

Infrastructure & Facilities

Flood Alleviation Schemes

Pluvial Flooding

Proposed Lagoons

Willerby & Derringham

Public Exhibitions

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Willerby and Derringham (WaDFAS)

Flood Alleviation Schemes

A6: Design Access

Statement



October 2012

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WaDFAS Design and Access Statement

1 Background to the development

1.1 During June 2007 significant rainfall events within East Yorkshire lead to considerable flooding within the city of Hull and the surrounding areas of Haltemprice. The flooding is understood to have arisen due to a combination of overloading of the sewerage network coupled with pluvial and fluvial flooding associated with the rivers and watercourses. Approximately 14,000 properties and business were affected across the city of Hull and the East Riding of Yorkshire area as a result of the flooding. In addition there was significant impact and disruption upon the region's transport links with several A roads and sections of the rail network being inundated with flood water. Furthermore, a single life was lost within the area as a result of this flooding.

1.1.1 The two Local Authorities of East Riding of Yorkshire Council (ERYC) and Hull City Council (HCC) have worked in collaboration to investigate and understand the nature of the flooding mechanism and propose, where practicable, flood alleviation schemes to reduce risk of future flooding events in this area.

1.1.2 The multiple flooding sources and mechanisms resultant from the events of 2007 have driven the requirement for an integrated catchment model to be constructed. There was a need to understand the multiple mechanisms and sources of flooding and the various pathways for rural runoff and exceedance flows. This has aided the understanding of the level of risk posed to the area by flooding. The resulting model has been used as an optioneering tool to develop and assess potential flood mitigation measures, which are currently being proposed as part of the Willerby and Derringham Flood Alleviation Scheme (WaDFAS), and Cottingham Orchard Park Flood Alleviation Scheme (COPFAS). The model outputs have been used to assist in the preparation of a Project Appraisal Report for Flood Defence Grant in Aid (FDGiA) funding and European Regional Development Fund (ERDF) funding applications.

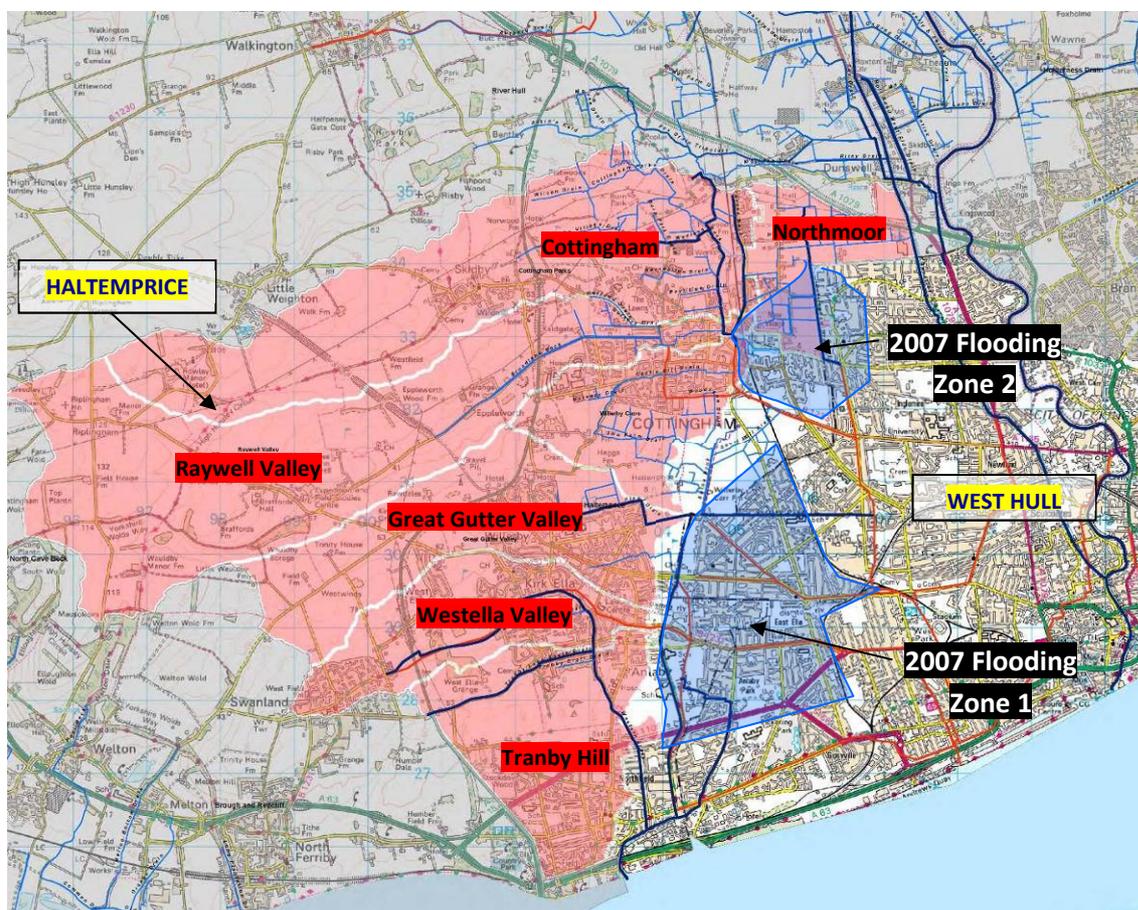
1.2 The Catchment and Scope of the Problem

1.2.1 The Haltemprice area lies to the west of the city of Hull with Cottingham and Northmoor being located to the north; this is shown in Figure 1 below. The catchment is predominantly rural and drains via a series of natural watercourses, culverts and manmade channels towards Hull. The Hull & Haltemprice Surface Water Catchment has no natural

outfall, being entirely reliant on manmade systems to permit discharge of flows to the Humber estuary.

1.2.2 There are seven identified watersheds, which flow westwards towards the City of Hull. The watersheds in the southern most areas, Westella Valley and Tranby Hill, discharge to the Humber Estuary and have been the subject of recent EA schemes. Additionally, a flood alleviation scheme has also been constructed along the Raywell Valley by ERYC to resolve flooding of a number of properties on Eppleworth Road in response to a 1 in 75 year event.

Figure 1: Hull and Haltemprice Area



1.2.3 The Great Gutter Valley drains the central portion of Haltemprice and Willerby. In extreme events, this watercourse can become overloaded and causes flooding of the Derringham area of Hull. The problem is exacerbated by a 110° bend in the watercourse; it is reported that at this location significant overland flows discharge eastwards into Hull, rather than remaining within the channel and flowing south to the Humber. The Willerby and

Derringham Flood Alleviation Scheme (WaDFAS) is being considered to address this issue, and is the subject of this Design & Access Statement and planning application.

1.2.4 The study area contains regions that are currently amongst the most deprived in the UK. As such the impact of flooding is widespread and on-going. Future business investment within the area has been discouraged by the flooding issues. The existing residents and businesses have little resources available to re-establish themselves after the flooding incidents. In order to promote development and improve opportunities for the residents, addressing these flooding issues is considered vital.

1.2.5 Whilst the study encompasses all the Haltemprice watershed areas, it is re-iterated that the main body of work is focused on the Great Gutter Valley watershed, as well as the interactions with the urban areas and impact zones within the city of Hull.

1.3 General Approach

1.3.1 The principal aim of the study was to establish the level of flood risk posed to the Hull and Haltemprice area as a result of interactions between pluvial, fluvial and sewer sources and pathways. This required the development of an integrated 1D and 2D model representing overland pathways, open watercourse, culverts and the sewer system. The model has been used to develop and test the viability of flood mitigation measures as part of the WaDFAS and COPFAS projects, and to assess what benefit, in terms of reduced risk, is offered by a shortlist of proposed solutions. The preferred solution has been submitted as the planning proposal.

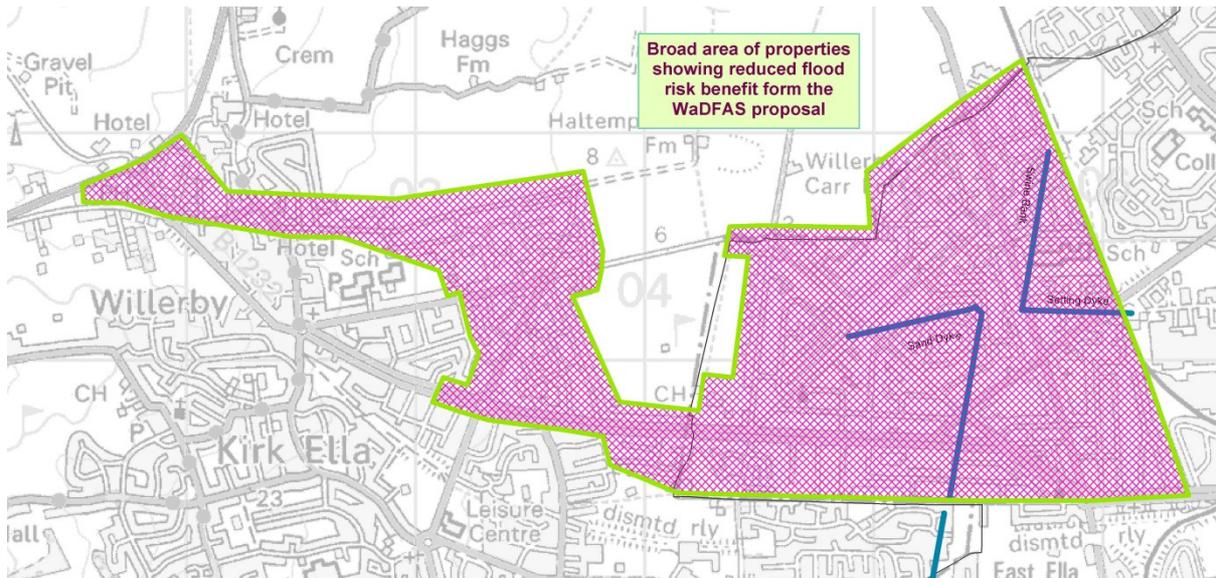
1.4 Flood Model Data

1.4.1 A comprehensive InfoWorks integrated 1D and 2D flood model, has been developed for the West Hull and Haltemprice area and a series of five applicable rainfall events applied to a Baseline (Do Nothing), a Do Minimum (present day), a Do Something (Clean system) and a WaDFAS proposal model. These are the M10, M25, M75, M100 and an exceedance event of M200. The model outputs have been utilised to determine the economic benefits of the WaDFAS shortlist options.



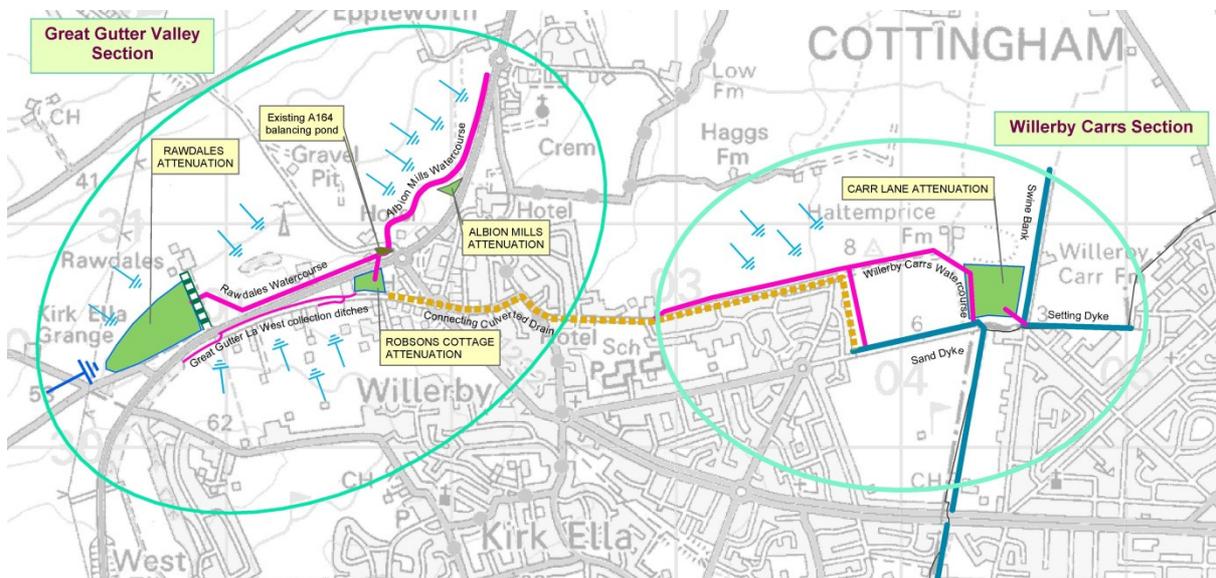
Indicative output of flood modelling for the Great Gutter Valley (Source: Environment Agency Website 12/10/12)

1.4.2 With the WaDFAS scheme proposal in place, minimal pluvial flooding is expected for rainfall events up to and including the 1 in 100 year event + an allowance of 30% for climate change, making the standard of protection effectively 1:300. The benefits area has been defined by comparing the flood model do nothing data with the flood model proposed model, and the properties showing a reduction in flood depth were plotted onto the flood model M100 baseline flood map. Any properties that were clearly not on a pluvial flood flow path were removed, and the remaining properties defined the benefit area.



Indicative Benefits Area: property potentially receiving reduced risk of flood due to the WaDFAS scheme proposals.

2 Surrounding Area and Application Site



2.1 The detail of this section is expanded upon within a separate landscape Appraisal Report accompanying this application. Further detail and photo references are contained within that document.

2.2 Rawdales Attenuation Lagoon

2.2.1 The Rawdales Attenuation lagoon project element is located within an area identified on the Beverley Local Plan as an ‘Area of High Landscape Value.’

2.2.2 Parks and Gardens of Historic Interest include one at Eppleworth (approximately 2km north of the site); Risby Park (4.2km north of the site) and Riplingham (4.2km North West of the site). Risby Park is also a Registered Park and Garden, however, as this is not open to the general public, it is not considered as a landscape and visual receptor. There are no other landscape designations identified on the site itself or the immediate surrounding area.

2.2.3 The Rawdales Attenuation lagoon project element contains arable farmland, enclosed to the east and west by closely clipped hedgerow defining field boundaries within a shallow valley feature. The southern extent of the site is bound by tree planting and outgrown hedgerow associated with Great Gutter Lane and the A164 carriageway. A hedgerow runs across the site from south to north with an adjacent field ditch. An existing line of telegraph poles runs diagonally to the west from south west to north east before tracking north along the alignment of the hedgerow. The eastern boundary is defined by a hedge lined access track which leads to Rawdales Farm overlooking the site on higher ground. An embankment and tree planting at the break of the slope forms the southern boundary before rising to form Great Gutter Lane.

2.2.4 Rawdales Farm lies outside the site boundary on the north eastern corner. The property consists; 1.5 storey bungalow with adjoining farm buildings. The property is anticipated to be partially screened by shelter belt to its west, north and east with a well maintained hedgerow along its southern boundary. Kirkella Grange is located along Riplingham Road to the west of the Rawdales attenuation lagoon project element. This is a substantial residential property with farm buildings. The property is well screened to the east by a group of trees and shrub vegetation.

2.2.4 The majority of the surrounding land use is rolling open arable farmland, defined by hedgerow boundaries. A line of pylons to the west of the site forms a visible feature within the landscape. The A164 and its associated vegetation is a prominent feature throughout the landscape.

2.3 Robson’s Cottages & new cut ditch to A164 (Willerby roundabout)

2.3.1 There are no landscape designations covering the Robson’s Cottages site, however the project elements between the Rawdales Attenuation Lagoon site and Willerby roundabout to the north of the A164 fall within an area identified on the Beverley Local Plan as an ‘Area of High Landscape Value’. The Robsons Cottages project element lies

immediately adjacent to this area. However, it should be noted that the policy is related to development within the defined plans area.

2.3.2 Parks and Gardens of Historic Interest are shown on the Beverley Plan. These include one at Eppleworth (approximately 1.2km north of the project element); Risby Park (4.2km north of the project element) and Riplingham (5km North West of the project element). Risby Park is also a Registered Park and Garden, however, as this is not open to the general public it is not considered as a landscape and visual receptor.

2.3.3 There are no other landscape designations identified on the project element itself or the immediate surrounding area other than those identified above.

2.3.4 The Robson's Cottages project element consists; rough grazing paddock with evidence of small scale horsiculture (currently grazed by ponies). Hedgerow forms the boundaries to the north and hedgerow with tree planting to the west and east. The southern boundary is defined by intermittent vegetation along Great Gutter Lane and contains a poorly managed outgrown hedge adjacent to the attenuation lagoon with a significant number of dead or dying trees. The trees appear to have been heavily pollarded / lopped.

2.3.5 Vegetation forms the eastern boundary of the Robson Cottages project element, adjacent to which is Robinson Cottages to the south east and a public house/Beefeater style eatery with associated car parking, to the north east.

2.3.6 Residential properties in the immediate surrounding area include; Robinson Cottages and to the south detached houses set back from the road along Great Gutter Lane. Ruston House lies to the west. The properties to the south of Great Gutter Lane are generally screened and enclosed by vegetation and landscaped gardens.

2.3.7 The A164 defines the site boundary to the north and is a noticeable feature in the landscape with the passing vehicle traffic. Vegetation in the form of hedgerow lines the majority of the road corridors in the area.



PHOTOPOINT 1 - View north into proposed site of Rawdales Attenuation Lagoon. (for detail of locations see Landscape Options Appraisal Report accompanying the planning application)



PHOTOPOINT 4 - View north & west into western area of proposed Rawdales Attenuation Lagoon site. (for detail of locations see Landscape Options Appraisal Report accompanying the planning application)

2.4 Albion Mills Relief Drain

2.4.1 The Albion Mills relief drain project element includes the cutting of new ditch to the east and north east. This project element also lies within the area identified on the Beverley Local Plan as an 'Area of High Landscape Value'. The policy states: 'Development proposals within this area will only be approved if they are of an appropriately high standard and will not adversely affect to any material extent the special character, appearance or nature conservation value of the landscape.'

2.4.2 Parks and Gardens of Historic Interest are shown on the Beverley Plan. These include one at Eppleworth (approximately 1km north of the project element); Risby Park (4km north of the project element) and Riplingham (5.4km north west of the project element). Risby Park is also a Registered Park and Garden, however, as this is not open to the general public it is not considered as a landscape and visual receptor.

2.4.3 There are no other landscape designations identified across the site element itself or the immediate surrounding area. Project element description and surrounding area

2.4.4 The project element consists a narrow corridor of land extending from Albion Lane to a point north of South West Lodge which is located to the east, along the A164 (Ref to Photo points 15, 17, 18). The element consists; agricultural grassland with small groups of early and mature trees with outgrown hedgerow trees forming boundary features. The northern boundary is open to the surrounding open rolling arable farmland. The southern boundary of the project element is defined by a post and rail timber fence and gated access across the highway verge off the A164. Evidence of the removal of a hedgerow along the A164 verge was observed during the site visit.



PHOTOPOINT 15 - View north from Albion Lane. Line of new cut ditch to follow the rear of the hotel to the right of the photograph. (for detail of locations see Landscape Options Appraisal Report accompanying the planning application)



PHOTOPOINT 17 - View west and east. New cut drain and attenuation lagoon area to extend from west to east to the north of the tree blocking in the view. (for detail of locations see Landscape Options Appraisal Report accompanying the planning application)



PHOTOPOINT 18 - View north into land east of Albion Filling Station.

2.4.5 The A164 runs along the southern boundary of the project element with a McDonalds, business units and associated car parking, situated to the south just off the highway. To the west of the project element is a Petrol Filling Station and a Toby Carvery. To the east lie a series of small arable fields surrounded by vegetation and to the north a much larger arable field. The project elements at this location include the cutting of a new ditch to the north east of the site before returning and running parallel with the A164 carriageway to a point north of South West Lodge.

2.4.6 Notable landscape features in the surrounding area include a stand of mature Scots Pines along the north eastern boundary of the project element. The stand is viewed against the skyline and is notably feature within the landscape being clearly visible from the passing road. To the west a private access road has been constructed off Albion Lane (Ref to photo point 15).

2.5 Carr Lane Attenuation Lagoon & new cut ditches

2.5.1 The Carr Lane project element lies within an area identified on the Beverley Borough Local Plan as an 'open area of strategic importance'. The policy states that 'no development will be permitted unless it is of an open nature'.

2.5.2 The project element lies immediately adjacent to the border of Kingston upon Hull. This is covered by the Kingston upon Hull Local Plan (adopted May 2000) saved policies. The area adjacent to the site, within Hull, is designated as an 'open area of strategic importance'. The policy states that 'developing Open Areas of Strategic Importance between the built up areas ... will not be allowed unless it is of an open nature.'

2.5.3 The project element lies immediately to the south of the Scheduled Monument of Haltemprice Augustinian Priory. This is covered in further detail in the Archaeology and Heritage Options Appraisal report (WYG June 2012) accompanying the planning application.

2.5.4 Parks and Gardens of Historic Interest include one at Eppleworth (approximately 2.8km north west of the site); Risby Park (5km north of the site) and Riplingham (over 7km north west of the site). Risby Park is also a Registered Park and Garden, however, as this is not open to the general public it is not considered as a landscape and visual receptor.

2.5.5 The Carr Lane Attenuation Lagoon lies across a predominantly open, flat arable landscape with an absence of a defined field. The main site consists of a medium size arable field, bounded to the west by an access track and public footpath (Ref to photopoints 23, 24 & 25).



PHOTOPOINT 23 - View north towards site of Haltemprice Augustinian Priory & existing derelict Haltemprice Farm.



PHOTOPOINT 24 - View south & south east across proposed site for Carr Lane Attenuation Lagoon. Public footpath extending into distance to the right of the panorama.



PHOTOPOINT 25 - View north from Carr Lane across proposed site for Carr Lane Attenuation Lagoon.

2.5.6 To the south, the site is defined by Carr Lane and beyond a group of mature trees which form the northern edge of Springfield Park Golf course. To the east it is defined by Swine Bank which is lined by hedgerows on both sides and leads to Willerby Carr Farm and associated outbuildings. Swine Bank turns into Wood Lane beyond Willerby Carr Farm, which is also a public bridleway. The northern boundary is identified by a change in the field pattern and where a recorded historic moat feature around the site of Haltemprice Augustinian Priory (SAM) is located, (Ref to Photopoint 23). Abbey Lane runs along the northern boundary from the west to the site of the derelict Haltemprice Farm. The new cut ditch connection extends from the west opposite Abbey Grove to the north of Well Lane, east to the north of existing field hedgerow north of Abbey Lane (Ref to Photopoint 20).



PHOTOPOINT 20 - View west along line of proposed new cut ditch.

2.5.7 The surrounding area consists a mixture of land use, with the residential area of Willerby to the west and south; the Springhead Park Golf Course lying immediately south of Carr Lane. Farmland lies to the east, with the outskirts of the City of Kingston upon Hull

beyond. Farmland is again situated to the north, containing the ruins of Haltemprice Augustinian Priory, and the settlement of Cottingham lying just over 1km north. Farms in the surrounding area include Haltemprice Farm, Willerby Carr Farm and Haggs Head Farm. To the west farmland forms the juncture with the developed edge of Willerby (ref to Photopoint 20)

2.5.8 Further detail of the Archaeology and Heritage of the area of the proposed site of the development is covered in the Archaeology and Heritage Options Appraisal Report accompanying the planning application.

3 Social and Economic Context

3.1.1 The floods of June 2007 directly affected circa 14,000 properties and businesses in the East Riding of Yorkshire and Hull City, of which approximately 8,951 premises were within the original area of intervention, Derringham & Willerby. The floods caused damage and disruption to businesses in the area, as well as distress and loss of confidence in the employees and residents of the area. It is known that significant uninsured business revenues were lost during this period although such information is difficult to quantify due to the commercially sensitive nature of such impacts

3.1.2 Hull has many deprived areas which suffered badly in the 2007 floods. The aim of this scheme is to take many properties that were flooded in 2007 out of the high risk flood areas and to improve the Standard of Protection (SoP) for thousands of households in the WaDFAS area. For both local authorities it is of paramount importance to demonstrate to local residents who were flooded in 2007 that measures have been taken to ensure that flood risk has been evaluated and reduced.

3.1.3 The main economic benefit of this scheme is reducing direct damages to 8,085 properties in Willerby and Derringham. The main non-monetary benefit is the reassurance to the local community that the flooding issues relating to events of 2007 have been addressed and positive measures undertaken to reduce the risk of flooding. This aspect cannot be underestimated in terms of 'stress' levels to local residents.

3.1.4 The model of the catchment has identified that the existing standard of protection (SoP) is below the 10% (1 in 10 year) event and based on local knowledge the SoP is estimated at the 20% (1 in 5 year) event. This is having a major impact on the ability of households and business to obtain insurance. The insurance companies have indicated that they require a minimum of 1.33% (1 in 75 year) standard of protection from flooding but this

is a voluntary agreement which is time limited. New build property require a 1% SoP for insurance purposes.

3.1.5 Within Hull there is a high number of deprived areas and these areas are affected severely by flooding and take a long time to recover. Hence these areas benefit significantly from the reduction of flood risk brought about by this planning application.

4 Community, public and stakeholder consultations

4.1 Various levels of consultation have been on-going throughout the development of the WaDFAS Scheme.: Initial discussions regarding the scheme were undertaken with Hull City Council within the Integrated Strategic Drainage Partnership and as part of the remit of the East Riding of Yorkshire Flood Protection and Resilience Board.

4.2 Stakeholders

Throughout the development of the scheme the following key stakeholders have been consulted:

- 4.2.1 The Environment Agency (EA)

The EA sits on the WaDFAS Project Core Steering Group and has been a key source of information and assistance throughout the scheme development and preparation of a Project Appraisal Report .

- 4.2.2 Yorkshire Water (YW)

YW have been invited to the monthly Project Team meetings and have been kept informed of the scheme development. YW also provided a copy of their Humbercare model of West Hull for incorporating into the overall integrated urban catchment model of West Hull and Haltemprice area.

- 4.2.3 East Riding of Yorkshire Council (ERYC)

ERYC's Flood Defence and Coastal Erosion Risk Management Team Leader, has attended all the monthly Project Team meetings, sits on the Project Core Steering Group and has been an integral part of the scheme development.

- 4.2.4 Hull City Council (HCC)

HCC are a partner in this scheme and their Flood Risk Planning Manager has attended all the monthly Project Team meetings, sits on the Project Core Steering Group and has been an integral part of the scheme development.

- 4.2.4 Parish Council, local residents and landowners

The Parish Council's, local residents and landowners have been kept up-to-date with the scheme progress and were all invited to exhibitions of the proposals. Landowners,

tenants and their agents have been written to formally to explain the purpose of the scheme and highlight the land expected to be required for the proposed flood defence measures.

- 4.2.5 Internal Drainage Board (IDB)

The chair of the closest local Beverley and North Holderness IDB has been contacted about this scheme, however as the proposals are outside their area and have no impact they stated they have no interest in this project and do not need to be consulted.

- 4.2.6 Department for Communities and Local Government (DCLG)

Lead project officers have been kept informed about the development of the scheme and a revised Outline Business Plan (OBP) for the scheme was re-submitted in October 2012

- 4.2.7 Local Flood Action Groups

Members of the Haltemprice Flood Action Group and the Cottingham Flood Action group have been kept fully informed of the scheme progress and were invited to exhibitions of the proposals. The Haltemprice Flood Action Group has confirmed their support for the scheme.

- 4.2.8 Humber Archaeology Partnership (HAP)

The HAP has been consulted regarding the scheme and further details are available in the Archaeology and Cultural Heritage Report.

- 4.2.9 English Heritage (EH)

Following advice HAP, EH have been consulted regarding the scheme proposals.

- 4.2.10 Natural England (NE)

NE have been consulted during the preparation of the Phase 1 Habitat Report. Natural England has confirmed that the scheme is likely to lead to an environmentally acceptable solution

- 4.2.11 ERYC Sustainable Communities and Coast Team

The Sustainable Communities and Coast Team Leader has been consulted and fully involved in the preparation of the Phase 1 Habitat Report.

4.3 Public Exhibitions

Public Exhibitions were organised in order to publicise the proposals and explain the scheme details. The details of two schemes were exhibited: the Willerby & Derringham (WaDFAS) scheme and the Cottingham & Orchard Park scheme (COPFAS). These were held on the following dates:

- 4.3.1 Monday 18th June 2012 between 1.30pm and 5.15pm at the Orchard Centre CSC (**Local Ward Members**)

- 4.3.2 Tuesday 19th June 2012 between 2.00pm and 5.15pm the Orchard Centre **(Public)**
- 4.3.3 Wednesday 20th June 2012 between 09.00am and 5.15pm Haltemprice Leisure Centre **(Public)**
- 4.3.4 Friday 29th June 2012 between 10.00am and 7.45pm Cottingham Civic Hall **(Public)**

4.3.5 The exhibitions were advertised on Humberside Radio, printed in the Hull Daily Mail and the Yorkshire Post.

4.3.6 Members of staff from the Project Core Steering Group and the project management team attended the exhibition to offer further explanation of technical information on display.

4.3.7 Attendees were provided with hand-outs detailing the locations of the proposed lagoons for both schemes (as shown below), they were also given comment forms to express their views, opinions and concerns, along with a briefing note explaining the storage volume of each scheme, the estimated cost, an indicative estimate of how many properties would be directly protected by each scheme and the indicative programme.

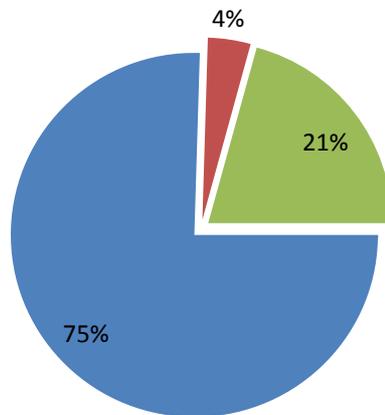
4.3.8 The overall response from the exhibitions is extremely supportive. The majority of the comment forms show a general indication that the public approve both the COPFAS and WaDFAS schemes and look forward to them being constructed. A sizable portion of the near residents of the schemes are eager to see the positive affect the lagoons will have on the surrounding properties which suffer quite severely from pluvial flooding when a heavy downpour occurs. Several residents made the same comment about currently feeling worried and uneasy whenever there is heavy rain, they feel as though they have to monitor the rainfall and be prepared just in case they flood again.

4.3.9 Comments were sought from the public. The returns from the public exhibition are summarised below:

75% Support, 4% Object, 21% Comment only

Public Exhibition Reutrns

■ Support ■ Object ■ Comment



5 Design

5.1 Project Objectives

5.1.1 The main project objectives are summarised below:

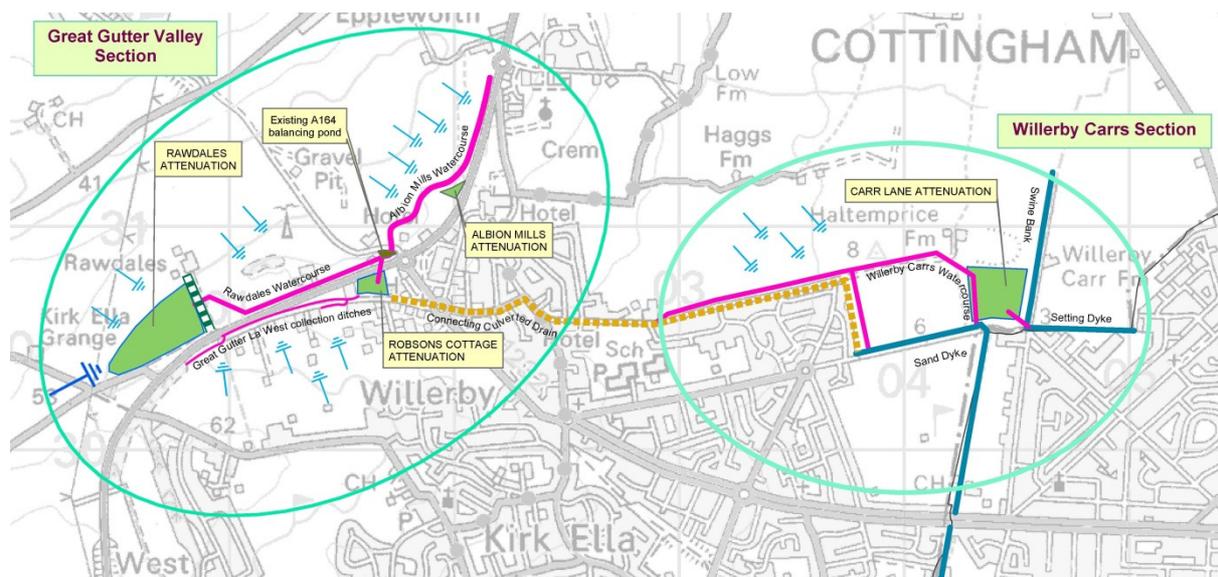
- To reduce flood risk to people and property.
- To ensure that the preferred option is a sustainable solution with minimal maintenance costs and responsibilities.
- To ensure that the preferred option is designed to be safe for the public during construction and operation.
- To ensure that the preferred option does not increase flood risk to any properties.
- To design works to minimise adverse impacts on the environment (both during the construction and operation phases)
- To design works to minimise the long term intrusion on the local landscape.
- To ensure that all enhancement opportunities are explored and realised where practicable.
- To reassure the local community that measures have been taken that will reduce the future flood risk and account for climate change .

5.2 General

5.2.1 The principal of the design of the flood alleviation scheme relies on the method of attenuation for pluvial overland flow, to protect the benefiting areas of Willerby and Derringham. The essential principle relies upon slowing the pass-forward of quantities of overland flow to the urban drainage system. The basis of the design has been centred on flood storage rather than diversion measures which would present significant cost and construction upheaval to the area and demonstrate limited overall value. Additionally the continual maintenance for such schemes adds a protracted liability to the whole life benefit of such proposal.

5.2.1 The proposed attenuation will be made up of an interlinking set of four restricted flow lagoons which have the effect of reducing the peak flow of surface water run-off from the generally agricultural and unmade areas of the Great gutter valley and areas of the Willerby Carrs catchment and redistribute this volume to the urban drainage over a longer period of time.

5.2.2 For optimum performance the attenuation measures are to be constructed on the alignment of the flood flow paths. Digression from the path of this route affects the simplicity and effectiveness of the design. There are limited undeveloped locations that would have such direct and effective influence upon flood flow other than those chosen for this scheme.



5.2.3 The scheme is broadly in two sections: Great Gutter valley section which includes the Rawdales earth dam and connecting open watercourses to an existing highway surface water catchment lagoon and to a new excavated low level storage area adjacent to dwellings known as Robson's Cottage. Additionally there is a lagoon to the North of the existing Fuel filling station (Albion Mills filling Station Lagoon) which stores run off to a new watercourse running northwards alongside the route of the A165. The requirement for this lagoon is to be determined after the full capacity of the Robsons cottage lagoon can be confirmed, which will be subject to on site confirmation of actual ground conditions. The second section; Willerby Carrs section consists of an open watercourse to the north of Well Lane / Abbey Lane which connects to a raised bunded area west of the twin dykes watercourse.

5.2.4 The four new lagoons Rawdales, Robsons Cottage, Albion Mills and Willerby Carrs have been sited and designed to incorporate minimal structural elements, be constructed from locally sourced materials (predominantly clays, sub-soils and top-soil), be sympathetic to the local environment and where possible have limited impact both visually and environmentally, taking account of the East Riding of Yorkshire Local Landscape Assessment.

6 Use:

6.1.1 The development is to be used for the controlled drainage of land. The mechanism of this control is by retention, or more precisely, attenuation (controlled slow release) of flood flows of overland (pluvial) rainfall run off. The development is only likely to become operational in heavy storm events and this would rarely be at capacity.

6.1.2 The attenuation lagoon areas are designed to accommodate a capacity of water that would be generated in a 1 in 100 year storm and there is an additional design capacity to accommodate the projected potential increase in rainfall events due to climate change (30% additional rainfall), equating to a standard of protection of 1 : 300.

6.1.3 Under normal circumstances the development will not contain water except for that contained within the 'low flow' drainage ditches. Accordingly the spaces constructed for the lagoon areas are required to be open and contain minimal growth or construction. It is the intention that the bases of the lagoon be relatively level and landscaped with grass to create a visually attractive area. Consideration to the specific use of the grassed lagoon areas will be undertaken subject to the approval of a change of use planning submission (separate to this application). Currently it is anticipated that the lagoons will remain unoccupied but

consideration is being given to potential uses such as pony paddock or arable farmland which would be dependent on the ability of the Authority in attaining suitable tenants for the land.

6.1.4 Below are pictures of similar lagoons in the area that have been constructed for the same purpose.



7 Amount:

7.1 The size of the WaDFAS scheme has been determined by the quantity of flood attenuation that is required to prevent pluvial flooding to the benefit area, given the most economic Standard of Protection (SoP). Similarly the length and number of watercourses required for the scheme is dictated by the areas of catchment that are required to be controlled and the distance that the water is conveyed to an acceptable outfall.

7.2 The SoP for the scheme has been calculated on the basis of best value with respect to cost of construction. This has been 'sensitivity analysed' by assessing several prescribed SoP's against respective estimated construction cost. The most cost effective standard of protection above that required to satisfy the minimum standards suggested by the Association of British Insurers (ABI), is a 1 in 100 year event with a 30% addition for the effect of climate change. Flood modelling of this scenario shows the cost effective reduction of risk and has dictated the volume of storage that has been recommended for the scheme.

7.3 The accumulation of flood water is governed by the surrounding catchment and the specific relief in the locality of the attenuation lagoons. At optimum depths, in their most efficient positions the attention areas cover the following areas within the 'Red Line' boundary:

- Rawdales attenuation area = 146,200m²
- Robsons attenuation area = 25,550m²
- Albion Mills attenuation area = 28,300m²
- Carr Lane attenuation area = 138,600m².

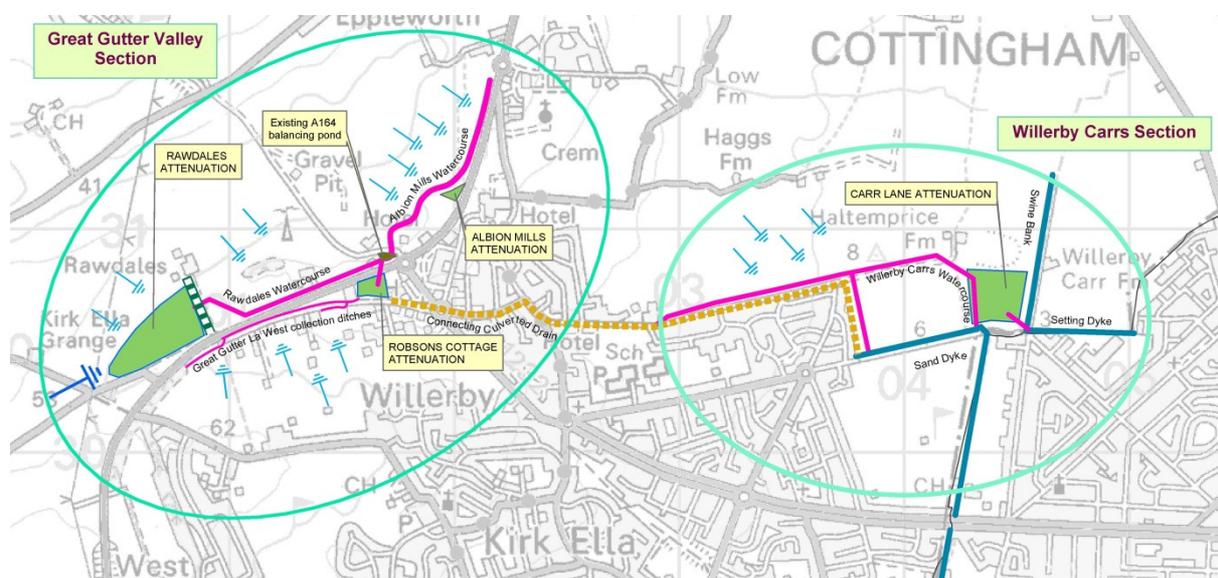
Watercourse lengths:

- Rawdales to Robsons = 725m
- Great Gutter Lane W = 871m
- Albion Mills = 824m
- Carr Lane = 1873m

8 Layout

8.1 General Arrangement

8.1.1 The preferred option for The Willerby and Derringham Flood Alleviation Scheme WaDFAS is referred to as Rawdales, Robsons Cottages and Carr Lane Attenuation Lagoons. The scheme consists of a number of discreet storage or attenuation lagoons situated along the predicted overland flow path of surface water down the Great Gutter Valley and into the urban area of Willerby and West Hull. A diagrammatic layout of this scheme is shown below:



8.1.2 The first upstream lagoon is adjacent to Rawdales farm and the A164 and is located in the natural valley. The lagoon would be created by placing an earth dam across the natural valley at the point at which the farm access is located. For the 1% (1 in 100 year) event including 30% climate change allowance, the size of this lagoon has been estimated at 104,000m³. Water would enter the lagoon by flowing along the natural flood route and pass forward flows would be restricted by a pipe at the base of the dam.

8.1.3 The pass forward flow from Rawdales will be taken down stream in a new cut ditch and then piped under the A164 and will discharge into the second attenuation lagoon which will be known as Robsons Cottages. This lagoon will be constructed in a field adjacent to some properties on Great Gutter Lane West and will comprise a mix of excavation and construction of earth bunds around the field with a storage capacity of 33,000m³ including 30% climate change allowance. In addition to the pass forward flows from Rawdales this lagoon will also accept flows from the area north of the A164 (above Albion Mills)

8.1.4 The computer model has identified that surface water from the land above the Albion Mills Petrol Station flows onto the A164 and then down Great Gutter Lane. It is proposed to intercept this water by cutting a new ditch at the low end of the fields above Albion Mills and to discharge this water into the existing A164 highway drainage lagoon and increase the pass forward flow from this lagoon across the A164 and into the Robsons Cottages lagoon. If necessary a new lagoon will be constructed at Albion mills with a capacity of 10,200m³

8.1.5 The overland flows from the south side of the valley are proposed to be collected in two new ditches which will be cut at the sides of Great Gutter lane west and taken into the Robsons Cottage Lagoon.

8.1.6 The pass forward flow from Robsons Cottages lagoon will be controlled using a restricted outflow pipe and this will lead into the existing surface water system in Great Gutter Lane which consists of a large diameter pipe which has been upgraded relatively recently.

8.1.7 The surface water system flows underground in a large diameter pipe or culvert to Well Lane in Willerby and subsequently outfalls into Sands Dyke which runs along the north side of Springhead Park Golf Course and Carr Lane. It is proposed to cut a new ditch along the north side of Well Lane to enhance the surface water system and to intercept flows from the existing ditches in the Willerby Carrs area, in particular Hags Farm Drain.

8.1.8 The final part of the proposed scheme will be an attenuation lagoon to be known as Carr Lane Attenuation Lagoon on the north side of the golf course. This lagoon will use the

natural topography combined with some bunding to retain approx. 68,000m³ of water including 30% climate change allowance. The outfall from this lagoon can be discharged into Sands Dyke or Setting Dyke.

8.1.9 The above lagoon sizes have been calculated based on the 1% (1 in 100 year) event with a 30% allowance for climate change. At detailed design stage the lagoon sizes may change slightly and this could include a review of the climate change allowance.

8.2 Safety of Layout

8.2.1 The aim of the scheme is to reduce the risk of flooding. If the risk of flooding is not reduced then there will be a high possibility of future loss of life and overall reduction in the quality of health in the community in Willerby and Derringham.

8.2.2 This scheme ensures that flood water will be stored safely in bespoke storage lagoons and will be delayed before entering the urban area in a controlled manor.

8.2.3 The lagoons will be constructed in a safe way and will be maintained safely with access restricted to ensure only authorised personnel are allowed access.

8.3 Preferred Option Evaluation

8.3.1 Various options and scenarios have been investigated and trialled through the overall computer model for the Great Gutter Valley and Raywell Valley Catchment areas to establish and understand the flow paths of the surface water and to give a general overview of the likely scheme requirements.

8.3.2 The various options and scenarios were modelled and the simulation output visually evaluated to understand how the surface water flowed down the valleys and into the urban areas.

8.3.3 A list of options was considered by the whole project team based on the model information provided by the modelling specialists. These options can be summarised as follows.

- (a) Option 1 – Do nothing
- (b) Option 2 – Do minimum
- (c) Option 3 – Do something

- (d) Option 4 – Attenuation lagoons at Rawdales, Robsons Cottages and Carr Lane
- (e) Option 5 – Additional attenuation at Albion Mills Petrol Station
- (f) Option 6 – Surface water flow bund at Willerby Carr Lane School
- (g) Option 7 – Attenuation lagoon on Springhead Golf Course
- (h) Option 8 – Construction of a bund at the north side of Willerby Carrs
- (i) Option 9 – Construct a new dedicated pipe and outfall to the Humber – pumping required.
- (j) Option 10 - Divert flows from Acre Heads Drain into Western Drain
- (k) Option 11 – Divert flows from Sands Dyke into Setting Dyke
- (l) Option 12 – Enlarge existing culverts and ditches
- (m) Option 13– Convert existing culverts to large open ditches
- (n) Option 14 – Reduce agricultural run off using ridge and furrow techniques.
- (o) Option 15 – Use of different locations for attenuation lagoons.

8.3.4 All of these options were the subject of an initial appraisal to determine their technical, environmental and economic viability. This process included a consideration of the likely environmental impacts and opportunities for each option and an assessment of whether any issues such as archaeological impacts were of sufficient concern for outright rejection of an option. Options were rejected on these grounds as follows:

- (a) Option 5 – Additional attenuation at Albion Mills Petrol Station – This scheme was investigated and is a potential site for additional storage if for any reason the proposed Robsons Cottages Lagoon does not have sufficient capacity. A large lagoon at Robsons Cottages is the preferred choice because it lies on the direct flow path for the majority of the water down the Great Gutter Valley and the need for one lagoon is considered more sustainable than constructing two smaller lagoons. The final model contains this option but the volume has been incorporated into the Robsons Cottages volume. The volumes could be split at a later stage if necessary.
- (b) Option 6 – Surface water flow bund at Willerby Carr Lane School – this was considered necessary to protect properties in Bellfield Drive from flood flows along Carr Lane and Well Lane. During construction of the extension to Willerby Carr Lane Junior School a small bund has already been constructed and when the proposed bund was modelled in more detail it was established that there is no significant reason to construct an additional bund in the school field.
- (c) Option 7 – Attenuation lagoon on Springhead Golf Course – Hull City Council have considered this option in some detail but during evaluation of this scheme

the topographical information has been studied in detail and to achieve the required storage volumes the existing golf course would require lowering and bunds required adjacent to existing properties on Willerby Road. This option was considered to have several negative impacts in that it would reduce recreational activity due to the golf course being 'low lying' and therefore prone to flooding, it may increase the flood risk to properties on Willerby Road due to the bund at the rear and the expense of excavating the golf course and reconstructing would be significant. Great Crested Newts have been identified as being present in the existing ponds on the golf course.

- (d) Option 8 – Construction of a bund at the north side of Willerby Carrs – Prior to the model being completed it was felt that flood waters from the WaDFAS and COPFAS areas had the potential to cause flooding in the adjacent areas. Further detailed modelling has identified that the two areas are not hydraulically linked and this bund would have no flood alleviation benefit.
- (e) Option 9 – Construct a new dedicated pipe and outfall to the Humber. This scheme was considered to be non-sustainable and would require significant maintenance expense and responsibility.
- (f) Option 10 - Divert flows from Acre Heads Drain into Western Drain – There is no spare capacity in Western Drain and so this is not technically feasible.
- (g) Option 11 – Divert flows from Sands Dyke into Setting Dyke – There is no spare capacity in Setting Dyke which outfalls into the combined sewer system and so this is not technically feasible.
- (h) Option 12 – Enlarge existing culverts and ditches – There is a large amount of risk and disruption with constructing through the built environment. It was considered that this scheme would require a pumped outfall into the Humber and this was considered as not sustainable with the possibility of increasing downstream flood risk should the pumps fail.
- (i) Option 13– Convert existing culverts to large open ditches – this was considered with the need to maintain the limited pass forward flows. In effect the wider ditches would become attenuation lagoons. Due to the shallow nature of the ditches and the general topography the resulting size of the ditches would be enormous and hence not sustainable and would have a large impact on the local environment.
- (j) Option 14 – Reduce agricultural run off using ridge and furrow techniques – this would have a major impact on the existing environment in the agricultural area and would require the cooperation of all the landowners in the catchment. This was considered a high risk option and not feasible to take forward.

- (k) Option 15 – Use of different locations for attenuation lagoons. These sites may be chosen if during the final design stage problems are encountered at the preferred sites. For example land acquisition may be more difficult at some sites and the geological condition may dictate alternative sites.

9 Scale

9.1 General

9.1.1 The Layout Drawing J5264 PL 105 P1 shows the layout of the whole scheme and demonstrates that the main lagoon sites are not related in terms of scale. The Lagoons are the main features of this development and each Lagoon stands alone in terms of scale. In between the lagoons the scheme is linked with a series of ditches which are below ground level and will generally be at existing ditch level. In terms of scale the ditches will be the same as existing ditches in the area.

9.1.2 The side slopes of the embankments and bunds are at a maximum of 1 in 3 and hence are relatively shallow.

9.2 Rawdales Lagoon

9.2.1 At Rawdales farm there is a natural valley running parallel to the A164. This lagoon will be formed by constructing an earth dam across the valley. At the lowest point of the valley the dam will be approximately 4.9m high reducing to zero at the edges. Hence the ends of the dam tie into natural existing ground level. The dam falls on the line of the existing farm access and results in the existing access road being raised up onto the top of the dam.

9.2.2 The scale of the dam fits within an existing valley which overall is very large with a vertical level difference of 50m between the base of the dam and the top of the valley. This demonstrates that the scale of the Rawdales dam is very small in relation to the whole valley cross section.

9.2.3 The side slopes of the Rawdales lagoon will in most places correspond to the existing ground profile. Along the dam and the spillway the gradient of the embankment will be 1 in 3.

9.3 Robsons Cottages Lagoon

9.3.1 At Robsons Cottages Lagoon the land is naturally low lying but has a significant fall to the south and east towards Great Gutter Lane West. This lagoon will be formed by excavating material from the existing field and constructing shallow earth bunds around the low sides of the field. The base of the lagoon will be at approximately an average of 4.5m below existing ground level. The scale of the lagoon fits within an existing valley which overall is very large with a vertical level difference of 50m. This demonstrates that the scale of the Robsons Cottages Lagoon is very small in relation to the whole valley cross section.

9.3.1 The side slopes of the Robsons Cottages Lagoon will be 1 in 3.

9.4 Carr Lane Lagoon

9.4.1 At Carr Lane Lagoon the land is naturally low lying and has a significant fall to the east towards the urban area. This lagoon will be formed by constructing earth bunds around the sides of the field with a maximum height of approximately 2.5m but tapering to zero at the high end of the field. Hence the lagoon will have bunds on three sides only with the high end of the lagoon being at natural ground level. The base of the lagoon will be at existing ground level. The scale of the earth embankments effectively fits in with the local field topography. This demonstrates that the scale of the Carr Lane Lagoon fits in with the existing topography of the surrounding area.

9.4.2 The side slopes of the Carr Lane Lagoon will be 1 in 3.

9.5 Albion Mills Lagoon

9.5.1 The lagoon at Albion Mills may not be required but is included in the planning application to cover for the case that the final design requires this storage capacity. At Albion Mills Lagoon the location of the lagoon is at the low end of a newly cut ditch. This lagoon will be formed by excavating material from the existing field and constructing shallow earth bunds around the low sides of the field. The lagoon will be 3.0m deep with a maximum bund height of 1.6m above existing ground level. The scale of the lagoon fits within an existing valley which overall is very large with a vertical level difference of 50m. This demonstrates that the scale of the Albion Mills Lagoon is very small in relation to the whole valley cross section.

9.5.2 The side slopes of the Albion Mills Lagoon will be 1 in 3.

10 Landscaping

10.1 A Landscape Options Appraisal Report has been completed. The recommendations of this report mainly relate to field boundaries, hedgerows and the seeding of embankments and lagoon floors.

The basic principle of the landscaping works would be as follows:

- i. The earth bunds will be seeded with a designed mix of grass seed and other wild flowers etc as stated on the landscape drawings. Planting of trees on the embankments or bunds is not possible as this could affect the water retention properties of the bunds.
- ii. Any hedge rows that are removed as part of the lagoon construction will be replanted in a new location to an agreed specification as shown on the drawings. Additional new hedges will be planted on the perimeter of the lagoons.
- iii. Additional trees will be planted to mitigate for the loss of any trees but these trees will need to be remote from the water retaining lagoons.

10.2 All the landscape proposals are shown on the drawings.

11 Appearance

11.1 The Appearance of the scheme will aim to make the development blend into the existing landscape. The development primarily involves the construction of earth embankments and the excavation of lagoons and ditches. The embankments and the lagoons and ditches will be seeded with an agreed mix of grass seed and wild flowers as stated on the landscape drawings. The slopes of the embankments and lagoons are shallow and hence the appearance will blend in with the surrounding land.

11.2 The base of the lagoons will be grassed and will be useable for grazing of animals which will give the appearance of a natural agricultural field.

The appearance of the scheme will change with the seasons in line with the surrounding landscape. Hence once again the aim is to blend in with the existing rural landscape rather than stand out from it.

12 Access Arrangements

12.1 The WaDFAS is a Flood Alleviation Scheme which is specifically designed to reduce the risk of flooding to the urban area of Willerby and Derringham. Under normal conditions the WaDFAS will consist of earth embankments and excavations below existing ground level these will be dry or will have a slight water flow. The majority of the lagoons, bunds ditches etc will be on private land and access will be restricted as it is at present. These areas are not being developed as public open spaces or amenity areas.

12.2 After severe rainfall events the ditches and lagoons will intercept surface water run-off and will fill with water. During these events there will be deep water in the ditches and lagoons and hence access will be required to be restricted to avoid danger to the public. Hence it is proposed that the lagoons will be fenced or surrounded by hedges to prevent unauthorised access.

12.3 At present the land is undeveloped agricultural land and hence access is restricted. It is proposed that restricted access will be maintained but that the lagoon areas may be used for similar agricultural purposes and hence the side slopes of the lagoons have been designed at a very low gradient slope of 1 in 3.

12.3 Existing ditches will be re-cut to achieve the correct gradients and new ditches will be cut. Access points across all ditches will be maintained and designed to allow access by all users. Lagoons will be provided with access points for maintenance and use for agricultural purposes. Generally the specification for the access points will be similar to the existing farm access tracks and field access points.

12.4 It is not considered that there is a full requirement of accessibility within the scope of these proposals due to the functional nature of the schemes and the requirement to maintain the attenuation areas as generally inert areas for the eventuality of flood. Currently there is no intention for these areas to be developed as amenity areas; however consideration could be given to such opportunities in the future if it was deemed appropriate for the local

community and such change of use was within planning remit. At such time then a full access assessment would be made.

12.5 The proposed scheme makes use of current access points from the adjacent highway to enable maintenance access to the lagoon areas and watercourses. The watercourses are required to have a 16m easement to allow access alongside the watercourse to enable periodic clearing and maintenance work.

13 Conclusion

13.1 The proposed Willerby and Derringham Flood Alleviation Scheme (WaDFAS) is a strategically important scheme with the intention of maintaining social and economic stability by providing extended flood resilience to the generic benefit areas of Willerby and Derringham. This is established by attenuating excessive pluvial, overland flood water from rainfall events like those sustained during the June 2007 flood event.

13.2 The dynamics of the scheme have been thoroughly investigated utilising the latest flood modelling techniques and codes of practise for such work. A full project appraisal has been carried out on the proposals and this has established significant economic and practical benefit of the scheme and confirms exceptional value with respect to the capital cost of the scheme.

13.3 The scheme relies on utilising undeveloped agricultural land along the natural flow path of flood waters by construction of attenuation lagoons and intercepting / conveyance watercourses. The effect on the local landscape is limited and sympathetic involving low profile retaining structures constructed of earth bunds and landscaped using seeding containing a rich diversity of species.

13.4 This scheme will have a significant benefit to the local communities of Willerby and Derringham and will enforce greater confidence in the region as a whole for the control and management of flood risk.