River Hull Advisory Board

River Hull Integrated Catchment Strategy
March 2015

Strategic Environmental Assessment

Draft Environmental Addendum Report
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Non Technical Summary

Introduction

This Non Technical Summary summarises the Strategic Environmental Assessment (SEA) undertaken to accompany the River Hull Integrated Catchment Strategy (RHICS). It is presented in non technical, accessible language in order to inform the widest possible audience.

The full versions of both this SEA, an addendum report that effectively updates a previous SEA undertaken by the Environment Agency in 2010 to support the River Hull Flood Risk Management Strategy of the same year, and the RHICS are available separately.

Strategic Environmental Assessment is a process used to consider the potential environmental consequences of high level decision making, including the RHICS, before they are approved. The requirement for SEA and the process to be undertaken is controlled by legislation, in England, namely ‘The Environmental Assessment of Plans and Programmes 2004 (Statutory Instrument number 1633). Whilst there is no specific requirement to undertake SEA for flood risk management strategies, of which the RHICS is one such strategy, it is a recommendation of the Department of Environment Food and Rural Affairs (Defra) and good practice to undertake one.

The RHICS will guide the management of flood risk within the catchment area of the River Hull over the next 100 years with a range of measures that will be implemented over the next few years. A strategy is needed to ensure that the risk of flooding within the catchment area is understood and best managed to reduce the potential damage to people, property and the wider environment. As the implementation of flood risk measures progresses, the RHICS will be updated to reflect the changing circumstances. The SEA addendum report illustrates how the potential environmental effects have been considered both during the initial period of implementation together with the longer term issues that may arise. The catchment area for the River Hull is extensive, hereafter termed the ‘study area’, and it forms the starting point to both the strategy and the accompanying assessment.

Study Area

The River Hull begins as small streams, termed Headwaters, which arise from springs in the chalk of the Yorkshire Wolds. These springs then flow in a southerly direction, broadening to become the River Hull and collecting tributary streams and becks as the river passes through open countryside. The river follows a course to the east of Beverley and then on through Kingston-upon-Hull into the Humber Estuary. In addition to examining of the natural course of the River Hull, the RHICS has also considered the major, man-made channels that drain valley; these include the Beverley and Barmston Drain, and the Holderness Drain (the latter drains directly into the River Humber). The RHICS takes an integrated approach to the catchment area, so the currently operational pumping stations that also contribute to the flow of the river, at Hempholme and Wilfholme, form part of the study together with the pumping stations at Tickton and Great Culvert that pump into the
Holderness Drains. For completeness, the newly upgraded pumping station at Bransholme, operated by Yorkshire Water, also forms part of the study.

The study area for the River Hull catchment, illustrated on the illustration below, extends to approximately 980km², and is bounded to the west and north by the Yorkshire Wolds, the River Humber to the south and the east coast hinterland to the east.

![Study Area Map]

**The Study Area; boundary shown as a red line**

The catchment area for the River Hull falls within the administrative boundaries of Ryedale District Council/North Yorkshire County Council, East Riding of Yorkshire Council (ERYC) and Kingston-upon-Hull City Council (HCC), with the larger part falling within the East Riding of Yorkshire. Although the study area includes Kingston upon Hull, the RHICS does not address the risk of tidal flooding from the adjacent Humber Estuary; this is covered by a separate Humber Estuary Flood Risk Management Strategy.

The natural River Hull valley is considered to be one of the most ‘at-risk’ developed flood plains in England, housing a population of approximately 360,000 (2011 census). Without defences, an area of approximately 5,500 hectares of land and nearly 131,000 residential properties would be at risk to flooding from the sea, river water, surface water and groundwater.

**Assessment Process**

Having decided to undertake the SEA, it is necessary to identify which environmental issues are important and relevant to the RHICS. The potential effects upon a range of environmental issues
were considered, a process termed ‘Scoping’, and only those where ‘significant’ effects have been identified at the strategic level have been ‘scoped’ into the assessment process. A detailed Scoping Report was published in advance of the previous SEA in 2010 to accompany the River Hull Flood Risk Management Strategy published by the Environment Agency. This new SEA Addendum report to accompany the RHICS has considered the same range of issues but has been updated to reflect changes that have taken place in the intervening period of time. There are some environmental issues that are still considered important but not relevant to this ‘high level’ assessment.

As the RHICS is taken forward and flood risk management measures are considered in more detail, project specific environmental assessment will take place. In some instances this may take the form of a statutory Environmental Impact Assessment (EIA) and then published in an Environmental Statement. These assessments will include issues which may be more important at a local level, or respond to the detailed design of proposed flood risk measures, but do not influence the selection of a strategic flood risk management approach unless significant effects at a regional level are predicted e.g. legally protected species and local sites designated for nature conservation.

The assessment process is not simply a matter of considering the likely effects upon the environment following completion of the RHICS. The process is iterative, that is to say it shapes the strategy with both initial appraisal of environmental issues and ongoing input to the development of flood risk management options.

**Key Environmental Issues**

Those environmental issues considered to be most important to the RHICS, and hence assessed in the SEA, are listed below.

- Properties and key assets including major roads and rail links
- The well-being of the local population
- Nationally and internationally designated sites of nature conservation interest including the Humber Estuary, of national importance e.g. Sites of Special Scientific Interest such as Pulfin Bog and Local Nature Reserves e.g. Noddle Hill
- Land use and in particular, high grade agricultural land
- Designated sites of cultural heritage importance e.g. Scheduled Monuments, Listed Buildings and Conservation Areas
- Maintaining, or improving, water quality and minimising pollution
- Amenity and recreation facilities
- Compatibility with regional and local planning policies together with other relevant plans and strategies e.g. River Hull Headwaters Restoration Project

When assessing the potential effects upon key environmental issues, it is an implicit part of the process that mitigation of any identified negative effects or opportunities to provide enhancement e.g. the creation of new habitats, particularly wetlands or green corridors, is undertaken.
Environmental Objectives

To support the objectives of the RHICS a series of environmental objectives have also been created. These objectives, with indicators of success, help guide preparation of the SEA but also provide a focus and direction for the environmental aspects of the flood risk management strategy, for example where we aim to protect properties from flood risk, how many properties could this be, and is the risk of flooding reduced?

The key environmental objectives are summarised in the list below.

- **Flood Protection:** Maintain an appropriate level of flood protection for people and their property, in partnership with opportunities identified in other Strategies and Plans
- **Wetland Habitat:** Protect and enhance a network of wetland habitats linked by a strong riparian corridor
- **Sustainable Land Use & Landscape:** Support appropriate, sustainable, land use and landscape changes
- **Agricultural Land Use:** Support existing agricultural practices within the catchment
- **Heritage Features:** Protect designated and cultural heritage features
- **Tourism and Recreation:** Protect, and where possible, enhance tourism, amenity and recreational facilities
- **Transport:** Protect existing transport infrastructure
- **Water Framework Directive:** Support the achievement of ‘good’ status and/or potential for surface and groundwater bodies under the Water Framework Directive
- **Water Resources:** Support better management of water resources
- **Climate Change:** Ensure that the flood risk management strategy (RHICS) takes account of climate change

A Strategy for the River Hull Catchment

In developing a strategy for the River Hull catchment, a series of defined steps have been undertaken; these are explained in more detail within the RHICS document. The RHICS builds on studies already undertaken, such as the work of Environment Agency’s Draft River Hull Flood Risk Management Strategy and other studies such as the Hull and Haltemprice Integrated Catchment Model.

The River Hull Advisory Board (RHAB) was established to develop the RHICS to provide for a comprehensive assessment of all sources of inland flooding. The strategy provides an integrated framework for the management of flood risk in the natural River Hull Valley, for all five flood Risk Management Authorities that operate in the study area; these include Beverley and North Holderness Internal Drainage Board, ERYC, the Environment Agency, HCC, and Yorkshire Water Services Ltd. The RHAB established a Project Board to oversee production of both the RHICS and SEA.
The Vision for the RHICS states that it will provide a clearly defined and sustainable multi-agency strategy for the management of flood risk in the natural River Hull valley and support a modified draft River Hull Flood Risk Management Strategy.

Planning Overview

It is important to identify any potential overlaps or conflicts between existing plans, policies and strategies with those relevant to the RHICS. We have therefore reviewed a number of plans identified as being most important and potentially influential to the flood risk management strategy. These include plans and policies ranging from national level planning guidance down to the emerging local plan policies of both ERYC and HCC. We have also examined the plans and strategies of other bodies including the Environment Agency e.g. Hull and Coastal Streams Catchment Flood Management Plan (2010), and the Humber Eel Management Plan (2011), as well as plans published by other bodies such as the Local Economic Partnerships and Yorkshire Water.

This review created a background of national, regional and local aspirations together with strategies, policies and objectives which the RHICS may help meet. Since the original SEA was published in 2010 there have been key changes in planning guidance, particularly at national level, with the recent National Planning Policy Framework (2012). National policy now places a clear emphasis upon sustainable development and strengthens the relationship between the natural and built environment to achieve this. National level guidance also now states that development in areas at high risk of flooding should be avoided but where necessary it should be made safe from flooding without increasing the risk elsewhere. Local planning has also changed with local authorities now in the process of creating new Local Plans to guide development at a local level. Both the emerging East Riding Local Plan and HCC Local Plan take a more inclusive approach to flood risk with policies that will be supported by local level flood risk management strategies; both are currently in preparation.

Following the planning policy review, it has been concluded that the RHICS is generally compliant with policies at all levels and furthermore will support the aspirations of policy at both national and local level.

Consultation

Both the RHICS and draft versions of the SEA Addendum have been consulted with internal specialists and members of the River Hull Project Board.

A Preferred Approach document which summarised the strategy intention of the RHICS was released for public and stakeholder consultation in November 2014. Comments have been received and the latest version of the RHICS has responded to these.

Furthermore an informal consultation of the draft SEA Addendum report took place with the key consultees, namely English Heritage, the Environment Agency and Natural England, in January 2015. Comments received from these consultees have also shaped the latest version of the SEA.

In accordance with SEA legislation, a formal consultation with both key consultees, stakeholders and the public will take place. Comments received will be reviewed and a final version of the SEA Addendum report prepared to acknowledge and reflect these.
Environmental Baseline

The process of scoping identified the key environmental issues most relevant to the RHICS and as a result comprehensive data was collected to build up a detailed picture of the existing environmental conditions, known as the ‘baseline, within the study area. This data, together with the stated environmental objectives, enables an assessment to be made of the potential environmental effects arising from implementation of the RHICS. The following environmental topics were considered and assessed.

People and Property

The majority of the study area is rural with the main population centres located at Beverley, Cottingham, Driffield, the ‘Haltemprice’ settlements (Anlaby, Kirk Ella and Willerby), Hessle and Kingston upon Hull. Beverley (population 30,500) and Kingston-upon-Hull (population 256,000), are the largest settlements although approximately half the population of the East Riding live in rural communities with fewer than 5,000 inhabitants. A large number of properties, both residential and commercial, within the urban area of Hull are at risk of flooding.

Natural Environment

There are no internationally designated nature conservation sites within the study area, however the Humber Estuary and Hornsea Mere which are sites of international and national importance is located adjacent to the River Hull catchment. Some 15 Sites of Special Scientific Interest (SSSI) are located within the study area and of these, six are hydrologically sensitive; these include the river Hull Headwaters, Tophill Low, Bryan Mills Field, the Leven Canal, Pulfin Bog and Lambwath Meadows. The condition of each SSSI is regularly monitored and so the baseline condition prior to the assessment of potential effects arising from the RHICS is well recorded. There are also five Local Nature Reserves (LNR) of which two, both designated in 2011, are identified as being most relevant to the strategy; Noddle Hill LNR which borders the northern extent of Hull and Rockford Fields LNR which lies within the urban area of the city at Stoneferry.

In addition to designated sites there are also legally protected animal species that reside within the study area, including badger, great crested newt, otter, grass snake and water vole. A number of UK Biodiversity Action Plan species also occur in the study area potentially relevant to the RHICS, which include European eel, Eurasian curlew, great crested newt, brown trout, otter, water vole and Northern lapwing. River lamprey have been recorded in the River Hull, and freshwater areas are used for spawning, however the status of sea lamprey in the river is uncertain. Both species of lamprey are European protected and receive protection under the Special Area of Conservation status afforded to the Humber Estuary.

The River Hull also provides valuable coarse fishing grounds with species including perch, roach, chub and bream.

Landscape and Land Use

The majority of the study area is rural and given over agricultural use. The western part of the study area is predominantly higher grade agricultural land (Grade 2 classification), whilst the eastern part
is good quality (Grade 3 classification). There are small pockets of poor quality agricultural land to be found east of Beverley but the distribution is localised.

Both the landscape within the East Riding portion of the study area and the urban area of Hull has been subject to landscape assessments that describe and appraise the key characteristics. In addition to the national level character areas there are also local level assessments that identify and describe landscape character types. Within the rural areas agriculture and the improvement of land by drainage to facilitate farming have heavily influenced the character of the landscape. The local geology has resulted in a gently sloping or rolling landscape leading to the wider, more open Holderness plain to the east.

There are no National Parks or Areas of Outstanding Natural Beauty within the study area. Both nationally designated areas of Heritage Coast, at Spurn Point and Flamborough lie outside the study area. The locally designated ‘Wolds Area of Landscape Protection’ extends within the northern part of the study area.

**Cultural Heritage**

As a result of human activity over the past 10,000 years the study area contains a rich heritage of archaeological sites dating from early prehistoric periods to present day. Although there are no World Heritage sites, there are numerous nationally designated Scheduled Monuments, Listed Buildings, Registered Parks and Gardens and Conservation Areas.

The Scheduled Monuments cover all time periods including prehistoric burial mounds, a Roman villa, medieval moated sites and two WW2 anti-aircraft batteries. Only one Scheduled Monument lies within the administrative boundaries of Hull, the buried remains of the 16th century town defences and 17th century Hull citadel. Significant concentrations of Listed Buildings are to be found in the larger settlements of Hull and Beverley but many villages also contain isolated examples. There are seven Registered Parks and Gardens of which Sledmere House is the largest, over 300 hectares in size, and designated as Grade I. Conservation Areas predominate within the more urban areas, but there are many covering the historic centres of the larger settlements and smaller villages. There are 26 Conservation Areas in Hull alone; accounting for some 6% of the city.

**Recreation and Amenity**

The study area contains a mix of both formal and informal recreation sites including popular tourist destinations such as The Deep, in Hull, together with more informal provision such as the extensive network of public rights of way catering for walkers, cyclists and horse riders. The River Hull itself is a recreational asset, creating a navigable route from Hull to Beverley whilst the banks offer informal footpaths enjoyed by walkers, ornithologists, anglers and cyclists.

**Material Assets**

There is a network of major and minor highways linking settlements within the study area. Major routes include the A164 between Hull, Beverley and Driffield, the A165 between Hull and Bridlington, the A614 passing through the study area between Goole and Bridlington and the A63 from Hull that runs westward to the M62 motorway. Although congestion is not considered to be a major issue across the East Riding, major centres including Hull and Beverley experience congestion
at peak hours. Being a predominantly rural area, a higher than average proportion of journeys are made by private car, in comparison to bus and rail, within the East Riding.

Key rail routes radiate out from Hull, with the Hull to Driffield line through Beverley contained entirely within the study area.

The River Hull is navigable with freight barges able to move between Hull and Beverley, and both centres have wharf facilities. The River Hull also connects to the busy commercial waterway of the Humber Estuary.

**Water Environment**

Historically the River Hull channel has been subject to extensive modification to defend low lying areas from flooding. Dredging has not taken place since the 1980s and a detailed hydrological survey undertaken as part of this study shows that the capacity of the river channel to convey water has reduced by some 6% since 2000. The Hull Tidal Surge Barrier, at the mouth of the River Hull, is used at high tides to prevent water from the Humber Estuary backing up the River Hull to then overtop the current defences; typically the barrier is closed between ten and twelve times a year.

Water quality in the upper reaches of the river, from Beverley upstream to the Headwaters, is good. However the quality deteriorates towards the Humber as a result of drainage from adjacent land (particularly the urban areas), and discharges from commercial premises.

The Environment Agency has targeted 2015 to achieve *good* ecological status, or potential, within the River Hull in response to the Water Framework Directive; this legislation has introduced a new method for assessing water quality. In order to check the potential effects of the RHICS, a separate Water Framework Directive (WFD) assessment has been undertaken as part of this update to the original SEA; a full version of the WFD is included within the SEA Addendum report.

**Development of the River Hull Integrated Catchment Strategy (RHICS)**

During the early stages of developing the strategy a wide range of flood risk management options were considered. The initial 18 options were subject to a preliminary appraisal based upon technical aspects and cost benefit. A number were rejected and the retained options were then developed, many with sub-options, and computer modelled to predict construction and operational costs with a more detailed economic appraisal. More detailed modelling followed to simulate various flood conditions with incorporation of various measures to test efficiency. A further round of selection then took place where options did not offer improved flood risk prevention.

The finalised list of eight options was taken forward for detailed study. Seven were subjected to detailed assessment; the eighth option focuses upon ongoing maintenance and cost issues and so was not modelled or is subject to the SEA. We have assessed these options individually, to a comparable process with the original SEA of 2010. However it is likely that implementation of the RHICS will include a combination or all options.

**Option A – Dredging of the River Hull**

The River Hull channel would be subject to dredging over a 29 kilometre length between the Hull Road Bridge (just north of Beverley) and the Hull Tidal Barrier. The preferred dredging technique
employed would be ‘Water Injection Dredging’ chosen for its more cost effective and environmentally acceptable performance. It is estimated that one metre depth of silt would be removed from the channel. In addition this option would include the removal of numerous sunken barges, boats and other structures to improve the flow along the river channel.

Option B - Tidal Exclusion

The current Hull Tidal Barrier is designed to remain open unless a particularly high tide (a storm surge) is forecast that will result in flood water ‘overtopping’ the River Hull defences. A substantial length of the River Hull is impacted upon by tidal flow, hence a combination of higher tides and river flooding would substantially increase flood risk. The implementation of new ‘lock gates’ downstream of the existing Tidal Barrier represents a simple solution to deal with higher, climate change driven tide levels.

Option C – Holderness Drain

A further measure to increase protection against the ‘overtopping’ described for Option B would be a simple raising in height of existing flood defence embankments; particularly at recognised low points. There are drawbacks to this approach, as raising embankments in one location may result in flooding elsewhere and the potential height of embankment at some locations may be very large. Nevertheless flood risk modelling has indicated that localised raising of embankments along sections of the Holderness Drain to the north east of Bransholme (approximately 2km in length) and along the Ganstead Drain (approximately 1.7km length) adjacent to Ganstead Lane would improve flood risk protection.

To improve flood protection along the Holderness Drain upstream of the Great Culvert Pumping Station, located to the east of Kingswood, a very extensive embankment would be required placing adjacent areas a risk of substantial flooding. This option, therefore, takes an alternative approach by increasing the capacity of pumping stations at Great Culvert and East Hull. The existing pumping station at Tickton would also be replaced with a weir and valve arrangement.

Option D – Bransholme Pumping Station

Bransholme is located between the protected sections of the River Hull to the west and the Holderness Drain to the east. The area is currently drained by a surface water network with water stored in a large raised lagoon in flood conditions when river levels are high. This lagoon is located close to the River Hull and so there is a risk of spilling into the river when volumes of water storage are high. Both the existing Bransholme Pumping Station and local surface water network are controlled by Yorkshire Water. The capacity of the Bransholme station is currently being improved by Yorkshire Water separately to this study, but the impact of additional pumping into the river was considered to ensure flood risk is not transferred elsewhere. A modified set of operating rules is to be agree between Yorkshire Water and the Environment Agency to ensure this.

Option E – Beverley and Barmston Drain/Western Drain

Similar to the approach described for Option C above, the potential to raise localised sections of embankment alongside the Beverley and Barmston Drain close to Dunswell (720 metres length overall) and the tributary Western Drain (approximately 3.2 km length) has been explored. Whilst
reduction in the overall volume of potential flood water is small, this option would offer flood risk protection to both buildings and high value agricultural land.

**Option F – Wilfholme and Hempholme Pumping Stations**

The performance of the existing pumping stations has been assessed with the result that a simple replacement of pumps and controls at both stations, with higher efficiency equipment, would both reduce flood risk (in particular to local agricultural land) and offer a reduction in maintenance costs.

**Option G – Natural Flood Management**

The options described above focus, in the main, upon increasing the capacity and efficiency of the River Hull. Natural Flood Management takes a different approach in that it aims to delay the flow of water into the catchment area. This type of approach is generally employed in areas upstream of settlements to both reduce and slow down the flow of water at peak times. A range of ‘soft’ engineering measures across a larger area of the upper catchment avoids the need for ‘hard’ engineering measures further downstream. These ‘soft’ measures include the creation of small ponds to act as localised storage areas, the introduction of debris into existing channels to reduce the speed of flow, and new swales (shallow, linear depressions to guide surface water flow) and trenches that will encourage infiltration of water below ground. The predominantly rural upstream areas in the Headlands are ideal for the introduction of such measures, although implementation will rely upon the co-operation of landowners and tenant farmers to embrace this approach.

**Option H – Asset Refurbishment**

As previously noted this option has not been modelled and does not form part of the SEA. The purpose of this option is to ensure adequate long term maintenance of existing and new assets.

**Environmental Impacts**

We have assessed the likely significant environmental impacts, at a strategic level, of the above options upon the existing baseline environment. We have also tested the potential effects upon the stated environmental objectives. The likely effects have helped shape the strategy and refine the options chosen. In assessing the effects we have considered the direct impacts associated with the implementation and operation of each option e.g. construction, together with the indirect effects resulting from a flood event. To test the indirect effects the flood model has assumed a ‘baseline’ situation i.e. a continuation of the existing protection measures, and then predicted a flood event for each option. We have looked at a ‘worst case’ scenario, namely a point in the future when the existing defences and protection measures combined with effects of climate change are least effective, and then modelled each option in the comparable year.

The key, strategic environmental impacts are summarised below in relation to each option. It should be noted that each option has only been developed to enable consideration and production of a flood risk management strategy for the very large study area. Prior to implementation each option will require further consideration and at that point, more detailed and localised effects will be considered during the project level Environmental Impact Assessment process, where required.
**Option A – Dredging of the River Hull**

The predicted ‘worst case’ scenario flood risk for this option is calculated to be little different, in terms of area at risk of flooding, to the modelled baseline situation. Major population centres are, however predicted to be largely unaffected except for small pockets within the centre of Beverley and north eastern fringe of Hull.

Key effects are considered to arise in respect of biodiversity, cultural heritage and the water environment.

In terms of direct effects that may result from construction and implementation, dredging will mobilise sediments and move them downstream into the Humber Estuary, which is a nature conservation site of international importance. Due to the past use of the river and adjacent areas, some of the sediment could be contaminated and so a comprehensive sampling and analysis exercise will need to be undertaken in advance of any implementation to prevent considerable impacts upon the Humber Estuary. The physical removal of sunken vessels and improvement to the channel cross section will also involve the removal of some aquatic vegetation, in particular sections of reed bed, which may also have localised effects upon other species.

In respect of cultural heritage, whilst there are unlikely to be any direct effects upon designated assets, there is potential for impact upon either non-designated or as yet unknown assets within the river channel, for example historic sunken vessels and former bankside structures such as staithes and bridge abutments.

This option is likely to create the largest potential impact upon the water environment. Dredging will introduce new mudflow and potential contaminants, leading to a short term reduction in water quality. The removal of sunken vessels and changes to selected areas of bankside to facilitate the re-profiling of the channel could also lead to longer term degradation of water quality.

The indirect effects are unlikely to be significantly different between the predicted baseline flood risk and that for predicted for this option.

**Option B - Tidal Exclusion**

This option is considered to give rise to largely neutral environmental effects; both direct and indirect. The construction of a new, but smaller barrier, may give rise to a short term, direct effect upon navigation into and out of the River Hull. Impacts on migratory fish movements have been considered and the change in frequency of tidal exclusion is not assessed to impede these movements significantly.

Whilst the predicted flood risk for this option is similar to the baseline situation the indirect effects would include enhanced protection to a section of the A1165 at Stoneferry Road and local rail links.

**Option C – Holderness Drain**

The implications of embankment raising could include direct adverse effects upon landscape/land use, cultural heritage and the water environment. These effects are likely to arise as a consequence of construction, including access to the riverside, e.g. removal of existing vegetation.
Swine Castle Hill, a Scheduled Monument, lies to the immediate east of the drain close to Bransholme. The extended footprint of the embankment, needed to accommodate an increase in height, may impact upon the edge of the monument and there may also be a potentially adverse visual effect resulting from the higher embankments. Additionally, there may a negative effect upon views to and from the nearby prehistoric burial mound and a number of non-designated sites located alongside the drain, such as bridges. Similarly, the increase in the height of embankments along the Ganstead Drain has potential to affect a number of non-designated cultural heritage assets.

Construction of the enhanced flood defence embankments may also create disturbance to the banks of the drain with a short term effect upon water quality.

The potential changes to embankments alongside the drain may also offer opportunities to create an enhanced network of paths and additional landscape features hence other positive effects, in addition to the reduced flood risk, may result from this option.

The predicted extent of flood risk associated with this option may have an effect upon Beverley’s Conservation Area due to an increased risk within a localised area. This option does however reduce flood risk to north east Bransholme hence preventing potential flood waters from both urban areas and agricultural land flowing back into the drain with consequent impacts upon water quality.

**Option D – Bransholme Pumping Station**

This option has effectively been implemented as a result of the upgrade to the Bransholme Pumping Station by Yorkshire Water. For the purposes of a strategic assessment this option is considered to offer neutral direct effects. In respect of indirect effects, it is considered that the reduced risk of flooding from the water storage at Bransholme will offer an improved situation.

**Option E – Beverley and Barmston Drain/Western Drain**

The effects of improved flood defence embankments to the Beverley and Barmston, and Western Drains will be largely similar to those described for Option C, although the location differs. Hence effects upon landscape/land use, cultural heritage and the water environment are considered likely.

Construction may lead to removal of vegetation in selected areas and disturbance to the banks could create a temporary deterioration in water quality. No direct effects upon designated cultural heritage sites are anticipated although a number of non-designated sites, including bridge and other drain infrastructure, may be impacted upon.

The potential changes to the embankments alongside the drain may also offer opportunities to create improved public rights of way and additional landscape features, and so other positive effects, in addition to the reduced flood risk, may result from this option.

**Option F – Wilfholme and Hempholme Pumping Stations**

The replacement of pumps at both stations is unlikely to create any significant, direct, environmental impact. Works would be confined within the existing site areas, both of which are operational pumping stations.
Whilst the predicted flood risk associated with this option is broadly similar to the baseline, more effective pumping could potentially reduce the duration, extent and depth of a flood event.

**Option G – Natural Flood Management**

The nature of this option, primarily low key, ‘soft’ engineering measures is such that significant direct, adverse impacts are unlikely. The exception to this, given that no actual sites for implementation have yet been identified, is the potential effect upon known or unknown cultural heritage sites. The development of this option will require a more thorough assessment of potential impacts, with consequent mitigation or enhancement measures, at the project design stage.

Positive benefits that may result from this option have been identified including the improvement of existing habitats, positive changes to landscape character through the introduction of more diverse features and reduced sedimentation within the river system as overland flows of surface water are disrupted and attenuated.

This option may also offer potential opportunities for enhancement both during implementation and future operation. This could include the provision of new ecological habitat and landscape features.

**Environmental Objectives**

Each of the seven options has also been assessed against the stated Environmental Objectives. It is considered that Options B, D and F are compliant with these objectives, in that no significant adverse effects have been identified. Options A and G do conflict with particular objectives, namely Cultural Heritage, although further development of these options though sympathetic design should enable satisfactory avoidance of impacts or the implementation of suitable mitigation measures. It is worth noting that in all other aspects Option G is overwhelmingly positive when assessed against the environmental objectives.

Options C and E give rise to conflicts with both Landscape/Land Use and Cultural Heritage objectives. Again, it is considered that more detailed development of these options should result in the satisfactory avoidance of impacts or the provision of suitable mitigation measures.

**Proposed Strategy**

It is intended that the RHICS options will be implemented over a timescale of some 20 years with a phased approach that incorporates a mixture of the respective options, however the strategy will guide flood risk management within the study area over the next 100 years.

The intended phases, with inclusion of each option are as follows:

**Phase 1**

- Option C – Raising of embankments to Holderness Drain
- Option D – Bransholme Pumping Station
- Option F – Replacement pumps installed at Wilfholme and Hempholme pumping stations

**Phase 2**

- Option A – Dredging and re-profiling of the River Hull channel, including the removal of sunken vessels
• Option B – Tidal exclusion, install new barrier at mouth of River Hull

**Phase 3**

• Option G – Natural Flood Management
• Option E – Raising of embankments along the Beverley and Barmston Drain/Western Drain.

The current programme is that Phase 1 will be undertaken between years 0 and 6 (i.e. short term), Phase 2 will be delivered between years 1 and 6 whilst Phase 3 will take place between years 6 and 20 (i.e. both long term).

**Water Framework Directive**

Each option has been assessed against the predicted effects upon groundwater assets (waterbodies) identified by the Environment Agency as being important in allowing the UK to meet its commitments under the EU Water Framework Directive. Our study examines the potential effects of the options on the ecological quality of waterbodies. Effects which are likely to reduce the possibility of meeting WFD objectives or otherwise cause deterioration in the status of waterbodies are identified and assessed.

Each option has been assessed against predicted effects on WFD waterbodies. The results of this assessment make it possible to determine whether each option complies with the overarching objectives of the WFD for each waterbody as set out below;

• **Objective 1**: The proposed scheme does not cause deterioration in the WFD Status of the Biological, Chemical and other assessed Elements of the waterbody;
• **Objective 2**: The proposed scheme does not compromise the ability of the waterbody to achieve its WFD status objectives;
• **Objective 3**: The proposed scheme does not cause a permanent exclusion or compromised achievement of the WFD objectives in other bodies of water within the same RBD; and
• **Objective 4**: The proposed scheme contributes to the delivery of the WFD objectives.

The strategic WFD assessment concluded that Objectives were met by each option subject to implementation of a range of mitigation measures.

**Monitoring**

A monitoring plan has been developed that links to a similar process intended for the RHICS. Monitoring is a fundamental part of the SEA process and is necessary to ensure that the actual environmental impacts arising from the RHICS are measured against the predicted impacts and that no unforeseen impacts occur. The effectiveness of mitigation is also checked and where necessary can be amended to meet the intended objective. Finally, any data gaps, or uncertainty highlighted by SEA can be addressed to provide a more comprehensive basis for the periodic RHICS review.

It is essential that in delivering the monitoring plan, co-operation with a range of stakeholders including the EA, Natural England, Flood Action Groups, landowners, farmers and tenants is undertaken to provide a sustainable flood risk management strategy for the River Hull.
Next Steps

The RHICS and accompanying SEA Addendum Environmental Report will be subject to formal consultation starting in April 2015. At the end of the consultation period, all comments received will be reviewed and any necessary changes made to the respective reports. A Statement of Environmental Particulars will be prepared which will explain how environmental considerations have been accommodated within the RHICS and how comments made during the consultation period have been taken into account.

Formal approval will then be sought from the EA and Defra at which point the final strategy document will be published together with the associated SEA.

If it is considered likely that significant effects resulting from the options proposed by the RHICS will occur in Humber Estuary Special Area of Conservation or Humber Estuary Special Protection Area, then options will need to be screened to assess whether Appropriate Assessment is necessary (Habitats Regulations Assessment) allowing us to fulfil a UK commitment to the EU Habitats Directive.
Introduction and Background

1.1 The River Hull Integrated Catchment Strategy

In 2010 the Environment Agency published a draft Flood Risk Management Strategy (FRMS) for the River Hull. The draft Strategy set out a plan for the sustainable management of flood risk to people, property and the environment over a 100 year period arising from the catchment area of the River Hull. To accompany this draft Strategy the Environment Agency also published a Strategic Environmental Assessment (SEA) in May 2010 which considered the likely environmental consequences of the various ‘elements’ that constituted the Strategy.

In the interim and in response to the FRMS of 2010 a new body, the River Hull Advisory Board (RHAB), was established to promote the development of an Integrated Catchment Strategy for the River Hull. This Integrated Catchment Strategy (RHICS) would build upon the existing FRMS and consider the impacts from all sources of flooding (surface water, groundwater and tidal flooding). Importantly the RHICS now provides an integrated approach to the management of flood risk in the natural valley of the River Hull and multi-agency working by the five flood Risk Management Authorities (RMAs): Beverley and North Holderness Internal Drainage Board (IDB); East Riding of Yorkshire Council (ERYC); the Environment Agency (EA); Hull City Council (HCC) and Yorkshire Water Services Ltd (YWS).

The natural River Hull valley is one of the most ‘at-risk’ developed flood plains in England with a land area of approximately 980 km² and a population of approximately 360,000 (2011 census). Without defences, an area of approximately 5,500 hectares of land and nearly 131,000 residential properties would be subject to flooding from the sea, river, surface water and groundwater.

Evolution of the FRMS to the RHICS has necessitated a re-examination of the original SEA. The results of that process are now contained within this document, an Addendum to the SEA of May 2010. To ensure continuity with the original document the key environmental issues identified in the Scoping Study for the SEA have been maintained together with the Environmental Objectives that were identified to accompany the FRMS. Within the interim period, both the East Riding of Yorkshire Council and Kingston-upon-Hull City Council have also progressed local flood risk management strategies. Both strategies, to be accompanied by SEA but currently at differing stages of completion, have informed this SEA Addendum to ensure a comprehensive and co-ordinated approach.

The purpose of SEA remains the same, namely an appraisal of the potential environmental consequences as a result of high level decision making; in this case the RHICS giving rise to the SEA Addendum Report. This Addendum retains that purpose and hence assesses the likely significant environmental effects that may arise as a result of the RHICS.

In preparing this SEA Addendum Report the original environmental baseline data has been reviewed and updated. A number of key changes have taken place during the interim four year period that need to be reflected in this Addendum; in particular to the Regional and Local Planning regime. The nature of environmental data is such that the baseline information is continually being reviewed and amended e.g. the number of Cultural Heritage assets may increase through additional designations.
and identification, and Biodiversity assets may also vary in response to changes in natural populations.

Whilst the Addendum should be considered a companion document, and is best read in conjunction with the original SEA Environmental Report, it has been prepared as a ‘standalone’ report.

1.2 The Study Area

Both the FRMS and SEA of 2010 considered a study area based upon the River Hull, Holderness Drain and Beverley & Barmston Drain catchments. These catchment areas fall within the administrative boundaries of Ryedale District Council/North Yorkshire County Council, East Riding of Yorkshire Council and Kingston-upon-Hull City Council; with the larger part falling within the East Riding of Yorkshire. The original study area encompassed an area of some 980km² bounded to the west and north by the Yorkshire Wolds and the River Humber to the south.

The current RHICS is based upon the same catchments but with a modified study area boundary to reflect updated baseline data from more recent storm and flood events together with the extensive computer modelling undertaken to predict future flood risks: see Figure 1.1. The modified study area is, in principle, little different to the original hence the assumptions in respect of scoping and environmental objectives that underpin the SEA Addendum are considered to be still valid.

![Figure 1.1: The Study Area; boundary shown as a red line](image)

In particular the northern boundary of the study area now extends beyond Sledmere up to West Lutton/East Sutton, whilst the north-west extremity is limited to Fridaythorpe (aligned
approximately along a section of the A166 and B1261. These modifications reflect the natural catchment extents influenced by topography. There are more minor changes to both the western and eastern extents of the study area, the boundary following a more precise line across the landscape dictated by the refined modelling that has taken place to underpin the RHICS.

Figure 1.2 below, taken from the RHICS, illustrates the study area boundary in respect of the River Hull catchment area and adjacent catchment areas.

![Figure 1.2: The River Hull Catchment](image)

1.3 The River System

In the upper reaches the River Hull is fed by a number of springs and becks within the Yorkshire Wolds. These watercourses converge south of Driffield where the river then flows through open countryside before skirting the eastern edge of Beverley and on to Kingston-Upon-Hull. Within the city of Hull the river flows through the centre of heavily populated, industrial areas before joining the Humber estuary at Victoria Pier; close to The Deep and the Tidal Surge Barrier. The River Hull is embanked for most of its length, in some places the embankments are over 5 m high, and the bed of the river is above the level of the surrounding land.

The main tributaries are West Beck, Kelk Beck, Old Howe, Frodingham Beck, Driffield Beck, Skerne Beck, Nafferton Beck, Scurf Dike, Mickley Dike, Watton Beck and Catchwater Drain/Aram Beck. Together with the River Hull, these form the River Hull “high level system”. The numerous drains in the low lying land predominantly to the west of River Hull, including Beverley and Barmston Drain.
form the River Hull “low level” system. These inter-connections are illustrated at Figure 1.3 below, a schematic illustration of the River Hull system reproduced from the RHICS.

Figure 1.3: River Hull Schematic Map

Holderness Drain is not a tributary of the River Hull per se but is an important part of the drainage network. The drain discharges flows from areas to the east of the River Hull directly into the Humber estuary. In common with the River Hull, Holderness Drain comprises both a high level and a low level system. Monk Dike, Catchwater Drain, Bowlams Dike and the lower part of Holderness Drain together form the Holderness Drain high level system. The numerous drains in the low lying land to the east of River Hull, including the upper and middle parts of Holderness Drain, form the Holderness Drain low level system. The embankments on the Holderness Drain high level system are much lower than those on the River Hull high level system; typically 1 or 2 m high.
Many of the river and drainage systems are complex due to a long history of modification. The response of the catchment to extreme rainfall is also complex due to the interaction of ground and surface water in addition to the large tidal influence of the Humber Estuary.

Much of the land adjacent to the river is low lying, including the majority of Kingston-upon-Hull together with significant parts of the East Riding of Yorkshire, and would suffer from frequent flooding without the presence of flood defences. This low-lying area is typically at risk from surface water, groundwater, fluvial (river); the northern part being limited to risk from fluvial flooding.

The key components of the River Hull system are illustrated at Figure 1.4 below. The River Hull Tidal Surge Barrier, at the mouth of the River Hull, is used to prevent surge tides overwhelming river defences. At the mouth of Holderness Drain and where Beverley and Barmston Drain, Scurf Dike and Watton Beck enter the River Hull, structures are installed which prevent reverse flow up the channels causing flooding. The Figure also illustrates the location of pumping stations on the River Hull system. Tickton Pumping Station and Great Culvert Pumping Station located on the Holderness Drain, pump flows along the drain to enabling it to discharge into the Humber estuary. Great Culvert Pumping Station connects both the Holderness Drain high and low level systems. East Hull Pumping Station pumps excess flows into the Humber Estuary during high river flows; when the tidal water levels within the Humber Estuary are too high for Holderness Drain to discharge. The Environment Agency has recently made improvements to maintain performance at the East Hull Pumping Station.

Figure 1.4: Key Components of the River Hull System
1.4 The Purpose of Strategic Environmental Assessment

The purpose of Strategic Environmental Assessment is set out in the original SEA Environmental Report of 2010. The legislation that drives the requirement for SEA in England, namely *The Environmental Assessment of Plans and Programmes Regulations 2004* (Statutory Instrument No. 1633), has not been repealed or amended in the intervening years since publication of the original SEA.

Defra guidance recommends that SEA is undertaken for medium to long term river or coastal management plans, such as the RHICS, but notes that on the basis of current legislation and guidance from the Office of the Deputy Prime Minister (ODPM) SEA is not a legal requirement. Flood risk management strategies contribute to the context of forward planning at both a regional and local level with potentially significant environmental implications and hence require extensive consultation. For these reasons, and to comply with good practice, Defra considers that adopting an SEA approach is a sound approach to the assessment of potential strategic effects.

Both the purpose and context of SEA are unchanged; consequently this Addendum report does not reproduce the relevant section of the SEA Environmental Report.

1.5 SEA Addendum Report Structure

As stated within the Introduction above, this SEA Addendum Report seeks to complement the original SEA hence a comparable report structure is employed to aid the reader. This Addendum Report consists:

A **Non-Technical Summary**: a concise overview written in non-technical language.

**Chapter 1 – Introduction and Background**: the context to the SEA Addendum.

**Chapter 2 - SEA Approach and Methodology**: a summary of the approach to SEA and process undertaken.

**Chapter 3 - Plans and Strategies**: a review of policies, plans and strategies relevant to the Integrated Catchment Strategy and study area.

**Chapter 4 - Consultation**: outlines the consultation undertaken to date and that which is proposed.

**Chapter 5 - The Current State of the Environment**: an updated summary of the environmental baseline conditions.

**Chapter 6 - Environmental Assessment of the Options**: a description of the options currently considered by the RHICS and identification of potential strategic environmental effects associated with each.

**Chapter 7 - Implementation and Monitoring Plan**: the programme of implementation in respect of RHICS, monitoring of environmental effects and efficacy of mitigation together with a review process.

**Chapter 8 - Conclusions**: a topic by topic summary of the key outcomes.
SEA Approach and Methodology

2.1 The SEA Process

SEA is a step by step process, developed and guided by current legislation, with a number of key inputs and required outcomes. This step by step process is summarised in The Office of the Deputy Prime Minister (ODPM) publication ‘A Practical Guide to the Strategic Environmental Assessment Directive (2005)’, namely:

A. Setting the context and objectives, establishing the baseline and deciding on the scope;
B. Developing and refining alternatives and assessing effects;
C. Preparing the Environmental Report;
D. Consulting on the draft plan or programme and the Environmental Report; and,
E. Monitoring implementation of the plan or programme.

Each step, or stage, includes a number of intermediary actions which are described in Section 2 of the original SEA; a summary is illustrated below at Figure 2.1 which replicates that of the original document.

Figure 2.1 Summary of the SEA Process

The SEA of 2010 followed the key stages, and hence met the requirements of the SEA Directive through:

- **SEA Screening and Scoping** – The Environment Agency determined that a non-statutory SEA would be undertaken for the River Hull FRMS. As a result of this decision Scoping took place in late 2005 culminating in the production of a Scoping Report in May 2006. For reference, the results of that scoping exercise are reproduced at Figure 2.2 below.
- **Identification of Objectives/Indicators** – The River Hull FRMS defined a number of overarching Strategy Objectives from which Environmental Objectives and Indicators were developed; the strategy then being assessed against the objectives/indicators to demonstrate how these might be furthered or hindered. The same objectives and indicators have been retained, in order to provide a more direct comparison between the original SEA
and this Addendum Report, however the assessment process will reflect the refinements to, and evolution of the FRMS now embodied in the RHICS.

- **Identification of Baseline Environmental Information** – the Scoping Report of 2006 identified both the key environmental topics that would form part of the original SEA of 2010 together with those that were ‘scoped out’ of the assessment. Environmental data was subsequently collected and collated for those subject areas; with reference sources indicated. The establishment of appropriate and current baseline information is a key element of the SEA process, hence this data has been subject to a new search and collation exercise.

- **Assessment** – the likely effects of implementing the high level options were assessed based upon the established approach of source-pathway–receptor. The significance of a potential environmental impact was then determined based upon a combination of ‘magnitude of effect’ and ‘value of receptor’. A simple matrix based methodology was employed with the assessment gauging likely effects over the short term and longer term in comparison to a defined baseline. Where adverse impacts of a major or moderate significance were identified then generic mitigation or risk management measures were recommended. The assessment process followed an accepted best practice methodology. A comparable assessment process has taken place in respect of the options promoted within the RHICS; including an account of rejected options considered to be reasonable alternatives. The results of the assessment are presented in this Addendum Report.

- **Reporting** – the results of the SEA were reported in the Environmental Report of 2010 accompanied by a Non Technical Summary. The Environmental Report was subject to widespread consultation, subsequently published as a final document and widely distributed by the Environment Agency. This Addendum Report will also be subject, in draft form, to consultation in accordance with the requirements of current legislation; this will include key consultees and stakeholders. The report will be subject to finalisation following feedback. A Statement of Environmental Particulars will be prepared that explains how environmental considerations have been accommodated within the RHICS and how comments made during the consultation period have been taken into account.

- **Implementation and Monitoring** – a recommended Monitoring Plan was presented in the 2010 SEA to accompany the FRMS. The purpose of monitoring, a fundamental element of the SEA process, is to compare the actual environmental impacts against those predicted, to ensure the planned mitigation is effective, to avoid unforeseen impacts and duplication of monitoring, and address any subsequent gaps in data or uncertainty highlighted by the assessment (thereby ensuring that a comprehensive baseline is provided for a future Strategy review). Monitoring would accompany strategy implementation which, in the context of this Addendum Report, is taken to mean adoption of any option within the RHICS.

### 2.2 Temporal Scope of the SEA

The RHICS considers a timescale of some 20 years for funding and project implementation, with a phased approach to construction, however the strategy is intended to guide flood risk management within the study area over the next 100 years; effectively a 20 year implementation period followed by some 80 years management and maintenance. This Addendum report considers environmental effects over a comparable timescale with consideration of both the initial implementation period
and the longer term; the latter being focussed upon a predicted ‘worst case’ scenario described below.

In considering the temporal scope of the SEA Addendum it is important to note that whilst the RHICS reflects an intended programme of implementation and operation to address flood risk, and longer term strategy duration, the nature of a flood event is less predictable. A ‘worst case’ flood event has there been adopted in order to assess potential environmental effects against the baseline conditions. The anticipated rise in sea level associated with climate change will directly impact upon the tidal extent of the River Hull with the existing Tidal Barrier increasingly acting as a regulator to control flood risk. The combination of effects will lead to an ever increasing peak water level however it is considered that the existing flood defences along the river and associated drains are generally high enough to contain peak water levels. There are predicted areas of detriment where flood risk will increase and these are described in detail within the RHICS.

If it is assumed that the Tidal Barrier continues to operate at the present high tide activation level i.e. is not adjusted to account for the effects of climate change, then flood risk will increase through to a key date of 2085; beyond which the increasingly activated barrier will lead to a decrease in risk up to the end of the 100 year strategy period in 2115. Both 2085 and 2115 represent 1 in 100 year flood events however the predicted inundation, both in terms of volume and extent, for 2085 is noted to be greater.

In contrast the flow of water from the Holderness Drain into the Humber Estuary, which includes active pumping of high water levels, is simply controlled by gravity; with structures in place to prevent backflow. As sea levels rise there will be a greater reliance upon pumping of water from the drain into the estuary. Assuming that the current pumping regime persists then the effects of increased flows through the Holderness Drain have a greater impact upon flood risk than rising sea levels as a result of climate change. Flood risk from the Holderness Drain will similarly rise over the period of the RHICS with a peak in 2085; with no further rise predicted up until 2115.

In combination this means that the year 2085, based upon the RHICS flood event predictions, represents the ‘worst case’ climate change scenario.

2.3 Scoping

The results of the previous Scoping exercise are illustrated below (table 2-1: Results of Scoping Exercise is reproduced from the original SEA of May 2010)

<table>
<thead>
<tr>
<th>Environmental Factors</th>
<th>Issues Scoped into SEA Report</th>
<th>Issues Scoped into Project level EIA (scoped out of SEA)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flora, Fauna &amp; Biodiversity</td>
<td>The study area is adjacent to internationally designated areas for nature conservation</td>
<td>Local level nature conservation designations</td>
</tr>
<tr>
<td>Land Use</td>
<td>High quality agricultural land, as well as industry and commerce in Kingston-upon-Hull are relevant at strategic level</td>
<td>Local level issues</td>
</tr>
<tr>
<td>Water</td>
<td>Water quality to be maintained or improved, prevention of pollution</td>
<td>Local level issues</td>
</tr>
<tr>
<td>Material Assets</td>
<td>Communication links into the region by road, rail and sea. Communication</td>
<td>Local level issues</td>
</tr>
<tr>
<td><strong>Environmental Factors</strong></td>
<td><strong>Scoped into SEA Addendum Report</strong></td>
<td><strong>Scoped out of SEA Addendum Report</strong></td>
</tr>
<tr>
<td>--------------------------</td>
<td>------------------------------------</td>
<td>-------------------------------------</td>
</tr>
<tr>
<td><strong>Land Use</strong></td>
<td>High quality agricultural land; Grade 3 and above. Key settlements.</td>
<td>Lower grade agricultural land. Sub-division of land use types e.g. residential, commercial and individual sites. Land use allocations as identified within local plans and policies.</td>
</tr>
</tbody>
</table>
**Material Assets**
Key transport infrastructure e.g. major (motorway, trunk) road, rail and river navigation routes. Communication links between key settlements that have a significant role in economic and social activities; that may include lower classification roads.

Full extent of highway and rail network.

**Population**
Key centres of population; high level data e.g. population size. Over-arching perception of flooding with key elements of flood warning system.

Population characteristics e.g. socio-economic classification and ethnicity. Residential densities.

**Cultural Heritage**
International and National level designations e.g. World Heritage Sites, Scheduled Monuments, Listed Buildings and Registered Parks and Gardens, Conservation Areas. Designated sites ‘at risk’.

Non-designated assets, (including as yet unknown archaeology) and Historic Landscapes.

**Landscape**
National and regional character areas; including city scale assessments. National designations e.g. Area of Outstanding Natural Beauty.

Local and site level landscape assessment. Individual landscape features e.g. woodland, hedgerows, etc more pertinent to project level assessment. This level of assessment and potential effect upon landscape quality and character together with individual features is pertinent to site/project level assessment.

**Air Quality & Climate**
The effects of climate change.

Air Quality Management Areas, air quality issues at any level; the implementation of the strategy is unlikely to have an effect at strategic level. Local, project level assessment may be required in due course.

**Soil**
The generic influence of soils upon agricultural land classification.

Soil types and distribution, impacts associated with site development e.g. soil stripping and handling, would be considered at site/project level assessment.

**Human Health**
Perception of effects arising from flood risk is included within the Population environmental factor.

The general health of the population, detailed analysis of health effects, both physical and psychological, together with potential monitoring of such data.

**Recreation and Amenity**
Key i.e. national and regional, tourist destinations and recreational assets. Public Rights of Way network, assessed as a single entity at strategic level, including long distance paths and trails. High level economic and employment characteristics.

Effects upon individual paths, routes and trials at a detailed level including potential diversions.

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**Table 2.2 Scoping Level**

In summary, this SEA Addendum Report will consider the same range of issues. Whilst the overall scope of environmental topics remains the same a number of minor modifications and refinements have been introduced to reflect a change in emphasis over the intervening years, provide an assessment aligned closer to the proposed flood risk strategy contained within the RHICS, deliver greater clarity to national/regional/local level environmental issues and address data gaps from the original SEA. These modifications are summarised below.
At a strategic level the pattern of land use within the study area has not changed significantly since 2010. The original SEA grouped land use with landscape and this association has been continued, however only a brief overview of key land use issues is provided with particular emphasis upon the relative effects of the strategy options in comparison to the baseline. Archaeology and Cultural Heritage was considered at a high level only in 2010. The detailed modelling of options associated with the RHICS options now enables a more focussed assessment of potential effects upon cultural heritage assets within the context of a study area rich in archaeology. Although ‘scoped out’ of the original SEA it is noted that the Environmental Report did however, consider outline landscape effects in respect of Do Minimum and proposed strategy options. The potential for landscape effects arising from flood risk management has been highlighted in more recent strategic assessment work to support the Local Flood Risk Management Study being undertaken by ERYC. On this basis, and in order to maintain consistency, landscape does form part of this Addendum.

2.4 Objectives

As stated above, objectives and indicators were outlined in the original SEA. The aim of both the previous FRMS and new RHICS is to provide a sustainable flood risk management strategy for the River Hull catchment over the next 100 years. The stated vision of the RHICS is, “The River Hull Integrated Catchment Strategy will provide a clearly defined and sustainable multi-agency strategy for the management of flood risk in the natural River Hull valley and support a modified draft River Hull Flood Risk Management Strategy”. Although not explicitly stated within this vision it is understood that, as a successor to the previous FRMS, will provide a sustainable strategy over the next 100 years.

The objectives are effectively the same hence in order to provide a more direct comparison between this Addendum Report and the previous SEA these objectives and indicators are retained.

A series of environmental objectives were then developed, supported by a series of indicators that acknowledged the results of the Scoping exercise, consultation and the objectives of the FRMS. The proposed strategy measures were then reconciled against the environmental objectives noting how they might hinder or assist the objectives. The inter-relationship between environmental objectives was also considered.

Given the evolution of strategy options it has been necessary to re-consider the effects that the RHICS may have upon the environmental objectives and provide refined sub-objectives; these are identified in italics in Table 2.3 below. Where necessary the terminology has been updated with the indicators refined, and sub-objectives expanded, to reflect a more thorough understanding of the baseline conditions.

A comparable, to the original SEA, appraisal summary table of objectives, sub-objectives and indicators is hence shown below.

<table>
<thead>
<tr>
<th>Objective</th>
<th>Sub-Objectives</th>
<th>Indicators</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1. Flood Protection</strong> – maintain an appropriate level of flood protection for people and their property; in partnership with any opportunities</td>
<td>To protect people and their property from the adverse effects (physical and psychological) of flooding</td>
<td>Numbers of people affected and/or property protected</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Employment sustained</td>
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</tr>
<tr>
<td>2. <strong>Wetland Habitats</strong> – protect and enhance a network of wetland habitats linked by a strong riparian corridor</td>
<td><strong>To avoid damage to designated sites</strong> (e.g. SSSIs, SPA, SAC, Ramsar)</td>
<td><strong>Reported levels of impact to designated sites</strong></td>
</tr>
<tr>
<td></td>
<td><strong>To promote favourable condition of River Hull Headwaters SSSI and other hydrologically sensitive designated sites</strong></td>
<td><strong>Reported favourable condition of River Hull Headwaters SSSI and other SSSIs impacted upon by the proposed options</strong></td>
</tr>
<tr>
<td></td>
<td><strong>To increase resilience of wetland habitats</strong></td>
<td><strong>Creation of wetland habitats and buffer zones</strong></td>
</tr>
<tr>
<td></td>
<td><strong>To contribute to relevant UK and local BAP habitats, species and other relevant important species in line with targets</strong></td>
<td><strong>Achievement of BAP targets for species and habitats</strong></td>
</tr>
<tr>
<td></td>
<td><strong>To promote a natural self-sustaining fishery (coarse and salmonid)</strong></td>
<td><strong>Species diversity, biomass and recruitment</strong></td>
</tr>
<tr>
<td>3. <strong>Sustainable Land Use and Landscape</strong> – support appropriate (sustainable) land use and landscape character/quality changes</td>
<td><strong>To support/promote land use change that promotes improved landscape character/quality. Promote sustainable landscapes that respond to climate change and flood risk. Support objectives of regional landscape character assessment.</strong></td>
<td><strong>Contribution to regional landscape character objectives; identifiable positive changes. Area of land providing flood risk management benefits or landscape improvement</strong></td>
</tr>
<tr>
<td>4. <strong>Agricultural Land Use</strong> – support existing agricultural practices within the catchment</td>
<td><strong>To reduce the vulnerability of high grade/productive agricultural land to flooding</strong></td>
<td><strong>Loss of high grade/productive land from existing agricultural practice, reduced protection to high grade agricultural land</strong></td>
</tr>
<tr>
<td>5. <strong>Cultural Heritage</strong> – protect, and where appropriate, enhance designated cultural heritage assets</td>
<td><strong>To prevent the adverse effects of flooding on designated and non-designated assets, and ensure measures for managing flood risk minimise harm to and, where appropriate, enhance their significance</strong></td>
<td><strong>Numbers of designated/non-designated assets whose significance is currently threatened or harmed through flooding that have been protected by flood protection measures. Numbers of designated/non-designated assets whose significance has been harmed through flood protection measures</strong></td>
</tr>
<tr>
<td>6. <strong>Tourism and Recreation</strong> – protect and, where possible, enhance tourism, amenity and recreational facilities</td>
<td><strong>To improve local tourism, amenity and recreation opportunities</strong></td>
<td><strong>Area/number of recreational and amenity facilities protected/created</strong></td>
</tr>
<tr>
<td>7. <strong>Transport</strong> - protect key existing transport infrastructure</td>
<td><strong>To prevent adverse impacts of flooding on major communication links including key motorway and trunk road communications within study area. Protect key rail links.</strong></td>
<td><strong>Length of major highways and rail line protected</strong></td>
</tr>
<tr>
<td>8. <strong>Water Framework Directive</strong> – to support the achievement of ‘good’ status/potential for surface water and groundwater bodies under the WFD</td>
<td><strong>To protect geo-morphological features of the river and floodplain and, where possible, provide opportunities for enhancement</strong></td>
<td><strong>Change in geo-morphological diversity and increased ‘naturalness’</strong></td>
</tr>
<tr>
<td>9. <strong>Water Resources</strong> – support better</td>
<td><strong>To protect water quantity for abstraction and supply</strong></td>
<td><strong>Water abstractions protected</strong></td>
</tr>
</tbody>
</table>
management of water resources

10. **Climate Change** – ensure that the Flood Risk Management Strategy (RHICS) takes account of climate change

<table>
<thead>
<tr>
<th>Environmental Objectives (subject areas)</th>
<th>Wetland Habitats</th>
<th>Sustainable Land Use and Landscape</th>
<th>Agricultural Land Use</th>
<th>Cultural Heritage</th>
<th>Tourism and Recreation</th>
<th>Transport</th>
<th>Water Framework Directive</th>
<th>Water Resources</th>
<th>Climate Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flood Protection</td>
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<td></td>
</tr>
<tr>
<td>Wetland Habitats</td>
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<td>Sustainable Land Use and Landscape</td>
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**Table 2.3 Environmental Objectives**

Further, the SEA of 2010 provided a matrix of compatibility between the Environmental Objectives to highlight potential conflicts between the over-arching objectives and respective indicators; this is reproduced below at Table 2.4 for ease of reference. In practical terms it is hence possible that in attempting to achieve the objective indicator associated with ‘Wetland Habitats’, in particular additional habitat creation, there may conflict with the agricultural land use indicator i.e. to prevent loss of high grade/productive land. In contrast the objectives in respect of Heritage Features and Tourism/Recreation can be considered compatible whereby the conservation or potential enhancement of cultural heritage assets may encourage further tourism and recreational use.

**Table 2.4 Compatibility of Environmental Objectives**

2.5 **Environmental Impact Assessment**

The basic process and methodology stated in the original SEA is still considered to be valid and appropriate hence has been carried forward to this Addendum report; the process is summarised at 2.1 above.

A reminder of the matrix employed, in line with current best practice, to determine impact significance is replicated below for ease of reference.
### Table 2.5 Matrix for Determining Impact Significance

Determining the strategic significance of an environmental impact is a combination of the value, or sensitivity, of a receptor and the predicted magnitude of effect. In the table above the value of a receptor, and hence the sensitivity to change, is equated to the level of designation i.e. those of international or national importance are deemed to be the most valuable. The magnitude of effect could be negative or positive; in respect of the strategy options the reduction in flood risk, area or duration of inundation compared to the baseline may be lower/smaller hence a positive magnitude of effect would be applicable. A degree of professional judgement, consistent with recognised methodologies, is taken during the assessment of likely effects.

#### 2.6 Assessment against the Water Framework Directive

A new, strategic assessment of the RHICS against the Water Framework Directive (WFD) has been undertaken to reflect both the evolution of the flood risk management strategy and the changes in baseline conditions that have taken place. This assessment, in line with the original SEA, focusses upon the first five years of the RHICS.

#### 2.7 Cumulative Assessment

The potential cumulative effects have also been considered within this SEA Addendum; note that this assessment is based upon a strategic level only. Any future project level EIA would take a more detailed assessment of cumulative effects and provide suitable mitigation.
2.8 Habitats Regulations Assessment

Since publication of the original SEA, legislation has been enacted to protect sites that benefit from European level nature conservation interest; commonly referred to as Natura 2000 sites. This legislation, the ‘Conservation of Habitats and Species Regulations’ (2010; as amended 2012), requires that any plan or project which may have significant impact upon a Natura 2000 site should undertake a step by step process set out within the legislation to assess the likely implications upon the site. In respect of the RHICS, the Humber Estuary is such a site.

This assessment process, the Habitat Regulations Assessment (HRA), will typically involve ‘screening’ i.e. is the project or plan likely to have a significant effect in consultation with the relevant statutory body e.g. Natural England. If a potentially significant impact is identified then an ‘Appropriate Assessment’ (to include an assessment of impact with considered avoidance, and/or mitigation together with a statement of residual effects) should be undertaken by a ‘competent authority’ (e.g. local authority, statutory body). Unless it is concluded, beyond reasonable doubt, that the plan or project will not adversely affect the integrity or conservation objectives of the Natura 2000 site then further steps are required. Further steps will include identification and assessment of alternatives considered and potentially justification (within narrowly defined reasons) for commencement of the plan/project where no other alternatives exist.

The RHICS will be subject to a HRA, in consultation with the relevant statutory bodies, with the results reported separately to this SEA Addendum.

2.9 Data Gaps and Uncertainties

In preparing this SEA Addendum we have undertaken an updated and revised data collection and collation exercise. It is considered that a robust approach to data collection will avoid major gaps in data. However, future consultation of this report may well identify some gaps. If required, further data would be collected and collated for future revisions of the RHICS and this Addendum report; or if more appropriate would be undertaken as part of any project level EIA.

A level of uncertainty is an inherent risk of the SEA process, largely due to the very large temporal and geographic scale of this strategy in particular; together with the long cause and effect relationships. Where a degree of uncertainty has been encountered, particularly with respect to the environmental implications of strategy options this is highlighted in the assessment.
Plans and Strategies

3.1 Introduction

The SEA of 2010 considered plans and strategies, in particular those at a local or regional level, relevant to development of the FRMS. In updating the baseline information for this Addendum Report, and taking into consideration the changes in policies during the intervening period that now influence the RHICS, a similar review has taken place.

A similar range of influence has been taken into account, namely those plans, policies or strategies that:

- Refer to flood protection or flood defence;
- Relate to access to rivers and other water bodies;
- Involve the development of land or settlements within the River Hull study area (as amended);
- Involve the protection of the natural environment within the River Hull flood plain area;
- Relate to regeneration, development or urban renaissance initiatives along the river corridor.
- Contain a significant constraint or opportunity to our Strategy, such as proposed regeneration developments in the floodplain; or
- Contain proposals that are at risk from our Strategy, such as flood storage areas that could impact on the land use plans of local authorities.

It is likely that a number of the plans and strategies considered will change or be replaced during the lifetime of the RHICS but the overall aspirations are anticipated to remain valid. Any major changes to such plans and strategies would be reflected in reviews of the RHICS.

The updated review is illustrated at Table 3.1 below; this includes identification of the plan or strategy, an overview of purpose, relevance to the RHICS and indication of how the RHICS might respond to any particular plan or strategy.

3.2 Environment Agency Plans and Strategies

Where a plan or strategy has been updated since the original SEA this is noted in the table; to assist comparison with the original document. Some plans/strategies have a relatively short lifespan, in contrast to the RHICS, again these are noted within the table together with any known replacement.

New plans or strategies are also noted. An overall increase is evident that reflects a greater focus upon flood risk management and likely effects of climate change upon water resource management.
<table>
<thead>
<tr>
<th>Plan/Programme/Strategy/Project</th>
<th>Description/Purpose</th>
<th>Relevance/Influence on RHICS</th>
<th>Integration with RHICS</th>
</tr>
</thead>
<tbody>
<tr>
<td>EA ‘Creating a Better Place corporate strategy.</td>
<td>The aims are to: 1. Act to reduce climate change and its consequences 2. Protect and improve water, land and air 3. Work with people and communities to create better places 4. Work with businesses and other organisations to use resources wisely 5. Be the best we can.</td>
<td>This is the overarching strategy of the EA so all of the plans, programmes and activities it is involved with need to be in line with it.</td>
<td>EA is one of five Flood Risk Management Authorities preparing and funding RHICS. It is represented on the Project and Advisory Boards.</td>
</tr>
<tr>
<td>Hull &amp; Coastal Streams Catchment Flood Management Plan (CFMP). Adopted in 2010.</td>
<td>High-level strategy covering most of East Yorkshire. Sets the framework for policies on sustainable flood risk management for watercourses entering the Humber and North Sea, includes all the River Hull catchment.</td>
<td>The CFMP sets out the EA’s policy approach to individual catchments within the plan area.</td>
<td>RHICS provides a more detailed strategy approach just for the River Hull, and includes proposals for particular actions.</td>
</tr>
<tr>
<td>River Hull Flood Risk Management Strategy (FRMS) (2010)</td>
<td>Intended to provide a more detailed policy approach for the River Hull Catchment. Deferred at partner request to consider the interactions of multiple flood sources and to undertake further modelling.</td>
<td>Base modelling for the FRMS was a significant component of RHICS, and its SEA forms the basis of this SEA.</td>
<td>RHICS is a replacement strategy for the FRMS, to be adopted by all 5 flood risk management authorities.</td>
</tr>
<tr>
<td>Humber Flood Risk Management Strategy (2008)</td>
<td>Long term high level strategy for managing defences around the Humber Estuary. Subject to partial review and refocusing in the light of likely resources available.</td>
<td>Strong inter-relationship between the two systems.</td>
<td>RHICS complements the Humber FRMS by proposing actions that incorporate tidal influences.</td>
</tr>
<tr>
<td>Humber River Basin District Flood Risk Management Strategy: Scoping Report (July 2014) Not in original FRMS of 2010</td>
<td>Scopes what the Humber Basin FRMS and RBMP will cover as they are prepared over the next two years.</td>
<td>Identifies RHICS as a joint local strategy in preparation.</td>
<td>Supports the two high level strategies by joint preparation of a local strategy.</td>
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<tr>
<td>Project Name</td>
<td>Nature of Study</td>
<td>Expected Outcomes</td>
<td>Status of Study</td>
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<td>River Hull Defences study (2014/15)</td>
<td>Feasibility study to explore the condition of and works required to improve defences within Hull</td>
<td>RHICS identifies the poor quality of many of the (privately owned) wharves and defences.</td>
<td>RHICS acknowledges and supports the EA’s study.</td>
</tr>
<tr>
<td>Albert Dock Tidal Defences (2014/15)</td>
<td>Feasibility study to prepare new flood defences to the west of Hull City centre following 2013 tidal surge flooding.</td>
<td>Supports RHICS by ensuring tidal inundation is managed.</td>
<td>RHICS seeks a commitment from partners to maintain and improve assets. This scheme will help achieve that.</td>
</tr>
<tr>
<td>Holderness Drain Improvements, Bransholme and East Hull</td>
<td>An option study to increase pumping capacity along the drain and to install a new embankment adjacent to Sutton</td>
<td>Deferred to consider revised modelling and options as part of RHICS</td>
<td>RHICS proposes a similar, but alternative, scheme with partnership funding. EA to compare and consider suggested revision.</td>
</tr>
<tr>
<td>Hull &amp; ER Abstraction Licensing Strategy (2013)</td>
<td>Replaces the 2006 abstraction strategy (CAMS). Sets out how the EA will license abstraction requests.</td>
<td>RHICS could potentially have had negative impacts on water resources.</td>
<td>RHICS does not propose any actions that conflict with the ALS.</td>
</tr>
<tr>
<td>River Hull Headwaters SSSI Water Level Management Plan (1999)</td>
<td>Overall objective to facilitate improvement and management schemes. Key issues are lessening of spring flows due to climate change and man-made impacts.</td>
<td>RHICs should recognise the importance of the SSSI and not propose any potentially harmful actions.</td>
<td>The proposed upland attenuation component in RHICS recognises the potential for improved water management in the upper catchment.</td>
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<tr>
<td>River Hull Headwaters Restoration Project</td>
<td>Joint project between the EA and Natural England to improve unfavourable conditions in the SSSI. Being taken forward as the River Hull Wetlands project with Yorkshire Wildlife Trust and East Yorkshire Rivers Trust.</td>
<td>Need for RHICS to recognise habitat and species issues and avoid potential negative impacts.</td>
<td>Some potential impacts already recognised, such as dredging for channel restoration. Upland attenuation offers potential positive benefits.</td>
</tr>
<tr>
<td>Pulfin Bog SSSI Water Level Management Plan (1999)</td>
<td>Its purpose is to ensure that operational works on the river are compatible with</td>
<td>RHICs should recognise the importance of the SSSI and not propose any potentially harmful</td>
<td>An off-line storage lagoon was proposed immediately to the east of the site, but the</td>
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Table 3.1 Relevant Plans and Strategies

3.3 Planning and Flood Risk Management

The evolution of the RHICS has given weight to the need to re-examine the original SEA; albeit its consequences are acknowledged to remain the same, namely to evaluate the potential environmental consequences of ‘high level’ strategic decision making in approaches to flood management in the study area.

Part of the justification, in addition to updating essential baseline data that may have changed in the intervening 4 year period, is to assess the implications of any key legislative changes in the delivery and management of flood issues. During the four year period planning has undergone some fundamental and far reaching changes that effect the delivery of planning policy and on the individual decision making process. It is appropriate therefore that the Addendum report should consider these changes and the revised priorities it applies to the planning system. In addition to the introduction of the National Planning Policy Framework there has been progression towards a new development plan for much of the study area.

Since 2012 the government’s intentions for the planning system have been articulated through the National Planning Policy Framework (NPPF) that replaced a raft of planning policy documents including most Planning Policy Guidance Notes (PPGs) and Planning Policy Statements (PPSs). The replaced documents include two of direct relevance to the issue of flooding in the context of development and the planning system; the former PPS 25 ‘Development and Flood Risk (March 2010)’ and its accompanying guidance in the form of ‘PPS 25 Supplement ‘Development and Coastal
Change (March 2010). However, this was not to be seen as an abandonment of the underlying guidance on the need to assess the implications of flood risk and development as unlike many of the PPG’s and PPS’s the issue was afforded similar weight in the emerging NPPF and was one of two topics, along with minerals policy, that was addressed in specific ‘Technical Guidance to the NPPF’.

The NPPF and its Technical Guidance retained the key elements of PPS 25 that were considered necessary and helpful in relation to these policy areas. It is important to note the reference to ‘policy areas’ in that flooding is not a development specific issue that should be used simply to determine individual planning applications but should inform wider planning policy in its decision making with regard to the key strategic development policy decisions.

The NPPF Technical Guidance in Paragraph 2 advises that:

‘Inappropriate development in areas at risk of flooding should be avoided by directing development away from areas at highest risk, but where development is necessary, making it safe without increasing flood risk elsewhere. For these purposes:

- “Areas at risk of flooding means land within Flood Zones 2 and 3; or land within flood zone 1 that has critical drainage problems”;
- “Flood risk” means risk from all sources of flooding – including from rivers and the sea, directly from rainfall on the ground, surface and rising groundwater, overwhelmed sewers and drainage systems, and from reservoirs, canal and lakes and other artificial sources’.

The NPPF makes clear the linkages between the natural and built environments and that the planning system must mitigate between the two elements to create ‘sustainable development’.

Paragraph 14 advises that, “...at the heart of the National Planning Policy framework is a ‘presumption in favour of sustainable development’ which should be seen as a golden thread running through both plan-making and decision taking”.

In the context of considering the implications of flood risk and flood management it is helpful to consider what definitions government place upon the terms ‘sustainable’ and ‘development’. The NPPF uses the following definitions:

- **Sustainable** means ensuring that better lives for ourselves don’t mean worse lives for future generations;
- **Development** means growth, and accommodating change to house a growing population, which is living longer and wants to make new choices. It acknowledges we must respond to change so that our lives and the places in which we live can be better.

Sustainable development is about change for the better and ‘positive growth’ making positive economic, environmental and social progress. The planning system must make this happen. To engineer this progress, mitigation and adaption to climate change is one of the key expectations that the planning system must deliver; an integral part of this is the relationship of flood risk
management and co-ordination of land use planning with science and engineering to achieve solutions or options through understanding the risks. The delivery of the RHICS aligns with this impetus for sustainable development.

3.4 Planning Policy Context

The introduction of the NPPF was hailed by government as a new approach to planning that fulfilled an economic, social and environmental role in an era of changing demands on the planning system. The NPPF seeks to protect and enhance the natural, built and historic environment that is facing new demands associated with climate change together with the need to move to a low carbon economy.

The NPPF does however, make clear that the development plan retains primacy in the decision making process. In Paragraph 11 it advises that “planning law requires that applications for planning permission must be determined in accordance with the development plan unless material considerations indicate otherwise”.

Paragraph 15 of the NPPF gives advice to local authorities that “policies in local plans should follow the presumption in favour of sustainable development”. The issue of flood risk is however, accepted as a ‘material consideration’ in the context of both plan making, in reaching strategic decisions on the location and form of future development, the status of settlements in an authority’s development hierarchy and on individual development proposals.

Planning policy for the RHICS study area is set out in a hierarchy of documents. The NPPF through setting out the government’s approach to planning, is not part of the development plan, but must be considered as a ‘material consideration’ in decision making.

In terms of the study area the statutory development plan consists of a series of old style development plans that include:

- Beverley Borough Local Plan (adopted June 1996)
- Boothferry Borough Local Plan (adopted April 1999)
- East Yorkshire Borough Local Plan (adopted June 1997)
- Holderness District Wide Local Plan (adopted April 1999)
- Joint Waste Local Plan (adopted November 2004)
- Joint Minerals Local Plan (adopted January 2004)
- Hull City Local Plan (adopted May 2000).

To highlight the current transitional nature of the planning system and policy, these plans are being replaced by ‘new style’ local plans with the four East Riding Local Plans due to be replaced by the ‘emerging’ East Riding Local Plan which is currently at the ‘Proposed Submission Strategy Document’ stage.
There is a consistency within the development plan articulated through policies that acknowledge one of the key underlying objectives of the RHICS, and evaluated as part of the original SEA, with regard to ‘Flood protection’ and the objective to:

- ‘Maintain an appropriate level of flood protection for people and their property, in partnership with any opportunities identified within other strategies and plans’

The sub objectives are to:

- ‘To protect people and their property from the adverse effects (physical and psychological) of flooding’

A key role that planning plays, through the development plan and development management, is in the location of development. The allocation of land in areas at least risk of flooding together with making proactive decisions on development proposals falls to the planning system. The outcome of the planning process should, in the context of flood risk, be to ‘limit the number of people affected and/or property protected (including the extent and duration of flooding)’.

In an attempt to establish the linkage between the objectives of the planning system and the RHICS we have considered relevant planning policies and NPPF guidance; in particular regard to flood risk. Relevant policies will be informed by a range of studies, including the RHICS in the future, in addition to Strategic Flood Risk Assessments (SFRA’s) prepared by local planning authorities.

Section 10 of the NPPF ‘Meeting the challenge of climate change, flooding and coastal change’ requires development plans to take account of flood risk, coastal change and changes to the landscape. Consequently the recommendations of the RHICS, together with the assessment within this Addendum report, may be considered fundamental to the delivery of local development plan objectives.

Paragraph 100 of the NPPF advises that:

“Inappropriate development in areas at risk of flooding should be avoided by directing them away from areas at highest risk, but where development is necessary, making it safe without increasing risk elsewhere. Local Plans should be supported by SFRA’s and develop policies to manage flood risk from all sources taking account of advice from the EA and other flood risk management bodies such as lead local flood authorities and internal drainage boards”.

The NPPF also advises that:

“Local plans should apply a sequential risk based approach to the location of development to avoid where possible flood risk to people property and to manage residual risk, taking account of climate change, by:

- applying the sequential test;
- if, necessary, applying the exceptions test;
- safeguarding land from development that is required for current and future flood management;
• using opportunities offered by new development to reduce the causes and impacts of flooding; and

• where climate change is expected to increase flood risk so that some existing development may not be sustainable in the long-term, seeking opportunities to facilitate the relocation of development to more sustainable locations.”

In terms of strategic responsibility, the NPPF is the most pertinent planning guidance on flood risk and should be used to inform the drafting of policies in new development plans and to mitigate and interpret the risk of flood within different administrative areas in a consistent and transparent way.

As the older development plans are gradually replaced, government expects more consistency to emerge. The extent of flood risk policies will, naturally, be dependent upon a range of factors including the topography of an administrative area, the nature of the local water environment and ground conditions. In the case of the study area both ERYC and Hull City Council acknowledge the vulnerability of areas to flooding and have been proactive in responding to this risk; the RHICS is just one example of this.

As unitary authorities both ERYC and Hull City Council have produced, or are producing, similar plans which relate to their function as Lead Local Flood Authorities, and importantly, in the role of development control ‘Local Planning Authorities’. In addition to Local Flood Risk Management Strategies both authorities have, or are in the process of producing, the following:

- Strategic flood risk assessments (SFRA’s) as a planning tool;
- Preliminary flood risk assessments; and
- Local Plans

The study area is positioned across more than one local authority area of administration; the primary ones, for the purpose of this SEA Addendum, being ERYC and Hull City Council. The planning context is further complicated by the fact that within the East Riding, for historic reasons, there are a number of different local plans; each of which is subject to saved policies directives and with differing flood related development control policies. Three ERYC local plans have implications for the RHICS study area; in addition to the Hull City Plan. These are:

- Beverley Borough Local Plan: policies D19, D20 and D21;
- Holderness Borough local Plan: policies U12 and U13;
- East Yorkshire Borough Wide Local Plan: policy EN17; and
- The Hull City Plan: policies ME10 and 11.

Whilst the policies in these plans provide the background to development management for each authority, it is considered appropriate to note that policy, particularly with regard to flooding, has advanced considerably in the years since their adoption; in the case of the ERYC over 17 years and for Hull City Council over 20 years.
The new emerging East Riding Local Plan (ERLP) has a much more inclusive approach to flood risk and will eventually, along with the policies of Hull City Council’s new Local Plan (which is at the preferred options stage), will be supported by flood risk management strategies such as the RHICS.

The ERLP considers flood risk in the ‘managing environmental hazards’ section. This advises, at Paragraph 8.76, that “as Lead Local Flood Authority the council is responsible for managing local sources of flooding, namely surface water, ground water and ordinary watercourses (smaller streams not classified as main rivers, and which drain large parts of the East Riding). Legislation requires the council to produce ‘flood risk management plans’ and to establish priorities and measures for managing flood risk”. The RHICS is one such example.

The emerging ERLP also proposes a comprehensive policy to address environmental hazards; draft policy ENV6 ‘Managing Environmental Hazards’. This policy proposes an inclusive approach to development that is identified as being within areas of flood risk. The natural River Hull valley, which includes large areas of the East Riding and Kingston upon Hull, is stated to be one of the “most at risk”, developed flood plains in England with a population (based on 2011) figures of over 350,000 people.

Policy ENV6 aims to manage flood risk “to ensure that development does not result in unacceptable consequences to its users, the wider community and the environment”. In the context of this emerging policy, flood risk will be managed by applying the sequential test to steer development to areas of lowest risk. Where this is not possible a sequential approach will be applied to development and design risk.

The policy also advises that flood risk will be managed by ensuring new development is design compliant with the objectives of water environment management at any particular site; taking into account the opportunities and constraints of the site and its location.

Importantly, in the context of the RHICS, the plan advocates “supporting proposals for sustainable flood risk management, including the creation of new and/or improved flood defences, water storage areas, and other schemes, provided they would not cause unacceptable adverse environmental, social or economic impacts’ and ‘supporting the removal of existing culverting and returning these sections to open watercourses”.

The consideration of flood risk within the emerging Hull Local Plan is described in section 3.5 below.

Planning and the Natural Environment

The above policy evaluation, in context of the RHICS, has primarily considered the impacts on the built environment within the area; both from a perspective of new development and alleviating ‘risk’ to existing development either individually or in terms of settlements. Within this assessment are implications for the natural environment, as an integral part of land use and development in the study area and beyond. The evaluation intentionally explores ‘opportunities and constraints’ to development.
Current planning law requires that development should only be permitted ‘in accordance with the development plan unless material considerations indicate otherwise’. This advice is reiterated in the NPPF hence protection of the natural environment is well established in both planning and national legislation.

Issues central to the theme of the ‘natural environment’ are evaluated within the relevant environmental topic sections of this Addendum report together with the RHICS. The various strands of environmental topics e.g. biodiversity are, where appropriate, afforded protection within development plan policy. They are also afforded protection through other legislation that support the role of planning and this planning assessment has therefore sought to draw attention to the key elements of the built environment.

Although we consider the role of planning, in the context of existing policy, to focus upon the built environment we do not consider that the issues of the built and natural environment can be naturally split. This is apparent through an examination of emerging policy context described earlier in this section. Policy references also reflect the current transitional nature of the development plan within the study area. The current development plans and saved policies are considered to be ‘out of date’, relying upon policy from the ‘old style development plans’ rather than the new style Local Plans currently being prepared for adoption by both Hull City Council and the ERYC.

In the case of ERYC the original local plans for the Holderness, Beverley and Boothferry areas, and for Hull the saved policies of the Hull Local Plan 2000 are relied upon for this planning assessment. We are aware that in both cases newer Local Plans are emerging but until formal adoption they do not constitute definitive ‘development plan policy’ and can only be afforded limited weight as a ‘material consideration’ in policy and decision-making; and by extension the policy context of the RHICS.

On balance, it is worth noting that the emerging documents offer an insight to the likely direction of travel for policy within the study area and, in particular, the link between the built and natural environments.

We reiterate that although the emerging policies cannot be afforded statutory weight, they have been reviewed as part of the SEA Addendum in the context of ‘background’ documents and to explore the potential policy direction for both the ‘built and natural’ environment.

In terms of the emerging Hull Local Plan, Chapter 10 of the ‘Issues and Options Paper’ provides an indication of the future approach to ‘Open Space and the Natural Environment’. Under the heading ‘Hull in 2014’, and the overall strategy, the scene is set for the city namely, ‘City has an extensive green network, based around the rivers, drains and disused railway lines and that joins the majority of the open spaces to the wider countryside, providing routes for wildlife, cyclists and walkers’.

The emerging Local Plan Vision to 2030 notes that by this date Hull will, ‘Have addressed climate change through wide ranging mitigation and adaptation measures’.

The Local Plan proposes a range of strategic priorities to be met by 2030 including two which are to mitigate flood risk and address climate change, it further advises that,
'Hull has addressed climate change through wide ranging mitigation and adaptation measures. Flood Risk has been minimised through the provision of sustainable urban drainage schemes and enhanced flood defences.'

The ‘Issues and Options Paper’ provides more information as to how planning and the natural environment and will be used to ‘frame’ emerging policies in the Local Plan. It acknowledges that, ‘open spaces provide relief from the built form, and are a venue for the exploration of nature and are important for the adaptation and mitigation of climate change’.

The proposed approach to green infrastructure in Hull also notes NPPF guidance; in particular the description of the benefits from green infrastructure. This is seen to be a, ‘Network of multifunctional green space that is capable of delivering a wide range of environmental and quality of life benefits for local communities. There is a growing realization that it is necessary in order to ensure communities are sustainable’.

A number of potential benefits are also described including, enhanced biodiversity, helping to adapt to and mitigate against climate change. Specifically, ‘Open space offers the greatest potential benefits when it is designed and managed to be multifunctional. For example, this could mean designing open space so that it offers opportunities for play, as well as storage of surplus floodwater and provide a habitat for wildlife’.

Given the probability that the above, or similar, policy content will be incorporated into the completed Local Plan there is a clear suggestion that the green space strategy of HCC will align with the key objectives of the RHICS. The proposed RHICS includes the use of green infrastructure as mitigation for the impacts of climate change in a manner that compliments the intended objectives of HCC to mitigate flood risk, control land use, and enhancement of the natural environment.

Turning to the emerging East Riding Local Plan, this has now progressed to Inquiry stage and the Inspector’s report is awaited. In this context the natural environment policies of the Local Plan may be afforded greater weight are still not regarded as definitive policy. The status of the ERLP is discussed earlier in this section. Guidance is drawn across a number of proposed policies, but cannot as yet be interpreted directly as support for the RHICS.

At Chapter 8 of the ERLP Submission Strategy, ‘A High Quality Environment’, the prospective direction for the Local Plan in respect of the environment and flood risk policy can be deduced. The links can be diverse, as in the case of Policy ENV 1 ‘Integrating High Quality Design’ which recognises that good design will, ‘13. Incorporate where possible, nature conservation and biodiversity enhancement into the development’ and ‘12. ‘Ensure infrastructure, including green infrastructure and flood mitigation are well integrated into the development’. At Policy ENV3 ‘Valuing our heritage’ there is no differentiation between ‘natural and built environments’ grouping them as ‘heritage assets’. Policy ENV4, ‘Conserving and enhancing biodiversity and geodiversity’ affords protection to assets whilst promoting enhancement of green infrastructure.

Proposed Policy ENV5, ‘Strengthening green infrastructure’, of the Submission Strategy also offers a clear link between the objectives of the RHICS in that it encourages ‘the incorporation of existing and new green infrastructure features within development’ and within the supporting text makes the link to ‘Sustainable drainage systems’.
By inclusion within this section of the Local Plan, namely environmental policy, ERYC makes the linkage between the provision of a high quality environment and flood mitigation. Proposed Policy ENV6 ‘Management of Environmental Hazards’ also references flood risk and the ‘proactive management of flooding’, a specific purpose of the RHICS, with Part D (2) stating that, ‘Supporting proposals for sustainable flood risk management, including the creation of new and/or improved water storage areas and other schemes providing they would not cause unacceptable adverse environmental, social or economic impacts’.

That these environmental policies from emerging plans cannot be afforded full weight in the assessment of the RHICS does not necessarily undermine their consideration. Collectively, the policy references from both emerging Local Plans are indicative that the RHICS will, in principle, be in conformity with policy direction and intent.

While Policy ENV6 makes a clear link between sustainable flood risk management and environmental impact, it does not differentiate between environmental damage to either built or natural environment. We contend that throughout this assessment of planning issues and challenges the two elements have been afforded equal weight.

We do note that the link between flooding and environmental impacts, in the context of the natural/built environment, is treated differently in the emerging Local Plans; in comparison to previous local plans. This is in part, we believe, due to the increased weight now attached to issues of climate change and flooding. Over the timeline of plan preparation through the planning system, which can be 20 years or more, these issues have now attracted greater concern.

3.5 External Plans and Programmes

A number of policies and plans prepared by statutory bodies are considered relevant to this Addendum report; these are described and discussed below.

Local Authority plans

Both ERYC and Hull City Council have produced, or are producing, similar plans which relate to their functions as Lead Local Flood Authorities and Local Planning Authorities. These are described at sub-section 3.4 above.

Local Economic Partnership Plans

The catchment area is covered by two Local Economic Partnerships (LEPs) – one for the Humber and one for North Yorkshire, York and the East Riding (NYYER). Both have produced Strategic Economic Plans (SEPs) that refer to flood risk. The Humber LEP has identified flood risk management as a strategic enabler and a sector of strategic importance. It seeks to stimulate economic development through further investment in flood and coastal risk management and contains objectives which make direct reference to supporting RHICS and the provision of defences to deal with surface and river flooding risk within the River Hull catchment. Significantly, through its Investment & Delivery Plan it has agreed to make a contribution of £12m towards the projects identified in the strategy.

In the NYYER LEP’s strategic plan recognises that parts of the East Riding in particular are at significant flood risk. Flood mitigation is needed to enable development opportunities, and ‘Action
19’ seeks to target flood prevention measures. In terms of opportunities, bio-renewables and low carbon energy are two of its sectors it is seeking to enhance. In particular, opportunities arise at the farm level to support the under-resourced bio-renewables supply chain and to provide on-farm low carbon micro generation.

Some of the EU’s funding is channelled through Local Economic Partnerships. The York, North Yorkshire and East Riding LEP has identified the strategic value of bio-renewables, particularly to support low carbon power station supply chains and farm based micro generation. Planting of renewable crops is recognised as a good means of reducing runoff whilst generating farm income. It is recommended partners work with bodies such as the East Riding’s rural partnership and economic development teams, Natural England, Yorkshire Wildlife Trust and the Farming & Wildlife Advisory Group to explore and maximise the potential for developing a scheme for the catchment.

**Other flooding-related studies**

Following the June 2007 flood event, a number of studies have been identified and promoted by the various flood risk agencies. It was recognised that there needed to be a multi-agency approach as the risks being addressed can in some cases, cross over a number of areas of responsibility.

The Environment Agency has completed a £10 million refurbishment of the River Hull Tidal Surge Barrier and is promoting a scheme to investigate options for pumping flows from the Holderness Drain at times when it becomes tide-locked by the River Humber. The scheme included options for flood plain storage and replacing/upgrading pumping equipment at East Hull PS, but recognising it is integral to the scope of the RHICS study, the EA scheme is currently on hold pending the outcome and recommendations of the RHICS study.

Suburban parts of the East Riding to the west and north of Hull and including parts of the City are identified as having significant surface water flooding risks. These areas are currently being investigated by ERYC working closely with Hull City Council, Yorkshire Water and the Environment Agency. Flood Alleviation Schemes (FAS) are being developed in the Willerby and Derringham areas (WaDFAS), Cottingham and Orchard Park (COPFAS), Anlaby and East Elia (AaEFAS). These schemes consist of a series of storage lagoons in the sub catchment which attenuate surface water and release it slowly over time so not to cause surface water flooding in large residential areas.

Funding has been identified for the construction of some of this work already and the hydraulic modelling has been included with the RHICS study work.

**Yorkshire Water plans**

Following the 2007 floods, Yorkshire Water invested approximately £40 million at the West Hull, East Hull and Bransholme Pumping Stations to increase their resilience under similar extreme weather events. The company is currently investing a further £16m at Bransholme PS to increase its capacity as the Kingswood and Bransholme catchment develops.

It has also commissioned a study by Arup to investigate future requirements for the wider urban drainage system serving the Hull and Haltemprice sub-catchment. This indicated that to increase protection to a 1 in 75 year standard a future long term investment of £360m by partners would be required. This strategy recognises that significant additional work will be required by partners.
working with YW to develop options in more detail during the company’s next 5 year (Asset Management Programme 6 (AMP6)) investment period, with a view including potential projects in its AMP7 and other partners’ programmes from 2020.

In line with Local Flood Risk Management Strategy it is recommended there is a strong case for the RHICS board to work with Ofwat to build a case that price determination should be based on a technical assessment of the need for investment to be prioritised over customers’ perceived willingness to pay.

Planning and development

The majority of the study area falls within East Riding of Yorkshire Council, with Hull City Council covering the urban area of Hull. A very small area to the north west of the study area falls within the administrative boundary of Ryedale District Council and North Yorkshire County Council.

The national spatial planning system has changed significantly since the publication of the River Hull Flood Risk Management Strategy in 2010. The Localism Act of 2011 replaces the requirement for Local Planning Authorities (LPAs) to produce Local Development Frameworks with the requirement to again produce Local Plans. Regional Spatial Strategies are now revoked. However until LPAs produce their Local Plans, predecessor plans and some of their policies are saved, and form the basis for decision making on planning applications. This includes the Joint Structure Plan, the East Riding’s four Local Plans (based on the former Borough Council areas), and Hull’s CityPlan Local Plan.

The National Planning Policy Framework (NPPF), see below, indicates that appropriate weight can be given to emerging plans or work already in preparation (such as studies and draft policies prepared for the Local Development Frameworks), as long as certain conditions are met.

Previous Planning Policy Statements were replaced with a single streamlined National Planning Policy Framework in 2012; this has been augmented by topic or theme based Planning Practice Guidance.

The Localism Act also places a duty on LPAs to co-operate, and the emerging Local Plans for the East Riding and Kingston-Upon-Hull reflect this. The Councils have agreed a Joint Planning Statement (2014), which sets out their joint priorities for spatial planning. Both Local authorities are committed to the regeneration and transformation of Hull; realising the potential of the Humber Ports alongside the growth of the renewable and low carbon energy sector; and protecting the integrity of the internationally important environmental and biodiversity designations around the Humber Estuary. The 2005 Joint Structure Plan is a saved plan, and the authorities are producing joint Waste and Minerals Local Plans.

The East Riding’s Local Plan Submission Strategy Document (April 2014) deals with flood risk through policies on climate change and the environment. This includes measures to:

- Conserve, enhance and link green infrastructure networks to provide flood management, shading for urban areas and natural air conditioning
- Promote development away from areas of high flood risk, as far as possible
- Limit run-off rates
• Ensure development does not increase flood risk on the development site or elsewhere
• Ensure developments incorporate SUDs where possible
• Limit culverting
• Ensure development is safe from residual risks such as ensuring resilient and resistant design and ensuring that there is access to a safe place during times of flood, and
• Support sustainable flood management proposals.

Hull’s Local Plan Issues & options consultation document (June 2014) specifically addresses Flood Risk in a separate chapter. There are links to it in the Climate Change, Open Space and Natural Environment chapters. Pertinently this document asks the following questions:

• Should the Local Plan include a policy about sustainable drainage solutions?
• Should the proposals map identify important flood defences?
• Should there be policies to protect and enhance these defences?
• Do you agree with the Council using its own locally agreed approach to flood zones when applying the sequential test?
• Do you agree that the development of the functional flood plain should be restricted when considering potential land uses?
• Do you agree that the locally determined Standing Advice should be used when requiring information and determining planning applications?
• Are there any other ways that the Local Plan can mitigate flood risk?

Both ERYC and Hull City Council have also produced Strategic Flood Risk Assessments (SFRAs) in accordance with the previous Planning Policy Statement 25 on Flood Risk; the two authorities liaised to ensure compatibility of the results. The SFRAs define different zones of flood risk. The policy response in both draft Local Plans is to steer development towards areas with the least risk of flooding. As an adjunct to its SFRA, Hull City Council also produced a Surface Water Management Plan (SWMP) with key partners in 2009.

The purpose of the SWMP is to:

1. To provide a properly conceived prioritised long-term strategy for the City of Hull’s surface water management
2. To provide a strategic overview of surface water flood risk across Hull City with detailed assessment of surface water risk at high risk locations, including identification and assessment of options and selection of preferred options for implementation
3. To consider the use of Aqua Greens (dual use public recreation and potential surface water temporary storage areas) alongside other surface water drainage options
4. To consider other plans and initiatives in the City of Hull in order to produce a shortlist of surface water drainage options that are effective, achievable and cost beneficial to the management of surface water flooding in the city.

5. To provide on the ground improvements to surface water flood risk reduction as soon as possible.

The SWMP lead to the development of the concept of Aqua Greens (dual purpose greenspace and temporary flood storage areas). These are being taken forward as flood alleviation schemes in the Hull and Haltemprice catchment area, on which the East Riding is taking the lead on behalf of partners. The first scheme in the Raywell valley was completed in 2010. The Willerby and Derringham scheme will shortly commence construction, with others proposed at Cottingham and Orchard Park, and Anlaby and East Ella.

Both Authorities’ Local Transport Plans also recognise the impact of climate change on the integrity of highway assets.

3.6 Achieving SEA Objectives

To gain further insight into the role of planning within the context flood risk strategy it is worth considering the content of the recent SEA Scoping Report produced by ERYC for the Local Flood Risk Management Strategy (LFRMS) and associated FRMP. The plans and programmes referred to above are relevant to the study area; environmental, economic and social baseline information gathering for the SEA and in defining the scope and extent of its objectives and potential monitoring indicators.

The purpose of the SEA directive is to:

“Provide for a high level of protection of the environment and to contribute to the integration of environmental considerations into the preparation and adoption of plans and programmes with a view to promoting sustainable development, by ensuring that, in accordance with the directive an environmental assessment is carried out of certain plans .... Which are likely to have a significant effect on the environment”.

The implications for land use in the study area, together with the planning process which guides the governance of land use and development, is highlighted in Table 4.1 of the Scoping Report – “Identification of environmental issues and problems’. It lists the following which are seen as the key problems in the context of flooding and its impacts and the delivery of the ‘planning function’ in the study area:

- Issue 1 – population growth and associated pressures for housing, infrastructure and services;
- Issue 2 – vulnerable population in some locations; and
- Issue 15 – threat to the local economy from flooding”.

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The role of planning is highlighted when compared to the objectives of SEA; these are identified using Table 5.1 of the Scoping Report and which sets out the – ‘Proposed SEA Objectives against the issues in Table 4.1’. They are as follows:

- ‘To minimise risk and manage consequences of flooding to people and commercial/economic assets’ – this relates specifically to issues 1, 2, 3, 13 and 15 of the Scoping Report.

Planning has a direct role in achieving these objectives through the locational control and type of development (subject to any need for planning permission) that may be built within the study area, in addition to areas affected by flood risk and management of the water environment within the study area.

Also at Table 5.1 indicators are suggested against which the impacts of flood risk management strategies can be evaluated; these predominantly relate to the built environment but can equally be applied to evaluating the effectiveness of planning policy and development management as follows:

- Number of properties at risk, (taking into account the effect of climate change) both residential and commercial;
- Number of new properties at risk against EA or SAB advice (taking account of climate change effects);
- Economic cost of flood damage; and
- The number of properties that benefit from flood risk management schemes.

For the purpose of this section of the Addendum report, the focus has been placed primarily upon the built environment; in order to reflect the issues noted above in the ERYC Local FRMS Scoping Report and the wider context of the NPPF highlighted in sub-section 3.4 above. It is important to note however, that the planning process is far more inclusive and has a role to play in both the built and natural environment. As such decisions made through the planning process can impact upon a wide range of environmental issues including, population and human health, biodiversity, geology and soils, climate change, cultural heritage and landscape. These are all within the generic description of ‘other material considerations’ and hence fall within the legitimate remit of planning.
Consultation

4.1 Introduction

Production of the 2010 SEA was supported by extensive consultation over a number of years. This included statutory and non-statutory organisations together with internal specialists all with the aim of identifying the key issues, receiving feedback through the SEA process, and informing the public of both the flood risk strategy and ongoing assessment. The extent of consultation and step by step process undertaken is described in detail within the 2010 SEA.

In drawing together the RHICS, and the subsequent SEA Addendum, a parallel series of actions has taken place; with future stakeholder consultation also planned.

4.2 Consultation Background

In taking forward and developing the previous FRMS a Multi-Agency Strategic Approach was adopted through the establishment of the River Hull Advisory Board (RHAB). The RHAB is a multi-agency stakeholder group with representatives of: Members of Parliament, EA, Internal Drainage Boards, Local Authorities and their boards, Yorkshire Water, Natural England, National Farmers' Union, local community/land owners/ business, and the Regional Flood and Coastal Committee. In February 2013, representatives of the RHAB attended a meeting with Richard Benyon MP, Minister for the Natural Environment, to highlight their issues and concerns and seek support for a review of the 2010 FRMS. The scope of the RHAB is to provide a holistic, multi-agency approach for the management of flood risk and future investment in the River Hull strategy area. These actions initiated both a review of the FRMS and subsequent commissioning of the RHICS; the rationale for the new study is detailed within the RHICS.

Integral to the RHICS is a clearly defined and sustainable multi-agency strategy for the management of flood risk in the natural River Hull valley with identified support for the ensuing strategy. To administer production of this new strategy the RHAB, in turn, established a Project Board with representatives from key statutory bodies and consultees. The Project Board hence consists of: EA, ERYC, Hull City Council, Beverley & North Holderness Internal Drainage Board, and Yorkshire Water. Consultation with all relevant stakeholders forms a key remit of the Project Board.

Progress of the RHICS, with reporting and decision making functions, is discussed at monthly meetings hence regular internal consultation takes place. To address the issue of SEA specific meetings have taken place with the EA, initiated by the Project Board, commencing with early discussions to outline the brief in April 2014. Development of the SEA brief, in tandem with initial option appraisal and internal consultation workshops, resulted in notification to Natural England in July 2014 of the intended SEA.

4.3 Consultation

Constituent consultee members of the Project Board have subsequently received monthly updates of the SEA process. In addition Natural England is represented on the Project Advisory Board and hence receives update dialogue.
The SEA project team have undertaken extensive data collection in order to update the baseline environmental data and as part of the process have engaged in informal discussions with consultees including English Heritage, ERYC and Natural England.

A draft version of the SEA Addendum was circulated amongst the Project Board members for review and comment as part of the ongoing consultation.

4.4 Future Consultation

The draft RHICS will also be subject to wide ranging stakeholder consultation starting in April 2015. This consultation will include a range of stakeholders such as local community groups, Ward Members, statutory and non-statutory consultees together with the general public. Feedback from this consultation will be incorporated within a final version of the RHICS.

To guide the wide ranging stakeholder consultation we have prepared some sample questions:

- Are there any other key issues or trends that you believe should be considered in the SEA?
- Do you believe a balance of flood protection has been achieved between people, property and the natural environment in the RHICS and this accompanying SEA Addendum report?
- Is there further mitigation of affects or enhancement opportunities that should be incorporated into the RHICS and SEA Addendum?
- Are there any key environmental indicators e.g. number of designated cultural heritage assets protected from flooding, that should be incorporated into the next review (in 5 years) of the RHICS and the SEA Addendum?
- How would you like to be informed of future updates to the RHICS and SEA Addendum, for example via a dedicated website?
- Please tell us if you have any overall views or comments on this SEA Addendum and the RHICS that have not been covered by the above questions.

How to respond

The consultation of this draft SEA Addendum report, together with the draft RHICS, is open for a period of 6 weeks commencing 2 April 2015 and closing on 14 May 2015. Please send your comments either by email or post to:

**Email:** RHICS@eastriding.gov.uk

**Post:** River Hull Integrated Catchment Strategy, Freepost RTJZ-RUSG-UJZJ, Despatch Office (FRS), East Riding of Yorkshire Council, County Hall, Cross Street, Beverley, HU17 9BA.

**Next Steps**

Following this consultation period all comments received will be reviewed and a Statement of Environmental Particulars prepared to inform the final version of the SEA Addendum. The completed RHICS, supported by the SEA Addendum, will then be submitted to the EA National Review Group and Defra to ensure compliance with over-riding national policy.
When the final strategy has been adopted a Post Adoption Statement can then be compiled to inform consultees and the general public of where the RHICS can be viewed along with the SEA Addendum and Statement of Environmental Particulars.

Looking forward, the implementation of any option arising from the RHICS would require a period of detailed design and likely application for planning permission. In order to support a planning application a project specific Environmental Impact Assessment is likely to be required integral to which is consultation and engagement process that includes all stakeholders. Screening of options has commenced to determine if any are likely to require a Habitats Regulations Assessment.
The Current State of the Environment

5.1 Population

Figure 5.1: Key Settlements

The main centre of population is the urban area of Kingston-Upon-Hull where approximately 256,000 people live in the city, resident in some 112,500 households (Office for National Statistics 2011 census). The urban area is a major focus for jobs, commercial interests, services and facilities, and has diversified into smaller industries to replace the loss of the fishing industry. High profile industrial and residential areas are also being developed to attract people to the city. However the majority of the city lies within the indicative floodplain.

The population of East Riding of Yorkshire totals some 334,000 people (2011 census) distributed in the main settlements (those within the study area) of Beverley (population 30,500), the
‘Haltemprice’ settlements to the west of the city including, Anlaby, Willerby and Kirk Ella (combined population of 23,000), Cottingham (population 17,500) and Hessle (population 15,000). The town of Driffield (population 13,000), is situated within the north of the study area. Approximately half the population of East Riding lives in rural communities of fewer than 5,000 people.

Flooding, and the fear of flooding, has been demonstrated to cause adverse health impacts; particularly psychological issues. The impacts of flooding can also extend to post-flood difficulties such as problems with insurers and the practicalities of re-building. Flood warning therefore benefit to population and human health issues associated with flood risk management and fear of flooding. The Environment Agency operates a tidal flood forecasting system that covers part of the east coast and the Humber Estuary up to Blacktoft. This system improves the accuracy of Flood Warning Systems; although for the tidally influenced section of the River Hull the warning is triggered as a result of the failure to the existing Hull Tidal Barrier.

5.2 Flora, Fauna and Biodiversity

Figure 5.2 Key Ecological Sites
Designated Sites adjacent to the Study Area

The study area is bordered to the south by the Humber Estuary which holds international and national designations for its nature conservation importance: Site of Special Scientific Interest (SSSI); Special Area of Conservation (SAC); Special Protection Area (SPA); and Ramsar site.

Additionally Hornsea Mere SSSI and SPA is immediately to the east of the River Hull catchment.

Humber Estuary SSSI, SAC, SPA and Ramsar site is the subject of an accompanying Habitats Regulation Assessment.

Hornsea Mere SSSI, SPA is located outside the River Hull catchment and consequently no impacts due to changes in overland flow are predicted. However, the site is in the same groundwater body as defined by Environment Agency in River Hull River Basin Management Plan.

Reference to the Hornsea Mere SSSI and SPA citations and Site Improvement Plan (produced as a part of Improvement Programme for England’s Natura 2000 Sites (IPENS)) indicates that the Mere has a catchment of some 1755ha and water levels are controlled by a sluice gate. No mention of the influence of groundwater levels is made.

Flood storage elements of RHICS will be lined to prevent contamination of groundwater, and changes in flow rates in River Hull and Holderness Drain catchments as a result of works associated with RHICS are not predicted to impact significantly on groundwater levels.

As no change in overland flow in Hornsea Mere catchment is predicted, and no significant changes in levels of groundwater body are predicted, then no significant impacts are predicted for Hornsea Mere as a result of RHICS and the site is not considered further.

Designated Sites adjacent within the Study Area

There are no National Nature Reserves within the study area.

There are 15 SSSIs within the study area (see Figure 5.2 above). Of these, six are reliant on hydrological balance and are therefore have the ability to be impacted upon by operations undertaken as part of the RHICS. The identified SSSI are:

- Bryan Mills Field – this site comprises a tall herb fen community of nature conservation importance which has developed over a complex of spring heads. Bryan Mills Beck drains the site and joins the tidal River Hull some 1.3km away.

- Lambwath Meadows – a suite of low-lying seasonally flooded meadows supporting unimproved, species-rich neutral grassland. The site is drained by Lambwath Stream which ultimately discharges into Holderness Drain.

- Leven Canal – the canal was cut in the early 19th Century across the marshes and meres of the Hull Valley and has since become an importance refuge for wetland plants representing a remnant of wetland vegetation once widespread in the valley. The canal is fed by calcareous springs supplying water of very high quality.
- Pulfin Bog – occupying some 16.8ha this is one of the last remnants of a fenland reed swamp community in the Hull Valley. It is valued both for its botanical interest, and for the reedbed habitat it provides for breeding birds.

- River Hull Headwaters - nationally important as the most northerly chalk stream system in Britain. The site includes adjacent ecologically important habitats including riverside grassland, woodland and fen.

- Tophill Low - The site consists of two artificial storage reservoirs situated in the River Hull valley some ten kilometres south west of Driffield. The site is important as one of few inland standing open water bodies suitable for wintering wildfowl in North Humberside.

Each SSSI is divided into management units, and the condition of each unit is assessed regularly leading to an assessment of the percentage of each site in favourable condition.

The following table indicates the latest assessment for relevant SSSI.

<table>
<thead>
<tr>
<th>Site</th>
<th>Assessment compiled by Natural England</th>
<th>Favourable condition (%)</th>
<th>Unfavourable recovering condition (%)</th>
<th>Unfavourable no change (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bryan Mills Field</td>
<td>01 Oct 2014</td>
<td>100</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Lambwath Meadows</td>
<td>01 Oct 2014</td>
<td>53</td>
<td>47</td>
<td>0</td>
</tr>
<tr>
<td>Leven Canal</td>
<td>01 Oct 2014</td>
<td>0</td>
<td>92</td>
<td>8</td>
</tr>
<tr>
<td>Pulfin Bog</td>
<td>01 Oct 2014</td>
<td>100</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>River Hull Headwaters</td>
<td>01 Oct 2014</td>
<td>14</td>
<td>81</td>
<td>5</td>
</tr>
<tr>
<td>Tophill Low</td>
<td>01 Oct 2014</td>
<td>0</td>
<td>100</td>
<td>0</td>
</tr>
</tbody>
</table>

Table 5.1 SSSI Condition

Local Nature Reserves (LNR) are statutory designated sites of local importance. Five LNRs were recorded in the study area (also illustrated at Figure 5.2), of which two are relevant:

- Noddle Hill LNR borders Hull city and was declared in 2011. The 42ha wetland reserve contains reed beds, ponds and wet woodland lying some 2.5km from River Hull.

- Rockford Fields LNR is within the urban area of Hull and consists of plantation woodland, lowland meadow, pond and hedgerows. The 9.7 ha site lies 0.5km east of the River Hull.
**Protected Species**

The following species receive a degree of protection under UK Law and may be impacted upon by decisions made as part of the RHICS; badger, great crested newt, otter, grass snake and water vole.

Implementation of RHICS options has the ability to impact on these species, however, these impacts are considered to be localised and time limited and therefore highly unlikely to have a significant impact on species populations at a regional level.

Legislation pertinent to each of these species should be taken into account at the Environmental Impact Assessment stage for individual projects and appropriate avoidance, mitigation and compensation measures undertaken to ensure that the law extant at the time of the project is not contravened. Consequently Protected Species are not considered further in this assessment.

**Biodiversity Action Plan (BAP)**

The following UK BAP Priority Species occur in the study area and are likely to be impacted upon by actions carried out under RHICS; European eel; Eurasian curlew; Great crested newt; Brown trout; Otter; Water vole and Northern lapwing.

Within the Rivers Priority Habitat, the Chalk Rivers Habitat Plan is of particular relevance. Other Priority Habitats to consider are Ponds, Eutrophic Standing Waters (including Canals), Coastal and Floodplain Grazing Marsh, Reedbed and Lowland Fen.

Three local BAPs exist in the study area; East Riding of Yorkshire, Hull and Ryedale. Priority species and habitats within these plans have been taken into account as part of SEA process, in particular where opportunities for habitat creation arise.

**Fisheries**

The EA are responsible for the management of eel stocks in England and Wales, and facilitate publication Eel Management Plans required by the Eels Directive (EC 1100/2007) to address concerns relating to a decline in eel numbers. The Sustainable Eel Group (with partners including the Association of Rivers’ Trusts and EA) published a Habitat Improvement Strategy for European Eel in 2011 which identifies habitat improvement priorities for Humber River Basin. None of these prioritised areas are within the River Hull catchment. Notwithstanding this, passage of juvenile (elvers) and adult eels past weirs, sluices and pumping stations is a significant issue to be addressed. Sustaining eel populations is also important as form the preferred prey for otter, a UK BAP species.

A good coarse fishery is supported in the middle and lower reaches of the Hull, which are more embanked and canalised with some saline influence, and in the agricultural drains and ditches where flows are slower. Species include perch, roach, gudgeon, dace, chub, bream and occasional flounder.

The River Hull Headwaters are recognised as a valuable salmonid and fly fishery, with the main species in these upper reaches being brown trout, grayling and pike.
Three National Character Areas (NCA) are pertinent to this SEA; Holderness, Yorkshire Wolds and Humber Estuary; see Figure 5.3 below. Each NCA supports distinct combinations of biodiversity, natural features and land uses including potential receptors which can be affected by water quality, river engineering, flood defence, coastal squeeze, water abstraction from aquifers and surface waters and rising sea levels.

Each profile includes a description of the natural and cultural features that shape landscapes, how the landscape has changed over time, the current key drivers for ongoing change, and a broad analysis of each area’s characteristics and ecosystem services.

Statements of Environmental Opportunity (SEOs) are suggested for each NCA, which draw on this integrated information. A number of SEO’s within each NCA are very relevant to delivery of RHICS and are tabulated along with relevant information about each NCA below.
### Holderness Character Area

<table>
<thead>
<tr>
<th>Description</th>
<th>Key Habitats</th>
<th>Relevant SEOs</th>
</tr>
</thead>
</table>
| The majority of the study area is within this NCA. | - River Hull and riparian fringes  
- Meres and other wetlands  
- Neutral Grassland  
This includes over 3,100ha Coastal and flood plain grazing marsh, 50ha lowland meadow, 13ha fen, 13ha reedbed, and purple moor grass and rush pasture. | SEO 1: Conserve, manage and enhance the River Hull and associated river system with its many associated drains, dykes and streams to improve water quality and supply, sustainably address flood risk management, and enhance biodiversity and the historic environment through a strategic, landscape-scale approach. |

**Key Habitats**
- River Hull valley with large field patterns bounded by drainage ditches and an extensive network of canals and canalised tributaries

### Yorkshire Wolds Character Area

<table>
<thead>
<tr>
<th>Description</th>
<th>Key Habitats</th>
<th>Relevant SEOs</th>
</tr>
</thead>
</table>
| Due to the underlying permeable chalk, this landscape has no major rivers, but its calcareous waters flow into the river headwaters of adjoining NCAs such as the River Hull in Holderness NCA. The chalk aquifer underlying the NCA supplies drinking water and allows irrigation of arable land but it suffers from pollution and over-abstraction. | - Chalk grasslands  
- Chalk streams (including headwaters of R Hull  
- Springs and flushes | SEO 1: Enhance, extend and manage the unique assemblage of chalk-based habitats (lowland chalk grasslands, streams), broadleaved woodland and maritime cliffs, while protecting the provision and quality of water. |

Calcareous grasslands occur on the steep-sided valleys, which can help to filter water, improving water quality and preventing soil erosion.

### Humber Estuary Character Area

<table>
<thead>
<tr>
<th>Description</th>
<th>Key Habitats</th>
<th>Relevant SEOs</th>
</tr>
</thead>
</table>
| Expansive, open, low-lying estuarine landscape, with wide expanses of open water, big skies and long views punctuated by views of major industrial installations, prominent structures, and busy shipping route along the estuary. | - Open water  
- Intertidal areas  
- Mudflats  
- Beaches  
- Saltmarsh  
- Reed beds  
- Saline lagoons | SEO 1: Protect and enhance the dynamic and inspiring estuarine and coastal landscape with its interrelated habitats of sand dunes, saltmarsh, reed beds, saline lagoons and mudflats, extending the internationally important habitats and the wildlife dependent upon them, while addressing coastal squeeze, climate change and dynamic coastal processes. |
Table 5.2 Relevant National Character Areas

Flora, Fauna and Biodiversity – Key Strategic Issues

- The catchment study area borders and includes elements of the Humber Estuary, designated at an international and national level for its nature conservation importance. The designated site receives discharge from both Holderness Drain and River Hull.

- River Hull Headwaters SSSI is nationally important chalk stream system and other SSSIs and LNRs are either hydrologically dependent on the River Hull or are located close to it.

- Scheme development should aim to maintain favourable status of all SSSI Units currently in favourable condition. Where SSSI Units are in unfavourable condition, actions should aim to contribute to their recovery.

- Options should be developed with cognisance of SSSI Impact Risk Zones and aim to contribute to ecological resilience at a landscape scale through incorporation of appropriate habitat creation within these zones.

- Biodiversity assets should be enhanced during development of options through incorporation of habitat creation, enhancement in flood storage facilities and other geomorphological alterations.

- Opportunities to promote self-sustaining fisheries (including eels) should be sought, including removal of obstructions to improve fish access and improving availability of spawning grounds for salmonids.
5.3 Landscape and Land Use

Figure 5.4: National Character Areas

Landscape Character

To determine potential landscape effects it is first necessary to define and understand the meaning of landscape character. The publication ‘Landscape Character Assessment: Guidance for England and Scotland’ (The Countryside Agency & Scottish Natural Heritage, 2002) defines landscape character as ‘...a distinct and recognisable pattern of elements that occur consistently in a particular type of landscape’. Particular combinations of geology, landform, soils, vegetation, land use, field patterns and human settlement create character. Character makes each part of the landscape distinct, and gives each its particular sense of place’. This definition is also paraphrased in ‘Guidelines for Landscape and Visual Impact Assessment: Third Edition’ (Landscape Institute and
Institute of Environmental Assessment, 2013) and so provides a useful starting point for the consideration of landscape character.

It is also helpful to understand the role that landscape character assessment may play in any appraisal or assessment process. ‘Landscape Character Assessment: Guidance for England and Scotland’ confirms that ‘Landscape Character Assessment is not a tool designed to resist changes that may influence the landscape. Rather it is an aid to decision-making - a tool to help understand what the landscape is like today, how it came to be like that, and how it may change in the future. Its role is to help ensure that change and development does not undermine whatever is characteristic or valued about any particular landscape, and that ways of improving the character of a place can be considered.’

Landscape character assessments already exist for study area hence this section of the SEA Addendum will reference those existing assessments to identify potential:

- **Landscape sensitivity and constraints** (related to the RHICS options); and

- **Landscape opportunities** (for mitigation of option measures, as well as the enhancement of landscape characteristics).

The susceptibility of the landscape to the RHICS options can then be determined.

‘Landscape Character Assessment: Guidance for England and Scotland’ also confirms that ‘Landscape Character Assessment can be applied at a number of different scales…’

Two tiers of the Landscape character assessment hierarchy are considered relevant to this SEA Addendum:

- **National/Regional scale** (‘...broad patterns of variation in landscape character’), as represented by the ‘National Character Areas’ (Natural England, 2013); and

- **Local Authority scale** (‘...a finer grain which can be mapped and described through Landscape Character Assessment...’), as represented by the ‘East Riding of Yorkshire Landscape Character Assessment’ (East Riding of Yorkshire Council, 2005) and the Hull Character Study (Hull City Council 2010).

The principle landscape baseline source will be the strategic ‘National Character Areas’ (NCAs), whilst the ‘Landscape Character Types’ (LCTs) identified in the ‘East Riding of Yorkshire Landscape Character Assessment’ and the ‘Townscape Character Types’ (TCTs) identified in the ‘Hull Character Study’ will be referenced where it is of relevance to the specific RHICS option measures.

**National Character Areas**

Natural England has assessed the landscape of England and divided the country into a total of 159 character area profiles. These profiles group geographical areas that share similar landscape characteristics following natural lines in the landscape rather than administrative boundaries. The profiles effectively create a high level, national landscape character assessment, a framework for decision making based upon the natural environment.
Some three National Character Areas cover the study area, namely: Yorkshire Wolds; Holderness; and Humber Estuary; see Figure 5.4 above. The character areas also provide a context and framework for managing development, safeguarding and, where possible, enhancing natural environment and landscape values.

The original SEA referenced ‘National Countryside Character Areas’ however these are now referred to as ‘National Character Areas’ (NCAs) in the current assessment published by Natural England which post-dates preparation of both the previous FRMS and original SEA.

The two National Character Areas subject to potential landscape effects are:

- **NCA 40: Holderness;** and
- **NCA 27: Yorkshire Wolds.**

The NCA profile describes NCA 40: Holderness as ‘...a low-lying, broad, undulating plain with the River Hull flowing south through the centre towards Hull. Eastwards lies the North Sea with the large expanse of the Humber Estuary to the south, while to the north and west the land rises to the dip slope of the Yorkshire Wolds’.

The River Hull (and associated catchment drainage) has a strong characterising effect on the NCA landscape, an aspect highlighted by the NCA ‘Key Characteristics’ which include:

- ‘A broad, gently undulating plain which is centred on the valley of the River Hull and is drained by a network of canals, ditches and canalised tributaries’

The proposed embankment raising that forms part of RHICS Options C and E relate specifically to NCA 40.

The NCA profile summary describes NCA 27: Yorkshire Wolds as forming ‘...an arc of high, gently rolling ground extending from the Humber Estuary west of Hull, to the North Sea coast at Flamborough Head, north of Bridlington. They comprise a prominent chalk escarpment and foothills rising from the Vale of York to the west and the Vale of Pickering to the north, and falling to the plain of Holderness to the east. A very low proportion of the area is urban and woodland, and the vast majority of the land is agricultural.’

It should also be noted that the NCA profile description states that ‘The headwaters of the River Hull rise in the Wolds and flow east into the Holderness plain.’

Therefore, the Natural Flood Management measures proposed in RHICS Option G relate specifically to NCA 27.

**East Riding of Yorkshire Landscape Character Types**

ERYC undertook a landscape character assessment of the entire East Riding administrative area in 2005. The assessment sub-divided the five nationally identified ‘Countryside Character Areas’ into a further 23 landscape character areas based upon key characteristics and with comments in respect of landscape quality, value, sensitivity and capacity for new development or changes in land use.
The primary landscape areas are defined as ‘Landscape Character Types’ (LCTs) which are then subdivided into ‘Landscape Character Areas’ (LCAs).

Based upon the ERYC Landscape Character Assessment, the Landscape Character Types subject to potential landscape effects in respect of the RHICS are:

- **LCT 17: Farmed Urban Fringe** (RHICS Options C and E);
- **LCT 16: Sloping Farmland** (RHICS Options E and G); and
- **LCT 13: Open, High, Rolling Farmland** (RHICS Option G).

*Figure 5.5: ERYC Landscape Character Types.*
Character type LCT 17: ‘Farmed Urban Fringe’ includes the following references that are relevant to assessment of the various strategy options:

- The ‘Physical Influences’ section states that ‘Land to the east is drained by a mix of improved streams and man made drains that drain into the River Humber to the south’;
- the ‘Human Influences’ section states that ‘There are few hedgerow trees throughout the landscape type. However, the west side of Hull does include a good cover of mature trees in clumps, in gardens and in hedgerows. This has helped to integrate the urban edge with the surrounding landscape’; and
- the ‘Ecological Influences’ section of the landscape character assessment describes LCT 17: ‘Where woodland remains it is an important feature’.

Drainage has played a key role in shaping the predominantly agricultural landscape and drains are therefore important landscape elements; also noted as a major influence within the Natural England National Character Areas. Although trees and woodland are sparse they are nevertheless sensitive features within a predominately flat landscape. Therefore the trees on the banks of the Beverley and Barmston Drain and the Holderness Drain are of importance to the landscape characteristics of LCT17.

Character type LCT 16: ‘Sloping Farmland’ includes the following relevant references:

- The ‘Physical Influences’ section states that ‘Land is free draining due to the slope and the chalk bedrock. There are several streams through the area running from the west to the east with their headwaters arising in the chalk Wolds. Lower lying areas to the east have a network of ditches draining the agricultural land.’

The ‘free draining’ nature of the underlying chalk may have a bearing on the nature of the Option G: Natural Flood Management measures, particularly the managed infiltration of surface water. Furthermore the ‘network of ditches’ may have potential as part of the strategy for the attenuation of surface water.

Character type LCT 13: ‘Open, High Rolling Farmland’ includes the following relevant references:

- The ‘Physical Influences’ section states that ‘There are no water courses in this area. The valleys are dry. This is due to the fact that the water table has lowered and the bedrock is permeable. Man made dew ponds for watering livestock were a common site on the Wolds. However, many of these have disappeared.’

Likewise, the ‘free draining’ nature of the underlying chalk may have a bearing on the nature of the Option G: Natural Flood Management measures and ‘man made dew ponds’ may have potential as part of an attenuation / infiltration strategy.

The ‘Local Flood Risk Management Strategy: SEA Draft Scoping Report’ (ERYC 2014) concludes (with reference to the ERYC LCTs) that ‘It is apparent from these that the water environment, such as the area’s main rivers, network of manmade drains/ditches, upland springs, and village ponds, are a key component of the character of the East Riding’s landscape.'
Given that the water environment, including the extensive manmade drainage network, is a key feature of the East Riding’s landscape, likely evolution without flood risk and water management interventions could result in reversion of low lying areas to marshland. Therefore, the LFRMS has a role in sustaining the existing landscape character.

The importance of existing drainage in shaping existing landscape character does not necessarily justify future drainage works; although it should be noted that the existing features also represent a historical landscape element. A balance needs to be struck between the functional purpose of flood risk management works and opportunities to conserve, manage and enhance landscape character that will be sustainable and recognises the increasing influence of factors such as climate change.

It should also be noted that ‘Local Flood Risk Management Strategy: SEA Draft Scoping Report’ (ERYC 2014) acknowledges that ‘The LFRMS may lead to measures that impact on the landscape, such as flood attenuation areas’.

Therefore it is necessary to identify the RHICS options that may cause potential landscape impacts.

**Hull Character Study**

The Hull Development Framework Hull Character Study (HCC 2010) identifies ‘Townscape Character Types’ (TCTs) and Section 2: ‘Landscape Setting of Hull’ states that ‘Open drains have long been a feature of Hull, as the city was built upon marshland and relies on its many drains to keep the land dry. The major surviving open land drains are Beverley and Barmston Drain (constructed in 1809) in the west of the city and Holderness Drain in the east.’

The Townscape Character Type subject to potential landscape effects is:

- **TCT 19: Agricultural Land** (RHICS Options C).

However, the urban areas of Hull form the main focus of the Hull Character Study and Chapter 6: ‘Townscape Types Assessment’ simply describes TCT 19 as ‘land used for crops or grazing’.


Figure 5.6: Hull Townscape Character Types (Extent of TCT19)

The extent of Townscape Character Type TCT19, together with the location of all character types within Kingston upon Hull, is illustrated at Figure 5.6 above.

Designated Landscapes

There are no National Parks or Areas of Outstanding Beauty within the study area.

The East Riding contains two nationally designated sections of Heritage Coast, at Spurn Point and Flamborough, both are protected for their special scenic and environmental value, however neither lie within the study area.

The northern part of the study area extends into the ‘Wolds Area of Landscape Protection’ (as defined in the ERYC Local Plan) and the landscape sensitivity of this local designation may be a constraint to Option G: Natural Flood Management measures.

Land Use

The majority of the study area consists of/historical influences upon current land use are discussed with the Cultural Heritage appendix at Appendix A.

The original SEA of 2010 identified that much of the study area is within agricultural use. This observation still holds true with no significant changes to the overall land use within the strategic study area. The Agricultural Land Classification (England), confirms that the western section of the
study area, an approximate line from the west of Hull to the west of Driffield, is Grade 2; hence classified as 'Very Good'.

The northern part of the study area, to the north of Driffield and within the upper catchment of the River Hull, is also Grade 2 classification. The eastern section of the study area, to the east of the A164 is predominantly Grade 3 classification (Good) with patches of Grade 2 land. Most holdings are large scale; mixed arable with some intensive livestock farming. Some small patches of Grade 4 (Poor) classification are located within the study area, primarily within the ‘Commons’ to the east of Beverley but also isolated areas associated with the former course of the River Hull.

The major centres of population coincide with the major urban areas contained within the study area, namely Kingston-upon-Hull, Beverley, the ‘Haltemprice’ settlements, Cottingham, Hessle and Driffield.

5.4 Cultural Heritage

A background cultural heritage context to the SEA Addendum study area has been prepared and is contained at Appendix A. This background presents a description of man’s intervention within the locality that has resulted in a rich cultural heritage resource reflecting the varied social and economic history of the region.
Current planning guidance contained within the NPPF notes that designated cultural heritage assets comprise World Heritage Sites, Scheduled Monuments, Listed Buildings, Protected Wreck Sites, Registered Parks and Gardens, Registered Battlefields and Conservation Areas.

**World Heritage Sites**

There are no World Heritage Sites, Registered Battlefields or Protected Wreck Sites within the SEA Addendum study area.

**Scheduled Monuments**

There are 155 Scheduled Monuments, including those which span or lie either side of the study area boundary (see Figure 5.7); some Scheduled Monuments are divided into several parts. Scheduled Monuments are nationally important and are protected by law, and they include the most prominent, best preserved and representative types of archaeological sites, but they form only c.4%
of the archaeological resource of East Yorkshire. Within the study area, the Scheduled Monuments cover all historic periods, and include prehistoric burial mounds, cemeteries and settlements, a Roman villa and other enclosures, numerous medieval moated sites, deserted villages and monastic sites, and two 2WW heavy anti-aircraft batteries. There is only one Scheduled Monument within the administrative boundaries of Hull, the buried remains of the town’s 16th century defences and 17th century Hull Citadel on the east bank of the River Hull near its confluence with the Humber (SM NHLE 1020426). Some 78 Scheduled Monuments within the study area are currently considered to be ‘at risk’ from a variety of actions (English Heritage 2014 figures). Scheduled Monuments within the study area are illustrated on a larger scale base plan at Figure CH2 (a – d) to be found within the Figures section of this Addendum report.

Listed Buildings

![Figure 5.8: Listed Buildings](image)

Some 1,454 Listed Buildings are situated within or partly within the study area, comprising 41 Grade I, 94 Grade II* and 1,319 Grade II (see Figure 5.8). These represent the full range of the built
environment, and include agricultural, religious, military, domestic, industrial and transport-related buildings and structures as well as other features important to the local scene such as street furniture. As might be expected, there are significant concentrations of Listed Buildings in the larger towns such as Beverley and Hull (450 and 465 items respectively), but many villages contain several and other isolated examples are scattered across the Wolds and Holderness. Seven Listed Buildings, including five churches, within the study area are currently considered to be ‘at risk’ from a variety of actions (English Heritage 2014 figures). Listed Buildings are also illustrated at Figure CH1 (a – d) to be found within the Figures section of this Addendum report.

Registered Parks and Gardens

There are seven Registered Parks and Gardens in the study area, see Figure 5.7 above. One of these, Sledmere House, is Grade I and is also the largest, covering c.300 hectares, dating to the mid-late 18th century. The others are Burton Constable (mainly late 18th century) and Dalton Hall (early 18th century) (both Grade II*), and Twaithie Hall (early 19th century), Risby (late 17th-late 18th century), East Park and Pearson Park (both late 19th century) (all Grade II). Only one Registered Park and Garden within the study area is currently considered to be ‘at risk’ (English Heritage 2014 figures). Registered Parks and Gardens are also shown at Figure CH2 (a – d) within the Figures section of this report.

Conservation Areas

There are 67 Conservation Areas within the study area, all of which have detailed Conservation Area Appraisals completed; that for Walkington is currently under review (November 2014). In the East Riding, the 41 Conservation Areas cover the historic cores of most of the towns, as well as some of the smaller villages; that for Beverley is spilt into nine separate areas. Within Hull, there are 26 Conservation Areas covering 6% of the city, of which three (Sulcoates, Charterhouse and the Old Town), border or lie in the immediate vicinity of the River Hull corridor. Two Conservation Areas within the study area, in Hull, are currently considered to be ‘at risk’ from a variety of actions (English Heritage 2014 figures).

5.5 Recreation and Amenity

There are numerous sites available for recreation and amenity activities within the study area. These range from formal, high profile tourist destinations such as The Deep in Hull or Beverley Minster, informal recreation sites such as the Yorkshire Wolds and the East Yorkshire market towns, to smaller, more local sites including local nature reserves such as the Beverley Parks nature reserve.

The study area also contains a very extensive number of formal recreation sites such as parks, sports grounds and golf courses; including sports stadia. The rich cultural heritage of Hull and East Riding also creates a number of tourist destinations including museums, for example the Streetlife Museum of Transport in Hull, stately homes open to the public including Burton Constable Hall, and the historic, remnant medieval core of the Hull. Together with more obvious destinations for visitors such as the Arctic Corsair trawler moored on the River Hull, the Hull Maritime Museum or the new Scale Lane Bridge that crosses the river Hull.
The public footpath and other rights of way network throughout the study area is also very extensive, there are some 1600km of paths and bridleways in East Riding alone. The footpath network also includes national routes such as the Trans Pennine Trail (a multi-purpose route some 346 km in length extending across northern England from Southport on the west coast to Hornsea on the east coast), together with regional routes including the Minster Way (an 80 km walking route through East Yorkshire between the Minster’s of York and Beverley, established in 1980) and the more recent Wilberforce Way (a 96 km route extending from Hull to York via Beverley established in 2007 to mark the bicentennial year of the abolition of involvement in the slave trade, to commemorate the work of locally born politician/philanthropist William Wilberforce).

Although of smaller scale, there are some 38 km of public rights of way with the City of Hull (Rights of Way Improvement Plan 2009 – 2019). The network, although fragmented, makes extensive use of
watercourses such as the River Hull for provision of footpaths along the river banks. In addition to footpaths there are numerous cycling and horse riding routes across the study area.

The River Hull itself is recreation asset, creating a navigable route for pleasure craft from Hull to Beverley and beyond; for smaller craft. The banks of the river also offer a mix of formal and informal footpaths enjoyed by walkers, ornithologists, anglers and cyclists. Work has also been undertaken to the Driffield Canal to open this up for recreation use.

The attractive countryside within the East Riding, coupled with villages, places of interest and coastline ensures that the area is well used as facility for the local community and visitors.

The value of recreational activities within the study area plays a vital role in the local economy. In 2013 the tourism trade within the East Riding and Hull was valued at some £757m (source: Visit Hull and Yorkshire). Within the East Riding alone it is reported that tourism contributed £497m to the economy in 2013 and provided employment for some 11,000 people.

At this strategic level it is not possible to list each and every site within the very large study area hence only an indication of the numerous recreation and amenity assets has been given.

5.6 Material Assets

Within the administrative area of ERYC there is over 3,000km of highway (The Transport and Accessibility in East Riding of Yorkshire Study 2009). Major highways include the M62/A63, and A1033; part of the Trans-European Network connecting Ireland with Northern Europe via the Port of Hull. These particular highways carry a high proportion of heavy goods vehicles and play a significant role in the competitiveness of the region.

Other major highway routes include the A164 (Beverley to Humber Bridge), the A1079 (Hull to York), the A614 (Goole to Bridlington) and the A165 (Hull to Bridlington). Congestion is not considered to be a major issue across the East Riding; however the main towns such as Beverley, together with the A164 and A1079 corridors, do experience significant levels of congestion, particularly during peak hours.

Being a rural area with dispersed communities, a higher than average proportion of journeys in the East Riding are made by private car compared to bus and rail. The overwhelming majority of commuting is car based with a high proportion of the East Riding workforce commuting to Hull. There are also numerous local commuter routes to smaller employment hubs throughout the study area.

Hull City Council is responsible for a highway network of approximately 720km (Local Transport Plan 2011-2026). Major highways include the A63, A1033, A165, A1079 and A1105/A1166, however they amount to just over 35km of the total network within the city. The majority of these routes are radial, orientated towards the city centre from the wider area. Improvements to the external transport links from the Port of Hull to the national transport system are seen as vital to the economic growth of the city and wider area. The A63 at Castle Street, linking to the M62 to the west, severely constrains access to the port hence proposals to improve this section of the A63 are currently the subject of discussions between Hull City Council and the Highways Agency.
Figure 5.10: Key Infrastructure Routes

Key rail routes within the study area include those that radiate north-south and east-west from the city of Hull. The rail link from Hull to Driffield through Beverley (then onwards to Bridlington) lies entirely within the study area whilst a short section of the route to Leeds via Hessle is situated to the southern extreme of the area.

The River Hull itself forms a navigable route for freight barges through Kingston-Upon-Hull, as far as Beverley, with wharf facilities along the river at Hull and Beverley. The river connects to the busy commercial waterway of the Humber Estuary, providing onward access to the international ports of Hull (and others around the estuary), which are of prime importance to the regional and national economy.
5.7 Water Environment

Geomorphology

Historically the River Hull has undergone much channel modification to defend the low lying catchment from flooding. This involves channel straightening and creation of embankments which has led to an elevated watercourse, where the river channel bed is higher than the surrounding flood plain. The channel has not been dredged since the 1980s and according to a hydro survey carried out as part of RHICS the water conveyance capacity has now decreased by 6% since the last survey of 2000. This conveyance loss is mainly due to the encroachment of reed beds narrowing the channel, but can also be attributed to siltation on the channel bed. The upper course of the River Hull lies within the River Hull Headwaters SSSI, see sub section 5.2 above, and is comparatively unmodified.
The Hull Tidal Surge Barrier, at the mouth of the River Hull, is used at high tides to prevent the Humber from overtopping defences along the River Hull. Typically it operates ten to twelve times a year, and was subject to a £10m refurbishment project completed in 2010.

The Holderness drain has embankments along both sides of the channel and the geomorphology is considered uniform.

**Water Quality**

The EA introduced a new method for assessing water quality in accordance with the WFD. All main watercourses should reach a classification of *good* status both chemically and ecologically. In the Humber River Basin Management Plan (RBMP) (Defra, 2009) the chemical status of the River Hull, from Beverley to the upper reaches, is considered *good* however results for the lower course are unknown. Previously, water quality had been assessed using the General Quality Assessment (GQA) indicator scheme published by the EA, a national indicator for water quality in rivers and canals, of which the results for River Hull and Holderness basin are reported as in the original SEA of 2010.

**Groundwater**

A Major Cretaceous Chalk aquifer, which is very permeable, lies underneath the study area; therefore springs feeding the hydrological system are dependent on the groundwater levels. The aquifer is fractured and vulnerable when top soils are thin, meaning most of the study area lies within a Nitrate Vulnerable Zone. According to the Humber RBMP the groundwater in the River Hull catchment is graded *poor* both chemically and quantitatively.

**Water Abstraction and Discharges**

There are numerous water abstractions from both surface water and groundwater for the River Hull and its tributaries upstream of Hempholme Weir.

Groundwater abstractions are predominantly for public water supply and irrigation but smaller volumes are used for commercial purposes including fish farming and domestic/agricultural/industrial use. Yorkshire Water, who provide potable water for the East Riding of Yorkshire and parts of West Yorkshire, are the major licensed abstractor of groundwater. There is a Source Protection Zone (SPZ) on the north and west of the city of Hull. Within these areas there are ‘inner’ and ‘outer’ zones with differing levels of protection.

Surface water is abstracted mainly by fish farms, which is mostly returned to the river system, but smaller volumes are used in spray irrigation, and industrial/domestic/agricultural use. At Hempholme, water is abstracted from the River Hull to feed the Tophill Low Water Treatment Works.

5.8 Summary of Key Issues and Opportunities

**Flora, Fauna and Biodiversity**

A number of key issues and opportunities are identified at sub section 5.2 above. In terms of existing designated sites the RHICS presents the opportunity to not only maintain the favourable status of a number of sites but also include actions that may contribute to the recovery of those that
are currently in an unfavourable condition. Habitat creation, in tandem with appropriate landscape measures, may also contribute to ecological resilience through recognition of SSSI Impact Risk Zones within the study area. Each option promoted within the RHICS also creates opportunities for small scale, localised enhancement that may be brought forward at project level; but within a strategic framework across the River Hull catchment.

Landscape and Land Use

The recent ‘Local Flood Risk Management Strategy: SEA Draft Scoping Report’ (ERYC 2014) recognises that the extensive manmade drainage network is a key feature of the study area landscape. The contribution from flood risk and water management interventions plays a pivotal role in preventing the reversion of low lying areas to marshland. Both the RHICS and local LFRMS have a part to play in sustaining the existing landscape character; particularly across the East Riding.

A balance must be struck between the functional requirements of flood risk management projects and the opportunities created to conserve, manage and enhance landscape character.

Cultural Heritage

Although there are a significant number of cultural heritage assets within the wider study area, comparatively few assets lie within the River Hull corridor, as historic occupation and activity has largely avoided the low-lying floodplain. However, it should be noted that the existing drainage system and flood defense network is also part of the historic landscape, and several elements of its infrastructure are designated assets. While it is important to preserve and enhance all designated assets, there are also opportunities for RHICS measures to conserve and improve the contribution of flood defense and drainage network to local heritage and cultural identity.

Recreation and Amenity

The study area benefits from an extensive network of public footpaths, bridleways and cycling routes including long distance routes that touch upon the River Hull corridor. The opportunity exists, as part of the RHICS, to provide enhancement of those routes along the River Hull and adjacent drains including the provision of interpretative information to maximise the benefit and enjoyment of such routes. The River Hull itself is both a navigable amenity route and historic feature which may benefit from provision of interpretative information for both walkers and boat users.

Material Assets

A number of key communication routes, both road and rail, traverse the study area. These routes play a vital role in the social and economic activity of the region hence protection from flood risk is viewed as a priority; the protection of existing transport infrastructure is identified as an environmental objective.

Water Environment

The main target for the water environment in the River Hull system is achieving good ecological status, or potential, by 2015; as part of the WFD. The WFD assessment is based on three criteria; chemical, biological and geomorphic properties. The key issues with this target are maintaining the good water quality grade, maintaining and creating more habitats for a variety of aquatic and
riparian wildlife, and returning the River Hull to a more natural geomorphic status. In achieving this target measures may include lowering the elevated river system and restoring the river to pre-modification conditions where feasible.
Environmental Assessment of the Options

6.1 Introduction

The RHICS fully describes the process of Option selection and appraisal criteria upon which the promoted options have been selected, hence only a summary is provided in this report.

The appraisal process commenced with discussions amongst the project team to initially identify concept ideas. Further to this, preliminary options were then developed and reviewed by the project team from which sub-options and combinations were produced. The various sub-options were then modelled and appraised economically with predicted construction and operational costs. A detailed and comprehensive modelling exercise was undertaken to simulate various flood return periods across the River Hull catchment. Within the model, floodplains, flow control structures and river embankments were incorporated for the River Hull, and the other drains, located in the catchment basin. The model was validated by simulating the flood event of June 2007 and comparing the results to the observed data for the event.

The initial options were assessed, in the first instance, in respect of their impact upon altering peak floodplain inundation volume in relation to the 100 year fluvial design event; relative to existing (baseline) predictions. These initial options included:

<table>
<thead>
<tr>
<th>OPTION Label</th>
<th>Short Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1a</td>
<td>Increased pumping station capacity (Great Culvert and East Hull PS limited to 22 m³/s peak)</td>
</tr>
<tr>
<td>1b</td>
<td>As for (1a), with Tickton PS replaced with flap valve + weir</td>
</tr>
<tr>
<td>1b (22limit)</td>
<td>Variation of 1b, with East Hull PS limited to 22 m³/s peak</td>
</tr>
<tr>
<td>2</td>
<td>Holderness Drain reshaping/widening</td>
</tr>
<tr>
<td>3b</td>
<td>Holderness Drain offline storage - upstream of Tickton PS</td>
</tr>
<tr>
<td>4e</td>
<td>Offline storage beyond River Hull wetland</td>
</tr>
<tr>
<td>4f</td>
<td>Weel offline storage</td>
</tr>
<tr>
<td>4g</td>
<td>As for (4f), with increased Waterside PS pump persistence</td>
</tr>
<tr>
<td>5</td>
<td>Increased Waterside PS capacity</td>
</tr>
<tr>
<td>6</td>
<td>Hull Maintenance</td>
</tr>
<tr>
<td>7b</td>
<td>Raise Holderness Drain embankments below Great Culvert PS</td>
</tr>
<tr>
<td>7i</td>
<td>Raise Beverley &amp; Barmston Drain embankments south of Beverley Beck</td>
</tr>
<tr>
<td>8</td>
<td>Upland natural attenuation</td>
</tr>
<tr>
<td>9</td>
<td>Holderness Drain Diversion</td>
</tr>
<tr>
<td>10</td>
<td>Upper Hull Diversion</td>
</tr>
<tr>
<td>11</td>
<td>Increased utilisation of Hull Tidal Barrier (i.e. lower activation threshold)</td>
</tr>
<tr>
<td>12</td>
<td>Upland natural attenuation combined with OPTION 1b, 4f &amp; 7b</td>
</tr>
<tr>
<td>13</td>
<td>Bransholme-specific flood mitigation (increased PS capacity)</td>
</tr>
<tr>
<td>14a</td>
<td>Combination of (4f) and (11)</td>
</tr>
<tr>
<td>15a,b,c</td>
<td>Removal of Wilfholme and Hempholme pumping stations.</td>
</tr>
</tbody>
</table>

Table 6.1: Initial Options
The options were assessed on the basis of the following mitigation benefit:

- Complete removal of a given extent of existing flood inundation
- Non-trivial reduction in peak inundation volume in one or more regions predicted to inundate under existing conditions

Options were then discarded if shown to produce a non-trivial detriment (i.e. increase in inundation depth or extent) at any location. Where predictions indicated that a given option produced a non-trivial benefit, modelling was repeated for 5, 10, 50 and 100 year fluvial events to present an estimation of flood damage. Separate fluvial models were developed for each of the progressed options set against the existing (baseline) model.

All options therefore assume:

- Existing flood defence embankments are maintained at current levels
- Pumping stations are maintained and operated with existing operational rules (except where variation is proposed as a component of an option)
- The Hull Tidal Barrier is operational according to existing operational rules with no adjustment for climate change (except where variation is proposed as a component of an option)
- All other control structures, including flap valves, are maintained and remain operational

Initial options varied from the construction of lagoon storage areas, raising embankments, altering the capacity of pumping stations, and various combinations together with more natural approaches to flood management. A detailed description of each initial option can be found in the full draft RHICS.

Following this initial options appraisal, seven options were taken forward as part of the recommended strategy, these form the basis of the updated SEA and are described below. An eighth option, not modelled, was added to address ongoing maintenance issues and costs; this option has not been subject to assessment within this SEA Addendum Report. The standard of protection from flood risk varies according to each option i.e. there is no standardised measure.

6.2 Assessment of Rejected Options

In conformance with ‘The Environmental Assessment of Plans and Programmes Regulations 2004’ and best practice guidance consideration of ‘reasonable alternatives’ was undertaken at an early stage during development of a strategy for the River Hull catchment.

It was determined that a number of potential alternatives could not be deemed ‘reasonable’ on the basis that their benefits were minimal or the option not be justified on cost benefit grounds; hence in turn would stand no chance of obtaining flood defence funding. For these reasons, no parallel environmental assessment was undertaken. For the sake of consistency, however, a brief environmental appraisal of these ‘unreasonable’ options was conducted retrospectively. The results
are shown in Table 6.2 below. Irrespective of the outcome of this appraisal (positive or negative) they remain rejected options and have been progressed no further.

<table>
<thead>
<tr>
<th>Option label</th>
<th>Nature of the works</th>
<th>Reason rejected</th>
<th>Potential impacts</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Rejected at first stage</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2: Holderness Drain conveyance improvements</td>
<td>Reshape and re-profile (primarily substantial widening and deepening) north of Tickton PS</td>
<td>Little benefit for most modest size increases</td>
<td>Loss of all bankside and basal habitat during construction works</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>would require up to a 20-fold increase in size to accommodate peak flood waters</td>
<td>Loss of bankside and near-bankside vegetation</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>substantial cost</td>
<td>Increased bankside area as replacement habitat</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>downstream pumps are the critical control feature</td>
<td>Increased water area</td>
<td></td>
</tr>
<tr>
<td>9: Diversion of Holderness Drain</td>
<td>Divert Holderness Drain to bypass the east of Hull</td>
<td>Marginal increase in capacity compared to current alignment</td>
<td>Potential impact on Humber designations during construction of new outfall</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Prohibitively expensive</td>
<td>Loss of existing habitat where old drain course infilled</td>
<td></td>
</tr>
<tr>
<td>10: Diversion of upper Hull</td>
<td>Two new watercourse routes investigated:</td>
<td>Flow reduction not significant</td>
<td>Potential impact on Hornsea Mere SSSI and former sand pits for second option</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Re-engineer Old Howe to flow east from Frodingham Bridge to Stream Dyke at Lisset, with new sea outfall south of Skipsea</td>
<td>Pumping would be required as poor gradient</td>
<td>New bankside and water body habitats created</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• New cut from Hempholme to Hornsea Mere via old R Hull course</td>
<td>Prohibitively expensive</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Rejected at second stage</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3b: Offline storage for Holderness Drain</td>
<td>New storage lagoon north of Leven Canal. Four adjacent locations considered at junction with Leven Canal; one considered adequate</td>
<td>Too expensive and little benefit outside immediate location of storage</td>
<td>Loss of productive farmland</td>
<td>Seasonal habitat creation when lagoons wet</td>
</tr>
<tr>
<td>4a to 4d: Offline storage for River Hull</td>
<td>Four variations of embankment raising near Arram Carrs</td>
<td>Option 4d was the most effective. Variations of 4d taken</td>
<td>Habitat disruption during bank raising</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Loss of productive</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Increased bankside area; replacement</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>with off-line storage east of Arram or at Figham Pasture</strong></td>
<td><strong>forward as options 4e and 4f. Option 4a to 4c were discarded</strong></td>
<td><strong>farmland to lagoons</strong></td>
<td><strong>Potential impact on Cultural Heritage sites</strong></td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>4e: Offline storage for River Hull</td>
<td>New storage lagoon east of Pulfin Bog wetland</td>
<td>• Too expensive and benefits circa half that of Option 4f</td>
<td></td>
<td>Loss of productive farmland</td>
</tr>
<tr>
<td>4f: Offline storage for River Hull</td>
<td>New storage lagoon between Weel and Wawne</td>
<td>• Combined with Option 11, then discounted as Option 11 alone would achieve the same benefit at far lower cost</td>
<td>• Loss of productive farmland</td>
<td>• Potential impact on Cultural Heritage sites</td>
</tr>
<tr>
<td>4g: As 4f + increased capacity at Waterside PS</td>
<td>Would offset additional upstream flooding when increased pumping occurs by creating new downstream storage</td>
<td>• Little benefit shown – virtually no difference to 4f alone, but would cost substantially more, so poor cost benefit</td>
<td>• Loss of productive farmland</td>
<td>• Potential impact on Cultural Heritage sites</td>
</tr>
<tr>
<td>5: Increased Waterside PS capacity</td>
<td>Increase pump sizes at Waterside PS, Beverley</td>
<td>• Increased capacity offset by reduced operational time; level controls shut down pumps when the river is full, so little benefit</td>
<td>• Additional area/depth/duration of flooding leading to increased loss of productive farmland</td>
<td>• Potential impact on Cultural Heritage sites</td>
</tr>
<tr>
<td>7: Embankment raising</td>
<td>Increased height or creation of new embankments at 12 ‘low spot’ locations: Holderness Drain (several sections), Monk Dyke (two locations), Mickley Dike, Roam Drain, Arram Beck, Watton beck and Beverley &amp; Barmston Drain (several sections)</td>
<td>Only Options 7b (Holderness Drain east of Hull) and 7i (Beverley &amp; Barmston Drain near Dunswell) demonstrated to be capable of providing flood risk mitigation without consequence elsewhere and with acceptably low height and length of required bank raising</td>
<td>• Disruption to wildlife during construction</td>
<td>• Possible long-term barrier to some species</td>
</tr>
<tr>
<td>11: Alterations to use of Hull Tidal Barrier</td>
<td>Use of tidal surge barrier to prevent high tides entering the river</td>
<td>Combination with 4f not considered beneficial. Alternative Options for 11 created – 11a and 11b, which are beneficial</td>
<td>Increased restrictions on fish movements compared to current restrictions when barrier lowered</td>
<td></td>
</tr>
<tr>
<td>14: Option 4f with Option 11</td>
<td>Modelling to test combination of</td>
<td>Flood reduction would increase from 13% to 17%, but would not otherwise be cost effective</td>
<td>Similar disbenefits as each option alone</td>
<td>Similar benefits as each option alone</td>
</tr>
<tr>
<td>15: Removal of Wilfholme and</td>
<td>Cease use of the two land drainage pumps</td>
<td>Would lead to significant additional</td>
<td>Loss of productive farmland</td>
<td>Seasonal habitat creation when</td>
</tr>
</tbody>
</table>
Table 6.2: Assessment of Rejected Options

6.3 Strategic Options

- Option A – Dredging of the River Hull

The River Hull would be subject to dredging using a technique termed ‘hydrodynamic dredging’ or ‘Water Injection Dredging’ (WID) over an approximate 29 kilometre length; between the Hull Tidal Barrier to Hull Road Bridge (just north-east of Beverley); see Figure 6.1 below.

![Figure 6.1: Section of River Hull to be dredged between Hull Bridge and mouth of River Hull](image)

WID is considered to be a more cost-effective and environmentally acceptable technique than traditional dredging. The process consists of injecting large volumes of water at a low pressure into the sediment through a series of nozzles on a horizontal jet bar.
The injection process loosens and fluidises the cohesive sediment to create a layer of mudflow which is denser than the rest of the water column. This layer remains close to the bed and does not mix with, or cause disturbance to, the upper layers of the flow. This property of WID being considered more environmentally sound, as the aquatic ecosystem is not disturbed by silt, unlike more traditional methods of dredging i.e. agitation. Tidal action and gravity then moves the sediment downstream. It is estimated that 1 metre depth of silt might be able to be removed from the channel.

This option would also include the removal of numerous sunken barges, boats and other structures to improve the overall cross section of the river, and to increase the effectiveness of the WID process. These actions will effectively re-profile the channel cross section together with selected removal of marginal reed beds.

- Option B – Tidal Exclusion

The Hull Tidal Barrier is designed to remain open unless water levels at the outfall into the Humber are forecast to exceed 4.25 m AOD. Since a substantial length of the River Hull is tidally-impacted, the barrier offers substantial protection against tidally-induced flood risk. However, tidal peaks below 4.25 m AOD are also capable of substantially increasing flood risk associated with a given fluvial event if peak fluvial and tidal timings coincide; such that operation of the barrier at lower tides would offer the potential to reduce flood risk. Although it should be noted that a degree of optimisation is required to prevent unnecessary closure thereby restricting river outflow and hence increasing flood risk.

The RHICS hence modelled a range of barrier closure thresholds to test this effect. This demonstrated that a 2 m AOD threshold offers the optimal benefit of reduced tidal propagation without detrimentally restricting river outflow.

This option would entail operation of the Hull Tidal Barrier under the same basic operational regime as at present, but with a new ‘mitre’ tidal barrier installed immediately downstream of the existing barrier; to provide the activation level of 2 m AOD. The potential location of such a tidal barrier is shown at Figure 6.2 below with an accompanying schematic diagram to illustrate the operation of a ‘mitre’ tidal barrier.

Figure 6.2: potential location of tidal barrier and schematic of barrier operation
• **Option C – Holderness Drain**

Where flood inundation may be the result of ‘overtopping’ along a length of existing river embankment or flood defences then a simple raising of this section of bank may provide flood risk mitigation. However, this approach has two basic limitations:

- If a given section of bank is raised to prevent flooding, the resulting new, higher in-channel peak water levels may induce or worsen flooding elsewhere; it is therefore important to assess the overall impact of even a limited section of bank raising.
- If the volume of existing flooding at a given location is substantially larger than the capacity of the local reach when the banks are full then the required amount of bank raising to prevent flooding may be large; indeed, it may extend much beyond the original extent of bank overtopping. In such situations, offline storage is more likely to be effective than simple bank raising.

The feasibility of embankment raising at individual sections was assessed. The Holderness Drain currently overtops its banks in several locations where a lower than average crest height occurs. This option, therefore, aims to directly alleviate flood risk by preventing this overtopping; however this would result in higher peak water levels in the impacted sections of the drain. Embankment raising of Holderness Drain is proposed downstream of Great Culvert pumping station to reduce flooding, particularly in the area of Bransholme, for a distance of approximately 2 kilometres and to an average height of 0.3m but up to 0.6m in places. In addition a section of the Ganstead Drain, totalling some 1731 metres in length, would be subject to embankment raising; with an average increase in height of 0.3m. The proposed section of Holderness Drain to be subject of embankment raising is illustrated at Figure 6.3 below.

*Figure 6.3: Proposed Embankment Raising to the Holderness Drain (including Ganstead Drain section)*
The large volume of flood inundation from the Holderness Drain upstream of the Great Culvert pumping station would require very extensive embankment raising to prevent inundation. The higher peak water levels would however, increase peak water levels detrimentally elsewhere in the Holderness Drain; resulting in substantial inundation (volume and extent). This option therefore includes a change in pumping regime to address such issues. Presently the Holderness Drain is divided into three reaches:

- An upstream reach, terminating with and drained by the Tickton Pumping Station (PS).
- A middle reach, below the Tickton PS, terminating with and drained by the Great Culvert PS.
- A lower reach, below Great Culvert PS, drained by a combination of gravitational flow during low tides and pumping by the East Hull PS.

Increased pump capacity offers a simple and logical option to reduce fluvial flood risk in the Holderness Drain system. Consequently this option entails the following alterations:

- Removal of the existing Tickton PS and replacement with a flap valve and overflow weir.
- Increase in Great Culvert PS peak capacity.
- Increase in East Hull PS peak capacity.

The existing bypass weir at Tickton PS is very high, relative to upstream bank levels, such that removing Tickton PS in isolation would substantially increase flood risk at upstream locations, and induce significant flooding even during fluvial baseflow conditions. It is therefore necessary to accommodate low level flows along Holderness Drain via a large flap valve to achieve comparable flood risk protection to existing conditions.

Embankment raising to the Holderness Drain below Great Culvert PS removes fluvial inundation risk in the Bransholme area and Ganstead Drain catchment; with some minor predicted detriment in the Foredyke Stream and its tributaries. Although in terms of volumetric reduction, embankment raising only reduces the peak 100 year inundation volume by 3%, the bulk of this reduction would occur in high-value urban areas. Furthermore the inclusion of increased pumping is predicted to decrease the peak 100 year inundation from the Holderness Drain system by 21%. A small portion of this reduction is predicted to occur upstream of the Tickton PS location, indicating that the proposed replacement of Tickton PS with a flap valve/high-flow weir does not cause a detriment when combined with increased pumping further downstream.

- **Option D – Bransholme Pumping Station**

The Bransholme area of Hull is situated between the embanked River Hull to the west and Holderness Drain to the east. The area is currently drained by a Yorkshire Water surface water network; with flows pumped into a large raised storage lagoon, adjacent to the River Hull. This lagoon has the potential to spill into the River Hull under very high storage conditions. The Bransholme surface water area is split by a ridge of high land, orientated in a north-south direction, and by the Wawne drain which connects to the surface water network at its eastern end. A larger catchment to the north of the Bransholme area is drained by the Engine Drain, which under normal flow conditions will drain eastward via the Croft Drain to the Holderness
Drain. Under high flow conditions, however it can also drain to the Kingswood/Bransholme area; where it is conveyed by pipe to the Wawne Drain.

Yorkshire Water is currently improving pumping station capacity for Bransholme; the location of which is indicated on the schematic plan below.

**Figure 6.4: Location of Bransholme Pumping Station**

Two inundation outcomes, based upon a 100 year event, have therefore been modelled based upon the increased capacity of the Pumping Station; a 2.4m$^3$ pump option and 23 m$^3$ pump option.

- **Option E – Beverley and Barmston Drain/Western Drain**

  The feasibility of raising sections of existing embankment has also been assessed for the Beverley & Barmston Drain; to the south of Beverley Beck. The situation in the Beverley & Barmston Drain is similar to that for the Holderness Drain described in Option C. The Beverley and Barmston Drain, along with its Western Drain tributary, overtops its banks in several locations where a lower than average crest elevation is present. As described in Option C, raising of embankments in one section of the Drain would tend to detrimentally impact flood risk elsewhere. A proposed embankment raise of the section south of Dunswell, over a distance of some 721 metres, on average 0.25m high, up to a minimum height of 1.45 metres AOD, being the only option that reduces local flood inundation without detriment elsewhere.
In tandem it is proposed to raise a section of the Western Drain bank to a minimum height of 2.0 metres AOD. Bank raising would be almost contiguous along the length of Western Drain to its confluence point with the Beverley and Barmston Drain; a length of 3213 metres. The average height of required embankment would be approximately 1 m. The existing flap valve discharge from the Western Drain into the Beverley and Barmston Drain is considered inadequate for the predicted higher flows during extreme events; without causing flooding. Changes to the Western Drain therefore include a 2m wide, high flow weir constructed at the confluence point.

The proposed sections of embankment raising to the Beverley and Barmston Drain together with the Western Drain are illustrated on Figure 6.5 below.

Figure 6.5: Proposed Embankment Raising to Beverley and Barmston & Western Drains

The raising of the embankments proposed by this option removes fluvial inundation risk in the area south of Beverley; however with some very minor detriment predicted further upstream.
Volumetrically, this option reduces the peak 100 year inundation volume for the River Hull system by only 2% but would protect relatively high value land/buildings from inundation.

- **Option F – Wilfholme and Hempholme Pumping Stations**

Option F comprises an evaluation of the two existing Environment Agency pumping stations located at Wilfholme and Hempholme; the locations are illustrated on Figure 6.6 below.

![Figure 6.6: Location of Wilfholme and Hempholme Pumping Stations](image)

The existing surface water management regime in the upper River Hull catchment includes the following transfer pumping arrangements:

- Hempholme Pumping Station: three number pumps that transfer water from the Roam Drain near Hempholme Bridge into the Mickley Dike immediately upstream of the Bunker Hill flap valves.
- Wilfholme Pumping Station: four number pumps that transfer water from the Beverley and Barmston Drain into the River Hull in the vicinity of Wilfholme Bridge.

It is proposed that the existing pumps are replaced with smaller, but more efficient pumps.

Both the current, and proposed, pumping regime would protect local agricultural land with the additional benefit that replacement pumps would lead to a reduction in maintenance costs.

- **Option G – Natural Flood Management**

The above options take an approach to flood alleviation that focusses upon the conveyance of water through the catchment by increasing channel capacity and efficiency. Natural Flood Management (NFM) however aims to delay the flow of water through the catchment by means
of attenuation and infiltration of surface water. NFM is generally employed upstream of towns and villages to both reduce and slow down peak flow, and involves a reversion from modern farming practises. The specific aim of this option is therefore to attenuate the predicted 100 year peak flow upstream through a range of ‘soft’ engineering measures across a greater area of upland catchment; rather than ‘hard’ engineered measures further downstream.

For example, if a typical farm, or small catchment, were to sacrifice between 2 and 10 per cent of the land to water attenuation and flood mitigation, this would dramatically change the characteristics of the runoff regime. Runoff Attenuation Features (RAFs) can typically be implemented within a farm or landscape to contribute to this type of flood mitigation. RAFs are favoured, and are often more desirable than traditional engineering solutions, due to their low cost and the cumulative benefits to all downstream flood sites.

RAFs include overland flow disconnection ponds which act as storage areas, intercepting overland flow; such features are ideal for disrupting fast surface runoff pathways during peak flow events. Other measures could include increased channel roughness, through introduction of debris, to reduce flow velocity with increased sedimentation and spillage onto the connected floodplain. These structures can also create a complex microhabitat for both aquatic and terrestrial organisms; as well as contributing to the nutrient cycling. Further measures such as swales and infiltration trenches can be introduced to alter the conveyance of water through the catchment by encouraging infiltration.

Within the River Hull catchment, farming is largely arable and hence considered a suitable candidate to accommodate RAFs. Potential sites for NFM would be identified through a combination of distance from main watercourses, floodplain connectivity, terrain type, land ownership and feasibility of implementation. This strategy option will however, require the cooperation of land owners and tenant farmers to adopt the necessary approach and be involved in catchment-scale flood management.

The total upper catchment area covers an extensive area to the north and north-west of the study area. In order to model the potential effects, this option assumes an area of NFM equivalent to approximately 10% of the upland area (292 hectares); which would be subject to agreements/initiatives with local landowners/farmers prior to implementation. The assumed 10% has been modelled to take place within the catchment areas of Upper Foston, Upper Forflorns, Driffield Beck, Driffield Trout and Walton Beck as illustrated at Figure 6.7 below; the respective areas shown for each catchment equates to @ 10% of the total area.
This option is not predicted to prevent the 100 year flood inundation at any particular location; rather it reduces the extent and peak depth of flooding. An overall volumetric reduction of 3% to the peak 100 year fluvial inundation is predicted.

- **Option H – Asset refurbishment**

This option has not been modelled and hence not assessed on the basis that it is a costing exercise only to ensure adequate long term maintenance of existing and new assets.

### 6.4 Baseline for Assessment

We have assessed the likely significant environmental impacts, at a strategic level, of the above options upon the existing environment. The likely effects have helped shape the strategy and refine the options chosen. In assessing the effects we have considered both the direct impacts associated with the implementation and operation of each option e.g. construction, together with the indirect effects resulting from a flood event. To test the indirect effects a ‘baseline’ situation i.e. a flood event based upon a continuation of the existing protection and management measures has been modelled, and then predicted a flood event for each option. We have looked at a ‘worst case’ scenario, namely a point in the future when the existing defences and protection measures
combined with effects of climate change are least effective, and then modelled each option in the comparable year.

The ‘Do Minimum’ option as modelled for the year 2085 (Option 0B as noted in the RHICS) was considered to best reflect the ‘baseline’ given that it models the retention, ongoing operation and maintenance of all existing flood elements within the River Hull system; obviously without implementation of any strategy options. The predicted inundation baseline is illustrated at Appendix D (Figure B1). It is noted that the predicted extent of flooding includes extensive areas of low lying land to both the west and east of the River Hull in its upper reaches including North Frodingham Carrs, Watton Carrs and Leven Carrs. This pattern continues to the east of Beverley and north east of Hull with bands of low lying areas vulnerable to inundation, in particular at Routh Carrs, Stone Carrs, east of Wawne and North Carrs. All of the above noted areas are predominantly rural, agricultural land. Small pockets of potential flooding are predicted within the centre of Beverley, primarily along Woodhall Way, to the immediate west of Dunswell, the north eastern fringe of Bransholme and the A1033 Stoneferry Road within the urban area of Hull.

This ‘baseline’ inundation has then been compared to the equivalent, predicted scenario for each strategy option, the year 2085, tested against the range of environmental factors scoped into the assessment; predicted inundation illustrations for each modelled option are also contained within Appendix D. The prediction of environmental effects (both direct and indirect) considers the likely impacts, at a strategic level, upon the baseline environment described at Section 5.

Additionally the original SEA assessed the potential effects arising from the FRMS upon the stated environmental objectives, and sub-objectives, i.e. these objectives were considered to constitute ‘receptors’. This high level process has been reviewed in preparation of the Addendum report with a comparable assessment presented at sub-section 6.6 below.

6.5 Prediction of Environmental Effects

6.5.1 Population

The RHICS is unlikely to form a major factor in respect of population trends, in terms of constituent elements or distribution, however it is likely to influence those strategies and policies that create other drivers such as the supply of land for residential development, employment use and location of new infrastructure.

The RHICS may also assist in helping sustain the attractiveness and/or appeal of an area (through managing/reducing local sources of flood risk), and in contributing to health and wellbeing. The experience and perceived threat of flooding can have significant effects on physical and in particular, psychological wellbeing of communities hence management of this risk can play a positive role.

At the strategic level the direct effects of option implementation are not assessed to be significant. The indirect effect, namely the potential inundation, is likely to be of greater concern to the local population; hence a review of the predicted inundation associated with each strategy option in comparison to the baseline is considered to be more relevant. The Integrated Catchment Model, presented in the RHICS, has also modelled the existing baseline scenario together with a combined scenario for all of the promoted options in order to derive the change
in flood risk to properties; see sub-section 13.1 of the RHICS. The model outputs the number of residential properties at risk for a range of storm durations and ‘return’ periods i.e. the number of years over which the storm events may occur. The worst case scenario, a 100 year return period, indicates that some 18,141 properties are at risk of flooding in the baseline (existing) situation compared to some 17,350 properties with the strategy options in place; a reduction of 791 properties.

More detailed analysis has been undertaken, again presented in the RHICS, to understand the reduction in flood risk arising from fluvial i.e. river, sources only in respect of both residential and commercial properties. This analysis examined residential properties within the defined EA flood risk categories, ranging from very low to very significant risk, and notes the reduction in risk i.e. where a property that is currently categorised as being subject to a Very Significant Risk (a 5% annual chance in flooding) in the baseline situation benefits in a reduction to say a Moderate Risk (a 1% annual chance of flooding) as a result of a particular strategy option. For commercial properties a more simplistic analysis of property numbers, where a property is removed from the risk of flooding, has been calculated for a range of return periods; to ensure consistency the 100 year return period is noted below for each option. The reduced risk, in terms of property numbers (residential), and change in number of commercial properties predicted to be at flood risk is noted for each option below.

**Option A: Dredging of the River Hull**

Flood risk is predicted to be little different to that of the baseline; see Figure B2 at Appendix D. Major population centres would be largely unaffected with the exception of small, selected areas to the centre of Beverley and north-eastern fringe of Hull (Bransholme) where a flood risk is predicted to remain. The majority of the smaller settlements and outlying villages within the study area would be protected. Some 13 fewer residential properties would fall into the Significant (a 2.5% annual chance of flooding) category however 4 more properties would be within the Moderate category. The analysis of commercial properties indicates that 16 will be removed from risk of flooding over the 100 year return period.

The overall, indirect effect of Option A is assessed to be *Minor Beneficial* in both the short and long term.

**Option B: Tidal Exclusion**

Major population centres are predicted to be largely unaffected in respect of this option with the pattern of inundation broadly similar to the baseline; see Figure B3 at Appendix D. Greater flood risk protection would be afforded to the city centre of Hull at Stoneferry Road, with reduced flood risk in this area. The majority of population centres including smaller settlements and outlying villages within the study area would be predicted. One less residential property would fall into the Very Significant category, with 18 fewer falling into the Significant category and 5 fewer properties within the Moderate category. The analysis of commercial properties indicates that 45 will be removed from risk of flooding over the 100 year return period.

The overall, indirect effect of Option B is hence assessed to be *Moderate Beneficial* in both the short and long term.
Option C: Holderness Drain

This option is also predicted to afford flood risk protection to major population centres with a pattern of inundation similar to that predicted under baseline conditions; see Figure B4 at Appendix D. Greater flood risk protection would be afforded to the north-eastern fringe of Hull at Bransholme, with reduced flood risk in this area. As a result some 573 fewer residential properties would fall within the Very Significant category, 200 fewer in the Significant category and 26 fewer in the Moderate category. The analysis of commercial properties indicates that 45 will be removed from risk of flooding over the 100 year return period.

The overall, indirect effect of Option C is assessed to be Major Beneficial in both the short and long term.

Option D: Bransholme Pumping Station

The current upgrade of Bransholme Pumping Station by Yorkshire Water has not been modelled. For the purposes of the Strategic Assessment this option has been assigned a Neutral indirect effect.

Option E: Beverley and Barmston Drain/Western Drain

Flood risk is predicted to be little different to that of the baseline but with the exception of greater protection to the western edge of Dunswell; see Figure B5 at Appendix D. Major population centres, together with the majority of the smaller settlements and outlying villages, are predicted to be largely unaffected. Consequently just 1 less residential property would fall within the Very Significant category, with 5 fewer in the Significant category and 4 fewer in the Moderate category. The analysis of commercial properties indicates that 31 will be removed from risk of flooding over the 100 year return period.

The overall, indirect effect of Option E is hence assessed to be Neutral in the short term (Option E will not be implemented in the short term, years 1 to 6, period of the RHICS) but Moderate Beneficial in the long term.

Option F: Hempholme and Wilfholme Pumping Stations

Major population centres are predicted to be largely unaffected in respect of this option with a pattern of inundation that replicates the baseline; see Figure B6 at Appendix D. As a result there would be no change in the numbers of residential properties within each flood risk category. Similarly, there would be no change to the number of commercial properties predicted to be at risk from risk of flooding over the 100 year return period.

The overall, indirect effect of Option F is hence assessed to be Neutral in both the short and long term.

Option G: Natural Flood Management

This option is predicted to afford flood risk protection similar to that of Option C; see Figure B7 at Appendix D. Greater flood risk protection would be afforded to the north-eastern fringe of Hull at Bransholme, with reduced flood risk in this area. A further 14 residential properties
would be added to the Very Significant category, however some 72 fewer would fall into the Significant category and 12 fewer in the Moderate category. The analysis of commercial properties indicates that 9 will be removed from risk of flooding over the 100 year return period.

The overall, indirect effect of Option G is assessed to be Neutral in the short term (Option G will also not be implemented in the short term period) but Minor Beneficial in the long term.

**Assessment Summary Table**

The assessed effects, both direct and indirect, for each option in respect of population are summarised in the table below:

<table>
<thead>
<tr>
<th>Option</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct Effect</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Indirect Effect: Short Term</td>
<td>Minor Beneficial</td>
<td>Moderate Beneficial</td>
<td>Major Beneficial</td>
<td>Neutral</td>
<td>Neutral</td>
<td>Neutral</td>
<td>Neutral</td>
</tr>
<tr>
<td>Indirect Effect: Long Term</td>
<td>Minor Beneficial</td>
<td>Moderate Beneficial</td>
<td>Major Beneficial</td>
<td>Neutral</td>
<td>Moderate Beneficial</td>
<td>Neutral</td>
<td>Minor Beneficial</td>
</tr>
</tbody>
</table>

**6.5.2 Flora, Fauna and Biodiversity**

When considering these options and their potential to impact ecological receptors, reference has been made to Chartered Institute of Ecology and Environmental Management (CIEEM) Guidelines for Ecological Impact Assessment in the United Kingdom (2006). This document sets out specific guidance for professional ecologists when considering the effects of proposals.

When considering the confidence of predictions, the following wording is recommended and these guidelines have been adhered to during this assessment:

- Certain / near-Certain: probability estimated at 95% chance or higher.
- Likely / Probable: probability estimated above 50% but below 95%.
- Unlikely: probability estimated above 5% but less than 50%.
- Extremely unlikely: probability estimated at less than 5%.

**Option A: Dredging of the River Hull**

Dredging can damage ecological receptors by directly affecting the physical habitat, disrupting riverine processes and reduced connectivity with the floodplain. These effects can prevent the achievement of WFD objectives and could result in the deterioration of status for the watercourse. Removal of periodically exposed sediments can impact on specialised species which may be protected (e.g. invertebrates of exposed riverine sediments), and dredging may also make a channel more vulnerable to exploitation by invasive non-native species such as signal crayfish and Himalayan balsam.

The process of water injection dredging mobilises sediments and moves them downstream, in this case discharging into the internationally important Humber Estuary. It is likely that due to past usage of River Hull these sediments may be contaminated and until chemical analysis of
sediment is known it is not possible to comment on the effects of contaminant release on water quality or the risk to biota living in both the sediment and the water column.

Similarly if contaminants were to be mobilised and then discharged into Humber Estuary, this could have serious consequences for estuarine biota and bird species feeding on them in the inter-tidal habitats which are internationally important for over-wintering and migrating wading bird populations. It is likely that WID constitutes permitted development; hence no planning application will be required. This option also includes the removal of sunken vessels within the River Hull, hence to assess any potentially significant effects on the Humber Estuary SPA / SAC (a Natura 2000 site), in consultation with Natural England, a Habitats Regulations Assessment will be undertaken.

It is likely that as part of any EIA, if required, to support an application for this option sampling of sediment will be required; to ascertain the nature and concentrations of contaminants and this will inform the methodology employed. Where contaminant levels are discovered to be above acceptable thresholds, the use of traditional dredging equipment and removal to contaminated waste facilities should be considered.

An element of this option involves removal of riparian vegetation, mainly reedbeds which have encroached along with accumulating sediment. Whilst there is very little undeveloped land adjacent to the River Hull on this section, there are areas of foreshore which will be used to create compensatory reedbed habitat. At present the amount of reedbed loss has not been quantified, however, it is understood that sufficient area on River Hull foreshore exists in order to create compensatory habitat.

Based on the Option as described it is considered that direct effects are considered likely to be Major Adverse in the short term and Neutral in the long term. No significant indirect effects are considered likely to occur (i.e. effects due to 2085 flooding scenario are not significantly changed).

Options B – F

The implementation of all of Options B - F is considered unlikely to have any significant direct adverse effects on receptors of national and international importance and is considered to have an overall neutral indirect effect both in the short and long term. This is based on the nature of the interventions, e.g. raising flood embankments away from nationally and internationally important sites or increasing pumping capacity at various locations. The implementation of these engineering options is unlikely to generate significant effects provided that legislation and guidance regarding protected species, pollution, invasive non-native species and other best practice methods are adhered to.

Option B involves construction of a new tidal barrier for River Hull which will be activated more frequently (at tides of 2m AOD rather than 4.25m AOD as at present). Consequently there is a possibility that increased closure of a tidal barrier will restrict fish movements between the River Hull and Humber Estuary for species including eels and sea lamprey. The risk of compromising fish movements is considered to be small (unlikely) as the river will continue to discharge into the Humber Estuary in the usual way on ebbing and low tides and all high tides less than 2m
AOD. Barrier usage is envisaged on spring tides during high rainfall events although this will be activated at 2m AOD rather than the current 4.25m AOD.

Whilst it is considered unlikely that there will be a significant adverse effect on fish movements it is proposed that fish presence both sides of the barrier be monitored post implementation to monitor impacts on fish movements.

Embankment raising and refurbishment of pumping stations have no direct impacts on SSSIs as no works within SSSI designated areas is planned. A series of models have been run by hydrological engineers to examine the potential operational impacts of each option. In each case impacts on groundwater are considered to be minimal with no significant change in infiltration rates or groundwater level in the short, medium or long term. Consequently no adverse impact on SSSIs sensitive to groundwater levels is predicted (including Pulfin Bog).

Changes to the flow regime in the River Hull will include an increased tidal range (including where it flows adjacent to Pulfin Bog SSSI) but no change in average water levels in the river. Consequently no impact due to change in river levels is predicted for Pulfin Bog SSSI.

Modelling based on the current situation predicts that Pulfin Bog SSSI is inundated to a depth of greater than 1m depth during a 1 in 5 year flooding event due to low embankments north of the site. Management of River Hull water levels is likely to reduce the frequency of inundation, however, this assessment is concerned simply with the ‘worst case scenario’ flooding event in 2085 and consequently predicted positive impacts due to reduced frequency of inundation for Pulfin Bog SSSI are not considered as part of this assessment.

Indirect impacts of 2085 flooding scenario show Pulfin Bog SSSI to be inundated with surface borne flood water which is likely to have a significant adverse effect on this spring fed wetland system. Sudden inundation of the site by floodwater which is likely to be of poor quality containing agricultural and urban runoff or sewage contaminants is considered to have a Moderate Adverse effect on this receptor. Frequent or long term flooding will change vegetation species composition at Pulfin Bog SSSI is considered likely to generate a Major Adverse effect.

All flooding scenarios also show flooding adjacent to Leven Canal SSSI and River Hull Headwaters SSSI which brings risk of reducing water quality within these designated sites and the risk of facilitating spread of invasive non-native species to and within both designated sites generating a likely Moderate Adverse impact but with the unlikely risk of a Major Adverse impact.

In each case the direct significant impact on identified receptors due to implementation of the Options is considered to be neutral.

The effect of all the flooding scenarios on receptors of national and international importance is considered likely to be moderate adverse as described above, however, this is also the case in the baseline scenario, therefore the overall indirect effect on ecological receptors due to implementation of the proposed Options at a strategic level is considered likely to be Neutral.
Option G – Natural Flood Management

Implementation of this option is considered to generate moderate beneficial effects on receptors of national and international importance as nationally important sites will be buffered from surrounding potentially damaging operations (e.g. fertiliser and herbicide drift), and seminatural habitats which develop will increase habitat connectivity.

However, the benefits accrued post-implementation are assessed to offer a major beneficial effect through their considerable contribution to creation of resilient habitat networks and connectivity at a landscape scale. Additionally measures aimed at naturalising watercourses and riparian habitats aim to reverse physical changes to river structure which have reduced habitat diversity, reduce fine sediment load and promote development of wetland habitats adjacent to river channels. Beneficial ecological effects are predicted to increase as time goes by as habitat features created for water attenuation and flood mitigation vegetate, and habitats of high ecological importance develop.

Benefits of this approach for fisheries including salmonid spawning grounds in River Hull Headwaters SSSI and similar catchments have been demonstrated to be effective. Action is already underway through the River Hull Headwaters Restoration Project led by a coalition of partners including East Yorkshire Rivers Trust, Yorkshire Wildlife Trust, Environment Agency and Natural England. Completed projects demonstrate the deliverability of this approach. Reference to the River Hull Headwaters SSSI River Restoration plan and wetland feasibility study will be made to inform development of this option at the detailed design stage when it is envisaged a project group will be created to promulgate activity. As RHICS is a high level strategy document, details of implementation and landowner agreements etc are not considered here.

It should be stated that Option G is a proposal in its own right and is not intended to mitigate for negative impacts in other parts of the Hull River Basin due to implementation of Options A-F. Overall implementation of Option G is considered certain to have a long term major beneficial effect on flora, fauna and biodiversity.

Indirect significant effects are considered likely to be minor beneficial as ecological receptors of national importance will be inundated both in the base line scenario and with the upland habitat creation programme in place, however, point source pollution and sediment load directly into River Hull Headwaters SSSI is likely to be considerably reduced, whilst impacts on Puffin Bog and Leven Canal SSSIs are likely to remain the same as the baseline scenario.

Assessment Summary Table

The assessed effects, both direct and indirect, for each option in respect of flora, fauna and biodiversity are summarised in the table below:

<table>
<thead>
<tr>
<th>Option</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct Effect: Short Term</td>
<td>Major Adverse</td>
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<td>Neutral</td>
<td>Neutral</td>
<td>Neutral</td>
<td>Neutral</td>
<td>Neutral</td>
</tr>
<tr>
<td>Direct Effect: Long Term</td>
<td>Neutral</td>
<td>Neutral</td>
<td>Neutral</td>
<td>Neutral</td>
<td>Neutral</td>
<td>Neutral</td>
<td>Minor Beneficial</td>
</tr>
<tr>
<td>Indirect Effect</td>
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<td>Neutral</td>
<td>Neutral</td>
<td>Neutral</td>
<td>Neutral</td>
<td>Minor Beneficial</td>
</tr>
</tbody>
</table>
6.5.3 Landscape and Land Use

Baseline Analysis

Landscape Constraints

The ‘Local Flood Risk Management Strategy: SEA Draft Scoping Report’ (ERYC 2014) Table 4.1 ‘Identification of environmental issues and problems’ Issue 17 identifies ‘Sensitive landscape threatened by detractors due to development pressure’ as a potential environmental issue/problem as ‘LFRMS measures can potentially result in alteration of the nature of the landscape and/or create detractors’.

The LFRMS acknowledges that the landscape is sensitive and susceptible to development. In respect of the landscape within the study area the RHICS options should seek to minimise ‘detractors’ and ensure that any ‘alteration of the nature of the landscape’ results in positive landscape change in the longer term.

Landscape Opportunities

The National Character Area Profile for NCA: 40 ‘Holderness’ identifies ‘Statements of Environmental Opportunity’ including:

- **SEO 1**: ‘Conserve, manage and enhance the River Hull and associated river system with its many associated drains, dykes and streams to improve water quality and supply, sustainably address flood risk management, and enhance biodiversity and the historic environment through a strategic, landscape-scale approach.’

This is essentially the purpose of the options promoted within the RHICS.

Examples of how the SEO might be realised are also identified:

- ‘Seeking opportunities to increase and link wetland habitats within the River Hull corridor including open water, reedbed, fen and wet grassland’;
- ‘Seeking opportunities to maintain and increase flood plain grazing marsh owing to its role in storing carbon, ensuring that sites are managed to enhance their biodiversity value’;
- ‘Where feasible, through partnership, seeking opportunities to support habitat enhancement and wildlife opportunities, managing flood risk and avoiding saline intrusion in relevant areas by creating permanent grassland, wet grassland and wet woodlands, and expanding or creating flood storage areas’; and
- ‘Seeking opportunities to create woodland to reduce flood flows’.

Whilst RHICS Options C and E may offer limited opportunities, the nature of RHICS Option G (Upland Management) actually offers greater potential (particularly on the boundary of the Holderness plain and the Wolds) for delivering these opportunities for landscape conservation, management and enhancement.
The National Character Area Profile for NCA: 27 ‘Yorkshire Wolds’ identifies ‘Statements of Environmental Opportunity’ including:

- **SEO 1**: ‘Enhance, extend and manage the unique assemblage of chalk-based habitats (lowland chalk grasslands, streams), broadleaved woodland and maritime cliffs, while protecting the provision and quality of water’; and

- **SEO 4**: ‘Maintain a sustainable but productive arable landscape, while expanding and connecting semi-natural habitats to benefit biodiversity, and soil and water quality by promoting good agricultural practice, extending grasslands along field margins and slopes, implementing extensive grazing regimes and ensuring compliance with regulations on nitrate vulnerable zones (NVZs) to manage fertiliser inputs’.

Examples of how these SEOs might be realised include:

- ‘Creating and managing grassland buffer strips along watercourses and consider reverting arable land to grassland on steeper slopes to reduce soil erosion and nutrient run-off in arable areas, and to create buffers and links to existing sites of biodiversity interest, particularly those adjacent to the tributaries of the River Hull draining to the east’;

- ‘Restoring and enhancing riverside wetland habitats on narrow valley floors, and retaining areas of extensively managed wet grasslands, especially across the floor of winterbourne channels and relict small-scale field patterns’;

- ‘Enhancing/improving chalk-based aquatic habitats by managing rivers, streams and flushes to maintain hydrological processes, enhance water quality and provision, and maintain the biodiversity of related plant and invertebrate communities’;

- Maintaining and improving the chalk aquifer for public water supply, its long-term resilience and water storage, by working with the local farming community to adopt sustainable farming practices and to improve filtration into the ground and reduce nutrient run-off through the creation or restoration of a network of grasslands’;

- ‘Through landscape-scale partnerships, undertaking joint initiatives in the adjoining National Character Areas (NCAs) to protect the water quality and supply of groundwater of the northerly chalk streams of the Yorkshire Wolds and the headwaters in adjoining NCAs into which they flow’;

- Encouraging farmers and landowners in the Yorkshire Wolds (and immediately adjoining NCAs) to restore and create semi-natural habitats to improve water infiltration and reduce nitrate input – for example, through take-up of environmental stewardship arable options, extending grasslands along field margins and slopes to prevent sediment run-off, and improving water quality, biodiversity and pollination’;

- Developing an integrated package of catchment sensitive farming initiatives along the headwaters of the River Hull and Settrington Beck/ River Derwent’; and
• Creating riparian woodland along watercourses and wider catchment planting on the lower eastern slopes to help promote rainfall infiltration into the soil, reducing water pollution and sediment run-off’.

All are of particular relevance to RHICS Option G (Upland Management).

Assessment Criteria

Helpfully the recently prepared ‘Local Flood Risk Management Strategy: SEA Draft Scoping Report’ confirms that ‘To predict the effects of the LFRMS on the environment, consideration will be given to likely changes to the environmental baseline, arising from the LFRMS proposed options, and compared to the ‘do nothing’ and ‘business as usual’ scenarios. The predicted effects will be characterised in terms of their magnitude, the time period over which they occur, whether they are permanent or temporary, positive or negative, probable or improbable, frequent or rare, and whether there are cumulative and/or synergistic effects’.

This approach reflects that which has been undertaken within this SEA Addendum report in respect of the RHICS options.

The assessment criteria may also include ‘direct’ effects (changes to the fabric of the landscape resulting directly from the development works) as well as ‘indirect’ effects (secondary effects arising as a consequence of the development works). GLVIA3 cites a relevant example of secondary effects:

‘…alterations to a drainage regime which might change the vegetation downstream with consequences for the landscape’.

Flooding is an ephemeral effect and does not form part of landscape character assessment. However, where an option will result in a significant increase in the frequency of inundation a change in vegetation structure is may occur. These potential changes are discussed in the Flora, Fauna and Biodiversity section. Nevertheless, it is considered that any changes to vegetation diversity are likely to enhance landscape character in the long term.

With reference to evaluating effects, ‘Local Flood Risk Management Strategy: SEA Draft Scoping Report’ (ERYC 2014) paragraph 6.1 states that ‘Assessing the significance of effects on the environment is essentially a matter of judgement, and this will be documented, in terms of the particular characteristics of the effect which are deemed to make it significant, and whether and what uncertainty and assumptions are associated with the judgement. The assessment of significance will also include information on how the effect may be avoided or its severity reduced, in the case of adverse effects, or enhanced in the case of beneficial effects. The SEA Practical Guidance recommends the following questions in evaluating effects of different options:

• ‘What exactly is proposed?’

• Will the option have a likely significant adverse effect in relation to each of the SEA objectives?

• If so, can the adverse effect be avoided or its severity reduced, or can the beneficial effect be maximised?’
If the adverse effect cannot be avoided, e.g. by conditions or changes to the way it is implemented, can the alternative be changed or eliminated?

If its effect is uncertain, or depends on how the plan is implemented, how can the uncertainty be reduced?

It is relevant, in consideration of potential landscape effects, that the above questions be posed for each RHICS Option.

In considering mitigation for each option it is considered best practice to identify significant effects then formulate suitable mitigation measures to prevent, reduce or offset adverse effects, and enhance positive effect.

Potential mitigation and enhancement measures should be identified for each RHICS Option.

Evolution of the Baseline

The NCA: 40 ‘Holderness’ Supporting Document 2: Landscape Change confirms that ‘Data from Countryside Quality Counts for the period 1999 to 2003 indicate that a significant expansion of woodland cover occurred resulting from woodland grant scheme agreements’ and that ‘New planting is mostly in small, scattered blocks or shelterbelts.’

This document also states that ‘A network of artificial drains (Beverley, Barmston and Holderness) are regulated by pumping stations helping to alleviate flood risk while optimising drainage and enabling a large area of the East Riding of Yorkshire to be effectively farmed. The Hull Valley and Holderness drains lie within the catchment sensitive farming priority area for the county. Much of the drainage system in individual fields and those managed by internal drainage boards has been improved to take advantage of the infrastructure.’

The NCA: 27 ‘Yorkshire Wolds’ Supporting Document 2: Landscape Change also confirms that ‘There has been new planting of small scattered woodland blocks on higher land and steeper slopes in the west and north’ and ‘There has been an increase in the area of woodlands managed under Woodland Grant Scheme agreements’.

Therefore if the RHICS Options are not delivered it may be assumed that (apart from sporadic woodland planting) the current landscape baseline would remain similar and intensive agricultural practices would continue to the detriment of potential surface water attenuation and landscape character enhancement.

Options Assessment

Of the seven options considered by this SEA Addendum, in respect of landscape issues it is anticipated that Options C, E and G have the greatest potential to cause strategic effects.

Option C: Holderness Drain

Option C comprises the raising of the Holderness Drain embankments below the Great Culvert Pumping Station, as well as increased pump capacity.
The raised height of the Holderness Drain / Ganstead Drain embankments may require the removal of sensitive landscape elements, including trees and vegetation.

Tree and vegetation loss may have a temporary, landscape impact (given that trees and vegetation could be replanted as mitigation) and (in addition to the limited geographical area affected) is assessed as having a potentially neutral direct landscape effects in the long term.

It is considered that any indirect effects arising from inundation and consequential changes to vegetation diversity are likely to enhance landscape character in the long term resulting in a minor beneficial effect.

Further detailed assessment of landscape effects should be undertaken at the project stage.

**Option E: Beverley and Barmston Drain/Western Drain**

Option E comprises the raising of the Beverley and Barmston / Western Drain south of Beverley Beck.

The raised height of the Beverley and Barmston / Western Drain embankments may require the removal of sensitive landscape elements, including trees and vegetation.

Tree and vegetation loss may have a temporary, landscape impact (given that new trees and vegetation could be replanted as mitigation) and (in addition to the limited geographical area affected) is assessed as having a potentially neutral direct landscape effects at a strategic level.

It is considered that any indirect effects arising from inundation and consequential changes to vegetation diversity are likely to enhance landscape character in the long term resulting in a minor beneficial effect.

Further detailed assessment of landscape effects should be undertaken at the project stage.

**Option G: Natural Flood Management**

Option G employs Natural Flood Management (NFM) to delay the flow of water by means of attenuation and infiltration of surface water through Runoff Attenuation Features (RAFs).

The ‘soft engineering’ measures associated with the implementation of RAFs may offer a substantial opportunity for landscape character enhancement.

Therefore the NFM is assessed as having potential long term major beneficial direct landscape effects at a strategic level.

It is considered that any indirect effects arising from inundation and consequential changes to vegetation diversity are likely to enhance landscape character in the long term resulting in a minor beneficial effect.

Further detailed assessment of effects should be undertaken at the project stage.
Significance of Landscape Effects

In order to fully manage potential impacts further assessment of the implications of each proposal is required at the project stage when more detail on the location, nature and type of works are known.

The consideration of potential effects arising from the implementation of any option upon landscape character should be fully integrated into the design phase of individual projects.

An assessment of landscape character should be undertaken followed by a landscape and visual impact assessment to inform the detailed design of individual schemes. This should allow potential adverse effects to be avoided or mitigated. It is not, however, possible to state with certainty at this stage that all adverse effects would be mitigated.

Assessment Summary Table

The assessed effects, both direct and indirect, for each option in respect of landscape and land use are summarised in the table below:

<table>
<thead>
<tr>
<th>Option</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct Effect</td>
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<td>Indirect Effect</td>
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<td>N/A</td>
<td>Minor Beneficial</td>
<td>N/A</td>
<td>Minor Beneficial</td>
</tr>
</tbody>
</table>

6.5.4 Cultural Heritage

Introduction

The FRMS Strategic Environmental Assessment Report notes that Archaeology and Cultural Heritage is a Key Issue, Constraint and Opportunity, and that a key objective is the protection of designated and [other] cultural heritage features (EA 2010, 10 & 33-34). This report also notes that it is more appropriate to consider Scheduled Monument and Listed Buildings at the strategic level, with other archaeology and cultural heritage features (including as yet unknown archaeology) at individual project level (EA 2010, 7).

One of the environmental objectives of the ERYC Local Flood Risk Management Strategy SEA Draft Scoping Report is the protection and enhancement of the historic environment (ERYC 2014, 51). It also recognises that some heritage assets are at risk from flooding, that flood defences and the drainage network are a significant part of the area’s heritage, and that there are opportunities for LFRMS measures to conserve and enhance the contribution of flood defence and drainage network to local heritage and cultural identity (ERYC 2014, 47).

Baseline

Although there are a significant number of cultural heritage assets within the wider study area, comparatively few assets lie within the River Hull corridor, as historic occupation and activity has largely avoided the low-lying floodplain. In terms of the baseline inundation area, three Scheduled Monuments, 50 Listed Buildings, one Conservation Area and no Registered Parks and
Gardens would be affected by not carrying out the works - these are considered to be indirect impacts. The three affected Scheduled Monuments are Rotsea medieval settlement and field system, south-east of Rotsea Manor (SM NHLE 1005212), the site of the Holy Trinity (Knights Hospitallers) preceptory in Beverley (SM NHLE 1013402), and a medieval moated tile kiln north-east of North Grange Farm near Wawne (SM NHLE 1008039).

Inundation may result in erosion and the deposition of imported silts onto archaeological sites, while a general raising of the water table might lead to increased waterlogging of otherwise dry deposits. Conversely, previously waterlogged sites might be affected and eventually destroyed if flood protection measures (e.g. sheet piling) create a barrier between them and the river, resulting in a gradual lowering of the water table. Inundation of Listed Buildings and Conservation Areas, whether from short or long term flooding, invariably causes harm and deterioration to historic fabric, while worse case scenarios can lead to structural instability and collapse. The majority of the affected Listed Buildings lie in Beverley, although there are outlying structures in Wansford (6) and one near Arram Grange. The one affected Conservation Area is Beverley, with eight of the nine subdivisions being affected to a greater or lesser degree. In addition to physical impacts, poorly designed flood defenses can also harm the setting or visual appreciation of individual or groups of heritage assets and/or settlements.

**Option A: Dredging of the River Hull**

**Designated Assets**

There is one Scheduled Monument and 12 Listed Buildings immediately adjacent to or within the c.29km length of river covered by this option, as follows. Apart from Hull Bridge Mills, all lie within the City of Hull.

- Buried remains of the town’s 16th century defences and 17th century Hull Citadel on the east bank of the River Hull near its confluence with the Humber (SM NHLE 1020426);
- Hull Bridge Mills (LB NHLE 1103423), on the east side of the river immediately south of the old Hull Bridge;
- River Hull Railway Bridge (LB NHLE 1197656);
- Former British Extracting Company Silo and attached Receiving House (LB NHLE 1208698);
- Wilmington Swing Bridge (LB NHLE 1197815);
- Sulcoates Bridge (LB NHLE 1197693);
- New North Bridge (LB NHLE 1292933);
- North Bridge House (LB NHLE 1293280);
- Pease Court (LB NHLE 197753);
- Lister Court (LB NHLE 1209801);
- Tubular Crane to NE of former Trinity House Buoy Shed (LB NHLE1268383);
- Former Trinity House Buoy Shed (LB NHLE 1197668);
- Central Dry Dock/Sand Southend Wharf (LB NHLE 1375866).

Three of Hull City Council’s Conservation Areas (Sulcoates, Charterhouse and the Old Town) border this section of the River Hull; none of the East Riding’s Conservation Areas do and neither do any of the Registered Parks and Gardens.
Direct Effects

There are unlikely to be any direct effects or impacts (either physical or visual) on the identified designated assets, as they are located on either side of the River Hull, or actually span it. However, there are expected to be a number of non-designated cultural heritage assets (both currently known and unknown) within the river channel, for example historic sunken vessels and other structures, as well as partially buried bank-side remains, such as former bridge abutments, ferry crossing infrastructure, landing places and weirs, fishing weirs, revetments etc, which might be affected by the option.

Although many assets will have been destroyed by previous flood schemes and dredging works, remaining assets could be affected by both the movement of the mudflow layer and more likely from the pre-intervention clearance work along the river channel. These impacts are likely to be especially important in the lower reaches of the river, as it passes through Hull Old Town - the river was extensively used for mercantile activity from the medieval period onwards, and there were numerous wharves and staithes lining the west bank.

Other direct effects may occur as a result of works associated with accessing the lengths of river to be managed, the establishment of site compounds etc, as well as works associated with the dredging, removal and off-site dumping of the mudflow from the river channel. There are unlikely to be any significant alterations to the existing water table as a result of the implication of this option.

Indirect Effects

In terms of the predicted inundation area, three Scheduled Monuments, 53 Listed Buildings and one Conservation Area would be affected by not carrying out the works - these are considered to be indirect effects. No Registered Parks and Gardens or Historic Battlefields would be affected. The three Scheduled Monuments are Rotsea medieval settlement and field system, south-east of Rotsea Manor (SM NHLE 1005212), the site of the Holy Trinity (Knights Hospitallers) preceptory in Beverley (SM NHLE 1013402), and a medieval moated tile kiln north-east of North Grange Farm near Wawne (SM NHLE 1008039). The majority of the affected Listed Buildings lie in Beverley, although there are outlying structures in Wansford (6) and one near Arram Grange. The one affected Conservation Area is Beverley, with eight of the nine subdivisions being affected to a greater or lesser degree.

Conclusions

It is considered that the adoption of this option would have a Low Negative impact on regional receptors, resulting in a direct Minor Adverse effect in the short term, while the indirect effect would be Neutral for both long and short term.

An assessment of the direct and indirect effects of this option on the cultural heritage resource (both designated and more importantly non-designated assets) will need to be undertaken, which will inform the EIA and detailed design, should the option be taken forward. This will allow impacts to be avoided or mitigated as necessary.
Option B: Tidal Exclusion

Designated Assets

There are no designated assets immediately adjacent or within the river corridor at the location of the proposed new barrier, although the nearest listed building (Central Dry Dock/Sand Southend Wharf - LB NHLE 1375866) lies only approximately 70m to the south-west and the nearest Scheduled Monument (Buried remains of the town’s 16th century defences and 17th century Hull Citadel - SM NHLE 1020426) lies approximately 150m to the south-east on the east bank of the River Hull near its confluence with the Humber. The Old Town Conservation Area is bordered by the west bank of the river here.

Direct Effects

There are unlikely to be any direct physical impacts on the identified designated assets, as they are located either side of the river, although there may be some visual impact depending on the type of construction and final design. It is also possible that there may be some direct impacts on non-designated buried cultural heritage assets (both currently known and unknown), both within this short section of river channel and along the adjacent banks (e.g. bank-side revetments, staithes and wharves), although some of the latter may already have been destroyed by previous development associated with the construction of the existing Tidal Barrier and its related infrastructure. Other direct impacts may result from works associated with accessing the development site and the establishment of a site compound etc.

Indirect Effects

In terms of the predicted inundation area, three Scheduled Monuments, 52 Listed Buildings, and one Conservation Area would be affected by not carrying out the works - these are considered to be indirect impacts. No Registered Parks and Gardens or Historic Battlefields would be affected. The three Scheduled Monuments are Rotsea medieval settlement and field system, south-east of Rotsea Manor (SM NHLE 1005212), the site of the Holy Trinity (Knights Hospitallers) preceptory in Beverley (SM NHLE 1013402), and a medieval moated tile kiln north-east of North Grange Farm near Wawne (SM NHLE 1008039). The majority of the affected Listed Buildings lie in Beverley, although there are outlying structures in Wansford (6) and one near Arram Grange. The one affected Conservation Area is Beverley, with eight of the nine subdivisions being affected to a greater or lesser degree.

Conclusions

It is considered that the adoption of this option would have a negligible impact on regional receptors, resulting in both short and long term direct and indirect Neutral effects.

An assessment of the direct and indirect effects or impacts of this option on the cultural heritage resource (both designated and more importantly non-designated assets) will need to be undertaken, which will inform the EIA and detailed design, should the option be taken forward. This will allow impacts to be avoided or mitigated as necessary.
Option C: Holderness Drain

Designated Assets

None of the three pumping stations (Tickton, Great Culvert and East Hull) are Listed Buildings; they were all built in 1972.

The only Listed Building along or within this section of the Holderness Drain lies adjacent to the East Hull Pumping Station, namely Sluices and Bridge over the Holderness Low Land Drain (LB NHLE 1390919); this is an unaltered example of an early 19th century two span bridge with side walls and evidence of former sluice gates which are likely to be contemporary with the creation of this section of the drain. One Scheduled Monument lies on the immediate east side of the drain, south of Castle Hill Farm at the point where Castlehill Road crosses the drain. This is Swine Castle Hill (SM NHLE 1008042) which represents the earthwork remains of an oval-shaped medieval motte surrounded by a moat; limited excavations in 1918 also discovered a probable 16th century manor house. The original excavation of the drain in the late 18th century truncated the south-west corner of the monument. A short distance to the north-east of this site lies the earthwork remains of a prehistoric burial mound, 2m high and 32m in diameter (SM NHLE 1008038).

There are no designated assets adjacent to or within 1km of the Ganstead Drain.

Direct Effects

The raising of the Holderness Drain embankments will have a direct effect on the Swine Castle Hill Scheduled Monument, which lies on the immediate east side of the drain. In addition to physical effects, which may result from an increased embankment footprint (if significant additional height is required), there will be adverse visual effects. The area of the Scheduled Monument extends to the waterline, and so Scheduled Monument Consent will be required for any work here. There may also be some visual impact on the adjacent prehistoric burial mound. Depending on the detailed design of the proposals at the southern end of this option, there may also be direct physical and/or visual impacts on the Listed structures adjacent to the East Hull Pumping Station, although this cannot be determined at this time.

There are also likely to be significant direct impacts (both physical and visual) on a number of non-designated cultural heritage assets (both currently known and unknown) located along the sides of the Holderness Drain. The known assets generally comprise the 19th century infrastructure associated with the construction of the drain, such as road and foot bridges, and culverts and links with other drainage channels, and these may be hidden or obscured by higher embankments. However, there are unlikely to be any significant alterations to the existing water table as a result of the implication of this option, as the raising the heights of existing embankments will be achieved through wider bases.

Other direct impacts resulting from this option may occur as a result of works associated with accessing the lengths of the drains, the establishment of site compounds, and the obtaining and transportation of embankment material etc.
The raising of embankments up to 0.3m high along the Ganstead Drain also has the potential to affect a number of non-designated cultural heritage assets (both currently known and unknown), either through the burying of remains under the new earthworks and/or disturbance due to groundworks.

Indirect Impacts

In terms of the predicted inundation area, three Scheduled Monuments, 53 Listed Buildings, and one Conservation Area would be affected by not carrying out the works - these are considered to be indirect impacts. No Registered Parks and Gardens or Historic Battlefields would be affected. The three Scheduled Monuments are Rotsea medieval settlement and field system, south-east of Rotsea Manor (SM NHLE 1005212), the site of the Holy Trinity (Knights Hospitallers) preceptory in Beverley (SM NHLE 1013402), and a medieval moated tile kiln north-east of North Grange Farm near Wawne (SM NHLE 1008039). The majority of the affected Listed Buildings lie in Beverley, although there are outlying structures in Wansford (6) and one near Arram Grange. The one affected Conservation Area is Beverley, with eight of the nine subdivisions being affected to a greater or lesser degree.

Conclusions

It is considered that the adoption of this option would have a Medium negative impact (i.e. undesirable consequences) on national and regional receptors, largely due to the impacts on Swine Castle Hill Scheduled Monument, resulting in a Moderate Adverse effect in the short term. The indirect impacts would result in a Neutral effect for both short and long term.

An assessment of the direct and indirect effects or impacts of this option on the cultural heritage resource (both designated and more importantly non-designated assets) will need to be undertaken, which will inform the EIA and detailed design, should the option be taken forward. This will allow impacts to be avoided or mitigated as necessary. Detailed consultation will also need to be undertaken with English Heritage during design work, so that direct physical and visual impacts on the Scheduled Monument can be minimised.

Option D: Bransholme Pumping Station

Designated Assets

The location of the new Bransholme surface water pumping station lies on the south-east corner of an existing water storage lagoon, and replaces a structure built in the late 1960s. It is not a Listed Buildings, and no Scheduled Monuments, Conservation Areas or Registered Parks and Gardens lie within 1km of the station. The nearest Listed Buildings lie c.400m to the south on the west side of the River Hull, and are Haworth Hall and its associated outbuildings, and an adjacent stirrup table (LB NHLEs 1197620 and 1207915).

Direct Effects

There will be no direct impacts on any designated assets arising from this option, and it is also unlikely that there will any direct impacts on any known or unknown non-designated assets.
Similarly, there are unlikely to be any direct impacts arising from construction works associated with the option.

**Indirect Effects**

The current upgrade of Bransholme Pumping Station by Yorkshire Water has not been modelled. For the purposes of the Strategic Assessment therefore, this option has been assigned a *Neutral* indirect effect.

Conclusions

It is considered that the adoption of this option would have no impact on regional receptors, resulting in a *Neutral* impact for both direct and indirect effects, in both the short and long term.

**Option E: Beverley and Barmston Drain/Western Drain**

*Designated Assets*

There are no designated assets adjacent to or within 1km of these sections of the two drains.

*Direct Effects*

There will be no direct effects or impacts on any designated assets as a result of this option. However, there are likely to be some direct impacts (both physical and visual) on a number of non-designated cultural heritage assets (both currently known and unknown) located along the sides of the Beverley and Barmston Drain. The known non-designated assets generally comprise 19th century infrastructure associated with the construction of the drain, such as road and foot bridges (e.g. Carr Lane Bridge and Dunswell Lane Bridge), and culverts and links with other drainage channels.

The construction of new embankments along the Western Drain up to on average 1.0m high also has the potential to also affect a number of non-designated cultural heritage assets (both currently known and unknown), primarily through burying remains under the new earthworks and/or disturbance due to groundworks.

For both sections of the option, other direct effects on non-designated assets may occur as a result of works associated with accessing the lengths of the drains, the establishment of site compounds, the obtaining and transportation of embankment material etc. As with Option C above, there are unlikely to be any significant alterations to the existing water table as a result of this option.

*Indirect Impacts*

In terms of the predicted inundation area, three Scheduled Monuments, 54 Listed Buildings and one Conservation Area would be affected by not carrying out the works - these are considered to be indirect impacts. No Registered Parks and Gardens or Historic Battlefields would be affected. The three Scheduled Monuments are Rotsea medieval settlement and field system, south-east of Rotsea Manor (SM NHLE 1005212), the site of the Holy Trinity (Knights Hospitallers) preceptory in Beverley (SM NHLE 1013402), and a medieval moated tile kiln north-
east of North Grange Farm near Wawne (SM NHLE 1008039). The majority of the affected Listed Buildings lie in Beverley, although there are outlying structures in Wansford (6) and one near Arram Grange. The one affected Conservation Area is Beverley, with eight of the nine subdivisions being affected to a greater or lesser degree.

Conclusions

It is considered that the adoption of this option would have a Low negative impact on regional receptors, resulting in a Minor Adverse effect in the short term. The indirect effects would have a Neutral impact, in both the short and long term.

An assessment of the direct and indirect impacts of this option on the cultural heritage resource (both designated and more importantly non-designated assets) will need to be undertaken, which will inform the EIA and detailed design, should the option be taken forward. This will allow impacts to be avoided or mitigated as necessary.

Option F: Wilfholme and Hempholme Pumping Stations

Designated Assets

Neither of the Hempholme and Wilfholme Pumping Stations are Listed Buildings, and no designated assets lie within 1km of the stations.

Direct Effects

There will be no direct impacts on designated assets arising from this option, and it is also unlikely that there will any direct impacts on any known or unknown non-designed assets.

Indirect Effects

In terms of the predicted inundation area, three Scheduled Monuments, 50 Listed Buildings, one Conservation Area and no Registered Parks and Gardens would be affected by not carrying out the works - these are considered to be indirect impacts. The three Scheduled Monuments are Rotsea medieval settlement and field system, south-east of Rotsea Manor (SM NHLE 1005212), the site of the Holy Trinity (Knights Hospitallers) preceptory in Beverley (SM NHLE 1013402), and a medieval moated tile kiln north-east of North Grange Farm near Wawne (SM NHLE 1008039). The majority of the affected Listed Buildings lie in Beverley, although there are outlying structures in Wansford (6) and one near Arram Grange. The one affected Conservation Area is Beverley, with eight of the nine subdivisions being affected to a greater or lesser degree.

Conclusions

It is considered that the adoption of this option would have no impact on regional receptors, resulting in a Neutral impact, for both direct and indirect effects and in both the short and long term.

An assessment of the direct and indirect impacts of this option on the cultural heritage resource (both designated and more importantly non-designated assets) will need to be undertaken,
which will inform the EIA and detailed design, should the option be taken forward. This will allow impacts to be avoided or mitigated as necessary.

**Option G: Natural Flood Management**

The western half of the Driffield Beck upland water catchment area lies outside the SEA Addendum study boundary, but information on the designated assets has been collected for all of the 292 hectare area.

**Designated Assets**

The large area covered by the five upland water catchment areas contains a large number of designated assets, namely 93 Scheduled Monuments, 85 Listed Buildings, part of one registered park and garden (Sledmere House), and parts or all of eight Conservation Areas. There are concentrations of Listed Buildings in the historic cores of villages such as Kilham (14), Sledmere (5), Wetwang (6), Kilnwick (8) and Thixendale (6), and a large percentage of the Scheduled Monuments lie on the higher Wolds around the north and west sides of the catchment areas.

**Direct Effects**

It has not been possible to assess any direct impacts on designated assets, as details of any proposed works have not been defined and will be the subject of future negotiations and agreement. However, given that the five catchment areas contain large numbers of designated assets, especially Scheduled Monuments, a significant number could potentially be affected by the creation of disconnection ponds, swales, infiltration trenches etc; direct impacts could therefore, in the worst case, be significant as could indirect impacts such as visual settings. Similarly, there will be an even larger number of non-designated assets (both known and unknown) within the catchment areas, which could also be directly or indirectly affected by scheme proposals.

**Indirect Effects**

In terms of the predicted inundation area, three Scheduled Monuments, 54 Listed Buildings and one Conservation Area would be affected by not carrying out the works - these are considered to be indirect impacts. The three Scheduled Monuments are Rotsea medieval settlement and field system, south-east of Rotsea Manor (SM NHLE 1005212), the site of the Holy Trinity (Knights Hospitallers) preceptory in Beverley (SM NHLE 1013402), and a medieval moated tile kiln north-east of North Grange Farm near Wawne (SM NHLE 1008039). The majority of the affected Listed Buildings lie in Beverley, although there are outlying structures in Wansford (6) and one near Arram Grange. The one affected Conservation Area is Beverley, with eight of the nine subdivisions being affected to a greater or lesser degree.

**Conclusions**

Although it is difficult to assess impacts given the undefined nature of the option, it is considered that its adoption could potentially have a High Negative effect on national receptors, resulting in a potentially Major Adverse impact in the short term. The indirect effects would have a Neutral impact, in both the short and long term.
An assessment of the direct and indirect impacts of this option on the cultural heritage resource (both designated and more importantly non-designated assets) will need to be undertaken, which will inform the EIA and detailed design, should the option be taken forward. This will allow impacts to be avoided or mitigated as necessary.

Assessment Summary Table

The assessed effects, both direct and indirect, for each option in respect of cultural heritage are summarised in the table below:

<table>
<thead>
<tr>
<th>Option</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct Effect;</td>
<td>Minor Adverse</td>
<td>Neutral</td>
<td>Moderate Adverse</td>
<td>Neutral</td>
<td>Minor Adverse</td>
<td>Neutral</td>
<td>Major Adverse</td>
</tr>
<tr>
<td>Short Term</td>
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<td></td>
<td></td>
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<td></td>
<td></td>
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</tr>
<tr>
<td>Indirect Effect;</td>
<td>Neutral</td>
<td>Neutral</td>
<td>Neutral</td>
<td>Neutral</td>
<td>Neutral</td>
<td>Neutral</td>
<td>Neutral</td>
</tr>
<tr>
<td>Long Term</td>
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</tr>
<tr>
<td>Indirect Effect;</td>
<td>Neutral</td>
<td>Neutral</td>
<td>Neutral</td>
<td>Neutral</td>
<td>Neutral</td>
<td>Neutral</td>
<td>Neutral</td>
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<tr>
<td>Long Term</td>
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</tbody>
</table>

6.5.5 Recreation and Amenity

At the strategic level the original SEA of 2010 outlined key recreation and amenity activities within the study area together an Environmental Objective to support local tourism, amenity and recreation opportunities. The protection of both formal and informal facilities was identified as a key strategic issue together with potential opportunities for enhancement of features or facilities as part of the previous FRMS. The RHICS will look to create similar opportunities.

The more recent ERYC Local Flood Risk Management Strategy SEA Draft Scoping Report also identifies the extensive local network of both formal and informal leisure facilities within East Riding.

Baseline

Key facilities that contribute to local tourism, amenity and recreation opportunities are considered within this Addendum Report. The very extensive network of local sites is not assessed to be directly relevant to this high level study. The RHICS may also assist in sustaining a wide range of existing facilities through implementation of options that protect or reduce flood risk. Key sites of recreation and amenity value e.g. the Trans-Pennine Trail are assessed in respect of the baseline conditions and strategy options.

The direct effects of option implementation are not assessed to be significant; at the strategic level although it is acknowledged that local sites such as footpath routes have potential to be disrupted. Indirect effects, namely the inundation of land following a flood event, are potentially relevant hence these are assessed below in respect of each strategy option.

Options A to G

For key long distance tourist routes including the Trans Pennine Trail and Minster Way the flood risk is predicted to be little different to that of the baseline. A short section of the Trans Pennine
Trail Key may be at risk of inundation to the north-eastern fringe of Hull; Bransholme. Similarly short sections of the Minster Way are potentially at risk to the centre of Beverley and south-east of Leconfield. Major tourist destination sites such as the Deep in Hull and Burton Constable Hall in East Riding are not predicted to be at risk.

Given the similarity of all options to the baseline prediction options B to F have been assessed as a Neutral indirect effect to both the short and long term. It is conceivable that Option A, through the clearance of submerged/wrecked boats and dredging, may improve the amenity and potential attraction for tourists to the River Hull so is assessed to offer Minor Beneficial direct effects across both the short and long term. Similarly Option G may offer opportunities for longer term effects upon the landscape through increased diversity which could, in turn, increase the amenity value and potential attraction for tourism to the upper catchment area. In response to this opportunity the assessment of Option G is a Minor Beneficial effect.

Conclusions

Project level environmental assessment is recommended to more fully explore the likely effects upon local level recreation and amenity sites. The opportunities to both protect and enhance such sites, in connection with the implementation of any promoted option, should also be fully considered during such an assessment.

Assessment Summary Table

The assessed effects, both direct and indirect, for each option in respect of recreation and amenity are summarised in the table below:

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct Effect</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Indirect Effect: Short Term</td>
<td>Minor Beneficial</td>
<td>Neutral</td>
<td>Neutral</td>
<td>Neutral</td>
<td>Neutral</td>
<td>Neutral</td>
<td>Neutral</td>
</tr>
<tr>
<td>Indirect Effect: Long Term</td>
<td>Minor Beneficial</td>
<td>Neutral</td>
<td>Neutral</td>
<td>Neutral</td>
<td>Neutral</td>
<td>Neutral</td>
<td>Minor Beneficial</td>
</tr>
</tbody>
</table>

6.5.6 Material Assets

The importance of strategic communication links was highlighted in the original SEA. The local links to smaller settlements, both road and rail, play a vital role in connecting communities and businesses. Protection of infrastructure from flood risk is seen as a key objective for the RHICS.

The direct effects of implementation arising from most strategy options are not assessed to be significant. There is however, potential for localised, short duration effects upon the navigation of the River Hull arising from Options A and B hence these are reflected in the assessment. The indirect effects, namely the potential inundation of key infrastructure, are also considered for each strategy option in comparison to the baseline.

Option A: Dredging of the River Hull

Flood risk is predicted to be little different to that of the baseline. Key communication routes such as the M62/A63 corridor would be unaffected. Highways including the A164 and A614 are
not predicted to be at flood risk. Short sections of the A1079 south of Dunswell, the A165 close to Ganstead and A1035 south of Leven are predicted be at risk but the pattern of inundation is likely to reflect the baseline. Direct effects, arising during implementation of the WID process, are likely however, given the current navigational obstacles along the River Hull this potential disruption is not considered significant. In terms of rail infrastructure the baseline identifies potential inundation risk to a short section of the Hull/Beverley/Driffield line to the west of Dunswell. A similar risk is identified to a short section of the local rail link with Hull docks; although the majority is constructed on a raised embankment. In both instances the flood risk arising from Option A reflects that of the baseline.

The overall, direct effect of Option A is hence assessed to be *Neutral* in both the short and long term. In respect of indirect effects these are also assessed to be *Neutral* in both the short and long term.

**Option B: Tidal Exclusion**

Again, flood risk is predicted to be little different to that of the baseline. Key communication routes would be largely unaffected with risks to short sections of highway and rail as identified for Option A. Option B may however, offer enhanced flood risk protection to both a section of the A1165 at Stoneferry Road and the local rail link from the centre of Hull to the ports.

Direct effects, arising during implementation of this option as the new tidal barrier is constructed, are likely however. This extent of potential disruption is not known at this stage but is considered to be significant. The overall, direct effect of Option B is hence assessed to be *Minor Adverse* in the short term but *Neutral* in the long term. In respect of indirect effects these are also assessed to be *Minor Beneficial* in both the short and long term.

**Option C: Holderness Drain**

This option is also predicted to afford flood risk protection similar to that predicted under baseline conditions. Greater flood risk protection would be afforded to a short section of the A165 west of Ganstead. The overall, direct effect of Option C is assessed to be *Neutral* however the indirect effects are assessed to be *Minor Beneficial* in both the short and long term.

**Option D: Bransholme Pumping Station**

The current upgrade of Bransholme Pumping Station by Yorkshire Water has not been modelled. For the purposes of the assessing both direct and indirect effects upon Material Assets this option has been assigned a *Neutral* effect.

**Option E: Beverley and Barmston Drain/Western Drain**

Flood risk is predicted to be little different to that of the baseline but with the exception of greater protection to the A1079 at the south-western fringe of Dunswell.

The direct effect of Option E is hence assessed to be *Neutral* whilst the indirect effects are considered to be *Minor Beneficial* in both the short and long term.
Option F: Hempholme and Wilfholme Pumping Stations

This option effectively replicates the flood risk prediction for baseline. No significant direct effects have been assessed hence Option F is considered to be Neutral in both direct and indirect effects across both the short and long term scenarios.

Option G: Natural Flood Management

This option is predicted to afford flood risk protection similar to that predicted for the baseline. No significant direct effects have been assessed hence Option G is considered to be Neutral in both direct and indirect effects across both the short and long term.

Assessment Summary Table

The assessed effects, both direct and indirect across short and long term scenarios, for each option in respect of material assets are summarised in the table below:

<table>
<thead>
<tr>
<th>Option</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
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<th>G</th>
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<tbody>
<tr>
<td>Direct Effect:</td>
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</tr>
<tr>
<td>Short Term</td>
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<td>Minor Adverse</td>
<td>Neutral</td>
<td>Neutral</td>
<td>Neutral</td>
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</tr>
<tr>
<td>Direct Effect:</td>
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<tr>
<td>Long Term</td>
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<tr>
<td></td>
<td>Neutral</td>
<td>Minor Beneficial</td>
<td>Minor Beneficial</td>
<td>Neutral</td>
<td>Minor Beneficial</td>
<td>Neutral</td>
<td>Neutral</td>
</tr>
</tbody>
</table>

6.5.7 Water Environment

The water environment can be assessed on the basis of the chemical quality of the water, the level of suspended silt and the geomorphic characteristics of the river system. Existing evaluations grade the River Hull system with good chemical water quality but the channel has been heavily modified and little remains with natural geomorphic features.

The direct effects of implementation arising from most strategy options are not assessed to be significant. There is however, potential for localised, short duration effects upon the water quality of the River Hull arising from construction and implementation of works, hence these are reflected in the assessment. The indirect effects based on impact of inundation are minimal for the water environment.

Option A: Dredging of the River Hull

This option will pose the biggest impact on the water environment due to the disturbance it will cause when carried out. Although the proposed water injection dredging method is considered more environmentally friendly than other dredging techniques, there will still be some impact to the water environment. Direct impacts will be the introduction of a new mudflow layer in the water column which could fluidise contaminants contained in the silt therefore reducing water quality. Sufficient preliminary assessments of contaminated sediment will be carried out before dredging takes place. Any potential contamination will move downstream and into the Humber.
Removal of sunken boats and reed bed cut back will impact the water quality as sediment and potential pollutants are disturbed. The long term effects could be degradation in water quality the existing riparian buffering zone will be removed.

All parts of this option will alter the cross section of the river channel. According to research, this modification of geomorphic properties will change the processes both upstream and downstream of the section being managed. The channel capacity will increase and therefore and improve the channel efficiency. Although an important quality for water conveyance through the channel in flood peak flow, erosion could occur downstream due to a higher energy system. The geomorphic implications of this option will be monitored in the long term to ensure impacts are minimised.

**Option B: Tidal Exclusion**

This option constitutes a replacement of the current tidal barrier, therefore further environmental impacts to the water environment are considered unlikely. There may be some small impact during construction of this barrier.

**Option C: Holderness Drain**

The construction process will likely impact the water system as banks will be disturbed. Raising the embankments will prevent the river from being connected to its floodplain, although there is already and element of this.

Increasing the pumping capacity will not cause much change to flow regimes along the Holderness Drain and therefore not alter the water environment. The installation of new pump may disrupt the water system in the short term.

This option prevents flooding in urban areas to the north east of Bransholme. Flood water of urban areas is likely more polluted than water which floods onto rural land. From preventing flooding in these areas, water quality of surface water flooding will be improved. Other areas where flooding is prevented are mainly agricultural land, therefore fewer fertilisers and agricultural chemicals will enter the water system at times of flooding.

**Option D: Bransholme Pumping Station**

This option is already a committed scheme, therefore any impacts to the water environment have already been considered and assumed to be minimal.

**Option E: Beverley and Barmston Drain/Western Drain**

Similarly to Option C, it is expected that a small level of disturbance will occur to the water environment during construction. The option will also disconnect the river from its floodplain, however this is already the case as embankments currently exist.

**Option F: Hempholme and Wilfholme Pumping Stations**

The pumping station upgrade will unlikely cause further impact to the water environment as there are already pumping stations in place. Potentially the construction of new pumping
stations could impact water quality but this will be kept to a minimum if construction is managed efficiently.

**Option G: Natural Flood Management**

This option will change the way water flows through the catchment. By attenuating water on land and reducing the volume of water reaching the channel in peak flow, the water environment within the River Hull during flood will not be as different from regular flow patterns. As well as this, infiltration of surface water will improve water quality before reaching the channel, removing agricultural fertilisers and contaminants. This option also aims to reduce sedimentation within the river system as overland flows are reduced, therefore preventing topsoil erosion from occurring and reaching the River Hull. Sedimentation would normally reduce the capacity and change the cross-sectional profile of the river channel leading to geomorphic change.

**Indirect Effects**

Wherever flooding of urban or agricultural land is reduced the aim should be to maintain good water quality. For example, if flooding of agricultural land is left to infiltrate though the ground then this will improve water quality as fertilisers and other agricultural chemicals will be filtered from the system. By contrast, if flood water from agricultural land is actively drained, as overland flow back into the River Hull or the existing drainage system in the catchment area, then water quality will be impacted.

Of the options assessed, Option G would encourage managed flooding of the land, resulting in improvements to water quality as noted above.

Due to the quantity and design of current flood defences within the catchment, flood events are unlikely to alter the geomorphic properties of the river channel and surround land.

**Assessment Summary Table**

The assessed effects, both direct and indirect, for each option in respect of water environment are summarised in the table below:

<table>
<thead>
<tr>
<th>Option</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
</tr>
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<tbody>
<tr>
<td>Direct</td>
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<td>Neutral</td>
<td>Minor</td>
<td>Neutral</td>
<td>Minor</td>
<td>Neutral</td>
<td>Moderate</td>
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<td>Neutral</td>
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</tr>
</tbody>
</table>

**6.6 Combined Impact Significance**

The combined, or aggregated, impact significance for each option promoted in the RHICS is illustrated in the table below; see Table 6.3 below. The significant strategic effects (both negative and positive) likely to arise from the implementation of each option have been assessed without mitigation or enhancement features which are evaluated in the following section.
<table>
<thead>
<tr>
<th>Environmental Topic</th>
<th>Assessed Effect</th>
<th>Population and Human Health</th>
<th>Flora, Fauna and Biodiversity</th>
<th>Landscape and Land Use</th>
<th>Cultural Heritage</th>
<th>Recreation and Amenity</th>
<th>Material Assets</th>
<th>Water</th>
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</thead>
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<td>Direct</td>
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<td>Minor Adverse</td>
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<td>Neutral</td>
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</tr>
<tr>
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<td>N/A</td>
<td>Neutral</td>
<td>Moderate Adverse</td>
</tr>
<tr>
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<td>Indirect</td>
<td>Short term Minor Beneficial</td>
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<td>Neutral</td>
<td>Neutral</td>
<td>Minor Beneficial</td>
</tr>
<tr>
<td></td>
<td></td>
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<td>Neutral</td>
<td>Neutral</td>
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</tr>
<tr>
<td><strong>Option B</strong></td>
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<td>Neutral</td>
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<tr>
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<td></td>
<td>Long term N/A</td>
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<td>Neutral</td>
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<td>N/A</td>
<td>Neutral</td>
<td>Moderate Adverse</td>
</tr>
<tr>
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<td></td>
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<td>Minor Beneficial</td>
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<tr>
<td><strong>Option C</strong></td>
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<td>Neutral</td>
<td>Minor Adverse</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Long term N/A</td>
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<td>Minor Adverse</td>
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<td>N/A</td>
<td>Neutral</td>
<td>Minor Adverse</td>
</tr>
<tr>
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<td>Neutral</td>
<td>Minor Beneficial</td>
<td>Moderate Beneficial</td>
</tr>
<tr>
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<td></td>
<td>Long term Major Beneficial</td>
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<td>Neutral</td>
<td>Minor Beneficial</td>
<td>Moderate Beneficial</td>
</tr>
<tr>
<td><strong>Option D</strong></td>
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<td>Neutral</td>
<td>Neutral</td>
<td>Neutral</td>
<td>Neutral</td>
<td>Moderate Beneficial</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Long term N/A</td>
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<td>Neutral</td>
<td>N/A</td>
<td>N/A</td>
<td>Neutral</td>
<td>Moderate Beneficial</td>
</tr>
<tr>
<td></td>
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<td>Short term Neutral</td>
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<td>Neutral</td>
<td>Neutral</td>
<td>Neutral</td>
<td>Neutral</td>
<td>Moderate Beneficial</td>
</tr>
<tr>
<td></td>
<td></td>
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<td>Neutral</td>
<td>Neutral</td>
<td>Neutral</td>
<td>Neutral</td>
<td>Moderate Beneficial</td>
</tr>
<tr>
<td><strong>Option E</strong></td>
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<td>Neutral</td>
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<td>N/A</td>
<td>Neutral</td>
<td>Minor Adverse</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Long term N/A</td>
<td>Neutral</td>
<td>Minor Adverse</td>
<td>N/A</td>
<td>N/A</td>
<td>Neutral</td>
<td>Minor Adverse</td>
</tr>
<tr>
<td></td>
<td>Indirect</td>
<td>Short term Neutral</td>
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<td>Neutral</td>
<td>Neutral</td>
<td>Neutral</td>
<td>Neutral</td>
<td>Neutral</td>
</tr>
</tbody>
</table>
Table 6.3 Combined Impact Significance

The matrix above illustrates a complex relationship between the options promoted and assessed effects in respect of environmental topics. The relationship varies not only between the predicted direct and indirect effects but also across the short and long terms periods as each option is potentially implemented.

Option D, which is effectively implemented, presents a relatively benign effect across the environmental topics considered. The majority of effects are noted to be Neutral with the exception of a Moderate Beneficial upon the water environment. Option F, which essentially reflects the impacts associated with the baseline conditions, is also considered to result in Neutral effects upon the environmental topics subject to this assessment.

Options C and E are likely to result in a similar pattern of environmental effects; a balance of beneficial, neutral and adverse impacts as a result of direct and indirect effects across the short and long term. Both are assessed to create adverse effects upon landscape/land use, cultural heritage and the water environment resulting from the direct effects of implementation to the short and long term. Following implementation however, both options would give rise to a mix of neutral and minor beneficial indirect effects (short and long term); although it is noted that Option C would also offer Major Beneficial indirect (short and long term) effects to population, Moderate Beneficial to the water environment (again both short and long term) and Minor Beneficial effects to landscape/land use and material assets (also short and long term).
The assessed effects of Option A also range from beneficial to adverse but the anticipated adverse effects are predominantly short term and limited to the environmental topics of biodiversity, cultural heritage and the water environment; although the adverse effect in respect of the water environment may persist into the long term. Indirect effects, both short and long term, to population, recreation/amenity and the water environment are assessed to be Minor Beneficial but Neutral to all other topics.

Option B is considered to have lesser impact, relative to the options described above, upon the environmental topics assessed; predominantly Neutral direct effects but Minor Adverse short term effects upon material assets. The indirect effects of this option would result in Neutral or Beneficial effects in both the short and long term with a noted Moderate Beneficial effect to population.

Option G has been assessed to create least environmental effect; based upon the topics considered in this SEA Addendum Report. The nature of this option, a low key, ‘soft’ engineered intervention is such that the assessment result is not surprising. Whilst a Major Adverse short term, direct effect to cultural heritage is considered possible, more detailed development of this option may mitigate or remove this potential. In all other respects, the potential direct and indirect effects of this option are assessed to be predominantly beneficial.

The progression of all options through a detailed design stage, and subsequent implementation, will create the opportunity for consideration of enhancement measures or provision of environmental mitigation to either reduce or realise positive benefits. The monitoring stage of this SEA Addendum, see section 7 of this document, will also allow a mechanism by which to record such progress and note progression of the promoted options.

6.7 Mitigation and Enhancement

Each option has been subject to a consideration of essential mitigation or enhancement features and assessed on this basis. Such features are different according to each environmental topic, but mitigation is deemed to be an essential and integral part of each option e.g. screening of views from a sensitive viewpoint to an intrusive structure, whilst enhancement is the provision of desirable features that would improve the benefits of a particular option e.g. new planting to assist the integration of a feature into the wider landscape. It should be noted that not all options are capable of providing mitigation or enhancement for each environmental topic hence the description of potential features varies.

The proposed mitigation associated with each option is described below, while the suggested enhancement features are detailed separately, but also described in relation to a particular option.

It should be noted that mitigation measures have been considered in outline terms only, relative to the current development of each option, and that the future implementation will include a more detailed, tailored approach to both mitigation and enhancement.

6.7.1 Mitigation of Options

Option A – Dredging of the River Hull

Flora Fauna and Biodiversity
There is evidence that riparian reedbeds have encroached by up to 4m since a detailed survey was undertaken in 1992, thus reducing the width of the river channel and encouraging sedimentation. This process has been promoted by a decline in river traffic which formerly helped maintain the watercourse channel through incidental dredging caused by turbulence from propellers. Water injection dredging mobilises sediment in a similar way to river traffic. Dredging and removal of riparian vegetation is proposed for this watercourse from Humber to Ennerdale Bridge only.

As part of the boat removal process, compensatory habitat will be created for fish, otter, water vole and nesting birds. The foreshore between the two embankments from Beverley industrial dockyard to Hull Bridge is considered wide enough to include marginal habitat, especially on the right bank. This marginal habitat will improve the geomorphological complexity of the River Hull which will in turn provide a greater variety in habitat.

Removal of reedbed will be off-set by the creation of new reedbeds where foreshore allows (the space between river channel and embankments). At the project level, detailed design supported by more targeted habitat survey could determine suitable locations for this mitigation measure.

Cultural Heritage

There are unlikely to be any direct effects (either physical or visual) on identified designated cultural heritage assets resulting from this option, but there are expected to be a large number of non-designated assets (both currently known and unknown) within and adjacent to the river channel. An appropriate level of research and field survey, initially involving a detailed desk-based assessment and walkover inspection along the 29km corridor but possibly also including some localised intrusive investigations to characterise the resource, will need to be undertaken to ensure that all potential assets within the development footprint have been identified at early stage. Consultations will need to held with the local archaeological curators and conservation officers as part of this process. Other surveys undertaken as part of this option, e.g. hydrological and profile surveys, may also help to identify assets currently hidden below the waterline. While many assets will have been removed by previous flood schemes, others are likely to be scattered throughout the length of the proposed works, and there are expected to be a concentration in the lower reaches of the river as it passes through Hull Old Town. Results from the above surveys will be fed into the design process, so that cultural heritage issues are addressed from an early stage of scheme development. Depending on specific impacts, further investigations and surveys may be required to adequately record and/or remove identified assets prior to scheme implementation; the nature of the proposed works suggests that there will be little potential for preserving identified historic structures in situ.

Water Environment

To mitigate the potential adverse effects associated with this option, WID will be carried out at a time when conditions are optimal and when the impacts are considered to be minimal. This will most likely be on the ebb of the spring tide so that upstream flows will not disturb the mudflow layer for the maximum length of time.
This option also proposes that encroaching reed bed be subject to selective cutting back; but not completely removed. Long term effects of water quality degradation due to lack of riparian buffer strip are unlikely to be great due to only encroaching sections of reed beds being removed.

**Option B – Tidal Exclusion**

*Flora Fauna and Biodiversity*

Mitigation will include the monitoring of fish movements to ascertain the impact of increased tidal barrier use.

*Cultural Heritage*

There are unlikely to be any direct physical impacts on identified designated cultural heritage assets, but it is possible that some non-designated buried assets (both currently known and unknown) will be affected, both within this short section of river channel and along the adjacent banks. As with Option A above, an appropriate level of research and investigation will need to carried out to ensure that any such sites are identified at an early stage of scheme design. Any potential visual impacts on designated or non-designated assets should also be considered and addressed as part of the design process.

*Water Environment*

Management of construction activities is considered to be a key mitigation factor to reduce the risk of pollution. It is recommended that during any detailed design and construction planning that a Construction Environmental Management Plan (CEMP) be prepared.

**Option C – Holderness Drain**

*Landscape*

The raising of the Holderness Drain embankments may create localised visual impacts hence mitigation measures will include a more detailed consideration of embankment profile i.e. where possible side slope gradients could be less steep and of variable gradient to create more natural profiles that integrate better with the generally flatter landscape of the locality. More detailed vegetation survey at the detailed design stage will also enable greater consideration of retaining such features. Planting of flood defence embankments is not considered to be appropriate due to necessary management measures.

*Cultural Heritage*

The raising of the Holderness Drain embankments will have a direct physical and visual effect on the Swine Castle Hill Scheduled Monument, which lies on the immediate east side of the drain. An appropriate level of desk-based research, together with a topographical survey of the castle site, will need to be undertaken to ensure that all potential impacts are identified at early stage. Construction is likely to require Scheduled Monument Consent, and design options will need to be discussed and agreed with English Heritage. A detailed desk-based assessment and walkover survey, perhaps also with localised intrusive
investigations, will also be undertaken across the whole development footprint, to ensure that non-designated cultural heritage assets (both currently known and unknown) are identified. Consultations will need to held with the local archaeological curators and conservation officers as part of this process. Results from the surveys will be fed into the design process, so that cultural heritage impacts issues are addressed from an early stage of scheme development. Sympathetic design will be required to minimise any direct or visual impacts on the Scheduled Monument and the listed structures adjacent to the East Hull Pumping Station. Depending on other specific impacts, further investigations and surveys may be required to adequately record and if necessary remove identified assets prior to scheme implementation, although it is assumed that much of the existing 19th century drain-side infrastructure will be preserved.

**Water Environment**

The potential adverse effects identified at the construction stage can be mitigated through careful site management and site protocols. Stockpiles and aggregates will be sealed and stored away from flow paths into the River Hull system. Furthermore reinforcing turf mats can be used along the embankments to ensure that topsoil is not eroded before it has vegetated. Similar to Option B it is recommended that a CEMP be prepared in advance of any works.

**Option D – Bransholme Pumping Station**

Works to the Bransholme Pumping Station have been undertaken by Yorkshire Water hence no mitigation measures have been considered as part of this SEA Addendum.

**Option E – Beverley and Barmston Drain/Western Drain**

**Landscape**

The raising of the Holderness Drain embankments may create localised visual impacts hence mitigation measures will include a more detailed consideration of embankment profile i.e. where possible side slope gradients could be less steep and of variable gradient to create more natural profiles that integrate better with the generally flatter landscape of the locality. More detailed vegetation survey at the detailed design stage will also enable greater consideration of retaining such features. Planting of flood defence embankments is not considered to be appropriate due to necessary management measures.

**Cultural Heritage**

There will be no direct impacts on any designated cultural heritage assets as a result of this option, although there are likely to be some (both physical and visual) on a number of non-designated assets (both currently known and unknown). An appropriate level of research and field survey, initially involving a detailed desk-based assessment and walkover survey but possibly also including some localised intrusive investigations, will need to be undertaken to ensure that all potential assets within the development footprint have been identified at early stage, and consultations will need to held with the local archaeological curators and conservation officers as part of this process. Results from the surveys will be
fed into the design process, so that cultural heritage issues are addressed from an early stage of scheme development. Depending on specific impacts, further investigations and surveys may be required to adequately record and/or remove identified assets prior to scheme implementation, although it is assumed that much of the existing 19th century drain-side infrastructure will be preserved.

**Water Environment**

The potential adverse construction effects identified during embankment raising can be mitigated through careful site management and site protocols. Stockpiles and aggregates will be sealed and stored away from flow paths into the River Hull system. Furthermore reinforcing turf mats can be used along the embankments to ensure that topsoil is not eroded before it has vegetated. It is also recommended that a CEMP be prepared in advance of any construction works.

**Option F – Wilfholme and Hempholme Pumping Stations**

**Cultural Heritage**

There will be no direct impacts on designated assets arising from this scheme, and it is also unlikely that there will any direct impacts on any known or unknown non-designed assets. Mitigation measures are therefore not currently proposed, although this can only be confirmed once detailed scheme designs are available.

**Water Environment**

Management of construction activities is considered to be a key mitigation factor to reduce the risk of pollution. It is recommended that during any detailed design and construction planning that a CEMP be prepared.

**Option G – Natural Flood Management**

**Cultural Heritage**

It has not been possible to assess any direct impacts on designated assets, as details of any proposed works have not yet been defined. However, given that the catchment areas contain large numbers of designated assets, a significant number could potentially be affected by individual elements of this option, both directly (i.e. physically) and indirectly (i.e. through a change in setting etc). Similarly, there will be an even larger number of non-designated assets (both known and unknown) within the catchment areas, which could also be directly or indirectly affected by scheme proposals.

Initial scheme proposals could be drawn up based on the locations of existing designated assets, and then an appropriate level of survey, initially involving a detailed desk-based assessment and walkover inspection but possibly also including some localised intrusive investigations to characterise the resource, will need to be undertaken to ensure that all potential assets within the development footprints have been identified at early stage. Consultations will need to be held with the local archaeological curators and conservation officers as part of this process. Results from these surveys will be fed into the design
process, so that cultural heritage issues are addressed from an early stage of development. Although the avoidance of designated and non-designated assets would be a priority, it may be necessary to undertake further investigations and surveys to adequately record and/or remove identified assets, should other factors determine scheme locations.

*Water Environment*

Potential adverse effects may arise during the implementation stage across a range of construction activities including excavation of ponds and trenches. Mitigation through careful site management is considered to be a key mitigation measure in respect of water environment. Stockpiles of materials will be segregated and stored away from flow paths into the River Hull system.

Reinforced turf mats can be used along new drains, pond edges and swales to ensure that topsoil does not erode before it has vegetated. Similar to Option B it is recommended that a CEMP be prepared in advance of any works.

**6.7.2 Enhancement of Options**

**Option A – Dredging of the River Hull**

*Cultural Heritage*

The design of the proposed option means that there are unlikely to be any direct cultural heritage enhancements resulting from scheme implementation, although associated works, such as publishing the results of any surveys and assessments, could be used to enhance the general understanding and appreciation of the history of the River Hull corridor.

**Option B – Tidal Exclusion**

*Cultural Heritage*

The design of the proposed option means that there are unlikely to be any direct cultural heritage enhancements resulting from the implementation of this scheme, although information relating to the history and importance of the area could be included in any general enhancement work (e.g. information panels, notice boards etc) in this area which already attracts a certain level of tourist footfall.

**Option C – Holderness Drain**

*Flora, Fauna and Biodiversity*

There is the opportunity, in conjunction with landscape enhancement measures, to increase habitat connectivity through creation of wet woodland strips between embankments and watercourse.

Education of landowners on sensitive land management practices to promote ecologically enhanced hydrological management could take place as part of a wider River Basin Management Plan programme.
Landscape

The potential visual effects of embankment raising have been noted together with the limited opportunities for landscape mitigation. Consideration, in consultation and agreement with landowners, of offsite planting areas may enable the addition of enhancement planting to both integrate the raised embankments into the existing landscape and offer additional visual screening at selected locations; project level landscape and visual impact assessment will assist this process. To supplement the suggested biodiversity enhancement measures, wet woodland could be created adjacent to the Holderness Drain at selected locations.

Cultural Heritage

There is some potential for the enhancement of the cultural heritage resource with this option, for example repairing or conserving the existing 19th century drain-side infrastructure and increasing public awareness and appreciation of the history of the River Hull corridor (e.g. through information panels, leaflets etc), particularly where the proposed works coincide with public footpaths and other rights of way.

Water Environment

There may be locations along the embankments where the flood plain can be included within the river and drain foreshore. This will allow for the channels to be connected to more of the flood plain and improve the geomorphology of the system.

Option D – Bransholme Pumping Station

No enhancement measures are suggested for this scheme undertaken by Yorkshire Water.

Option E – Beverley and Barmston Drain/Western Drain

Flora, Fauna and Biodiversity

There is the opportunity, in conjunction with landscape enhancement measures, to increase habitat connectivity through creation of wet woodland strips between embankments and watercourse.

Landscape

The potential visual effects of embankment raising have been noted together with the limited opportunities for landscape mitigation. In consultation and agreement with landowners, offsite planting areas may be considered to enable further enhancement planting to take place. Such planting could both integrate the proposed sections of raised embankments into the existing landscape and offer additional visual screening at selected locations; a project level landscape and visual impact assessment will assist this process.

To supplement the suggested biodiversity enhancement measures, wet woodland could be created adjacent to the Holderness Drain at selected locations.
Cultural Heritage

There is some potential for the enhancement of the cultural heritage resource with this option, for example repairing or conserving the existing 19th century drain-side infrastructure and increasing public awareness and appreciation of the history of the River Hull corridor (e.g. through information panels, leaflets etc), particularly where the proposed works coincide with public footpaths and other rights of way.

Option F – Wilfholme and Hempholme Pumping Station

Cultural Heritage

There are unlikely to be any direct cultural heritage enhancements resulting from the implementation of this scheme.

Option G – Natural Flood Management

Flora, Fauna and Biodiversity

A raft of strategies to slow flow off the land and ameliorate peak flows could be enacted using Countryside Stewardship and other grants directed at landowners.

Wet woodland, riparian vegetation and flood-plain grazing marsh could be created as part of this option implementation also using Countryside Stewardship and other grants directed at landowners.

Landscape

Many of the suggested elements that form part of the RAFS are likely to add diversity of landscape features. The introduction of new planting, in particular hedges, copses and woodland would further contribute to landscape diversity. The reinstatement of features such as ponds would address those features that have been lost from the Wolds; and are noted in the ERYC Landscape Character Assessment.

The open, rolling farmland of the Wolds and sloping farmland of adjacent areas (LCT13 and LCT 17 Landscape Character Types) note the relative sparsely wooded landscape hence provision of copses and small woodlands in conjunction with the proposed natural flood management would redress this. Given that this option is intended to be implemented through agreement then landscape features can only be implemented on a similar basis. Encouragement to achieve the inclusion of such features, to enhance this option, could be made through Countryside Stewardship and other grants directed at landowners.

Cultural Heritage

At present, scheme designs are not sufficiently advance to be able to identify specific cultural heritage enhancements, although some low-key elements would be expected.
6.8 Assessment of Environmental Objectives

A comparable assessment of the strategy options, described at 6.2 above, has been undertaken in respect of the stated environmental objectives. In drawing conclusions as to the likely effect upon the stated Environmental Objectives, an element of professional judgement has been applied as to the short and long term consequences arising from the promoted options upon the key factors that constitute each objective. For consistency with the original SEA the results of this high level assessment are presented in tabular form; see Table 6.4 below. The significance of effect is based upon the matrix presented at sub-section 2.5 of this report.

<table>
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<th>OBJECTIVES</th>
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</tr>
</thead>
<tbody>
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<td>Transport</td>
<td>Neutral</td>
</tr>
<tr>
<td>Water Resources</td>
<td>Moderate Beneficial</td>
</tr>
<tr>
<td>Climate Change</td>
<td>Moderate Beneficial</td>
</tr>
</tbody>
</table>

Table 6.4 Summary Table Assessment of Objectives

In summary, Options B, D, and F are considered to be predominantly aligned with the stated environmental objectives i.e. no adverse effects have been assessed. Option G is noted to have no particular conflicts with any of the stated objectives; indeed this option is assessed to be overwhelmingly positive in respect of environmental objectives.

Options C and E are considered to give rise to conflicts with both Landscape/Land Use and Cultural Heritage objectives. The refinement of such options should, where practicable, consider changes to the proposed nature of the development or include an appropriate mitigation package. For example, more detailed archaeological desk study of the Option C based upon a developed proposal in respect
of the likely footprint of embankment raising may enable avoidance of key features or, if suitable following consultation with the appropriate body, an acceptable mitigation strategy.

Option A is noted to conflict with the Wetland and Cultural Heritage objectives. The conflict with the Wetland objectives arises, primarily, in relation to the need for bankside/reedbed clearance to achieve the dredging of the River Hull and re-profiling of the channel cross-section. It should be noted that such clearance will only take place following more detailed survey at the project level, which may reduce or target such clearance, but also that this option provides the opportunity for mitigation with the creation of new reedbeds and marginal vegetation to offset the loss. Further, more detailed survey and assessment particularly in respect of non-designated cultural heritage assets may also address the conflict with the cultural heritage objective.

All options are noted to offer positive benefits in respect of WFD. Option G is considered to present the best opportunities for delivering compliance with the four over-arching objectives of WFD.

All options, as they are progressed through implementation of RHICS should consider opportunities for enhancement or provision of environmental benefits that support the stated environmental objectives; which may be reported in more detail should a project level EIA or Habitats Regulations Assessment be required.

6.9 Compliance with SEA Objectives

There is an obligation on both ERYC and Hull City Council to produce a ‘Local Flood Risk Management Strategy’ (FRMS) and both authorities are currently working on their delivery and are at the draft stage. When adopted, both will set out the approach to flood management in their areas. Ultimately the RHICS will feed into this process and form an integral part of the wider information bases underlying the respective local strategies.

The study area consists of a mixed catchment area, largely rural but with implications for urban areas including the city of Hull and the north bank settlements which define the transitional area into to the rural hinterland to the north.

The upper catchment, to the north of the study area, is acknowledged as being largely rural and in agricultural use. The low lying land of the River Hull basin is artificially drained but is still liable to flood whilst the southern ‘lower catchment’ covers Hull itself; a major port and city of prime importance to the local regional and local economy.

The diverse nature of this environment is of particular importance to the established and projected settlement patterns of the study area and adjacent areas. As a result, the susceptibility of different areas to flooding and flood risk is a ‘material consideration’ in planning terms. Within the emerging plans projected land use allocations are based upon the underlying planning principle, within the NPPF, that places a priority on the principles of ‘sustainable development’. Each authority has developed a hierarchy of settlements based upon the service and infrastructure provision within them. Whilst these are based on the availability and access to community services such as health, education, retail, recreation and leisure, employment and public transport services that are essential to sustain communities, they must also take account of environmental constraint such as flood risk; the degree of exposure to risk and the extent of flood protection.
Both authorities are facing demands for future growth and the ERYC Local FRMS SEA Draft Scoping Report of 2014 identifies potential growth patterns for the East Riding and the location of these growth patterns should be of direct relevance to the FRMS albeit it is acknowledged that the ‘FRMS is unlikely to have a strong influence on population trends, it may have some influence on helping to sustain the attractiveness/appeal of the area (through managing/reducing local sources of flood risk’, and in contributing to health and well being’.

Within the East Riding for example, national predictions quoted in the ERYC housing strategy (2011) predicts that by 2033 there will be a need for a total of 197,000 households; in comparison to a total of 144,000 households in 2011. The predicted need for future housing growth is also supported by the increase of 28,300 new homes, to 2029, proposed within the Submission draft of the ERLP.

The locational demands in the study are not however just from pressures for residential development but also from the local economy and its drivers for growth to sustain the area and its residents.

In 2010 the economies of the East Riding and Hull contributed over £7,800m to the national purse. Central government has designated the Humber as ‘Centre for Offshore Renewable Engineering’, a super cluster of enterprises focusing on renewable energy; additionally it has also designated two ‘enterprise zones’ across the Humber area. Collectively this will require over 430 hectares of land to be allocated for employment uses within the region, much of which (some 65%) is likely to be within tidal or fluvial flood risk areas.

The effect of the RHICS options upon economic viability and population are considered to be the key objectives when assessing potential influence and support the objectives of planning and land use, in its wider sense, including the built and natural environments. Each allocation or development proposal will have its own implications for environmental impact, by nature of the potential changes to a particular site and/or character, but not all may be negative however, they must be taken into account as key impacts within the SEA.

The original SEA set out a series of objectives in the context of long standing studies together with a number of flood events; including that of 2007. The SEA included a management strategy that set out a number of options; recognising that a single solution was unlikely to exist. These were:

- Reduce or stop maintenance of defences in the upper catchment;
- Maintain defences in the upper catchment;
- Maintain defences in the middle catchment with pumping stations operating;
- Maintain defences in the middle catchment without pumping stations operating; and,
- Sustain defences in Lower Catchment.

In each case the potential environmental impact arising from the options described within the River Hull FRMS was outlined; including impacts upon property and people.
As result of a comprehensive modelling exercise discussed in Paragraph 6.1 of this SEA Addendum report a number of revised options have been explored involving a range of interventions that include lagoon storage areas, raising of embankments to existing defences, increasing the capacity of pumping stations, and various combinations of these actions together with more, less intrusive natural approaches to flood management.

The RHICS options, described at 6.2 above, consist of engineering led approaches that include dredging of the River Hull, design and operational amendments to the Hull Tidal barrier, embankment raising, changes to pumping regimes and upland water management. There is, in principle, no conflict with the planning system in the physical delivery of any option promoted subject to works meeting the ‘other material consideration’ tests applied to prospective development.

It is noted that, in planning terms, functional impacts of the options are likely to localised and tend, with the exception of the Hull Tidal barrier, to be located within predominantly rural areas where land use impacts may consist of socio-economic issues; such as loss of farmland and impacts upon existing holdings, residents and businesses.

The number of houses and properties within the study area at risk of flooding is likely to increase due to the effects of climate change (under a ‘worst case’ undefended scenario). There is currently strong, identifiable demand for additional land within the study area to be allocated for housing, business use, employment and infrastructure consistent with the objectives of sustainable, planned growth. Some forms of development are more susceptible to flood risk than others, but this risk is a material consideration in all decisions within flood zones 2 and 3; and on occasion in zone 1. A number of settlements within the ERYC settlement hierarchy, that might be expected to include new or extended allocations in forthcoming plans, are located within areas at risk of flooding hence the proposed management of flood risk is entirely consistent with the development plan and its policies.

The options assessed within this Addendum report seek primarily to provide mitigation of flood risk. None would completely alleviate flood risk, however the use of a flood management strategy is consistent with the obligations on local authorities in the NPPF (Section 10 Paragraph 100 which requires local planning authorities ‘to develop policies to manage flood risk from all sources’). The RHICS will further the response of both ERYC and Hull City Council in meeting this objective; both having identified flood risk as a specific issue.

The proposed strategy is also consistent with the policy objectives of the development plans both the existing adopted plans and the emerging development plans. All of these documents contain specific policies that require the consideration of ‘flood risk’ as part of development proposals. Where definitive adopted policy, and/or flood specific guidance is available, then this can be a factor in the ‘decision making process’. The RHICS will form an integral part of the suite of documents which SFRA’s, Hull’s Surface water management plan, Preliminary Flood Risk assessments and other flood risk management strategies.

The strength of flood management policy and mitigation is essential to underpin the use of specific policy within the development plan, and to ensure that planning decisions are both robust and consistent with ‘actual flood risk’. The adoption of a proven management strategy for the River Hull catchment area, given that the river influences the water environment of such a large area in both
the East Riding and Hull, is an important milestone in the response to flood risk in the area. The RHICS will provide comfort to the development and financial industries to secure involvement and investment in delivering growth objectives for the region. Adoption of a robust ‘option’ strategy will further those objectives through either a ‘status quo’ situation or subject to identifying improvements a ‘beneficial’ situation.

The original SEA ‘scoped’ a series of environmental factors, objectives and indicators which may, in the context of planning, be interpreted as:

- Flood protection for people and properties;
- Sustainable land use; and
- Transport infrastructure.

The baseline assessment within this Addendum report considers both current and possible future flood events including ‘Do Nothing’ and ‘Do Minimum’ scenarios. The underlying prediction arising from the RHICS is however, that it is unlikely to form a major factor in population trends within the study area, but should influence strategies that are fundamental to the supply of development land and infrastructure. Overall the RHICS will contribute to that objective but its effectiveness will be dependent on planning decisions and outcomes that must be reviewed through the planning system at a project level.

6.10 Water Framework Directive Assessment

Water Framework Directive (WFD) Assessment examines the potential effects of a proposed scheme on the ecological quality of relevant receptor WFD waterbodies. Effects which are likely to reduce the possibility of meeting WFD objectives or otherwise cause deterioration in the status of downstream and groundwater waterbodies are identified and assessed. The table below, Table 6.5, summarises our assessment of the RHICS options against WFD objectives for each effected waterbody; a detailed assessment to underpin this summary table is attached at Appendix C.

If it is considered likely that significant effects will occur, as a result of RHICS options, in Humber Estuary Special Area of Conservation (SAC) or Humber Estuary Special Protection Area (SPA), then options will need to be screened to assess whether Appropriate Assessment is necessary (Habitis Regulations Assessment).

Each option is assessed against predicted effects on WFD receptors identified in Table 6.5 and, taking into account mitigation, the residual effect on quality elements for each waterbody has been assessed. Using the results of this assessment it is possible to determine whether the proposed flood alleviation scheme complies with the overarching objectives of the WFD for each waterbody as set out below;

**Objective 1**: The proposed scheme does not cause deterioration in the WFD Status of the Biological, Chemical and other assessed Elements of the waterbody;

**Objective 2**: The proposed scheme does not compromise the ability of the waterbody to achieve its WFD status objectives;
**Objective 3:** The proposed scheme does not cause a permanent exclusion or compromised achievement of the WFD objectives in other bodies of water within the same RBD; and

**Objective 4:** The proposed scheme contributes to the delivery of the WFD objectives.

<table>
<thead>
<tr>
<th>Waterbody</th>
<th>Complies with Objective 1</th>
<th>Complies with Objective 2</th>
<th>Complies with Objective 3</th>
<th>Compliance with Objective 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>GB104026066950 Holderness Drain Source to Fordyke Stream</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Sediment management strategies</td>
</tr>
<tr>
<td>GB104026066800 Holderness Drain from Fordyke Stream to Humber</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Educate landowners on sensitive management practices. Sediment management strategies</td>
</tr>
<tr>
<td>GB104026067130 Garton Wold / Water Forlorns</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Educate landowners on sensitive management practices. Sediment management strategies</td>
</tr>
<tr>
<td>GB104026067060 Driffield Trout Stream</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>None listed – NA</td>
</tr>
<tr>
<td>GB104026067080 West Beck Upper</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Educate landowners on sensitive management practices.</td>
</tr>
<tr>
<td>GB104026067040 West Beck Lower to River Hull</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Educate landowners on sensitive management practices. Sediment management strategies</td>
</tr>
<tr>
<td>GB104026067000 River Hull from West Beck to Arram Beck</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Provide flows to move sediment downstream. Sediment management strategies Maintain sediment management regime to avoid degradation of the natural habitat characteristics of the downstream river.</td>
</tr>
<tr>
<td>GB104026066870 Arram Beck 1</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Sediment management strategies.</td>
</tr>
<tr>
<td>GB104026067210 River Hull from Arram Beck to Humber</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Sediment management strategies.</td>
</tr>
<tr>
<td>Groundwater body G41 - GB40401G700700 Hull and East Yorkshire</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>RHICS does not compromise efforts to achieve Good Ecological Status by 2027.</td>
</tr>
</tbody>
</table>
6.11 Consideration of Cumulative Effects

Cumulative Effects of RHICS

The context for consideration of cumulative effects is one where synergistic i.e. effects working together, and cumulative i.e. effects increasing by successive addition of options, may arise as a result of option implementation. This may be as a result of combined options promoted within the RHICS; the RHICS in combination with other Environment Agency activities; and from the RHICS together with plans/programmes/strategies of others.

The original SEA of 2010 stated that synergistic and cumulative effects can be difficult to identify as a result of the spatial and temporal distribution of any proposed works or potential change in maintenance activities within the 100 year horizon of the FRMS. It was identified that where FRMS elements could be combined to present a proposed strategy option, it would be reasonable to conclude that certain impacts associated with a strategy element may be altered.

An option implemented in one part of the study area may have effects in another part; hence the more detailed flood risk modelling that forms part of the RHICS and considered within this Addendum report. It is important to understand, at a strategic level, the potential cumulative effects that may arise as a result of the RHICS implementation. In order to address the potential issues a combined impact significance matrix has been prepared at table 6.2 above as a first step. This matrix highlights those environmental factors assessed to be vulnerable to adverse effects in relation to each of the options proposed. Furthermore both the short term and long term effects have been considered. The RHICS has also considered the combined effects of a ‘combined’ model i.e. all options, to examine potential effects upon flood risk; in particular effects upon property, heightened or reduced risk and monetary value of any damage.

At this stage of assessment only key issues can be identified. As options are brought forward, in sequence or in combination, then any necessary project level EIA will more fully consider the likely cumulative effects; additionally these effects will be considered in the context of a more detailed, site specific environmental baseline.

Effects would also be considered at both construction and operational phases of any proposed works enabling effective mitigation, or preferably ‘designed out’ impacts, to be suggested.
Cumulative Effects with other Environment Agency Activities

The EA are responsible for the promotion of a number of strategies and projects within the study area; to be undertaken within the projected lifetime of the RHICS. The likely integration of the RHICS with currently known EA plans and strategies has been reviewed at sub section 3.2 of this Addendum Report. In each instance the purpose of each plan or strategy has been assessed against the RHICS with a judgement made in respect of potential integration. The likely cumulative effects of the stated plans and programmes, together with any relevant activities that may emerge during the lifespan of the RHICS, will be monitored as part of the RHICS review process.

Given the long term duration of the RHICS, and the strategic nature of this Addendum report, it is not possible to accurately identify the all cumulative effects that may arise. It is possible however, to summarise the relevant plans or programmes where cumulative effects may occur and note how these may be considered.

<table>
<thead>
<tr>
<th>Plan/Programme/ Strategy/Project</th>
<th>Potential for cumulative effect with RHICS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hull &amp; Coastal Streams Catchment Flood Management Plan (December 2010)</td>
<td>Potential for <strong>positive</strong> cumulative effects: opportunities for strategic level influence upon emerging Local Plans, and a range of flood risk management/surface water management/asset management plans, down to detailed, project level habitat creation. The Hull &amp; Coastal Streams Catchment Flood Management Plan (H&amp;CSCFP) covers a very large area, some 2,226 square kilometres, includes 44 Sites of Special Scientific Interest, two Special Areas of Conservation, one Ramsar site and three Special Protection Areas. There are also 449 Scheduled Monuments and nine Registered Parks and Gardens within the catchment area. This catchment area is coincident with much of the RHICS study area. The actions identified within the H&amp;CSCFP include measures to sustain the current scale of flood risk within the River Hull upper catchment and to reduce flood risk in the lower catchment. Measures complement those identified in the RHICS and point towards potential improvement of SSSI condition.</td>
</tr>
<tr>
<td>Humber Flood Risk Management Strategy (March 2008)</td>
<td>Potential for <strong>positive</strong> cumulative effects: The Humber FRMS relates to an area of some 90,000 hectares that is at risk of flooding from a storm surge. The strategy seeks to manage flood risk around the River Humber that takes account of natural estuary processes with proposals that are technically/ economically/environmentally/socially appropriate. The management strategy proposed maintains existing defences, identifies potentially unsuitable development in the floodplain and provides targeted warnings. Where required inter-tidal habitat will be replaced if affected by the strategy but also opportunities exist for conservation and enhancement. Improvements to landscape character and amenity/recreation facilities are also considered. There are opportunities for joint initiatives with the RHICS.</td>
</tr>
<tr>
<td>Humber River Basin District Flood Risk</td>
<td>Potential for <strong>positive</strong> cumulative effects: joint</td>
</tr>
<tr>
<td>--------------------------------------------------</td>
<td>--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Humber Local Enterprise Partnership: Investment and Delivery Plan (March 2014)</td>
<td>Potential for positive cumulative effects: supports maintenance and improvement of assets. The standard of protection offered by existing defences at Albert Dock is known to be lower than the rest of the Humber frontage at Hull. In line with the stated objective of stimulating economic development/promotion of sustainable development to sustain the natural environment the tidal defences at Albert Dock are targeted. The improvement of these defences will reduce risk with a view to encouraging inward investment. Programmed work during period 2014 to 2016.</td>
</tr>
<tr>
<td>River Hull Headwaters Restoration Project (June 2010)</td>
<td>Some potential impacts already recognised, such as dredging for channel restoration. Upland attenuation offers potential positive cumulative effects. Document outlines a vision for the River Hull Headwaters, as part of wider SSSI units, based around water quality/ecological enhancement with restoration measures. Includes positive management and removal of man made features. Opportunities for collaborative working (NE, EA and partner organisations) recognised in document together with longer timescales for sustainable recovery. Detailed restoration measures described for defined sections of watercourses.</td>
</tr>
<tr>
<td>Pulfin Bog SSSI Water Level Management Plan (1999)</td>
<td>Potential for positive cumulative effects. Although neutral impact is assessed at strategic level as a result of RHICS further consideration of mitigation measures upstream to control or minimise flood risk to SSSI could be undertaken during option development. Effects, including more detailed examination of mitigation, would be required at any project level cumulative assessment.</td>
</tr>
<tr>
<td>Humber Eel Management Plan (2011)</td>
<td>Potential for cumulative effects; likely to be neutral, requires incorporation of control structures at project level with assessment of effects. Humber area identified as a priority habitat; seven key habitat priority and ten pass priority sites but all lie outside study area.</td>
</tr>
</tbody>
</table>

**Table 6.6: Summary of EA Plan/Programme Interaction**

**Cumulative Effects with other Plans/Programmes/Strategies**

The current situation in respect of planning at a national, regional and local level has been considered within section 3 of this Addendum report. In order to provide a comparable review of the likely interaction with planning at these various levels to that included within the original SEA of 2010, a summary table has been provided at Appendix B. It is notable that at a national level the replacement of many PPG and PPS with the NPPF has simplified the assessment of cumulative effects. This has also been reflected at a local level through the emerging Local Plans.
The long term duration of the RHICS certainly lies beyond the anticipated plan period of the emerging Local Plans; and those at a national level. To ensure that the RHICS remains aligned with the planning context, at all levels, then the programmed review of the strategy will include consideration of background planning situation.

Cumulative effects will also be considered at a project level as part of any necessary EIA taking account of relevant interaction. The opportunity for a more co-ordinated approach to project design and implementation, given the recent establishment of a Project Board to ensure a more integrated approach to flood management, now exists and represents a step forward from the previous FRMS. This co-ordinated approach should permit a robust and forensic approach to the potential cumulative effects projects with the very large study area.

6.12 Habitat Regulations Assessment

If it is considered likely that significant effects resulting from the options proposed by the RHICS will occur in Humber Estuary Special Area of Conservation or Humber Estuary Special Protection Area, then options will need to be screened to assess whether Appropriate Assessment is necessary (Habitats Regulations Assessment) allowing us to fulfil a UK commitment to the EU Habitats Directive.

In conjunction with both Natural England and the Environment Agency preliminary input to the screening process has already commenced and will be reported separately to this SEA Addendum.

6.13 Next Steps

The RHICS options will be implemented over a timescale of approximately 20 years, undertaken in phases and based upon an approach that incorporates a mixture of the respective options. The vision of the RHICS is very much that the strategy will guide flood risk management within the study area over the next 100 years; but subject to periodic review every 5 years.

The intended phases, with inclusion of each option are listed below:

**Phase 1**
- Option C – Raising of embankments to Holderness Drain
- Option D – Bransholme Pumping Station
- Option F – Replacement pumps installed at Wilholme and Hempholme pumping stations

**Phase 2**
- Option A – Dredging and re-profiling of the River Hull channel, including the removal of sunken vessels
- Option B – Tidal exclusion, install new barrier at mouth of River Hull

**Phase 3**
- Option G – Natural Flood Management
- Option E – Raising of embankments along the Beverley and Barmston Drain/Western Drain.
The current programme is that Phase 1 will be undertaken between years 0 and 6, Phase 2 will be delivered between years 1 and 6 whilst Phase 3 will take place between years 6 and 20.
Implementation and Monitoring Plan

7.1 Introduction

The original SEA outlined a detailed Monitoring Plan to complement the strategy options contained within the FRMS. The assumption at the time of publication was that no single option could be selected to present a preferred final Strategy option; hence the SEA of May 2010 assessed all promoted options as ‘reasonable alternatives’ in accordance with the requirements of the SEA Regulations. It was considered that a number of strategy elements, potentially a combination from several options, would be taken forward to create a preferred option. It was further recognised that some elements may change over time.

A fundamental element of the SEA process is the development of a monitoring system. To reiterate, this enables:

- Comparison of the actual environmental impacts arising from the Strategy against the predicted impacts;
- A check that mitigation is effective;
- A check that no unforeseen impacts occur and that existing arrangements for monitoring are not duplicated; and,
- Any data gaps, or uncertainty highlighted by this assessment, can be addressed to provide a more comprehensive baseline when the Strategy is periodically reviewed.

It is considered that the original Monitoring Plan is still relevant to the more recent RHICS, with modifications to reflect the options as currently presented, and hence will form the basis of forward looking actions. The full Monitoring Plan is not reproduced in this report however an amended summary appraisal table is presented below; table 7.1.

7.2 Monitoring Plan

The monitoring plan is essentially a ‘live’ document in that it provides a template for continual review. Baseline information to reflect changes in the environment over a period of time are monitored together with any reviews of the RHICS; the latter being undertaken to an approximate five year cycle. The development of promoted options from the latter, in particular where combinations of options may be considered, may necessitate changes to the monitoring plan. A vital role of the RHICS will be to monitor and report the actual effects of implementation, compare these to those predicted in this SEA Addendum Report and feed those back into the strategy so that any changes are reflected in strategy reviews.

Sensibly the original SEA recommended a number of actions to assist in management of the currently identified risks and inform the short term implementation of the strategy or, more pertinently, the likely project level EIA and/or future project level WFD assessments. These actions included:

- Work together with Local Authorities, Flood Action Groups, Internal Drainage Boards, Yorkshire Water, Natural England, farmers, landowners and many other partner
organisations to identify sources of funding wherever possible, and to agree which other partners can play a greater role and take more responsibility for managing flood risk in the long term.

- Work with Natural England to investigate in more detail potential impacts on the River Hull Headwaters and Pulfin Bogg SSSI.
- Investigate local flood protection measures for additional properties at risk.
- Work with ERYC to review planning policies, including taking account of any significant development proposals.
- Review the WFD assessment.
- Note the results and any consequential actions arising from any HRA.

<table>
<thead>
<tr>
<th>Environmental Objective</th>
<th>Sub-Objective</th>
<th>Indicators</th>
<th>Data Source/ Current Monitoring</th>
<th>Monitoring Responsibility &amp; Timescale</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flood Protection</td>
<td>To protect people and their property from the adverse effects (physical and psychological) of flooding</td>
<td>Numbers of people affected and/or property protected (including duration of flooding) Employment sustained</td>
<td>Register of properties at risk of flooding. Outcome measure targets through projects</td>
<td>Environment Agency/RHICS Project Board: update in line with RHICS reviews</td>
</tr>
<tr>
<td>Wetland Habitats</td>
<td>To avoid damage to designated sites (e.g. SSSIs, SPA, SAC, Ramsar)</td>
<td>Reported levels of impact to designated sites</td>
<td>Condition of River Hull Headwaters and SSSIs as assessed by Natural England</td>
<td>Natural England, with input from EA: updated approx. every 6 years</td>
</tr>
<tr>
<td></td>
<td>To promote favourable condition of River Hull Headwaters SSSI and other hydrologically sensitive designated sites</td>
<td>Reported favourable condition of River Hull Headwaters SSSI and other SSSIs impacted upon by the proposed options</td>
<td>Condition of River Hull Headwaters and SSSIs as assessed by Natural England</td>
<td>Natural England, with input from EA: updated approx. every 6 years</td>
</tr>
<tr>
<td></td>
<td>To increase resilience of wetland habitats</td>
<td>Creation of wetland habitats and buffer zones</td>
<td>Outcome measure targets in respect of habitats</td>
<td>EA annually</td>
</tr>
<tr>
<td></td>
<td>To contribute to relevant UK and local BAP habitats, species and other relevant important species in line with targets</td>
<td>Achievement of BAP targets for species and habitats Increase in eel populations</td>
<td>No strategic level monitoring required. Reporting of habitats and species at project level. Existing Eel Management Plan objectives &amp; actions</td>
<td>Natural England/EA: on project by project basis, feedback to RHICS reviews. EA: as per Eel Management Plan</td>
</tr>
<tr>
<td></td>
<td>To promote a natural self-sustaining fishery (coarse and salmonid)</td>
<td>Species diversity, biomass and recruitment</td>
<td>Fisheries Surveys</td>
<td>EA: update in line with RHICS reviews</td>
</tr>
<tr>
<td>Sustainable Land Use and Landscape</td>
<td>To support/promote land use change that reduces flood risk and promotes improved landscape character</td>
<td>Area of land providing flood risk management benefits or landscape improvement</td>
<td>No strategic level monitoring required. Project level reporting of landscape character and land use changes</td>
<td>RHICS Project Board: in line with strategy updates</td>
</tr>
<tr>
<td>Agricultural Land Use</td>
<td>To reduce the vulnerability of high grade/productive</td>
<td>Loss of high grade/productive land from existing</td>
<td>Feedback from farmers, landowners, IDBs, LPAs and</td>
<td></td>
</tr>
</tbody>
</table>

142
<table>
<thead>
<tr>
<th></th>
<th>agricultural land to flooding</th>
<th>agricultural practice</th>
<th>relevant partner groups in relation of ongoing land use</th>
<th>RHICS Project Board: in line with strategy updates</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cultural Heritage</strong></td>
<td>To prevent damage to designated assets within the floodplain</td>
<td>Numbers of designated assets protected from the adverse effects of flooding</td>
<td>No strategic level monitoring required. Project level assessment and reporting</td>
<td></td>
</tr>
<tr>
<td><strong>Tourism and Recreation</strong></td>
<td>To improve local tourism, amenity and recreation opportunities</td>
<td>Area/number of recreational and amenity facilities protected/created</td>
<td>No strategic level monitoring required</td>
<td>RHICS Project Board: in line with strategy updates</td>
</tr>
<tr>
<td><strong>Transport</strong></td>
<td>To prevent adverse impacts of flooding on major communication links to Hull</td>
<td>Length of roads and rail track protected</td>
<td>No strategic level monitoring required. Project level assessment and monitoring</td>
<td>RHICS Project Board: in line with strategy updates</td>
</tr>
<tr>
<td><strong>Water Framework Directive</strong></td>
<td>To protect geo-morphological features of the river and floodplain and, where possible, provide opportunities for enhancement</td>
<td>Change in geo-morphological diversity and increased ‘naturalness’</td>
<td>Achievement of Good ecological status or potential. Project level WFD assessment</td>
<td>EA: updated WFD assessment in line with strategy updates</td>
</tr>
<tr>
<td><strong>Water Resources</strong></td>
<td>To protect water quantity for abstraction and supply</td>
<td>Water abstractions protected</td>
<td>Issues relating to abstractions highlighted by Yorkshire Water/other abstractors</td>
<td>EA/Yorkshire Water/other abstractors: in line with strategy updates</td>
</tr>
<tr>
<td><strong>Climate Change</strong></td>
<td>To reduce vulnerability to the impacts of climate change and ensure flexibility of options</td>
<td>Flexibility to different climate change scenarios</td>
<td>No strategic level monitoring required</td>
<td>RHICS Project Board in line with strategy updates</td>
</tr>
</tbody>
</table>

**Table 7.1 Monitoring Plan Summary Appraisal Table**

### 7.3 Project Level Monitoring

Changes to the baseline environment will also be recorded through any necessary EIA associated with the proposed implementation of options. A more detailed level of information is typically gathered to inform such assessments with a geographic or temporal coverage appropriate to the development proposal. The relevant local planning authority will have input at the Scoping stage, together with other statutory consultees, to ensure that relevant baseline conditions are fully considered.

Project level WFD assessments may also be required, again providing the opportunity to review the environmental baseline.

### 7.4 The Next Steps

This draft of the SEA Addendum Report together with a draft version of the RHICS will be subject to Stakeholder Consultation. This SEA Addendum report will be subject to a six week consultation period during April 2015. The document will be uploaded to the dedicated RHICS website with direct communication to over 100 organisations undertaken by ERYC.
Feedback from the consultation process will be studied and issues raised will influence the final version of the Addendum Report. A Statement of Environmental Particulars will also be published which will illustrate how comments received during consultation have been taken into account. Subject to approval by the Project Board both the RHICS document and accompanying SEA Addendum Report will then be submitted to the EA and Defra.


Conclusions

8.1 Population

At a strategic level the direct effects of implementation associated with any option is unlikely to be significant. The key effects, and concern, to local communities within the study area are likely to be those that arise from inundation; with particular emphasis upon the effects to property.

No option promoted within the strategy is predicted to give rise to effects that are worse than the baseline prediction. Options B, C, E and G however, all offer a potential beneficial effect through a reduction to the area of inundation.

For Option B this minor beneficial effect is notable for a reduction in predicted inundation within the urban area of Hull; adjacent to Stoneferry Road. Options C and G are both predicted to reduce the area of inundation to the north-eastern fringe of Hull; adjacent to the residential suburb of Bransholme. Option E would offer reduced flood risk to the western edge of Dunswell village.

8.2 Flora, Fauna and Biodiversity

The predicted flood risk for all options involves inundation of nationally important designated sites for nature conservation, and flooding adjacent to other nationally important sites increasing risk of harm through degradation of water quality and introduction of alien species. Consequently Options A – F are predicted to have very similar significant indirect effects on ecological receptors compared to the baseline and are therefore considered likely to be neutral in each case.

Direct significant effects are considered likely to be major adverse for Option A if water injected dredging is carried out in the absence of mitigation, and neutral in the long term. Short term direct effects of other approaches (Options B – F) are considered likely to be neutral both in the short and long term as operations do not impact on receptors considered in this document.

Option G offers a more sustainable solution in that measures put in place will increase in effectiveness as time goes by aiming to create a coherent suite of habitats along waterways buffering nationally important sites and increasing ecological resilience at a landscape scale. The deliverability of this approach is currently being demonstrated in River Hull Headwaters SSSI. Consequently from a flora, fauna and biodiversity point of view, Option G presents a scenario where direct effects are considered certain to deliver moderate beneficial effects in the short term and certain to accrue major beneficial effects in the long term. Indirect effects are considered likely to be minor beneficial as whilst localised adverse effects commensurate with baseline conditions on SSSI will occur, there will be a degree of amelioration of adverse effects due to reduction in point source pollution and overland flow in River Hull Headwaters SSSI.

8.3 Landscape and Land Use

Overall the Strategy Options are considered to have a minor impact on the landscape of the River Hull and Holderness Drain catchment.
The raising of drain embankments (RHICS Options C and E) may result in minor short to medium term adverse direct effects on landscape character; largely as a consequence of tree/vegetation loss. However, Natural Flood Management attenuation and infiltration features (RHICS Option G) offer the opportunity for significant long term landscape character enhancement.

Uncertainty remains over local or detailed level impacts and mitigation measures that will need to be addressed at project level.

**8.4 Cultural Heritage**

The predicted flood risk for all options involves the inundation of several nationally important designated cultural heritage assets, and flooding adjacent to other assets, thus increasing the risk of harm through a combination of factors including erosion, damp and the deposition of silt and other material. However, relatively few assets will be affected by the various options, compared to the overall populations for the SEA Addendum study area, because historic occupation and activity has largely avoided the low-lying floodplain. Options A and E are predicted to have similar direct effects compared to the baseline, although these effects will be primarily on non-designated assets rather than designated ones. Option C is considered to have a higher level of impact due to the immediate proximity of a Scheduled Monument (Swine Hill Castle). Option G is considered to have the greatest potential adverse direct effect, purely because of the number of areas likely to be involved and the lack of any detailed proposals at this stage. In all cases however, it should be possible to mitigate the adverse effects of all options at the detailed project level.

**8.5 Recreation and Amenity**

The network of recreation features across the study area is extensive. They form both an essential amenity to local communities and key element of the local economy. It is not considered that implementation of any option would result, at a strategic level, in significant direct effects. The exception to this is Option A where it is considered that dredging and removal of sunken/abandoned vessels would, in combination, improve the River Hull as a recreational and amenity feature.

Potential inundation, arising from each option, would create localised effects; with the extent of impact depending upon a number of factors including level of inundation and duration. In comparison to the baseline prediction the effects are largely neutral. Option G may introduce opportunities for landscape diversity that enhance the existing landscape character and, by implication, offer an improved amenity resource to what is a predominantly rural study area.

**8.6 Material Assets**

The importance of major infrastructure, in particular road and rail routes, to a predominantly rural study area has been identified within this Addendum report. The vital role that communication routes play in the economic and social activities of local communities is similarly recognised. Protection of this infrastructure from flood risk is hence a key objective of the RHICS.

Direct effects arising from any option, other than potentially Option B, are unlikely to be significant. The introduction of a new tidal barrier at the mouth of the River Hull would undoubtedly lead to short term disruption of the navigation route during construction; but tempered by longer term benefits.
The effects of inundation, most notably potential disruption to communication routes, have been identified and assessed. In this respect, compared to the predicted baseline scenario, Options B, C and E all offer beneficial effects. Option B offers enhanced flood risk protection to both a local road and rail links whilst Option C reduces flood risk to a local road. Option E provides a predicted flood risk protection to an important local trunk road, the A1079 (adjacent to Dunswell).

8.7 Water Environment

The direct effects arising from the implementation of most strategy options are not assessed to be significant. There is however, potential for localised, short duration effects upon the water quality of the River Hull arising from construction and implementation of works. In particular Options A, C and E are anticipated to give rise to short term adverse effects through construction works related to each option; primarily the result of silt disturbance.

The indirect effects, based upon the impact from inundation, are minimal for each option with the majority resulting in an overall beneficial situation.

8.8 Environmental Objectives

The strategic level environmental assessment of the final RHICS options has enabled identification of potential conflicts, and opportunities, in respect of the stated environmental objectives; and sub-objectives. We have reviewed the likely effects upon the environmental objectives arising from each option. This differs from the original SEA which at that time only considered each option as elements within a larger strategy; hence was unable to chart the potential effects of single options or make a comparison between options in terms of potential impacts. The latter is considered, in preparation of this Addendum report, to offer more insight into the strategic effects resulting from each option in order to guide the project level design, development and environmental assessment.

8.9 Strategic Water Framework Directive Assessment

Each option has been assessed against the predicted effects upon groundwater assets (waterbodies) identified by the Environment Agency as being important in allowing the UK to meet its commitments under the EU Water Framework Directive. Our study examines the potential effects of the options on the ecological quality of waterbodies. Effects which are likely to reduce the possibility of meeting WFD objectives or otherwise cause deterioration in the status of waterbodies are identified and assessed.

Each option has been assessed against predicted effects on WFD waterbodies. The results of this assessment make it possible to determine whether each option complies with the overarching objectives of the WFD for each waterbody as set out below;

- **Objective 1**: The proposed scheme does not cause deterioration in the WFD Status of the Biological, Chemical and other assessed Elements of the waterbody;

- **Objective 2**: The proposed scheme does not compromise the ability of the waterbody to achieve its WFD status objectives;

- **Objective 3**: The proposed scheme does not cause a permanent exclusion or compromised achievement of the WFD objectives in other bodies of water within the same RBD; and
• **Objective 4:** The proposed scheme contributes to the delivery of the WFD objectives.

The strategic WFD assessment concluded that Objectives were met by each option subject to implementation of a range of mitigation measures.

**8.10 Summary**

The assessment process has considered a range of previously scoped environmental factors which have been re-appraised in the context of an evolved flood risk management strategy for the River Hull and updated baseline data. Additionally the Environmental Objectives have been reviewed and refined to reflect the new strategy and consultation responses from the key consultees.

The process of option selection, by which a large number of initial flood risk management options were first appraised and a select list of deliverable strategy options then promoted, has been described in this report.

This SEA Addendum Environmental Report has also considered the implementation and operational timescale of the new strategy. Both the direct environmental effects arising from implementation and initial operation together with the indirect effects that may arise as a result of predicted inundation have been assessed for each option and reported accordingly. The potential, significant effects have been assessed against a known, and current, baseline of environmental data within the study area; at a strategic level and relative to the level of detail currently developed for each option.

Where appropriate, mitigation measures and potential enhancement opportunities have been explored for each option with suitable recommendations made to avoid or reduce environmental impact. These recommendations have been incorporated into the RHICS as part of the iterative development process.

Each option has also been evaluated against the stated Environmental Objectives, and sub-objectives, created to align the defined scope of strategic environmental assessment, consultation responses and over-arching objectives of the proposed flood risk management strategy. Taken together, the Environmental Objectives seek to deliver a sustainable flood risk management strategy for the River Hull catchment.

The RHICS has been assessed against current, relevant plans and policies (including the strategies of a range of stakeholders) at national, regional and local level; including the emerging Local Plans. Compliance against these plans, policies and strategies has been tested and reported.

In accordance with current legislation a strategic Water Framework Directive assessment has been undertaken. The strategic WFD assessment, undertaken in liaison with the Environment Agency, concluded that the over-arching compliance objectives were met by each option subject to implementation of a range of mitigation measures.

The sensitivity of the Humber Estuary, as recognised by designation of the nature conservation interest at International, European and National level, has necessitated commencement of an Appropriate Assessment as defined by the relevant legislation. Undertaken in consultation with Natural England this separate, but related, assessment has started and will be reported without this Addendum Report.
In respect of the assessed environmental factors a degree of consensus has been reached through this strategic assessment, namely that those options which include a simple upgrade to existing facilities i.e. Options D and F present the least environmental harm with the majority of effects assessed to be Neutral; although it should be noted that Option has already been implemented by Yorkshire Water.

Both options that include sections of embankment raising to existing flood defences, Options C and E, are assessed to present similar impacts and benefits. The noted adverse effects for both options arise primarily through initial construction. A more detailed examination of the outline mitigation proposed in this assessment may reduce the potential impacts.

The provision of further tidal exclusion measures, Option B, would offer a balance of adverse and beneficial effects; but with the balance tipping towards beneficial.

Dredging of the River Hull, Option A, presents a series of challenges resulting from the nature and extent of physical intervention required. Adverse effects are again a function of the implementation phase and considered to be largely short term. Mitigation measures to be examined at the project level may reduce the identified impacts based upon a more detailed picture of the river environment. This option does however offer a balance of beneficial effects.

The option that consists of least intervention, Option G, and is based upon a series of ‘soft’ engineering measures is assessed to offer a consistently greater balance in favour of beneficial effects.

All promoted options will require more detailed examination, and further assessment, at the project stage to facilitate implementation.
References


Communities and Local Government (March 2012) National Planning Policy Framework

Environment Agency (December 2010) Hull and Coastal Streams Catchment Flood Management Plan


Environment Agency (2014) Managing the risk of flooding in the Humber River Basin District


East Riding of Yorkshire Council (November 2005): Landscape Character Assessment

East Riding of Yorkshire Council (2011): Housing Strategy


The Environment Agency (EA) (August 2011): Strategic Environmental Assessment and Climate Change: Guidance for Practitioners


Hull City Council (January 2011): Local Transport Plan (2011 – 2026)

Humber Local Enterprise Partnership (March 2014) Investment and Delivery Plan 2014-2020


Natural England/Environment Agency (June 2010) Restoring the River Hull Headwaters (River Restoration Plan)

Office for National Statistics: 2011 census
Sustainable Eel Group (2011) *Habitat Improvement Strategy for the European Eel (Anguilla Anguilla)*

## Glossary of Terms

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<tr>
<th>Term</th>
<th>Definition</th>
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<td>AAP</td>
<td>Area Action Plan</td>
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<tr>
<td>ALC</td>
<td>Agricultural Land Classification</td>
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<tr>
<td>AWB</td>
<td>Artificial Waterbodies (associated with WFD)</td>
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<tr>
<td>Baseline</td>
<td>In environmental assessment it is a description of existing conditions</td>
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<tr>
<td>Biodiversity</td>
<td>Biological diversity, the number and abundance of species present.</td>
</tr>
<tr>
<td>Biodiversity Action Plan (BAP)</td>
<td>A plan to achieve targets for enhancing the diversity of biological life, the abundance of species and their habitats. There are national and local BAPs (LBAP) including a draft one for the Humber</td>
</tr>
<tr>
<td>CAMS</td>
<td>Catchment Abstraction Management Plan</td>
</tr>
<tr>
<td>Catchment</td>
<td>Surface water catchment is the total area that drains into a river, while a groundwater catchment is the total area that supplies the groundwater part of the river flow</td>
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<tr>
<td>CEMP</td>
<td>Construction Environmental Management Plan, a document that records relevant environmental constraints for a particular site, states the proposed site management protocols to avoid impacts upon the environment and documents the procedures undertaken through the construction period.</td>
</tr>
<tr>
<td>CFMP</td>
<td>Catchment Flood Management Plan</td>
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<tr>
<td>Conservation Area</td>
<td>Areas of settlement designated for their special architectural and historic interest by the Local Authority. They can include the cores of historic towns and villages, fishing and mining villages, 18th and 19th century suburbs, model housing estates, country houses set in their historic parks, and transport links and their environs</td>
</tr>
<tr>
<td>Countryside Agency (CA)</td>
<td>Statutory authority tasked with making life better in the countryside and improving the quality of the countryside for everyone, now re organised to be part of Natural England</td>
</tr>
<tr>
<td>CPRE</td>
<td>Council for Protection of Rural England</td>
</tr>
<tr>
<td>Cumulative effect</td>
<td>Cumulative effects can be defined as incremental effects of an action when added to other past, present, and reasonably foreseeable future actions. These effects can result from individually minor but collectively significant actions taking place over a period of time</td>
</tr>
<tr>
<td>Defra</td>
<td>Department for Environment, Food and Rural Affairs Government</td>
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<tr>
<td>DPD</td>
<td>Development Plan Document</td>
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<tr>
<td>Designated Cultural Heritage Assets</td>
<td>Defined as comprising World Heritage Sites, Scheduled Monuments, Listed Buildings, Protected Wreck Sites, Registered Parks and Gardens, Registered Battlefields and Conservation Areas</td>
</tr>
<tr>
<td>EA</td>
<td>Environment Agency</td>
</tr>
<tr>
<td>Environmental appraisal</td>
<td>The process whereby the environmental effects of a proposal are identified, measured and assessed to determine their significance</td>
</tr>
<tr>
<td>Environmental assessment</td>
<td>A tool for understanding environmental risk and integrating environmental considerations into decision-making by ensuring that significant environmental effects of the decision are taken into account. In the SEA Directive, an environmental assessment means ‘the preparation of an environmental report, the carrying out of consultations, the taking into account of the environmental report and the results of the consultations in decision making and the provision of information on the decision’, in</td>
</tr>
<tr>
<td>Term</td>
<td>Definition</td>
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<tr>
<td>EC Directive</td>
<td>Legislation issued by the European Union that is binding on Member States in terms of the result to be achieved, but leaves choice as to methods</td>
</tr>
<tr>
<td>Environmental Impact Assessment (EIA)</td>
<td>The specified process for undertaking the environmental appraisal when a proposed scheme is covered by The Town and Country Planning (Environmental Impact Assessment) Regulations 2011 or other Regulations implementing EC Directive 85/337, and the amending EC Directive 97/11</td>
</tr>
<tr>
<td>Environmental Report</td>
<td>Document required by the SEA Directive as part of an environmental assessment, which identifies, describes and evaluates the likely significant effects on the environment of implementing a Plan or Programme</td>
</tr>
<tr>
<td>ERYC</td>
<td>East Riding of Yorkshire Council</td>
</tr>
<tr>
<td>Flood and Coastal Defence Project Appraisal Guidance (FCDPAG)</td>
<td>Series of guidance documents produced by Defra which are designed to provide advice on best practice for the appraisal of flood and coastal defence projects. Documents cover: overview (PAG1); strategic planning and appraisal (PAG2); economic appraisal (PAG3); approaches to risk (PAG4); and environmental appraisal (PAG5)</td>
</tr>
<tr>
<td>English Heritage (EH)</td>
<td>English Heritage is the Government’s statutory adviser on the historic environment. Officially known as the Historic Buildings and Monuments Commission for England. The principal powers and responsibilities of EH are set out in the National Heritage Act (1983)</td>
</tr>
<tr>
<td>Environment Agency (EA)</td>
<td>The Environment Agency is an executive, non-departmental public body sponsored by the Department of Environment, Food and Rural Affairs (Defra) with a responsibility for the regulation of major industry, waste, contaminated land, water quality/resources, fisheries, inland rivers/estuaries/harbour navigations and conservation/ecology</td>
</tr>
<tr>
<td>FRM</td>
<td>Flood Risk Management</td>
</tr>
<tr>
<td>FRMS</td>
<td>Flood Risk Management Strategy</td>
</tr>
<tr>
<td>Geomorphology</td>
<td>The physical processes which have caused the topography and shape of the river and its floodplain.</td>
</tr>
<tr>
<td>GEP</td>
<td>Good Ecological Potential (associated with WFD)</td>
</tr>
<tr>
<td>GES</td>
<td>Good Ecological Status (associated with WFD)</td>
</tr>
<tr>
<td>GQA</td>
<td>General Quality Assessment</td>
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<tr>
<td>HCMAFF</td>
<td>Hull Catchment Multi Agency Flood Forum</td>
</tr>
<tr>
<td>HMWB</td>
<td>Heavily Modified Waterbodies (associated with WFD)</td>
</tr>
<tr>
<td>Improve (Flood Defences)</td>
<td>Defences are raised to improve the Standard of Protection including a consideration of climate change, so the improved standard of protection is sustained over time</td>
</tr>
<tr>
<td>Indicator</td>
<td>A measure of variables over time, often used to measure achievement of objectives.</td>
</tr>
<tr>
<td></td>
<td>– Input (or response) indicator: indicator that focuses on actions to be undertaken to achieve an outcome (e.g. installing catalytic converters in new cars to reduce air pollution), i.e. the means rather than the ends.</td>
</tr>
<tr>
<td></td>
<td>– Outcome indicator: indicator that focuses on the outcome sought (e.g. clean air) rather than how it should be achieved (e.g. installing catalytic converters), i.e. the ends rather than the means</td>
</tr>
<tr>
<td>Indicative floodplain</td>
<td>Broad extent of area at risk of possible flooding</td>
</tr>
<tr>
<td>IDB</td>
<td>Internal Drainage Board</td>
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<tr>
<td>Integrated Catchment Study (ICS)</td>
<td>Joint Structure Plan</td>
</tr>
<tr>
<td>JSP</td>
<td>Joint Structure Plan</td>
</tr>
</tbody>
</table>
| Landscape Character | Landscape Character Assessment is a process for identifying, describing,
| **Assessment (LCA)** | classifying and mapping the landscape. It helps explain what makes landscapes different from each other. The assessment process involves identification of features or combinations of elements that contribute to the character of the landscape. The assessment provides a clear understanding of the issues affecting the landscape, enabling the development of appropriate recommendations for its future conservation and management |
| **LDF** | Local Development Framework |
| **LDD(s)** | Local Development Documents |
| **Listed Building** | A building or structure which is considered to be of 'special architectural or historic interest.' All Listed Buildings are placed on the statutory list held by English Heritage (in England). There are three grades of Listed Building, Grade I, Grade II* and Grade II. All are afforded statutory protection |
| **Local Plan** | The generic title applied to a collection of Development Plans prepared by a local planning authority which guides the development of a local area; as adopted under the ‘Planning and Compulsory Purchase Act 2004’. Includes Core Strategies and other planning policies that constitute Development Plans; including older policies prepared before 2004 but saved under the 2004 act |
| **MAFF** | Ministry of Agriculture, Fisheries and Food (now subsumed within Defra) Ministry that formally had responsibility for flood defence, abolished in 2001 with its tasks transferred to Defra |
| **Maintain (Flood Defences)** | Defences are maintained at their existing level and, therefore, over time the Standard of Protection will reduce as a result of climate change and sea level rise |
| **Mitigation** | Measures to avoid, reduce or offset significant adverse effects |
| **Monitoring** | A continuing assessment of conditions at and surrounding the action. This determines if effects occur as predicted or if operations remain within acceptable limits, and if mitigation measures are as effective as predicted |
| **National Planning Policy Framework (NPPF)** | National Planning Policy Framework sets out the Government’s planning policies for England and how these are expected to be applied. It provides the framework for production of Local Plans |
| **Natural England (NE)** | Natural England is the government’s advisor on the natural environment. The remit of Natural England is to ensure sustainable stewardship of the land and sea so that people and nature can thrive |
| **NCPMS** | National Capital Project Management Service (within EA) |
| **NEAS** | National Environmental Assessment Service (within EA) |
| **Neap tides** | The smallest rise and fall of the tide, caused when the sun and moon are at right-angles to one another |
| **NFCDD** | National Flood and Coastal Defence Database |
| **NRG** | National Review Group (within EA) |
| **Office of the Deputy Prime Minister (ODPM)** | Formerly the Now replaced by the Department for Communities and Local Government |
| **Objective** | A statement of what is intended, specifying the desired direction of change in trends |
| **PPS** | Planning Policy Statements. National level guidance that set out the Government’s approach to key planning issues |
| **PRoW** | Public Right of Way |
| **PSA** | Public Service Agreement |
Preliminary Strategic Review

Ramsar

River Basin Management Plan

Sites of former battles from 1066 to 1750 considered by English Heritage to be of special importance (in England). Although assessed as being of national importance, they are not afforded statutory protection

Those gardens, parks and other planned open spaces (such as town squares, cemeteries and institutional landscapes) considered by English Heritage to be of special historic interest (in England). Although assessed as being of national importance, they are not afforded statutory protection

River Hull Flood Risk Management Strategy

Regional Planning Guidance

Royal Society for Protection of Birds

Regional Spatial Strategy

A fish or species of the salmon and trout family

Building or other archaeological or historic feature of national importance protected under UK Ancient Monuments and Archaeological Areas legislation

The process of deciding the scope i.e. range of environmental topics to be considered, and level of detail required for an SEA, including the environmental effects and alternatives to be considered, the assessment methods to be used, and the structure and contents of the Environmental Report

The process of deciding whether a strategy or plan requires SEA

Site notified under the National Parks and Access to the Countryside Act, 1949 and subsequently under the Wildlife and Countryside Act, 1981. Land which is of special interest for its flora, fauna, geological or physiographic features may be notified as a SSSI. These sites are statutory designations

Site designed under the European Union's Habitats Directive (92/43/EEC)

Site Designated under the European Union Directive on the Conservation of Wild Birds

Source Protection Zone

Supplementary Planning Documents

The flood event return period above which significant damage and possible failure of the flood defences could occur

Strategic Environmental Assessment - Assessment under Directive 2001/41/EC

Defences are raised in line with climate change water level increases and, therefore, the Standard of Protection is sustained

Effects that interact together to produce a total effect greater (or less than) than the sum of the individual effects

The prevention of free flow of fresh water through a sluice at the tidal limit when the rising tide equals or exceeds the fresh water level, causing these levels to rise

EC Water Framework Directive 2000/60/EC, as transposed into The Water Environment (Water Framework Directive) (England and Wales) Regulations 2003. The regulations set out a system for the integrated and sustainable management of river basins so that the ecological quality of waters is maintained in at least a good state or is restored. The Humber is catchment
is one of the river basin districts. The Directive lays down a six yearly cycle of river basin planning.

<table>
<thead>
<tr>
<th></th>
<th>Water Level Management Plan</th>
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<tbody>
<tr>
<td>Winter base flows</td>
<td>The typical portion of river surface flow which remains after deduction of storm flow and/or purchased imported water, at a particular time of year</td>
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<tr>
<td>NTS 2</td>
<td>Key Components River Hull System</td>
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Section 1

1.1 Study Area
1.2 River Hull Catchment
1.3 River Hull Schematic
1.4 Key Components River Hull System

Section 2

2.1 Summary of SEA Process

Section 5

5.1 Key Settlements
5.2 Key Ecological Sites (SSSI, SAC, SPA, RAMSAR, LNR)
5.3 National Character Areas
5.4 National Character Areas
5.5 ERYC Landscape Character Types
5.6 Hull Townscape Character Types (extent of TCT19 only)
5.7 Scheduled Monuments/Registered Parks & Gardens
5.8 Listed Buildings
5.9 Key National/Regional Recreation Routes
5.10 Key Infrastructure Routes
5.11 Key Water Environment Figure

Section 6

6.1 Option A Extent of Dredging
6.2 Option B Tidal Barrier/Schematic
6.3 Option C Proposed Embankment Raise
6.4 Option D Bransholme Location
6.5 Option E Proposed Embankment B&B
6.6 Option F Location Wilfholme/Hempholme
6.7 Option G Upland Water Catchment Areas

Appendices

Appendix A Cultural Heritage Background - none
Appendix B Updated Planning Appraisal Table
Appendix C Water Framework Directive Assessment
Appendix D Inundation Maps:
  Baseline (2085) – Figure B1
  Option A (2085) - Figure B2
  Option B (2085) – Figure B3
  Option C (2085) – Figure B4
  Option E (2085) – Figure B5
  Option F (2085) – Figure B6
  Option G (2085) – Figure B7
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<td>2.2</td>
<td>Scoping Level</td>
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<td>2.3</td>
<td>Environmental Objectives</td>
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<td>2.4</td>
<td>Compatibility of Environmental Objectives</td>
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Appendices

Appendix A: Background Historical Heritage Context

Appendix B: Updated Planning Appraisal Table

Appendix C: Water Framework Directive Assessment

Appendix D: Inundation Maps