 2015.

Six different barrier gate types were assessed for their suitability. Examples are shown on **Error! Reference source not found.** to **Error! Reference source not found.** and are described as follows:

- **Caisson gates.** These are a form of lock gate consisting of a large, typically steel structure that are usually filled with water to sink them and create a watertight area. There are four types of caisson gates: floating, bottom hinged, side hinged and sliding. All are single leafed gates that, once in position can be opened and closed with their respective mechanisms.
- **Mitre gates.** These are the most commonly known types of gate and have been used for several tidal barriers. They can be single leaf or twin leaf.
- **Rising sector gates.** These are semi-circular in shape and sit flat on the bed when in the open position. When closed, the gate is raised on a circular axis to hold back flood waters.
- **Vertically hinged sector gate.** These are typically the gate of choice when a tidal control structure is to be created, as they can resist a full water differential (ie. where the water level on either side of the gate is different) in either direction.
- **Up and over surge gate.** These involve the raising and lowering of a vertically mounted gate between two large towers that contain the lifting equipment.
- **Bottom hinged flap gate.** These are tilting gates that are raised from the cill level either hydraulically or with lifting wires.

	
Plate 3-1: Side hinged caisson gate at Bristol.	Plate 3-2: Double leaf mitre gates at Ipswich.
	
Plate 3-3: Floating sector gates in Yeongsan, South Korea.	Plate 3-4: Vertical hinged sector gate.
	
Plate 3-5: Up and over surge gate in Hull.	Plate 3-6: Bottom hinged flap gate in Kuwait.

Following consideration of the gate options against various technical, navigational and construction related factors, it was determined that a twin leaf mitre gate would be the most appropriate option. Given their established application, the fact that twin leaf mitre gates can be deployed quickly and that there is a mechanism for managing siltation risks were key factors in favour of this selection.

This type of gate comprises a relatively simple lattice of structural beams, with all parts accessible for maintenance, painting and inspection. The gate only functions in one direction and will only support a differential head of the sea level being higher than Lake Lothing. The gate cannot open against any significant differential head, meaning it would be necessary to wait for the tide level to fall to match the Lake Lothing level before opening the harbour entrance.

Plate 3-7: Mitre gates deployed against high surge.

4. Likely Significant Effects and Proposed Mitigation

The following sections summarise the likely significant effects associated with the construction and operation of the tidal barrier. In order to undertake the environmental assessments, we have collated and assessed information from a wide range of sources, using a range of techniques and models, for example:

- Hydraulic computer models of the harbour to understand flood levels today and in the future;
- Information on climate change to understand future changes in sea level;
- Review of ecological records;
- Survey information for ecological features and habitats;
- Mapping and ground level data;
- Navigation use studies;
- Historic records relating to changes to the coastline and use of the harbour;
- Ground investigations to understand potential contamination and the engineering properties of soil; and
- Consultation with key organisations and stakeholders, including landowners, members of the public and other interested parties to consider what they regard as key issues and priorities.

Assumptions across the Scheme, and details of the approach taken for each environmental topic area are summarised below.

4.1 Assumptions, Uncertainties and Exclusions

The environmental assessments within the ES are based on the Scheme proposals, construction methods and operational regimes as detailed in Chapter 6: Scheme Description.

It is acknowledged that, given the 100 year design life of the barrier, baseline conditions will alter in future years. Climate change is the key consideration when assuming future baseline conditions for this Scheme, and particularly the resulting effect of sea level rise. Whilst sea level rise has been considered within the modelling and design for the Scheme, and within the predictions made for future barrier operation, it is acknowledged that the longer the lifetime of a development, the greater the uncertainty about the impact of climate change over time.

Where there is a possible alternative design or a detailed design or construction solution is yet to be finalised, the impact assessments presented in Chapters 8 to 17 assess the 'worst realistic case'.

Both the barrier structure and the 35m length of tidal flood wall on Hamilton Road will require future maintenance and refurbishment works throughout its design life, the expected frequency and extent of which is described in Chapter 6: Scheme Description. Full details of these activities are not yet known and timescales are largely dependent on the performance and frequency of operation in future years.

4.2 Population and Human Health

The construction and operation of the Scheme has the potential to impact on population and human health. The population and human health assessment considers:

- Effects of the Scheme on the local economy, in relation to local businesses, port operations, including commercial boat users;
- Effects of the Scheme in relation to recreation and tourism, including the effects on recreational boat users; and
- Effects of the scheme in relation to human health.

The Scheme is situated within the Outer Harbour of the Port of Lowestoft. The Port is a key part of the town's economy, particularly in support of the UK Offshore renewables sector. There are also numerous recreational marinas and boat users located around the Inner Harbour (Lake Lothing). In the Outer Harbour the Yacht Basin is home to the RN&SYC and houses the Royal National Lifeboat Institute (RNLI) lifeboat. The Mincarlo trawler museum is also docked in the Yacht Basin within the Outer Harbour. Surrounding land uses include residential areas and commercial areas, with shops, bars and restaurants. South Pier has a number of recreational uses and there is also Lowestoft South Beach & Royal Plain just south of the Scheme.

Methodology

The assessment of effects has been informed by guiding criteria to establish the sensitivity of the receptors and the magnitude of the impacts from the Scheme during construction and operation. This has been informed by consultation with landowners, local businesses and other stakeholders to understand potential impacts.

Construction Effects

Construction of the tidal barrier is programmed to last for over two years, although the periods of activity for certain particularly noisy construction activities, such as piling and concrete pours for example, would be shorter. During construction a range of measures will be undertaken to minimise the impact on the local community. It is likely that construction and associated channel closures would have significant effects on boats users accessing the inner and outer harbours. Discussions on mitigation, timings and extents of the closures are still ongoing and the project is working closely with affected landowners and businesses.

There will be moderate (significant) adverse socio-economic effects in relation to commercial and industrial users of the Port of Lowestoft and Port operations. This would occur through the loss of quayside to construction compounds for the duration of the works.

There will also be a moderate (significant) adverse residual effect on the RN&SYC and other recreational boat users during construction. Measures such as alternative boat storage and parking, alternative crane and fuelling provision and alternative mooring positions would provide mitigation for impacts, and the avoidance of Inner Harbour channel closures during the peak recreational season (between mid-July and the end of August) would minimise the impact on members of the RN&SYC and other recreational users of the port. The Yacht Club and other recreational users of the port would nevertheless still experience significant disruption during construction of the Scheme.

Operational Effects

During operation there would be a moderate to major significant beneficial effect on the local economy (including commercial and industrial enterprises, and RN&SYC) as a result of the reductions in flood risk. This would also have major significant health benefits through the reduced effects of flooding, which can impact on people's mental health.

When the barrier is closed, this would prevent boat passage from the Outer Harbour into the Inner Harbour and vice versa. It is anticipated that the barrier would close once every three years for a storm event, although this would increase in frequency with climate change. There would also be regular, planned closures for maintenance and silt management, which would be for short durations. It is anticipated that as these would be communicated in advance, the effects could be managed and would not be significant.

4.3 Noise and Vibration

The existing ambient noise climate in the area of the works is dominated by road traffic noise from vehicles using the A12 / A47 and noise from seabirds. There are residential dwellings located to the north and south of the construction working area that are considered sensitive to noise and vibration, the closest being at Waveney Road, Station Square and Pier Terrace. The RN&SYC is also considered to be sensitive to noise and vibration and some of the port structures are also considered to be potentially sensitive to vibration.

Construction activities by their nature produce noise and vibration. The impact is highly site specific and depends on the proximity of works to residents and the type of construction activity being undertaken. In particular, piling, the installation of long steel sections deep into the ground, can cause noise and vibration.

Once built, the tidal barrier will not generate significant levels of noise or vibration. Therefore, noise and vibration during operation of the Scheme has not been considered further in the assessment.

Methodology

An assessment has been undertaken that is based on an estimate of the construction plant and equipment that will be used to build the Scheme. Calculations of noise and vibration levels during construction have been made for the closest residential dwellings and port structures. These calculated levels have been considered against measured baseline noise levels and British Standards to determine the impacts to residents and structures.

Construction Effects

Construction of the barrier is programmed to last for over two years, with different phases of construction following on from one another. During construction, some significant effects are reported, however, as listed below, the impact of construction on these receptors can be managed successfully and with a range of best practice measures, ongoing community engagement and advanced notice of particularly noisy works being given. Noise and vibration construction impacts and mitigation include:

- If cofferdam and abutment piling operations over-run into the evening and night-time and for scheduled concrete pours planned over 24hrs periods, exceedances of noise thresholds leading to significant observed adverse effect levels of noise will occur at Waveney Road, the corner of Commercial Road and the Railway Station, Station Square and The Harbour PH.
    - Mitigation: the contractor will keep a record of over-runs and in the event of the temporal threshold of 10 days or nights in any consecutive 15 days or nights period being reached (the threshold for defining significant effects), piling works will be stopped to prevent this being exceeded.
- The demolition of the RN&SYC Bosun's store building is predicted to give rise to significant observed adverse effect levels of noise.
    - Mitigation: the extent and duration of this activity is considered to be below the temporal scope of 10-days in a 15-day period, and as such would not result in a residual significant effect.
- Construction of the new boat crane on the South Quay (including piling) is predicted to result in significant effects.
    - Mitigation: use of temporary noise screens placed between the construction activity and the RN&SYC will reduce this to a non-significant level.
- Predicted levels of vibration on humans during vibratory piling will be above the significant observed adverse effect level at 21 residential dwellings, and therefore is predicted to result in a significant effect.
    - Mitigation: advance notice of this activity being given to these receptors will reduce this to a non-significant effect.
- The threshold for cosmetic damage would be exceeded during vibratory piling at four locations.

- Mitigation: The implementation of pile testing and a Vibration Management Plan will reduce this adverse impact to a non-significant.

Standard best practice measures are proposed to mitigate non-significant effects.

4.4 Biodiversity, Flora and Fauna

The effects of the Scheme have the potential to impact on statutory and non-statutory nature conservation sites and legally protected or otherwise notable flora and fauna. The flora and fauna are diverse covering both the terrestrial and marine environments with receptors such as migratory fish species, marine mammals, kittiwakes, benthic habitats and bats. The assessment focuses on the potential for significant effects during both the construction and operational stages of the Scheme and, where necessary, proposes mitigation measures to avoid, reduce or minimise effects.

Methodology

The assessment has drawn on existing records of habitats and species as well as undertaking dedicated surveys to understand baseline data conditions. Natural England, the Marine Management Organisation and the Environment Agency have been consulted to discuss and agree the approach to data collection and analysis. Many of the biodiversity interests are within sites of international and national importance for nature conservation and therefore have the benefit of legal protection. The reasons for the designation of the sites have been reviewed and taken into account in the assessments. Assessments have been carried out in accordance with ecological impact assessment guidance developed by the Chartered Institute of Ecology and Environmental Management.

Construction Effects

Many of the anticipated impacts to biodiversity will occur during construction. The significant impacts and proposed mitigation for the construction phase of the Scheme are summarised below. Once mitigation has been applied, no impacts will be considered significant.

- Disturbance to harbour porpoise as a qualifying feature of Southern North Sea Special Area of Conservation.
    - Significant effects of noise and vibration on harbour porpoise will be mitigated by implementing Joint Nature Conservancy Council Guidance including:
        - the presence of an experienced marine mammal observer on site during piling operations;
        - a 30-minute pre-piling search within a 500m radius of impact piling works to detect the presence of marine mammals with works delayed until 30 minutes has elapsed with no sightings within the 500m zone; and
        - soft start protocols to be agreed with the Marine Management Organisation for all impact piling operations through the water column.
- Damage to statutory and non-statutory nature conservation designated sites within the vicinity of the works from construction operations.
    - No specific mitigation measures are considered necessary but standard best practice will be employed, including the items below, which are proposed for non-significant effects:
        - Production of a Construction Environmental Management Plan;
        - Production of a Pollution Prevention Plan
- Disturbance to breeding kittiwake and/or destruction of nests during construction.
    - Prior to works commencing anti-bird nesting measures will be installed along suitable nesting locations on the Inner North and Inner South Piers to discourage kittiwake from nesting within the vicinity of the works;
    - To compensate for the loss of nesting habitat, ledges will be incorporated into the design within the order limits.

- Killing/injury of bats and damage/destruction of a roost if present within the Bascule Bridge Control Building.
    - A pre-construction survey will be undertaken on the Bascule Bridge Control Building. The survey will confirm the presence or likely absence of roosting bats to determine the most appropriate course of action to ensure legislative compliance.
- Damage/disturbance to benthic habitats and species under the footprint of the works and from construction operations.
    - No specific mitigation measures are considered necessary but standard best practice will be employed, including the items below, which are proposed for non-significant effects:
        - Production of a Construction Environmental Management Plan ;
        - Production of a Pollution Prevention Plan
- Introduction of invasive non-native species.
    - Compliance with the Exchange Standards contained in the International Maritime Organisation's Ballast Water Management Convention and carry a Ballast Water Management Plan and a Certificate of Compliance.
- Damage/disturbance to estuarine and marine fish within the vicinity of the works and from construction operations.
    - No specific mitigation measures are considered necessary but standard best practice will be employed, including production of a Construction Environmental Management Plan and a Pollution Prevention Plan, are proposed for non-significant effects;
    - Soft-start protocols put in place to protect cetaceans will reduce the potential for effects of noise and vibration on fish as set out above in relation to statutory designated sites of international importance.
- Damage/disturbance to estuarine and migratory fish within the vicinity of the works and from construction operations.
    - No mitigation measures other than standard best practice, including production of a Construction Environmental Management Plan and a Pollution Prevention Plan, are proposed for non-significant effects;
    - Soft-start protocols put in place to protect cetaceans will reduce the potential for effects of noise and vibration on fish as set out above in relation to statutory designated sites of international importance.
- Damage/disturbance to estuarine and marine mammals (harbour porpoise and seal) within the vicinity of the works and from construction operations.
    - No specific mitigation measures are considered necessary but standard best practice will be employed, including production of a Construction Environmental Management Plan and a Pollution Prevention Plan, are proposed for non-significant effects;
    - Soft-start protocols put in place to protect cetaceans will reduce the potential for effects of noise and vibration on fish as set out above in relation to statutory designated sites of international importance.

Operational Effects

The operational effects of the Scheme are limited to potential effects on marine species only. These are summarised below. Once mitigation has been applied, no impacts will be considered significant.

- Passage of migratory fish.

- None required owing to frequency of barrier closures through operation and maintenance.

Opportunities

Biodiversity net gain will be incorporated into the detailed design for the Scheme. This will result in a 14.54% increase in biodiversity units against the baseline habitats present within the Scheme order limits.

4.5 Landscape and Visual Amenity

The Scheme has the potential to impact on landscape character and visual amenity. Landscape character and visual amenity impact assessments are separate, but related topics. The landscape character assessment relates to changes to the elements, features and patterns which together make up the landscape character as the receptor. The visual assessment relates to the change in the view from particular locations, referred to as the visual receptors.

The existing landscape is characterised by the harbour and the highway and the Bascule Bridge. To the south is the Royal Plain with the RN&SYC to the north of the square, a range of entertainment facilities and extending south to the promenade by the beach. To the north is the railway station and Station Square with its shops and cafes. The Bascule Bridge is dominated by highway features including gantries and signals.

There are a range of visual receptors within a defined visual envelope – the zone of assessed visual impact. They are a mix of residents, workers, amenity facilities and people using the roads, footpaths and public spaces.

Methodology

This assessment has predominantly followed the procedures set out in Guidelines for Landscape and Visual Impact Assessment (GLVIA) 3rd Edition, Standards for Highways, Design Manual for Roads and Bridges, LA 107 Landscape and Visual Effects, Revision 2 and Design Manual for Road and Bridges LA 104 Environmental Assessment and Monitoring.

The National Character Areas developed by Natural England and local landscape character assessments undertaken by the Local Authority have been referenced. Due to the nature and scale of the proposed tidal barrier within the urban area of Lowestoft, both these assessments have been scoped out from the assessment as they consider the landscape at a larger scale.

The study area is the extent of the landscape character area likely to be affected by the Scheme and the zone of theoretical visibility. The study area has been established through site survey work and it focuses on the immediate area around the proposed barrier. The surrounding buildings and the barrier itself, which will sit low within the existing Inner North and Inner South Piers, has determined the extent of the zone of theoretical visibility.

Construction Effects

The character and quality of the South Lowestoft and Kirkley Conservation Area would be temporarily affected during the construction period with the intrusion of construction plant, machinery and construction activity.

The character of the site would be adversely affected in particular by the taller construction machinery such as piling rigs and cranes which would be visible across the local landscape character area. The presence of this type of plant would also be for a significant duration. There are limited opportunities for landscape and visual mitigation during construction with good practice measures by the contractor being the most effective mitigation.

Operational Effects

The Scheme, once operational, will not significantly affect the conservation area. The fundamental characteristics of land use, buildings, working harbour and as a busy thoroughfare are unaffected, with the tidal barrier sitting low down with the existing Inner North and Inner South Piers.

The new tidal barrier and ancillary buildings will be new features in the local landscape area. Their influence on the local landscape area will vary depending on whether the barrier is open or closed. When open, the barrier itself would generally sit within the piers. When closed, the barrier would be more visible, notably in the view from the Bascule Bridge where it would be in close proximity and dominant in the view east from the bridge.

4.6 Water, Geomorphology and Ground Conditions

The tidal barrier has the potential to impact on water, geomorphology and the ground. The coastal processes and geomorphology in Lake Lothing, the Outer Harbour and the Suffolk coastal water body are assessed, in relation to the Scheme. The assessment also considers the effects on groundwater, surface water, and ground conditions resulting from construction and operation of the Scheme. Potential changes associated with these assessment areas may impact on water quality and waterbody status (defined by the Water Framework Directive).

Methodology

The identification of potentially significant effects on the water environment has been derived from a qualitative, assessment using a wide range of desk-based sources. Sediment modelling has been undertaken to provide a quantitative approach to sediment transport and contamination.

The assessment has been undertaken with regard to best practice guidance produced by the Institute for Environmental Management and Assessment, National Highways and the Environment Agency.

Construction Effects

The following effects resulting from construction of the Scheme have the potential to affect the water environment:

- There is potential for a change in tidal flows resulting from channel narrowing due to the abutments and cofferdams that will be in place during construction. Channel deepening associated with dredging may also affect tidal flows;
- Seabed disturbance from the construction of cofferdams, dredging and piling activities is likely to result in increased suspended sediment concentrations within the water column;
- Disposal of dredged material is also likely to result in increased suspended sediment concentrations. The increase within the disposal site will be of similar magnitude to existing maintenance dredging;
- There is potential for elevated pollutant concentrations within bed sediments at the Colin Law Way compound leading to a potential impact to the Suffolk coastal and Bure & Waveney & Yare & Lothing water bodies from remobilisation of contaminants from dredging and disposal;
- The haul route, which will be established using existing infrastructure routes, to transport material from the main site compound to the barrier site, has the potential to result in accidental spillages or runoff of oils, chemicals, cement, or other construction materials. These may enter Lake Lothing via runoff or through existing drainage systems;
- Construction works taking place in and adjacent to water have the potential to affect water quality through spills and contamination. This may occur through the mobilisation of contaminated soils or the creation of new flow pathways;
- Excavations and piling have the potential to impact water quality and groundwater flows within the underlying aquifers. This may disturb bed sediment and create new flow pathways or mobilise contaminated sediment;
- Disturbance of land contamination during construction has the potential to impact human health. Pathways may include ingestion, skin contact on inhalation. Physical hazards in made ground such as metal or glass also have the potential to affect human health;
- Impacts to existing buildings and infrastructure may occur though damage from the ground gas regime being altered through construction activities; and
- Increased flood risk may result from the main site compound, which has the potential to reduce floodplain storage and change existing flow paths. In channel works may reduce flow conveyance.

Mitigation to be implemented to address these potential impacts, includes:

- Monitoring surveys;
- Production of a Construction Environmental management Plan and Surface Water Management Plan;
- Measures to manage sediments and stockpiles, including production of a Materials Management Plan; and
- Developing a Flooding Emergency Response Plan.

The construction impacts noted above are temporary and will result in no effects to the surrounding water environment once mitigation has been adopted and implemented.

Operational Effects

When operational, the tidal barrier will close when there is a risk of a peak tidal flood event. Closure of the barrier has the potential to cause the following effects:

- Changes in tidal flows resulting from the tidal barrier structures such as the abutments;
- Closure of the barrier has the potential to alter the tidal regime during surge events and maintenance. This could lead to changes in the tidal regime across the North Sea (neutral effect) and extreme water levels at the Inner and Outer Harbours (neutral effect) and Pakefield and Lowestoft North Denes Beach (slight effect);
- Periodic sediment management has the potential to increase suspended sediment concentrations and create a plume of sediments which could be transported offshore. This is dependent on the amount of sediment deposited over the period and the stage of the tides when this occurs;
- Barrier operation has the potential to result in changes to sediment deposition. Barrier closures may lead to changes in the volume of dredging required within the Inner Harbour entrance as storm surges carry sediment into the harbour (albeit, a neutral effect). Tidal flows will not be allowed into the Inner Harbour and Lake Lothing and less sediment will reach these areas during the closure. Reductions in tidal flows within the Inner and Outer Harbours will also see an increase in deposition rates;
- Dewatering of the abutments will be required periodically; this has the potential to affect physico-chemical indicators and increase concentrations of pollutants, if the water becomes stagnant. Discharge into the channel has the potential to impact water quality;
- Land contamination remaining after construction has been completed may present a risk to future land users. Exposure pathways may include accidental ingestion, skin contact or inhalation; and
- New flow pathways resulting from the Scheme have the potential to contaminate groundwater. Spillages during maintenance may also contribute to contamination of surface water or groundwater.

Mitigation to be implemented to address these impacts, includes:

- Sediment management during dredging operations; and
- Analysis and management of water arising from abutment dewatering.

There will be no significant effects on the water environment during operation, with mitigation in place.

Flood risk will be greatly reduced by operation of the barrier, as the largest risk to Lowestoft is tidal flooding. The barrier will be deployed to protect against tidal surges. There is unlikely to be any adverse impacts on any other forms of flood risk.

4.7 Historic Environment

The Scheme lies within an area which enjoys statutory protection as the South Lowestoft and Kirkley Conservation Area. As such, the Scheme has the potential to affect the 'character and appearance' of an area of known heritage significance. The assessment considers the significance of the heritage assets, and their associated settings, within the vicinity of the tidal barrier.

A range of heritage features have been identified in the 500m study area. There are 25 Listed Buildings, one Conservation Area and 91 non-designated heritage assets in the study area. Most non-designated assets relate to WWII features identified from documentary evidence and have no known surviving physical presence.

Methodology

The assessment draws on information from desk-based information, archaeological records and previous archaeological investigations for the Scheme. The chapter was informed by the National Heritage List of England (NHLE), Historic Environment Records (HER) as maintained by Suffolk County Council. The assessment presents an updated baseline to a desk-based assessment produced by Archaeology South East in 2018.

The assessment considers:

- Archaeological Remains – the material remains of human activity from the earliest periods of human evolution to the present;
- Historic Buildings – architectural or designed or other structures with a significant historical value; and
- Historic Landscape – the current landscape, whose character is the result of the action and interaction of natural and human factors.

Construction Effects

No significant negative impacts on cultural heritage assets have been identified during construction. Temporary impacts to the setting of Royal Norfolk and Suffolk Yacht Club, Grade II* Listed Building, a number of other Listed Buildings in the study area and the South Lowestoft and Kirkley Conservation Area are anticipated as a result of construction activities. These are considered to be no more than minor impacts during the construction phase.

Construction of the Scheme will not have any impact on the non-designated heritage assets.

There is a possibility for previously unknown archaeological remains to be present within the Scheme. Based on the results of previous investigations, the predicted value of such remains, if present, is likely to be low. Considering that the area of the Scheme has been used as a harbour and for industrial activities for decades, the overall potential for previously unknown archaeological remains to survive within the Scheme can reasonably be identified to be low.

Operational Effects

Once construction is completed, no significant negative impacts on cultural heritage assets are expected and the improved standard of coastal protection to the area will help preserve cultural heritage into the future, in particular the Royal Norfolk and Suffolk Yacht Club (grade II* listed building).

The Scheme will not alter the character of the historic landscape.

4.8 Transport

Traffic and transport impacts are primarily focused on the construction period when the majority of traffic movements will take place to transport materials and staff to and from the works sites. Once operational, the Tidal Barrier Scheme will have minimal impact on transport infrastructure due to the barrier's minimal staff requirements, outside of major maintenance periods. The Tidal Barrier Scheme will also offer an improved standard of flood protection to the road and public transport network.

Methodology

In defining the study area for the assessment of traffic and transport impacts, consideration was given to the primary routes and location to be impacted by traffic generated by the Scheme. The main routes for large construction traffic include the A47 and A12, with Denmark Road and Waveney Road also considered for car trips.

Traffic surveys for these areas were obtained from Suffolk County Council, undertaken in the middle to end of July 2015. Whilst this data is relatively old, it means that it is not affected by the reduced traffic levels during the Covid-19 pandemic and the following shift to higher working from home. The Gull Wing Bridge third crossing will also be operational when the construction of the Tidal Barrier begins, which is predicted to lower the traffic flows around the existing Bascule Bridge. This older data is therefore considered to provide representative conditions.

The traffic data was assessed to determine the impact of additional traffic to severance, delay, amenity, and safety, focuses on areas identified as sensitive to changes in traffic flows such as the Bascule Bridge and surrounding junctions. The assessment also considers the impact of parking displacement from the Associated British Ports (ABP) and RN&SYC grounds, due to the construction compounds in these areas.

Construction Effects

During the construction stage of the tidal barrier, some minor adverse impacts relating to severance, driver delay, pedestrian / cyclists / public transport delay, and safety are anticipated. These will cause impacts of minor significance at areas of high sensitivity. There will also be moderate impacts relating to the pedestrian / cyclist amenity and minor impacts from displaced parking. These will require mitigation measures to be implemented, as discussed in chapter 14 of the ES, to ensure the residual impact is minor. All impacts during the construction phase will be temporary (29 months maximum duration).

One of the key transport impacts is anticipated to be reduced parking provision, due to the displacement of vehicles which would normally park within the ABP and RN&SYC grounds, especially during the summer months when the area would also experience high demand for tourist parking. Alternative parking will be provided for RN&SYC in the Royal Green Car Park; traffic data shows that the car park should be able to accommodate public use alongside the displaced RN&SYC vehicles. Alternative parking for ABP is available within their existing grounds, around the Trawl Basin.

Operational Effects

Once operational, the Scheme will have a negligible impact on transport infrastructure. Periods of major maintenance will result in some minor impacts comparable to during the construction phase, but for a much shorter duration. The improved standard of flood protection to the road and public transport network will result in significant positive effects.

4.9 Navigation

The installation of a tidal barrier is likely to introduce changes to the navigable channel and temporary disruption to the existing navigational environment of the Port of Lowestoft. The port is used by both commercial and recreational vessels and is used for leisure activity, hosting several marinas for yachts and pleasure craft. Upstream of the Bascule Bridge there are multiple small-medium enterprises and marinas in Lake Lothing as well as in Oulton Broad adjacent to Mutford Lock. Within the Outer Harbour, the Yacht Basin is primarily used by the RN&SYC (the RNLI is also based here), the Trawl Basin by ABP Pilots and Hamilton Dock and Waveney Dock are used for mooring of fishing and survey vessels.

Methodology

A navigational impact assessment (NIA) has been undertaken which assesses the impact on navigation from the construction and operation/maintenance of the proposed tidal barrier.

The primary sources of information used to conduct the assessment were:

- Navigation Simulation reports (included in the ES as Appendices 15C and 15D);
- Results from numerical modelling;
- Knowledge of port operations gained from consultation with the Statutory Harbour Authority (ABP), the Harbour Master, and others with an interest in navigation;
- Publicly available information; and
- Consultation feedback received from navigation users.

The NIA has assessed navigational impacts on commercial and recreational traffic compared to the set baseline. It has considered a number of types of impact: safety, the environment, access and business/commerce and navigational risks (a Navigational Risk Assessment has been completed and is included as Appendix B to the Navigation Impact Assessment (Appendix 15A of the ES).

Acknowledging the many navigation users that could be impacted by the Scheme, the significance of effect has been assessed by categories of user. Receptor groups have been apportioned by geographical area within the study area, namely:

- Western end of Lake Lothing and Oulton Broad;
- Inner Harbour – North shore;
- Inner Harbour – South shore;
- Yacht Basin;
- Trawl Basin; and
- Outer Harbour including Waveney and Hamilton Docks.

The sensitivity of receptors has been established using professional advice, judgement or experience and, where appropriate and available, any publicly available data and consultation. The magnitude of impact has been classified based on the degree of disruption to a receptor group's operations.

Construction Effects

During construction, the following impacts are anticipated to occur.

Impacts on navigation:

- Closures of the Inner Harbour Entrance Channel of up to 3 weeks duration for a single construction work possession will temporarily remove eastern access to and from Lake Lothing.

- Constriction of the navigable channel width within the Inner Harbour Entrance Channel.

Impacts on commercial port operations:

- Small permanent loss of water space in the Trawl Basin.
- Temporary displacement of Port operations within the Trawl Basin including temporary loss of southern floating pontoon and western and north western quayside.
- Temporary loss of the Inner North Pier landing stage.
- Disruption to Port operations arising from the Inner Harbour Entrance Channel Closures (referred to above).
- Temporary loss of quayside space in the Outer Harbour to accommodate vessels from the Inner Harbour during channel closures.

Impacts on recreational navigation users:

- Loss of ability to access the North Sea during channel closures.
- Disruption to planned events such as regattas.
- Reduction in navigation users visiting Lowestoft and Oulton Broads from elsewhere in the UK and abroad.

Impacts on RN&SYC and other Yacht Basin users:

- Temporary reduction in available water space within the basin for movement and mooring of vessels.
- Temporary loss of yacht club moorings.
- Mooring pontoon layout changes.
- Temporary loss of yacht club boatyard facility and car parking.
- Small permanent loss of water space in the Yacht Basin north west corner.
- Displacement of the yacht club boat crane, refuelling and pump out facilities.
- Restriction on use of the jetty.
- Disruption to planned events such as regattas.
- Reduced ability to accommodate navigation users visiting from elsewhere in the UK and abroad.
- Disruption to boat trips out to the North Sea.
- Reduction in visitors to the Mincarlo heritage vessel.

Mitigating actions proposed to address these potential impacts include:

- Navigational aids for night-time approaches, protection piles for inbound vessels and training for ABP Pilots.
- Notification of channel closures in advance for the 3 week, 5 day and 1 to 2 day closures.
- Planned closures to be over the weekdays as far as possible, with no closures during the peak season for recreational users between mid-July and the end of August.
- Provision of additional berths within the Outer Harbour (Trawl Basin, Yacht Basin and LEEF East quayside) for use as layby berths during channel closures.
- Regular communication with ABP, the Broads Authority and highways authorities.
- Reconfiguration of moorings within the Yacht Basin to maximise available berthing space (including temporary relocation of the Mincarlo Lowestoft).
- Installation of a new boat crane for use by RN&SYC and other users of the Yacht Basin (including RNLI).

- Access to a slipway to facilitate RNLI access to the Inner Harbour for rescues.
- Provision of a temporary floating fuel dock facility and a pump out boat within the Yacht Basin.
- Provision of a temporary pontoon along the north side of the Trawl Basin.

The Scheme's design, approach to construction and mitigation measures seek, where reasonably practicable, to avoid and minimise impacts on users of the navigation channel, nevertheless for some users, residual adverse effects are still expected to arise. These are unavoidable given the need to carry out the proposed works within the navigable channel, however they will be temporary in nature.

Operational Effects

During operation, impacts include:

- Non-significant impacts from regular planned closures whilst the Bascule Bridge is normally down.
- Up to 12-hour channel closures during barrier deployment for tidal flood event or during planned quarterly test closures.
- Impacts from planned intermittent major maintenance interventions similar to those for construction but only those that relate to closure of the Inner Harbour Entrance Channel for up to one week:
    - Disruption caused by waterborne construction activities and occupation of water and quayside space in the Trawl and Yacht Basins.
    - Temporary loss of quayside space in the Outer Harbour to accommodate barrier gate and hydraulic cylinder replacement/refurbishment.

As mitigation for the above impacts, the following will be implemented:

- navigational aids will be in place and will include lighting and fendering along the faces of the barrier gates.
- Prior to each barrier closure, notice of all temporary restrictions to navigation through the Inner Harbour Entrance Channel will be provided.
- For major maintenance interventions, similar mitigation to construction will be implemented.

With mitigation in place, it is considered that there will be no significant residual effects on navigation users. Residual effects will occur for ABP, as a result of scheduled maintenance and dredging activity and major maintenance operations (however these are planned only take place every ten years). There will be a major beneficial impact as a result of the reduced risk of flooding of the quaysides within Lake Lothing during tidal surge events and protection of the adjacent infrastructure, plant, equipment and materials from flood damage.

4.10 Air Quality and Climate

The Scheme has the potential to impact on air quality at sensitive human and ecological receptors. These potential impacts could arise from dust emissions during the construction phase. Air quality impacts from the operation of the Scheme were scoped out.

The Scheme also has the potential to affect the climate by causing (either directly or indirectly) the emission of greenhouse gases (GHGs) into the atmosphere, both as a result of its construction and throughout its operational life.

Methodology

Air Quality

The construction dust risk assessment has been carried out in accordance with the Institute of Air Quality Management (IAQM) *Guidance on the assessment of dust from demolition and construction* and considers three separate dust effects:

- Annoyance due to dust soiling;
- Harm to ecological receptors;
- Risk to health

Climate

The GHG emissions for the construction and operation of the Scheme were calculated using the Carbon Tool (Version 6) published by the Environment Agency for use in capital delivery of flood risk and coastal management projects.

For construction, the assessment included quantifying the GHG emissions embodied in products and materials, and GHG emissions associated with the transport of materials and people to and from the site, energy and fuel use during construction and from waste materials and transport. Examples of operational GHG emissions calculated using the tool include the planned maintenance and anticipated repair, refurbishment and replacement of the various components and assets which form the Scheme.

Construction Effects

Air Quality

The proposed demolition, earthworks, construction and construction vehicle movement activities are predicted to be a medium to high risk for potential dust soiling impacts. With regard to human health impacts, there is predicted to be a negligible to medium risk for all stages of the Scheme.

Good practice dust mitigation measures would be needed to reduce the potential for dust emissions to lead to adverse impacts in the vicinity of the Scheme. With the effective implementation of the mitigation measures, the effect on air quality is concluded to be not significant.

Climate

The proposed construction of the Scheme is anticipated to result in GHG emissions of approximately 11,900 tonnes carbon dioxide equivalent (tCO2e). This represents a very small percentage change in GHG emissions in relation to existing GHG emissions locally, regionally and nationally, and is not anticipated to impact on the UK government's ability to meet the respective carbon reduction targets. Given the importance of reducing GHG emissions to meet GHG reduction targets, mitigation measures relating to the use and management of materials and the reduction of GHG and energy consumption are proposed to reduce emissions as far as practicable.

Operational effects

Climate

As was indicated for the construction phase, the proposed operation of the Scheme is anticipated to result in a very small percentage change in GHG emissions in relation to existing GHG emissions and the carbon budgets. The estimated total GHG emissions associated with the operation of the Scheme over the 100-year appraisal period is approximately 13,100 tCO_2e, which equates to an average annual emission of 131 tCO_2e per year.

There are opportunities to potentially reduce GHG emissions further and these could be investigated in more detail during the barrier's detailed design.

4.11 Cumulative Effects

This assessment considers the following types of cumulative effects:

- Intra project cumulative effects: where receptors are affected by more than one type of impact as a result of the Scheme; and
- Inter-project cumulative effects: where receptors affected by the Scheme are also affected by other plans or projects.

Methodology

The study area for assessment of intra-project effects is as set by individual topic chapters. Intra-project cumulative effects were identified where a review of topic chapters identified a receptor that was affected by more than residual effect.

The study area for inter-project effects was a zone of 2km from the Scheme, although Nationally Significant Infrastructure Projects (NSIPs) located more than 2km from the Scheme were also considered. Small scale commercial, agricultural or domestic projects were excluded at this point, as well as developments of less than 50 dwellings and projects which had either (i) no overlap in construction period with the Scheme or (ii) no potential for in-combination operational phase effects due to the nature of the project. This process produced short list of projects for consideration, which were then examined in terms of potential pathways through which the residual effects of the project and the residual effects of the Scheme could interact, total change in environment brought about by each in-combination effect, and whether this combined effect would result in an increased level of significance when compared to the residual effect of the Scheme alone and/or require additional mitigation measures.

The significance of cumulative effects was determined based on the value of receptor affected and the duration of the impacts (temporary or permanent). Permanent effects on receptors or moderate or high value, and temporary effects on receptors of high value, are considered to have moderate or major significance.

Intra-project cumulative effects

The following intra-project cumulative effects have been identified:

- Negligible adverse (not significant) effect on benthic habitats arising from construction related residual effects associated with loss of habitat, disturbance due to dredging and risk of water pollution;
- Slight adverse (not significant) effect on estuarine/marine and migratory fish arising from construction related residual effects associated with dredging and underwater noise and vibration; and
- Moderate adverse (significant) effect on humans associated with impacts on navigation for commercial and recreational vessels, traffic disruption and driver stress, noise pollution, risk of exposure to solid and water contaminants and vulnerability to flood events during construction.

No additional mitigation over and above that set out in individual topic chapters has been identified for the significant adverse effect on communities detailed above, however of key importance in minimising the disruption experienced by local communities will be the appointment of a Community Liaison Officer who is available to discuss the Scheme with residents and businesses and liaise with the Contractor minimise or avoid adverse effects and allay concerns.

Inter-project cumulative effects

The following inter-project cumulative effects have been identified:

- Additional vessel movements in and out of the Port of Lowestoft once the LEEF and East Anglia TWO and East Anglia THREE projects are operational would increase the magnitude of effect on this receptor during construction, however the significance of the cumulative effect is still considered moderate

adverse (significant) due to its temporary nature. Operational effects associated with the barrier closures for maintenance and when flood events are predicted are assessed as having a minor adverse (not significant) cumulative effect; and

- Competition for construction workers and pressure on construction workers and materials supply between the Scheme and Sizewell C nuclear power plant project may also occur, although it is not possible to assign significance to this effect due to uncertainty around market and employment conditions at the time of construction.

It is recommended that the Project Proponents and Contractors for the Scheme and for the LEEF, Anglia TWO, Anglia THREE and Sizewell C nuclear power plant projects liaise further to better understand how the inter-project cumulative effects identified can be mitigated further using additional measures not already included within Chapter 8: Population and Human Health and Chapter 15: Navigation of this ES.

5. Conclusion

The Lowestoft Tidal Barrier Scheme is essential to the completion of the wider LFP project as supported by the strategic documents set out in Chapter 2: Background of the ES, including the Waveney Local Plan. The Scheme requires the construction of a tidal barrier and demountable flood defences to connect the flood walls (as part of the wider LFP project) across the Inner Harbour Entrance Channel.

The majority of the likely significant effects reported in the ES are of a temporary nature and are anticipated to arise during the construction period of the proposed barrier. This is due to the barrier being located in a complex busy interface between the urban environment of Lowestoft town and the Port of Lowestoft. For this reason, the construction of the barrier has the potential to affect many receptors. However, with mitigation measures implemented, many of the impacts to these receptors are substantially reduced.

During operation, the barrier has a number of key benefits:

- Better tidal flood risk protection to Lowestoft over the next 100 years;
- Supporting the UK Levelling Up agenda by contributing to reducing social deprivation for those living and working in the areas benefitting from better tidal flood risk protection and creating a more viable and resilient coastal community;
- Reducing the current burden on emergency services and other organisations in responding to tidal flood events;
- Allowing the development of brownfield sites within the Riverside Local Enterprise Zone and the Powerpark Local Development Order zone;
- Enabling the town of Lowestoft to deliver wider Government objectives for reducing the impacts of climate change by creating one of the UK's largest green energy hubs and supporting offshore wind in the North Sea and the new Sizewell C nuclear power station construction;
- Providing confidence to local businesses and encouraging investment and growth in the local economy;
- Reduce the impact of tidal flooding on local roads and business infrastructure including the strategic A12/A47 and telecommunications infrastructure; and
- Reducing the risk of tidal flooding to areas of the Port of Lowestoft located within the Inner Harbour area of Lake Lothing and to the Royal Norfolk and Suffolk Yacht Club.

These benefits outweigh the largely short-term construction impacts and as such, consent for the Scheme should be granted.

6. What happens next?

The Environmental Statement and supporting documents can be viewed at: https://www.eastsuffolk.gov.uk/lowestoft-tidal-barrier-TWAO-application and electronic copies are available for inspection at the locations shown on page 5.

We have submitted our Environmental Statement to the Secretary of State (Defra) as part of the Transport and Works Act Order application.

Any objections to, or other representations about, the proposals in the application should be sent to arrive on or before Thursday 23 November 2023 to:

Secretary of State for Environment, Food and Rural Affairs

c/o Floods Casework Team

Flood and Coastal Erosion Risk Management Team

Department for Environment, Food and Rural Affairs

Seacole Block – Ground floor

2 Marsham Street

London SW1P 4DF

Or by email to: FloodsCasework@defra.gov.uk

An objection or representation MUST: (i) be received by the Secretary of State on or before Thursday 23 November 2023; (ii) be made in writing (whether sent by post or e-mail); (iii) state the grounds of the objection or representation; (iv) indicate who is making the objection or representation, and (v) give an address to which correspondence relating to the objection or representation may be sent. If you are sending your objection or other representation by e-mail, please provide a postal address.

The Secretary of State may make complete copies of any objections or other representations public, including any personal information contained in them, and will copy them to East Suffolk Council as the applicant for the Order.

EASTSUFFOLK COUNCIL

To find out more about the Lowestoft Tidal Barrier, email or visit our website.

lowestoftfrmp@eastsuffolk.gov.uk

www.eastsuffolk.gov.uk

To view the Lowestoft Tidal Barrier TWAO Application Documents visit:

https://www.eastsuffolk.gov.uk/lowestoft-tidal-barrier-TWAO-application

Lowestoft Tidal Barrier Order

October 2023