



Church Street Flood Alleviation Scheme Environmental Screening Report

Scarborough Borough Council

December 2012

Final Report

9W5572



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Document title Church Street Flood Alleviation Scheme
Environmental Screening Report
Status Final Report
Date December 2012
Project name Whitby Coastal Strategy 2
Project number 9W5572
Client Scarborough Borough Council
Reference 9W5572/Z6/304258/Newc

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Date/initialsMS.....21/12/12.....

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1 INTRODUCTION

Church Street is located on the right bank of the River Esk in Whitby, North Yorkshire, upstream of the Swing Bridge (see Figure 1). Church Street provides access to businesses, wharves, public houses, boat pontoons/jetties, slipways, the historic Seaman's Hospital, the Captain Cook Memorial Museum, two car parks and residential properties on the east side of the River Esk. Access to Church Street is via the Swing Bridge at its northern end, and from Spital Bridge road in the south.

A flood alleviation scheme for the Church Street area is being progressed as one of the priority schemes from the Whitby Coastal Strategy 2. The preferred strategic option is to implement a capital flood alleviation scheme consisting of a combination of flood walls and flood gates. The works will take place in 2014 and will provide a 1:100 year Standard of Protection (SOP) to 2051. The location of these proposed works are shown on Figure 1.

This document has been prepared to support a request for a Screening Opinion in accordance with Regulation 5 of the Town and Country Planning (Environmental Impact Assessment) Regulations 2011.

1.1 Description of Study Area

The study area, showing the main places that are described below, can be seen on Figure 2.

Along the whole length of Church Street the near-vertical quay wall is constructed from a combination of brick, masonry, concrete and steel sheet piles. It acts as a retaining wall for the adjacent highway and also provides erosion protection from the Esk and incoming tides. The form of construction varies, depending upon age and usage.

From Eskside Wharf to the Fleece Inn public house, between the quay wall and the road there is a footpath, the width of which is approximately 1.4m. Where the footpath deviates sufficiently away from the quay wall, the intervening space has been used as an area for fishermen to store (and repair) lobster pots.

Along this stretch of the study area, there is a continuous length of 1.1m high handrails, which provide a barrier between the public and the quay wall edge. In one location, the handrails have been inset to form a bay for public benches, with views overlooking the harbour.

There is a gap in the handrails approximately 26m to the north of Eskside Wharf, which allows access to a set of steps that lead down to the bank of the Esk. This access point is used for the historic Penny Hedge ceremony, whose origins date back to 1159, and is still celebrated every Ascension Day. Installation of any defences at this point will need to consider the retention of access for this purpose. There is a plaque located at this point which commemorates this ceremony.

Opposite the Middle Earth Tavern public house, there is an access point (via a gap in the handrails) to floating pontoons for private moorings. An electrical supply cabinet has recently been installed in this location, which is the most vulnerable in terms of overtopping and flood risk.

There is a third and final access point in the handrails located adjacent to the bus stop (opposite 42 Church Street). This is the access point for the fishermen who store their lobster pots.

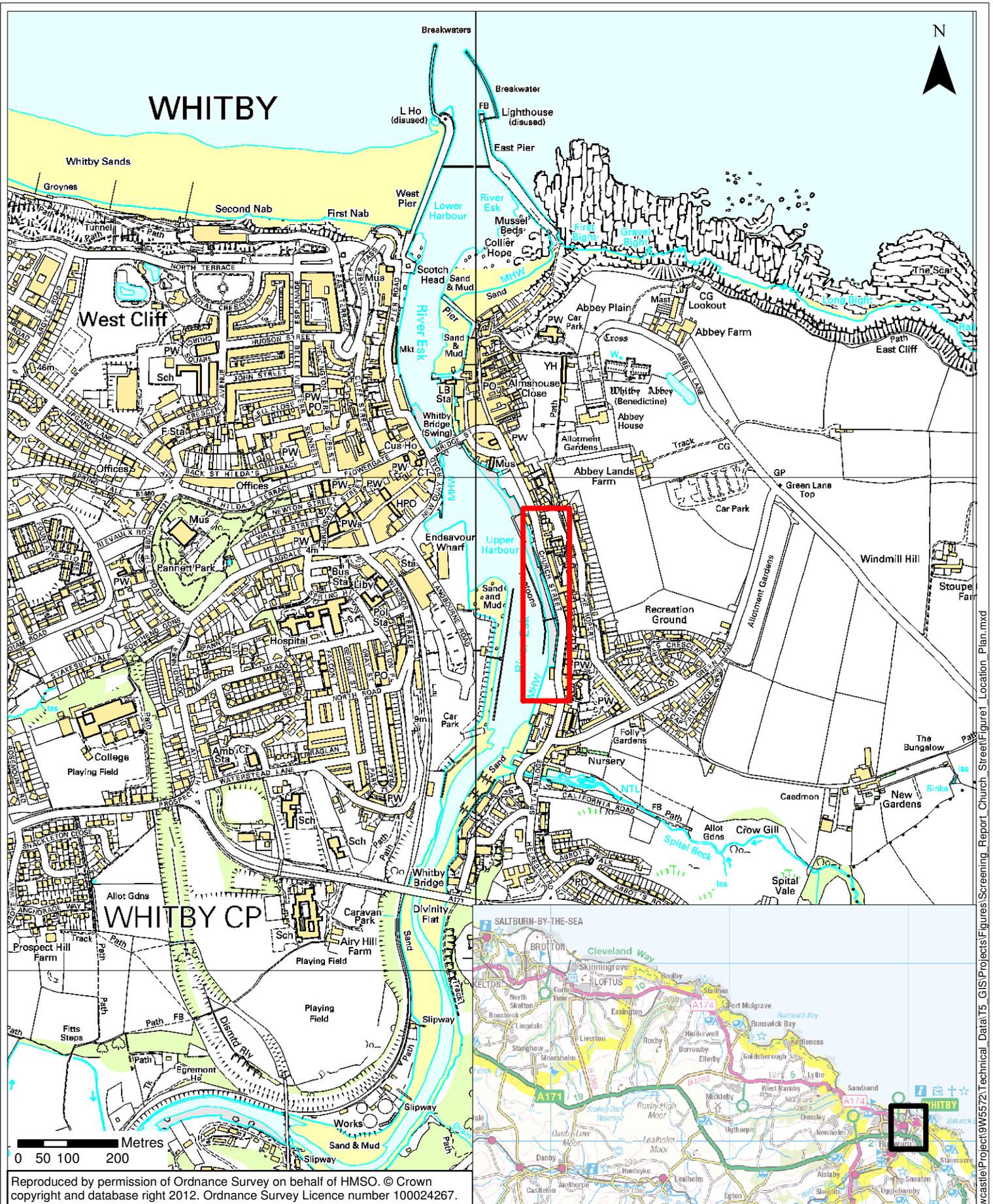
Adjacent to the Fleece Inn public house, the area between the quay wall and the footpath has been used to create a recreation garden area for the Seaman's Hospital. This area is fenced off with a locked access gate and also includes two summer houses, one at each end of the feature.

The Fleece Inn public house backs onto the quay wall, where a patio/beer garden area looks directly out onto the Esk.

To the north of the Fleece Inn public house, the area between the quay wall and the footpath is used to provide two public pay-and-display car parks. A slipway bisects the two parking areas. The most northerly parking area backs onto the walls of the Captain Cook Memorial Museum and the most southerly backs onto the boundary wall of the Fleece Inn public house.

There is an electricity substation in the car park, adjacent to the Fleece Inn public house boundary wall. A row of street lights have been installed on the pavement on the west side of Church Street, in addition to numerous other inspection covers, gulleys and similar utility service assets.

Church Street is widely used for residential and public on road parking, in designated bays on the west side of the road (closest to the quay wall), the east side being restricted almost entirely with double yellow lines.



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 Church Street Flood Alleviation Scheme Location

Title:
Location Plan

Project:
Church Street Flood Alleviation Scheme

Client:
Scarborough Borough Council

Date:
November 2012

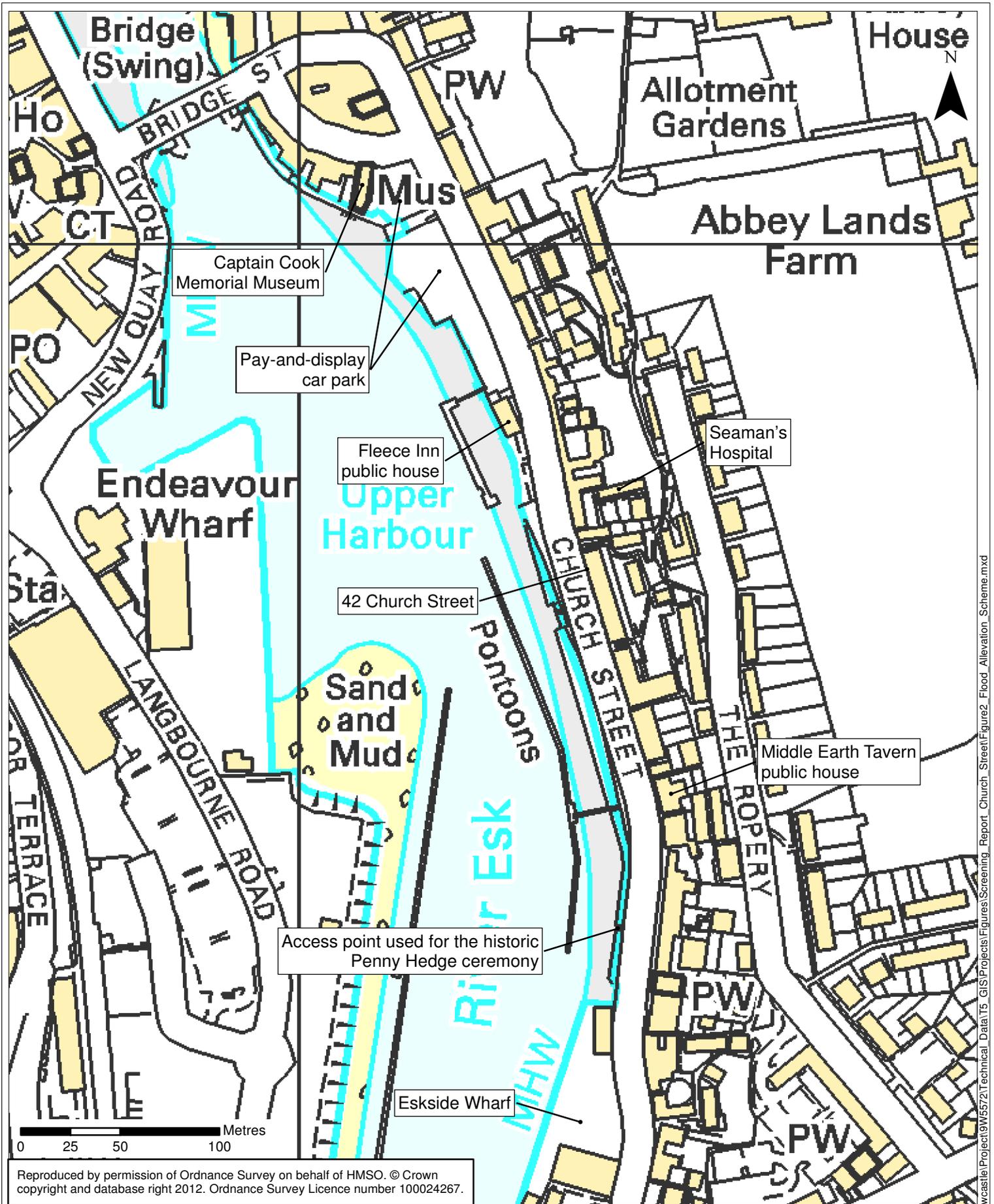
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Key:

Title:
Flood Alleviation Scheme
Location

Project:
Church Street Flood
Alleviation Scheme

Client:
Scarborough Borough Council

Date:
November 2012

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2 PERMISSIONS AND LICENCES

2.1 Marine Licence

Any works below Mean High Water Spring (MHWS) tides will require a Marine Licence from the Marine Management Organisation (MMO). As set out in Section 4.2, and as shown in **Appendix A**, because all of the proposed works are above MHWS a marine licence will not be required.

2.2 Planning permission

Scarborough Borough Council is the local planning authority (LPA) for the proposed scheme. It is anticipated that planning permission from the LPA would be required for the land based activities, extending to Mean Low Water Springs (MLWS) mark as shown in **Appendix A**.

2.3 Land Drainage Act 1991 and Water Resources Act 1991 and associated byelaws

Prior written consent from the Environment Agency is required for any works in, under or near a watercourse or flood defence structure on any main river. The River Esk is classified as a main river by the Environment Agency; therefore, it is considered that an application for 'Consent for Works affecting watercourses and / or flood defences' would be required.

3 ENVIRONMENTAL IMPACT ASSESSMENT DEVELOPMENT

3.1 Development type

3.1.1 Town and Country Planning (Environmental Impact Assessment) Regulations 2011.

Under the Town and Country Planning (Environmental Impact Assessment) Regulations 2011, Environmental Impact Assessment (EIA) development is defined as either:

- "Schedule 1 development", for which EIA is mandatory; or,
- "Schedule 2 development" for which EIA is required only if the project is likely to give rise to significant environmental effects. Projects of a type listed in Schedule 2 which are not in a sensitive area¹, and are below the threshold in Column 2 of that Schedule, do not require EIA. However, where any part of the proposed development is in a sensitive area, or any threshold in Column 2 of that Schedule is exceeded or met, EIA may be required.

It is considered that the proposed works, as set out in Section 3, would fall within Schedule 2, item 10(m) as:

"Coastal work to combat erosion and maritime works capable of altering the coast through the construction, for example, of dykes, moles, jetties and other sea defence works, excluding the maintenance and reconstruction of such works"

There is no threshold applied to these types of projects, with all schemes listed as Schedule 2 developments.

¹ As defined in the Regulations and DETR Circular 02/99

3.2 Sensitive areas

If a project is located within or close to a 'sensitive area' it must automatically be screened for the need for EIA, regardless of its scale. The Town and Country Planning (Environmental Impact Assessment) Regulations 2011 define sensitive areas, of which the following are of relevance to the propose scheme:

- coastal zones; and,
- landscapes of historical, cultural or archaeological significance.

The proposed scheme is located within the North Yorkshire and Cleveland Heritage Coast. In addition, the River Esk is locally designated as a Site of Importance to Nature Conservation (SINC) and the coastal cliff and slope is classified as Maritime Cliff and Slope priority habitat under the UK Biodiversity Action Plan (BAP). In addition, Whitby is an area of special architectural and historic interest and is designated as a Conservation Area. As such, the location of the proposed scheme is considered to be within a sensitive area and automatically requires screening for EIA.

4 PROPOSED WORKS

This section provides a description of the works proposed as part of the flood alleviation scheme. Draft cross sections of the proposed defences are provided in **Appendix A**.

4.1 Preliminary works

Site Investigation

Intrusive site investigation works are proposed to be carried out in September / October 2013 and are to include:

- Trial pits excavated to the full depth of the proposed construction (assumed maximum 1.5m) extending across the full width of the pavement to allow identification of services and depth and position. It is assumed that a maximum of 8 trial pits will be excavated. The works will require the reinstatement of holes and surface material and disposal of waste.
- Window sampling at the location of the proposed two flood gates to the full depth of the proposed gate support structure (assumed minimum 2m depth).
- Assessment of the structural condition of the walls at the Fishermen's Hospital Garden and at the Fleece Inn.

Mobilisation

The Museum car park will be set aside for use by the Contractor from September 2013 to March 2014. This area will be used for their welfare facilities, site office and material stores. This will result in the loss of 41 parking spaces for up to 7 months.

Permit holders for this car park will need to be reallocated spaces in the Church Street car park for the duration of the works.

4.2 Construction works

The works, to provide a 1:100 year Standard of Protection (SOP) to 2051, will take place in 2014 and assuming that the Contractor will work back towards the compound (i.e. starting at the furthest point) and only have a single working frontage (i.e. not working in more than one location at a time) the estimated construction works are as follows.

Eskside Wharf to Seamen's Hospital Gardens

- There will be temporary isolation and/or removal of street lights and footpath/quay lights for the duration of the works, and replacement with temporary lighting units powered by generators. There is the possibility that temporary power supply may also be required to the pontoons.
- The handrails are to be removed, shot-blasted, painted and reinstalled.
- Existing handrails will be removed as the works progress and are to be provided to Scarborough Borough Council (SBC) for reuse elsewhere in Whitby.
- Excavation to depth of foundations of the proposed wall base, using a JCB, to a depth of no greater than 1.5m. The full width of the footpath will be excavated (2.5m wide) and surfacing materials disposed of (sub base may be reused for backfilling to the structure if suitable).
- The electricity junction box will be relocated at tie in to Eskside Wharf.
- Services may require relocation or feeding through the new wall (i.e. water and electric supply to jetties) this may require the construction of new draw pits.
- There will be construction of reinforced concrete wall bases and flood gate support structure (x2) using in-situ concrete delivered from Church Street (i.e. not across the Swing Bridge).
- New bases will be constructed and new ducts and draw-pits installed for street lighting and quay lighting.
- Reinforced concrete walls will be constructed using in-situ concrete delivered from Church Street (i.e. not across the Swing Bridge). Services to be ducted through the wall as required and the riverward face of the walls are to have an exposed aggregate finish.
- Flood gates will be installed onto support structures/walls and are to be delivered (via Church Street) prefabricated and connected to structure.
- The landward faces of the walls are to be faced with brick work and the bricks are to be delivered via Church Street. The colour and type of brick is to be approved by Planners/SBC Heritage Officer.
- Fill material to be reinstated against walls, using JCB and stockpiled selected excavated materials.
- Pavement and quay surfaces to be reinstated; tarmac for the pavement and reused masonry paving on the riverward side. Tarmac will probably be laid when the whole wall is complete to gain cost efficiencies for plant and labour.
- Wall crests to be capped with precast concrete copings.
- Penny Hedge related artwork to be installed onto landward face of flood gate at this location; laser etched or similar cladding enhancement and replacement of Penny Hedge sign/plaque.
- Wall works, at this point, will stop short just to the south of the Gardens and tie into the proposed steps.
- There will be construction of reinforced concrete steps at the boundary of the Seaman's Hospital Gardens to allow access to the area where lobster pots are stored. Construction will require removal of the existing masonry paved area; excavation with a JCB will be carried out to a depth of approximately 1m to form the foundations. The steps and integral walls will continue the defence height to the

Gardens and the external faces of the walls will have an exposed aggregate finish. Handrails will be required along the edges of the steps and possibly low height rails along the length of the boundary wall (to provide minimum 1.1m height from step platform and also to provide additional security to the Gardens).

- Non-return valves are to be installed on the outfalls of all highway and surface water drains along this length.

Seamen's Hospital Gardens

- The Summer Houses are to be carefully taken down and stored.
- There will be demolition of the existing brick wall facing the river and the bricks will be reclaimed and reused for facing the new wall.
- The construction of a new flood wall, methodology and approach, is the same as the above flood wall (as per 'Eskside Wharf to Seamen's Hospital Gardens').
- New ground slab for the Summer Houses to be cast and raised up 430mm above the existing floor level.
- The Summer Houses are then to be constructed onto the new ground slabs.
- The masonry paved areas and gravelled areas are to be reinstated with appropriate gradient access ramps leading to the doorways of the Summer Houses. Laid cross-falls shall be arranged so that surface water drains back towards the highway to prevent the need to install holes through the flood wall and avoid the need for non-return valves.

Fleece Inn

- Existing steel fencing is to be removed and stored for re-use.
- Existing low level brick wall is to be demolished.
- To construct a new brick wall to defence height with outfall pipes installed at ground level to allow surface water discharge. A brick wall is to be constructed on new mass concrete footing and coping is to be formed with bricks laid end on.
- Existing patio area drains through the existing wall and to ensure that falls are retained and non-return valves installed on surface water drain outfalls.
- Fencing is to be reinstated.

Church Street Car Park

- Access ramp and pontoon bridge to be moved to allow works to be carried out.
- Loose concrete will be removed from the top of the existing concrete wall.
- To cast a new reinforced concrete wall around the end position of the pontoon bridge to allow entrance to bridge to be raised above (or onto) the new defence height.
- To raise the existing wall by casting on top of the existing, up to defence height.
- The pontoon bridge is to be replaced and a new (longer) access ramp is to be installed.

Future works

As stated in Section 1, the works will take place in 2014 and will provide a 1:100 year Standard of Protection (SOP) to 2051, however if you take in to account climate change sea level rise and global warming, it is assumed that no greater than a 1:50 SOP can be provided up to 2115, with wall raising proposed for 2051.

4.3 Estimated programme of works

The construction programme is anticipated to be from September 2014 to March 2015. This would avoid the main Summer and Easter (peak) tourism season.

5 CONSULTATION

Informal consultation has been undertaken with Scarborough Borough Council's (SBC) Conservation Officers to discuss the potential effects to features of the Whitby Conservation Area.

Formal consultation has been undertaken as part of the Whitby Coastal Strategy 2 scheme with a wide variety of statutory bodies, stakeholders and the general public.

Prior to the application stage, and throughout the development of the scheme, consultation will be carried out with SBC, Natural England and the Environment Agency.

6 POTENTIAL ENVIRONMENTAL EFFECTS

This section provides an overview of the potential effects that could arise as a result of the proposed scheme and describes measures that have been identified to date to avoid or mitigate these effects throughout the development of the scheme, where appropriate. Given the nature and location of the scheme, the following aspects are considered relevant:

- Tourism and recreation;
- Biodiversity, flora and fauna;
- Water quality;
- Archaeology and cultural heritage;
- Landscape, seascape and visual amenity value;
- Air quality;
- Road traffic; and,
- Noise and vibration.

In addition to the receptor-specific measures set out below to avoid / mitigate any adverse effects that could arise through the implementation of the proposed scheme, best practice guidance would be adhered to throughout the programme of works, such as:

- Environment Agency guidelines, in particular Pollution Prevention Guidelines - Works in, near or liable to affect watercourses: PPG 5;
- CIRIA Coastal and Marine Environmental Management Site Guide (CIRIA report C584); and,

- CL:AIRE (Contaminated Land: Applications in Real Environments) Code of Practice.

6.1 Tourism and Recreation

The coast and harbour at Whitby are valuable recreational facilities and provide the principal attraction for many visitors to the area. The tourism value of Whitby has been estimated as part of a tourism and leisure study (Planning Solutions Consulting Ltd., 2011). The study estimated value of total tourism revenue generated in Whitby of £41.25 million per annum.

The construction works are to be carried outside of the main peak tourism season and, therefore, this will minimise the potential impact of the proposed scheme on tourism as far as possible.

6.2 Biodiversity, flora and fauna

The River Esk is locally designated as River Esk SINC, whilst small areas of mudflat BAP habitat are present at the mouth of the River Esk, as well as strips further into the upper harbour on alternate banks. A small area of saltmarsh is present in Spital Beck. To the east and west of the piers, the coastal cliff and slope is classified as Maritime Cliff and Slope Biodiversity Action Plan (BAP) habitat.

The SINC is approximately 5.5km in length, stretching from where the A169 Pickering to Whitby road crosses the River Esk to the harbour mouth in Whitby. It is a 'pre-existing' SINC, which means that it was included by Scarborough Borough Council in their Local Plan following the Phase 1 habitat surveys carried out in the 1980-1990s. However, the site has never been re-surveyed since the establishment of the North Yorkshire SINC Panel and, therefore, there is no citation report or habitat mapping available.

Fish species recorded in the Esk estuary include sea trout, five-bearded rockling, flounder, plaice, viviparous blenny, sea scorpion, cod, sand goby, sprat, smelt, sandeel, saithe, eel, whiting, pollock, pipefish, bream, stickleback, herring and mullet (Environment Agency, 2010). Salmonid species (including salmon and sea trout) migrate through the estuary in order to reach spawning grounds further upstream within the River Esk and its tributaries.

To ensure best practice the following recommendations have been identified:

- Works will need to consider the impact on salmonids and their migration, therefore further consultation will be undertaken with the Environment Agency to identify suitable measures to avoid and / or mitigate for any adverse effects on migratory fish.
- Works should be undertaken during daylight hours only, to minimise disturbance to migratory fish.

6.3 Water quality

The Water Framework Directive (WFD) (2000/60/EC) establishes a legal framework to protect and restore clean water across Europe and to ensure its long term sustainable use. WFD waterbodies that have the potential to be affected by the proposed scheme are presented in **Table 1**.

Table 1 WFD waterbodies within the study area (AWB - Artificial Water Body; HMWB - Heavily Modified Water Body)

Water body category	Water body name	Water body ID	Hydromorphological designation	Current overall status / potential	Status Objective
River	Whitby (North of Esk)	GB104027068690	Heavily modified	Moderate	Good by 2027
River	Rigg Mill Beck/Long Mill Beck catch (trib. of Esk)	GB104027068140	Not Designated AWB/HMWB	Poor	Good by 2027
Transitional	Esk (E)	GB510402703400	Heavily modified	Moderate	Good by 2027
Ground water	Esk & Yorkshire Coast Ravenscar	GB40402G702300	N/A	Good	Good by 2015

Specific mitigation measures are set for waterbodies that have been classified as artificial or heavily modified in order to achieve the Environmental Objectives of the WFD. The only waterbody that has been set mitigation measures within the study area is the Whitby (North of Esk) river waterbody, as presented in **Table 2**.

Table 2 Specific mitigation measures for Whitby (North of Esk) river waterbody

Waterbody	Mitigation Measures	Status
GB104027068690 Whitby (North of Esk)	Educate landowners on sensitive management practices (urbanisation)	Not in place
	Alteration of channel bed (within culvert)	Not in place
	Re-opening existing culverts	Not in place

The proposed works have the potential to affect the status of the WFD waterbodies through the release of potentially contaminated material, from accidental leaks and spillages. Consequently, it is proposed that a WFD compliance assessment is undertaken on the proposed scheme to ensure that the WFD status of the waterbodies is maintained and any opportunity for enhancement is identified.

6.4 Archaeology and cultural heritage

Whitby is an area of special architectural and historic interest and is designated as a Conservation Area. No character appraisal has been undertaken of this site. Any works within a Conservation Area require prior consent by the Local Planning Authority.

Scheduled Monuments (SMs) are nationally important archaeological sites protected under the Ancient Monuments and Archaeological Areas Act 1979. Whitby Abbey SM is located within the study area. An additional SM, the alum quarry at Saltwick Nab, is present approximately 1.3km to the east of East Pier. The Grade II Gardens of Whitby Abbey House are also a Registered Park and Garden. However, there are no heritage sites or listed buildings to where the flood walls are to be constructed.

The flood defence wall, except for about 15- 20% of its length, would replace existing railings of a little under 1m high comprising cast iron posts, square on section and with fluted sides and spanned by tubular rails. These railings are both unusual quite distinctive to Whitby harbour and the wider Conservation Area. Identical railings are found on the other side of the river, but downstream. The railings therefore contribute to

the distinctiveness of Whitby Conservation Area and therefore the design needs to take account of this.

The normal presumption would be for the retention of these railings. However this must be balanced against the benefits arising from the provision of a flood defence wall in the protection of other heritage assets. About 30 Listed Buildings are prone to damage from flooding along with other non-designated heritage assets, such as the former gas works. In these circumstances, the need for a wall is, therefore acknowledged; however, it is vital that it is well detailed and executed. The following mitigation measures have been identified:

- The wall should be kept as low as possible consistent with providing adequate flood defence.
- The appearance from across the river should be designed so that it is not intrusive. White or light grey concrete above the stone revetment would be likely to be intrusive and therefore the concrete will need to be toned down in some way.
- It is proposed to face the Church Street elevation in brick. This should be a mellow red brick such as from the Ibstock Birtley Olde English range or the Furness Classic Clamp range rather than a hard red engineering brick. The coping will need to be very well detailed.
- The 'penny hedge' plaque should be incorporated into the wall and provision made for seating - at present there is one seat overlooking the river which will be affected.
- In addition to the loss of a feature of the Conservation Area, the removal and scrapping of the iron railings (especially the posts) presents a sustainability issue. There is to be consideration in to the potential re-use of some of these railings and enhance the area by replacing some of the poor quality 'Kee Klamp' railings around the Grape Lane Car park and the river side section of the Church Street car park.

A Written Scheme of Investigation and recording which will be approved by the County Archaeologist (a detailed account of mitigation requirements and how they are to be met including working methods, anticipated outputs, the dissemination and archiving of information, monitoring and quality assurance arrangements and a timetable) should also be undertaken prior to commencement of works.

6.5 Landscape, seascape and visual amenity value

As stated above, Church Street is within the Whitby Conservation Area and is part of the tourism appeal of the town, with views across the harbour. The properties along Church Street face onto the quayside and enjoy panoramic views across the working harbour.

The railings, when seen from the west bank of the river, are seen above, of the riverside revetment. Over some of this length the view is interrupted by stacked lobster pots but these are transitory and the greater part of the length is not interrupted. The railings lack the solidity of a wall and thus have a low impact upon the vista and, although there are cars parked behind, these are transitory. Views across the river are very important to the character of Whitby Conservation Area and its special qualities. There will, therefore, be important visual, social and environmental considerations when determining the maximum allowable height for the flood wall.

It is likely that a height of 1.4m will be the maximum acceptable, as this will still allow adult pedestrians to see over the top of the wall. The scheme will be constructed to provide a 1:100 year Standard of Protection (SOP) to 2051. A handrail will be installed

in front of the floodwall between the Seaman's Hospital Garden and Eskside Wharf to ensure there is a 1.1m high barrier along the quay for public safety. There will be an intervention in year 2051 to increase the height of the wall to accommodate further climate change to ensure that the scheme continues to provide a 1 in 100 year SoP up to the end of the appraisal period.

Following the intervention a handrail will no longer be necessary as the wall height will be greater than 1.1m. At the intervention in 2051 the extent of the scheme will be extended to the north around the Church Street Car Park and Museum Car Park (including a floodgate across the top of the slipway between the two car parks) to prevent outflanking of the scheme. In addition, a floodwall with a consistent height above ground level will provide a more unified appearance to the area, and reduce the visual appearance of the defence.

In addition to the mitigation measures set out in Section 6.4, the following measures are proposed to minimise any adverse effects:

- locally advertising the proposed works;
- conducting the works outside of the peak tourism period; and
- informing local residents of the proposed works.

6.6 Air quality

Construction work on some parts of the site will take place in relatively close proximity (within 500m) to residential properties. There is, therefore, a potential risk of reduction in air quality through construction plant machinery and fugitive dust emissions. This risk will be minimised through adhering to best practice and routine dust control procedures.

6.7 Road traffic

The delivery of equipment and materials to site is anticipated to be by road, where possible avoiding the Swing Bridge and coming along Church Street from the turn-off before Spital Bridge. It is assumed that the site compound will be in the car park, in the area adjacent to the boundary wall of the Fleece Inn (i.e. at the southern end of the main car park). General measures to avoid and reduce any impacts on road traffic, include:

- the works are proposed to commence in September 2014 to avoid the peak tourism period;
- delivery times will be organised to not coincide with peak traffic periods, such as commuting periods; and,
- the proposed works will be locally advertised, with a letter drop exercise undertaken to all properties within 500m of the proposed works.

Once the construction methodology has been finalised, consultation with the Borough Council is proposed to ensure the appropriate mitigation measures are put in place.

6.8 Noise and vibration

There are a number of commercial and residential properties within close proximity to the proposed works.

Significant potential effects from noise and vibrations would result from the construction of the flood wall (e.g. with the use of construction equipment, such as generators, and vehicles).

In order to minimise the potential effects to tourism and recreation, the proposed works are to take place outside of the peak tourism period. Furthermore, information signs will be placed around the site compound providing contact details for any complaints to be sent to and promptly dealt with.

Measures to reduce the potential effects to residential and commercial properties include the proposed working hours are to be restricted to:

- Monday to Friday – 08:00 to 18:00.
- Weekend working by agreement only.

Furthermore, all local residents within 500m will be informed of the proposed works by letter drop, providing them with a contact details should they require any further information about the proposed works or wish to make any complaints.

7 CONCLUSIONS

It is considered likely that the proposed scheme falls under Schedule 2 of the Town and Country Planning (Environmental Impact Assessment) Regulations 2011. In addition, the proposed scheme is considered to be located in a Sensitive Area.

It is proposed that the identified environmental issues can be addressed through undertaking discrete items of work to accompany a planning application to the LPA without the requirement for a statutory Environmental Impact Assessment. Appropriate consultation will be maintained with SBC, Natural England and the Environment Agency throughout the development of the scheme.

Appendix A

Draft cross sections of the proposed defences

