

# Musselburgh Flood Protection Scheme Environmental Impact Assessment Report: Non-Technical Summary





**Musselburgh Flood Protection Scheme: Environmental Impact Assessment – Non-Technical Summary (DRAFT) 701909-JEC-S4-XXX-XXX-RE-I-0008**

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## Preface

[Note: the Scheme is assessed to a Nov.'23 design freeze and will be finalised in Feb'24 to the final design, construction methodology report and considering any final consultation feedback]

This document is the Non-Technical Summary (NTS) of the Environmental Impact Assessment (EIA) Report undertaken for the Musselburgh Flood Protection Scheme, which is being designed by Jacobs on behalf of East Lothian Council. This document includes a Scheme overview drawing but should be read in conjunction with the Scheme outline design drawings, which provide more detailed context on the outline design.

The EIA was undertaken by a team of competent experts employed by Jacobs in the respective environmental disciplines studied including those listed in the following table:

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The Environmental Impact Assessment Report (including NTS) may be viewed online on the Scheme website:

<https://www.musselburghfloodprotection.com/>

Any person wishing to make representation on the Environmental Impact Assessment Report should write to East Lothian Council [details to be added at formal publication].

## Executive Summary

A Flood Protection Scheme has been proposed by East Lothian Council to address current and future flood risk in the town of Musselburgh. The Scheme will reduce the risk of flooding to in the order of 3,000 properties, and comprise some 6.4 km of riparian and coastal flood walls and embankments, including maintenance of 2.7 km of the existing sea wall containing the Musselburgh (coal ash) Lagoons at Levenhall Links.

During outline design and preliminary environmental assessment, measures were identified that effectively reduced the height of defences required to achieve the desired level of flood protection (namely, the 1-in-200-year level with some allowance for climate change). The measures included using existing upstream reservoirs as storage basins (to catch floodwater before it reaches the town), installing a large debris trap (to stop trees blocking the channel within the town) and raising footbridges (to allow more floodwater to pass through). Other measures were then built into the design to soften impacts on the historical townscape including aligning the Scheme to avoid amenity trees, using landscaped embankments with raised walkways where possible, or specifying stone clad walls in the Musselburgh and Inveresk Conservation Areas.

The Environmental Impact Assessment of the resultant Scheme outline design and likely construction methods identified impacts with likely significant effects on important assets such as flora and fauna, human health, watercourses, views, historic buildings and archaeology, air quality and the transport network. Mitigation measures were developed to address such effects (e.g. seasonal working near over-wintering bird locations, appropriate planting, a Construction Environment Management Plan to manage impacts during construction, a Carbon Management Plan to reduce greenhouse gas emissions), while enhancement measures were developed to ensure the Scheme would have a lasting positive effect on the environment through, for example: creating new areas of biodiversity-rich habitat, improving amenity areas and incorporating the planned active travel routes along the river and coastline, with a new bridge linking the John Muir Way section at the river mouth. A Landscape and Habitat Management Plan will be prepared to ensure such 'positive effects for Biodiversity' are realised in accordance with Policy 3 of the National Planning Framework 4 (SG 2023).

Additional public realm improvements include the redesign of spaces along the River Esk, Murdoch's Green and Mall Avenue, and new public spaces at The Valley, Millhill Slipway, Fisherrow Links and Fisherrow Harbour, all of which will help to create new scenic spaces for users that enhance the appearance of the spaces and improve visual amenity.

Some of the adverse effects identified could not be completely mitigated including effects at construction such as temporary, localised townscape and visual disturbance impacts associated with demolition and vegetation clearance and the presence of construction compounds, materials storage areas and construction vehicles and plant. Once built, some significant adverse effects will remain on the townscape and views associated with

vegetation loss, which will reduce over time as vegetation becomes established and the Scheme becomes more embedded in the landscape. While more extensive tree felling is required along the riverside footpath to the south of Olive Bank Road, people are likely to become accustomed to the changed character of the area. In areas where compensatory planting is proposed, the experience and views will be improved over time, as will the biodiversity value of some of the newly planted spaces.

Some monitoring will be required to check for any unidentified issues (e.g. below-ground contaminants or archaeology), to ensure mitigation measures are effective and to take further opportunities to reduce adverse effects and achieve more positive effects where feasible. A community liaison manager will also be appointed during the construction phase to understand community concerns as they arise and to make sure they are appropriately responded to.

Significant positive effects include improved health through better flood protection and enhanced opportunities for physical activity due to the improved footways and cycleways included in the Scheme design. Other positive effects are predicted for built heritage and historic landscapes, which will not be exposed to as much flood damage over time.

Overall, it is concluded that while the Scheme will have some unavoidable, significant adverse effects during construction and for a few years once built, in the long-term, the Scheme will have positive effects on the environment due to reduced flood risk, and once all the proposed landscaping becomes established.

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# Section 1: Scheme Overview



*Image: Photo montage of proposed landscaping with sea wall defence in background at Fisherrow Links*



## 1 Scheme Overview

### 1.1 Need for the Scheme

Musselburgh is a town of approximately 19,000 people (ELC 2022) located on the southern shore of the Firth of Forth directly to the east of Edinburgh in the local authority area of East Lothian. The town has experienced flood events in the past and is identified by the Scottish Environment Protection Agency (SEPA) as being at risk from severe tidal flooding (during storm surge events; e.g. Photo 1), fluvial flooding from the River Esk and Pinkie Burn (following periods of sustained and heavy rainfall in the wider catchment; e.g. Photo 2) (SEPA 2018).

Figure 1 on the following page shows the map of Musselburgh during a modelled extreme flood event (such events would have a 0.5% probability of occurring in any year; also referred to as the 1-in-200-year event).



Photo 1: High Tide and Storm Surge Event of March 2010

Such events are predicted to become more severe and frequent with climate change (up to 0.86 m sea level rise, 56% increase in peak fluvial flow, and 39% increase in peak rainfall intensity by 2100; SEPA 2023), and East Lothian Council are promoting a Flood Protection Scheme for Musselburgh (hereafter the 'Scheme'), as part of their duty under the Flood Risk Management (Scotland) Act 2009 (SG 2009) to protect people, property, public spaces and infrastructure from current and future flood risk.

This Non-Technical Summary (NTS) sets out the key findings of the Environmental Impact Assessment (EIA) undertaken to support the development of the outline design for the Scheme, as required by the applicable EIA Regulations (SG 2010).



Photo 2: Flood event in 1891 in Eskside East (Courtesy John Grey Centre)



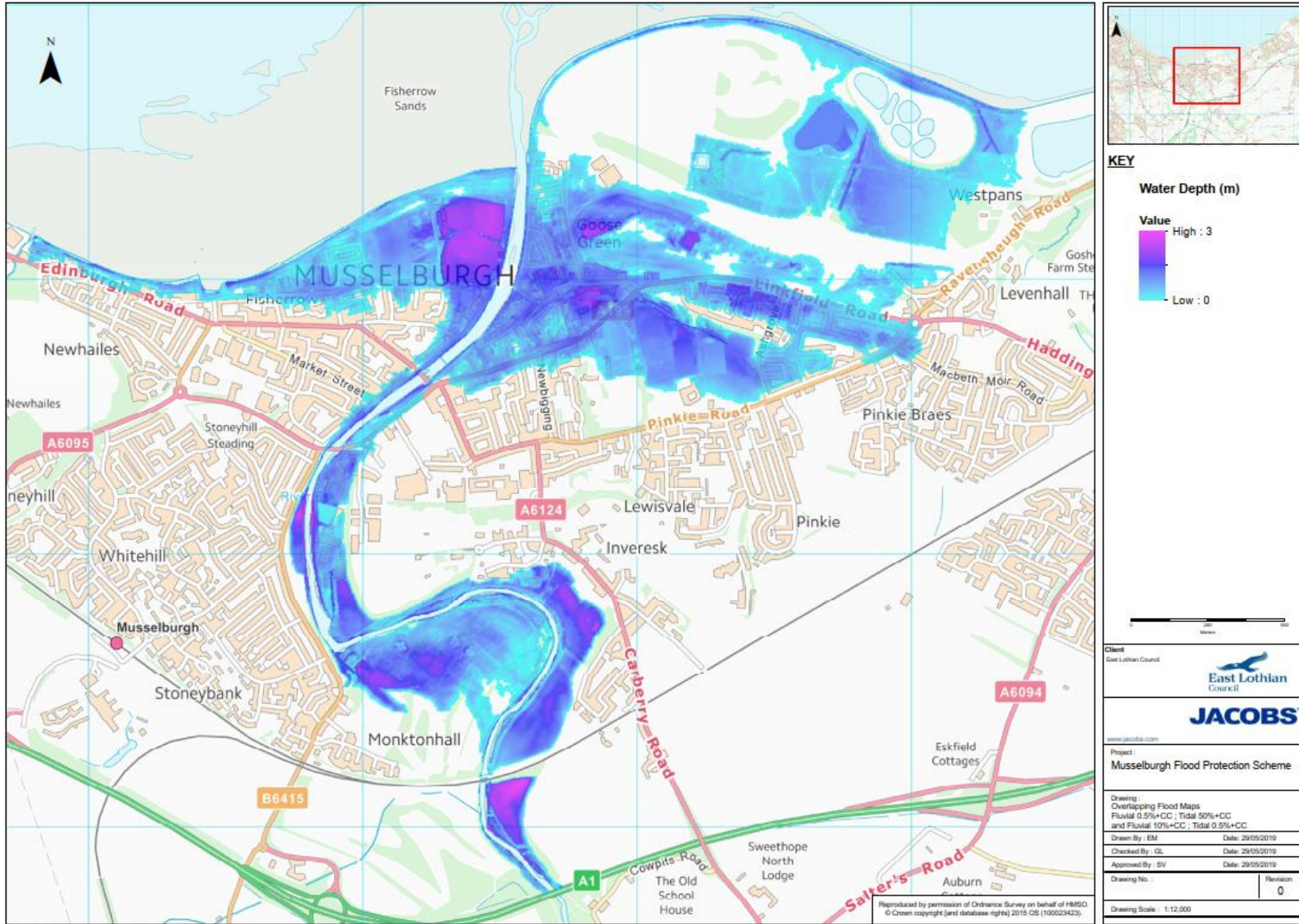


Figure 1: Blended flood extents for the Scheme's three design events (0.5%AEP coastal event plus allowance for climate change; 0.5%AEP River Esk fluvial event plus allowance for climate change; 0.5%AEP Pinkie Burn fluvial event plus allowance for climate change)



## 1.2 Summary of the proposed Scheme

The Scheme will provide flood protection to in the order of 3,000 properties and will comprise approximately 6.4 km of riparian and coastal flood walls and embankments, including repair and improvement of 2.7 km of the sea wall that contains the Musselburgh Lagoons (originally constructed in 1964 to contain coal ash deposits from the now decommissioned Cockenzie Power Station). Figure 2 on the following page shows the location and type of defences within Musselburgh.

Additional measures designed to reduce flood risk from the River Esk include the adapted management of the Rosebery and Edgelaw Reservoirs (17-20 km upstream) to store flood water, and the construction of a large debris trap upstream of the A1 road bridge, to reduce the risk of bridges in the town being blocked by fallen trees and other debris during major storm events (Figure 3). Photo 3 shows an example of an embankment along Eskside West; Photo 4 shows a flood wall along Eskside East, and Photo 5 shows the debris trap.



Photo 4: Photomontage of stone clad wall within the Conservation Area (Eskside East looking southwest)



Photo 3: Photomontage of an embankment at Eskside West (looking southwest)



Photo 5: Photomontage of the debris trap located upstream of the A1 road bridge



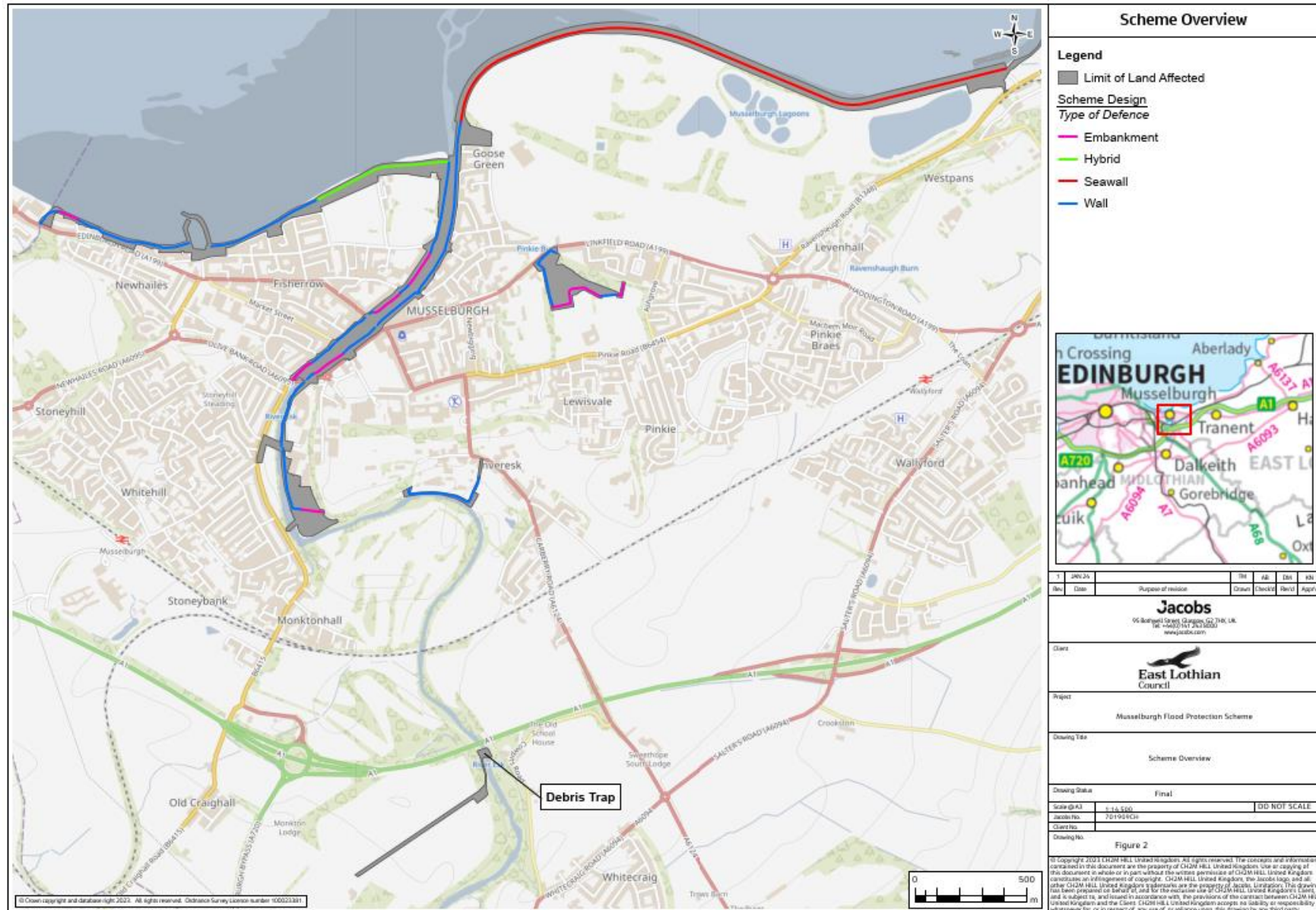


Figure 2: Scheme overview Scheme overview showing limit of land affected and proposed types of flood defence (Musselburgh)

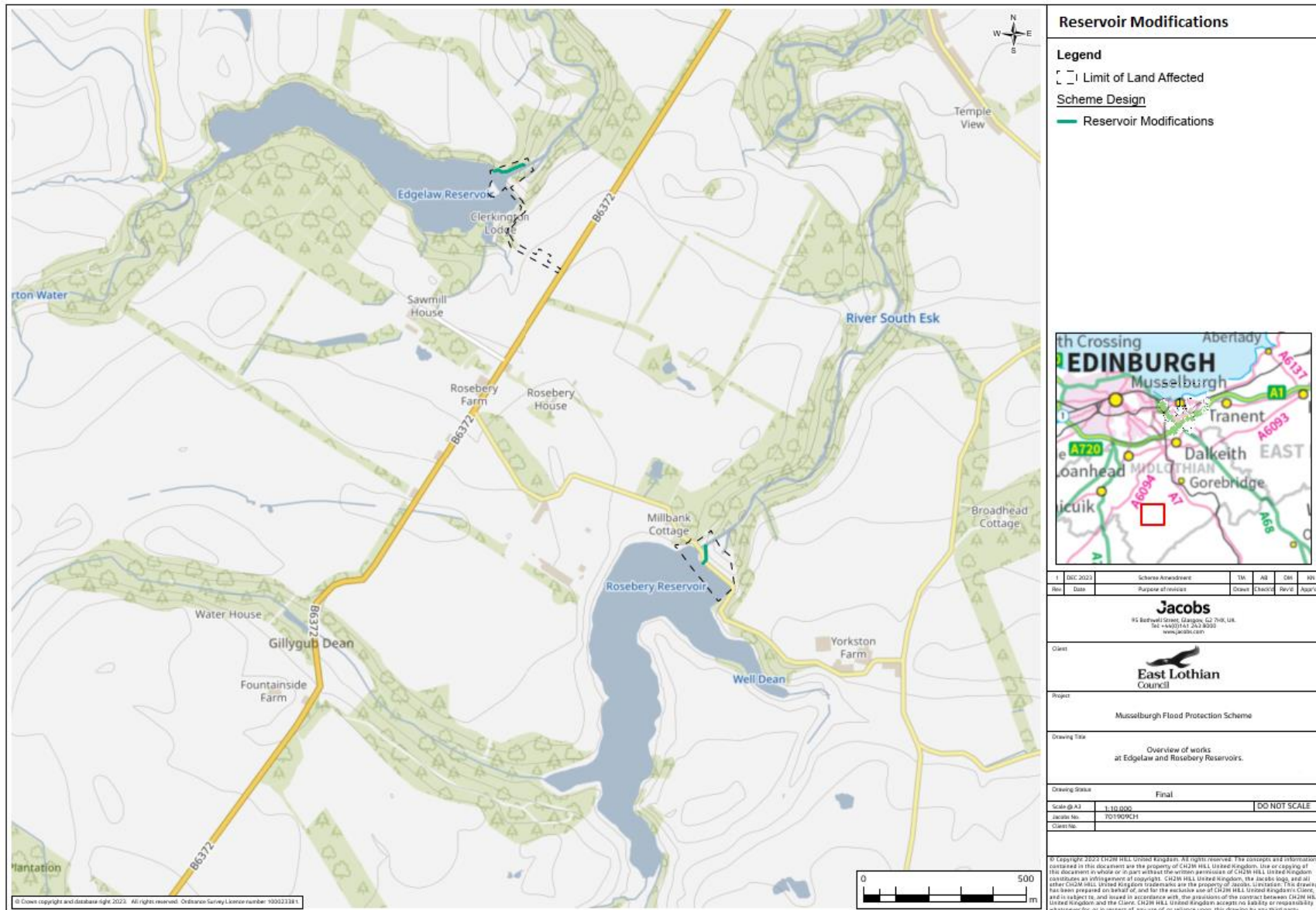


Figure 3: Location of reservoir works



Replacement bridges shall be constructed for the Ivanhoe Footbridge (Photo 6), Shorthope Street Footbridge (Photo 7), Electric Bridge (Photo 8) and Goose Green Footbridge (Photo 9), which will be higher (to allow more floodwater to flow through them (see Figure 4 for locations).

Where appropriate the locations of the new footbridges have been altered to improve transit links across the river (Ivanhoe and Shorthope Street Bridges) and along the coastal John Muir Way (Goose Green Bridge).



Photo 6: Photomontage of the replacement Ivanhoe Footbridge (repositioned to Haugh Park)



Photo 8: Photomontage of the replacement Electric Bridge



Photo 7: Photomontage of Shorthope Street Footbridge



Photo 9: Photomontage of Goose Green Footbridge (relocated downstream toward mouth of river)

The defences will generally be set back from the river's edge where possible to maintain the amenity greenspace through the town, with embankments being used instead of walls where there is sufficient space. At Fisherrow Links, a hybrid embankment / short wall will be built to ensure the defences blend in with the local landscape (Photo 10).



Photo 10: Hybrid embankment with short wall at Fisherrow Links

The height of the walls and embankments will vary along the defences depending on the modelled height of flood water at each location and the ground level once complete.

Figure 4 on the following page shows the location of ancillary features that will be incorporated into the Scheme including flood gates, ramps, and a short section of demountable defences.

The Scheme will incorporate drainage measures to ensure that the defences do not exacerbate surface and groundwater flood risk during heavy rainstorms in the town, while the measures proposed at the Pinkie Playing Fields will ensure floodwater shall be contained within the playing field area.

The Scheme construction works are expected to include establishing site compounds (Figure 4) and working areas, preparing the site (for example clearing vegetation and excavation), setting up temporary flood protection and erosion protection, piling, earthworks, concrete construction, movement of materials, wall cladding and landscaping.

In places where the flood defence is located next to the riverbank, a temporary raised working platform will be constructed within the river channel with a width of approximately 5m to allow access.

The combined measures will provide protection against flood events up to and including that which has a 0.5% probability of occurring in any year (also referred to as the 1-in-200 years flood event) with some additional provision for climate change.

Scheme construction is anticipated to commence in 2026 and will take approximately three to four years to construct (a final summer construction period in year four will likely be required to complete the sea wall works, which may be seasonally restricted to avoid seasonal impacts on over-wintering migratory bird species). It will be built in sections with construction activities being timed to reduce disruption in the town and limit the duration of disturbance at any single location.

The design of the Scheme may be refined further at the detailed design stage or during construction by an appointed contractor should additional limitations be identified, such as previously unidentified underground services. Any changes to the design will be conducted through a change management process, which will include environmental appraisal to determine whether any further mitigation to avoid potentially significant environmental impacts is required.



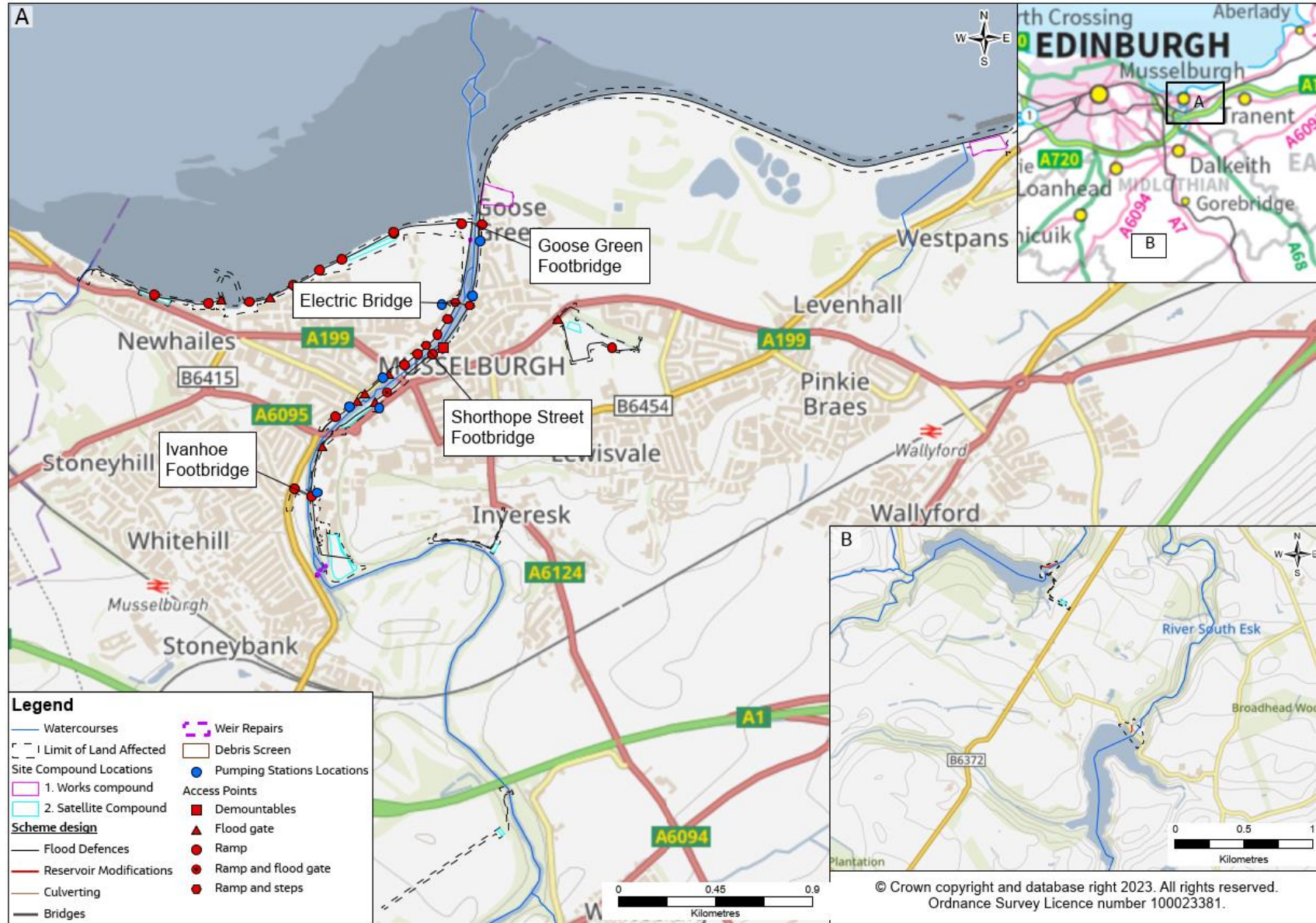


Figure 4: Scheme ancillary features

### 1.3 Stakeholder engagement and design alternatives

The design has been developed over several years and was influenced by consultation feedback from environmental specialists (e.g. NatureScot, RSPB and Forth Rivers Trust for Biodiversity), locally affected stakeholders and the general public during environmental and civil engineering workshops, site walkovers with affected residents and public exhibition and feedback events. A RAG (red, amber, green) Analysis approach was adopted to explore the feasibility and appropriateness of certain options ranging from “do nothing” to building sheet-pile walls along the existing riverbanks, as well as considering multiple design options for discreet locations (e.g. embankment vs stone clad wall vs hybrid embankment with dwarf wall vs glass topped wall).



Photo 11: Public consultation open day at The Brunton, 2019

As the Scheme is located within Musselburgh town centre and along the urban coast, much of the early design effort focused on exploring whether measures other than flood walls or embankments could be used to reduce the flow of water reaching the town over a given time

period. Such measures are in certain cases referred to as “natural flood management” and include e.g. drain blocking on slopes, peat restoration, tree planting along the watercourses or creating log jams in tributaries.

While effective in providing some degree of flood protection in other areas of Scotland (e.g. the Eddleston Water Project<sup>1</sup>), it was concluded that adopting such opportunities upstream of Musselburgh would provide only marginal reduction in flood risk relative to the scale of event the proposed Scheme would protect against. There also continue to be considerable uncertainties associated with the performance of such natural solutions, as well as potentially substantial maintenance burdens, and the risk of complex land-use agreements with landowners.

Adapting the use of the Rosebery and Edgelaw reservoirs - which were previously constructed to ensure the ongoing supply of water to power the industrial mills in Musselburgh - was however deemed feasible and cost efficient. The reservoir water levels shall be lowered by approximately two meters, which will allow flood water from the upper catchment to be stored during a flood, thereby reducing peak flow in the River Esk and through Musselburgh during heavy rainfall events.

For the coastal section, offshore wave attenuation barriers or dune restoration measures were considered, however, both were discounted due to cost, feasibility, and maintenance issues; dunes have to be significantly higher than walls to be able to withstand extreme storm and erosion events, and there wouldn't be enough space to accommodate such scale of dunes without demolishing property and reducing the extent of open greenspace along Fisherrow. In any case,

<sup>1</sup> See: <https://tweedforum.org/our-work/projects/the-eddlestone-water-project/>



the height of defences required along the coast was considered acceptable in terms of visual intrusion and severance from the beach environment.

Environmental input during the evolution of the outline design and options appraisal stage of the Scheme resulted in the following aspects, which are referred to as Primary Mitigation in the EIA Report:

- Modification of the operation of the Rosebery and Edgelaw Reservoirs to serve as flood storage basins during periods of heavy rainfall and high flows in the river system, effectively reducing the height of defences required to meet the same standard of protection in the town.
  - Inclusion of a large debris trap to trap e.g. tree trunks during periods of high flow, thereby reducing the risk of debris blocking and potentially damaging bridge arches and exacerbating flood risk at key areas within the town.
  - Designing the defences through the town centre to be at a more acceptable height through the adoption of a smaller allowance for climate change, but with foundations designed, where practicable, so that the heights may be raised in future to address increased climate change effects.
  - Using embankments with raised walkways and ramps where possible as they generally offer improved access, raised views of the river environment, and they are less imposing on views and the townscape than walls (Photo 12).
  - Amending wall alignments along the length of the Scheme (and implementing a one-way system between the Roman and Rennie Bridge) system to retain as many trees as possible.
  - Specifying stone cladding to be used on walls located within the conservation areas to address potential visual and setting effects.
- Aligning the wall on Eskside West with the Category A-Listed Roman (Old) Bridge to reduce the impact on the view of the structure from adjacent streets.
  - Replacing the existing Ivanhoe, Shorthope and Goose Green Footbridges as well as the Electric Bridge with new higher footbridges that allow unrestricted flows (and debris) to pass through them, thereby lowering the required height of defences in the town, reducing local flood risk and avoiding potential damage to the footbridges.
  - Redesigning the proposed ramp onto the new Electric Footbridge to minimise visual impacts from and to adjacent residential properties.
  - Incorporating applicable sections of the planned Musselburgh Active Toun project into the outline design, thereby reducing disturbance impacts associated with constructing each project at separate times.

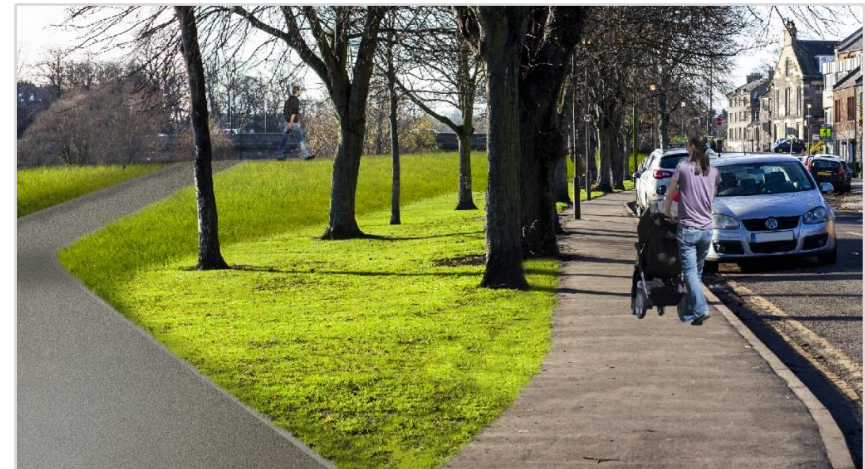


Photo 12: Photomontage of a ramp, raised walkway and embankment at Eskside West (looking southwest)

## Section 2: Environmental Impact Assessment Process



Image: Photomontage of new sea wall along the beach, looking east from Murdoch Green



## 2 Environmental Impact Assessment Process

### 2.1 Overview

Environmental Impact Assessment (EIA) was undertaken for the Scheme in accordance with the applicable EIA Regulations (SG 2010), which included the following stages:

- Preliminary Environmental Appraisal: a non-statutory stage undertaken to inform the options appraisal stage and identify a 'preferred scheme concept'.
- EIA Screening and Scoping: Screening to determine whether the Scheme should be considered "EIA Development"; and Scoping to determine the extent of environmental assessment required in consultation with the "consultative bodies", i.e. NatureScot (NS), Scottish Environment Protection Agency (SEPA), Historic Environment Scotland (HES), ELC planning authority and other organisations with an interest in the environmental effects of the Scheme.
- EIA Report: including a description of the Scheme, the likely significant effects, mitigation and compensation measures, as well as a description of the reasonable alternatives considered. The report must also include any monitoring measures of significant adverse effects on the environment of the Scheme and an NTS (this document).

The following subsections consider each of these stages in turn.

### 2.2 Preliminary Environmental Appraisal

The appraisal was conducted at the early design stages and informed the decision-making process on the Scheme options being considered,

influencing the design where possible to limit adverse effects on the environment.

### 2.3 EIA Screening

Once the Preferred Scheme concept was identified, the Screening and Scoping stage of the EIA process commenced, during which all the potential environmental receptors (e.g. sites designated for nature or heritage conservation, potential for protected species, Listed buildings, important views, noise sensitive receptors etc) that may be affected by the Scheme construction or operation were identified. Given the sensitivity of Musselburgh's built and natural environment (including nature conservation and heritage designations of international and national importance) and the Scheme's close proximity to residents, it was considered at an early stage that the proposed Scheme would have the potential to generate significant environmental effects, and the Scheme was accordingly regarded as EIA development.

### 2.4 EIA Scoping

An EIA Scoping Report was drafted in July 2020 and submitted to East Lothian Council for consideration by their Planning Department and relevant consultative bodies and stakeholder organisations; the report was then redrafted in Spring / Summer 2023 to account for Scheme changes and changes in policy, legislation and guidance relevant to the EIA. The Scoping Report provided a description of the alternative and Preferred Scheme options and outlined the environmental characteristics of the areas potentially affected by the Scheme. It then specified the proposed scope, extent and methods of environmental studies to be carried out as part of the EIA. The consultees were invited

to comment on the environmental baseline, the planned content of the EIA and the proposed assessment methods, and to provide additional relevant environmental information where appropriate.

## 2.5 EIA Report

### 2.5.1 Overview of the process

Once there was enough certainty around the Scheme outline design, likely construction methods and materials required, the EIA team completed their respective assessments. Each discipline required information on the current state of the environment to establish the environmental baseline (e.g. the presence of protected species, sensitive views or Listed buildings).

Figure 5 to Figure 9 on the following pages show some of the environmental constraints (or sensitive resources) that were identified and mapped during the desk-based appraisal (where digitised map data was available). The maps presented here mainly show the locations of sites designated for ecological or historical conservation and, as such, are for illustration purposes only and do not show all the environmental constraints pertinent to the EIA.

Some disciplines required site-based surveys to be undertaken (e.g. species or habitat surveys for the Biodiversity chapter) and each assessment was informed by additional data received from relevant organisations (e.g. traffic data from the Council) and guided by ongoing consultation with relevant stakeholders (e.g. NatureScot to agree the scope of surveys expected to be undertaken to inform the assessment of impacts on the Firth of Forth Special Protected Area).

The assessments were undertaken in accordance with the EIA Regulations, which require assessors to identify the sensitivity or value of the baseline receptor (i.e. the environmental feature that may be impacted) and the nature, scale and duration of the potential impacts associated with the construction and operation of the Scheme. The potential for cumulative impacts was also considered, which includes the combined effect of multiple impacts on single receptors as well as the combined effect of the Scheme along with other planned developments that may be constructed in the same time period.

Once the assessments were complete and potentially significant effects identified, each discipline had to develop mitigation measures designed to remove, minimise or offset effects. Where required, further tweaks were made to the design where opportunities were identified (e.g. changing the position of a flood wall or footpath to reduce impacts on important habitats).

After all mitigation measures had been identified and agreed with the project design team and East Lothian Council, the EIA team considered the mitigation proposals from other disciplines to ensure they were consistent and to consider whether such measures may produce further effects. The residual effects of the Scheme construction and operation were then identified, i.e. the remaining effects once mitigation is effectively applied, and any further monitoring, particularly where significant effects could not be avoided.



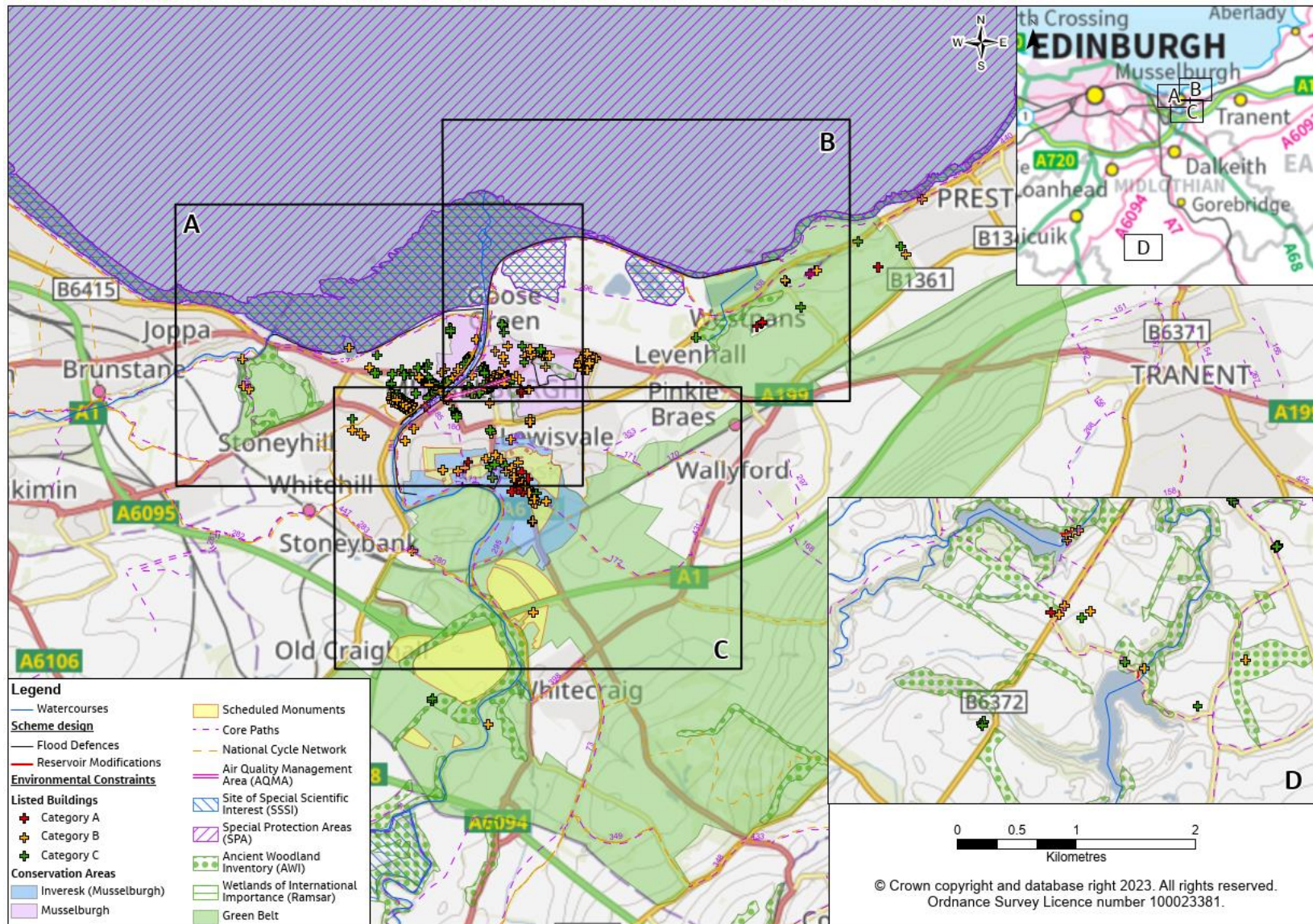


Figure 5: Desk-based environmental constraints (overview)



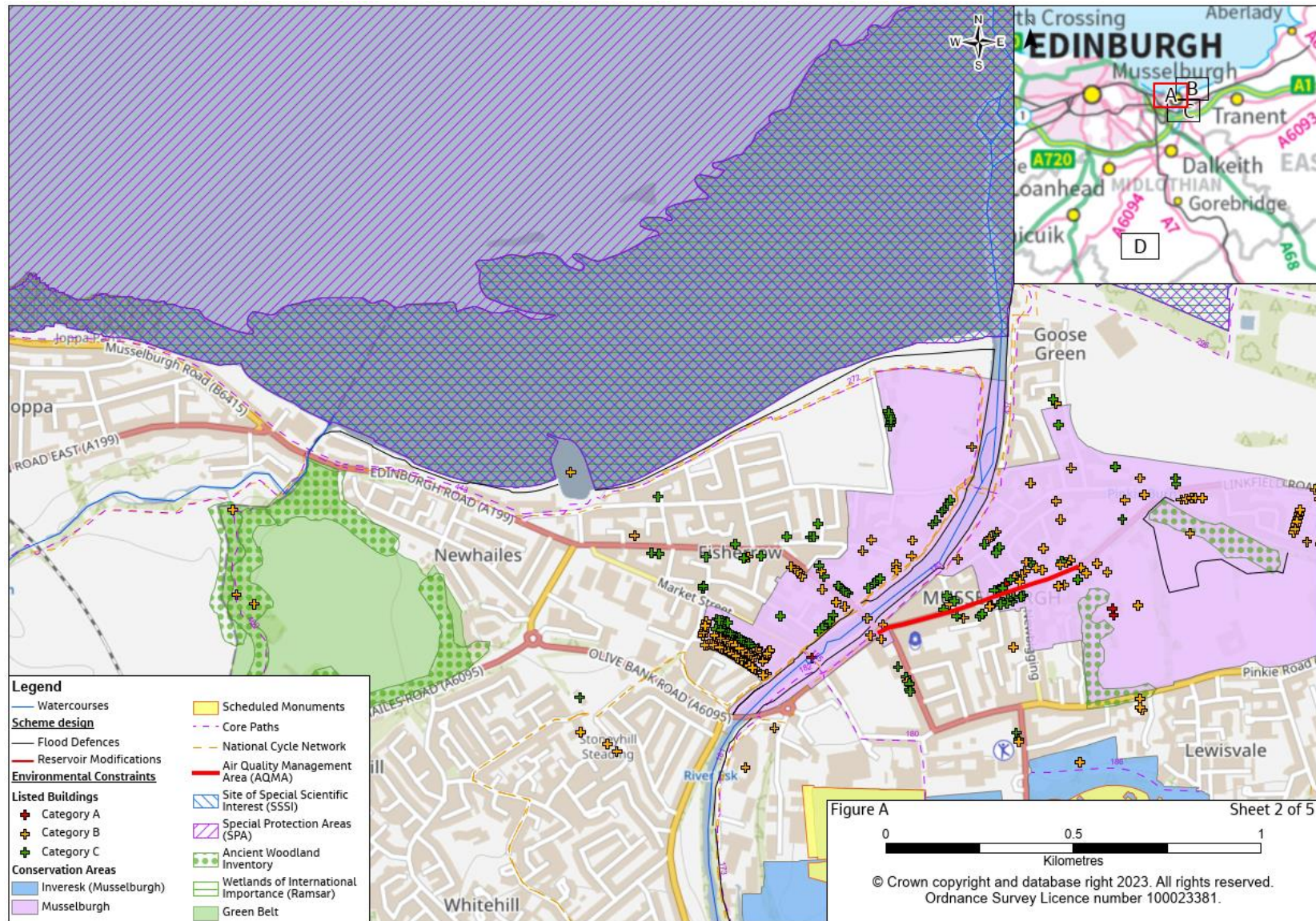


Figure 6: Desk-based environmental constraints (Area A)



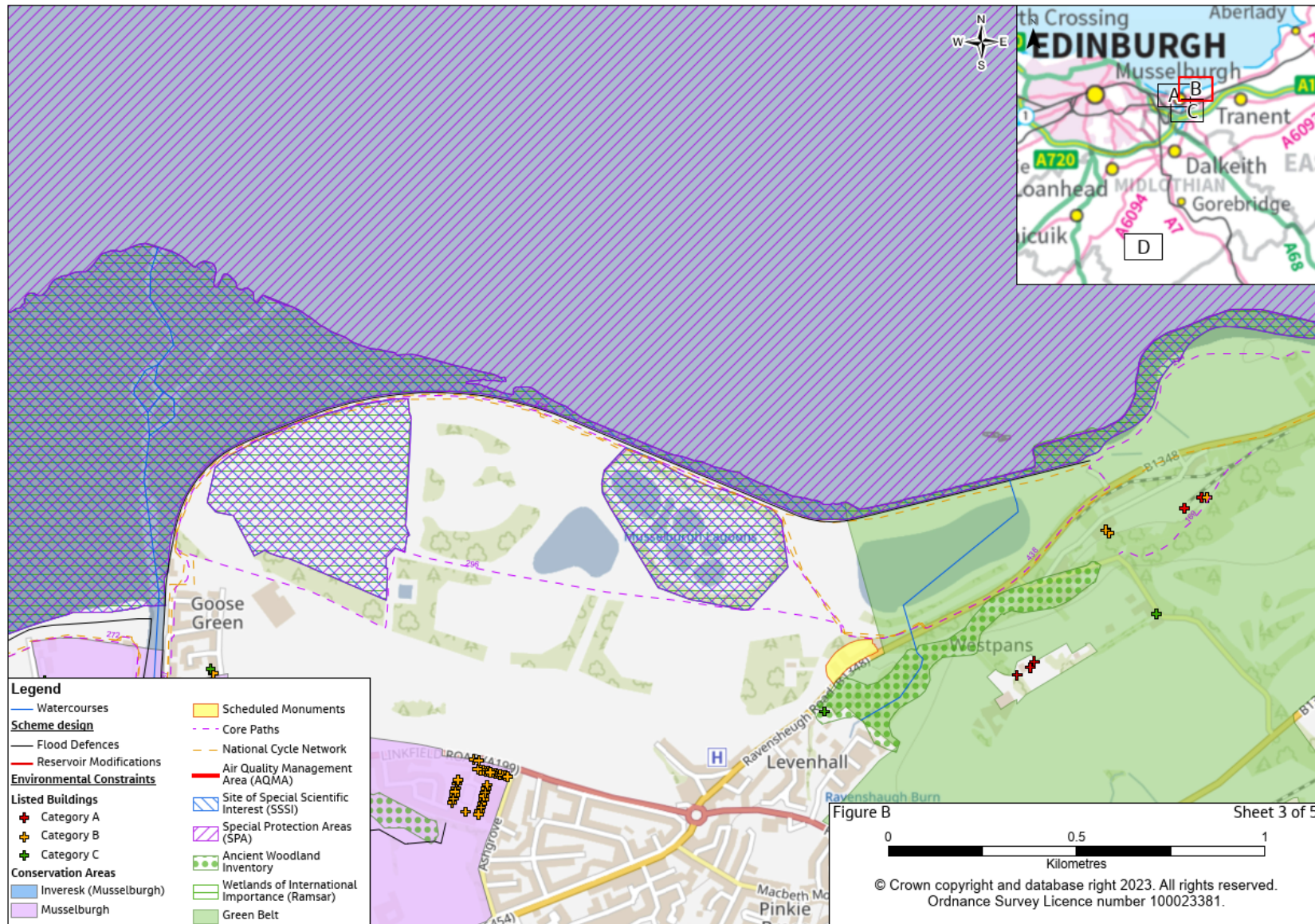


Figure 7: Desk-based environmental constraints (Area B)

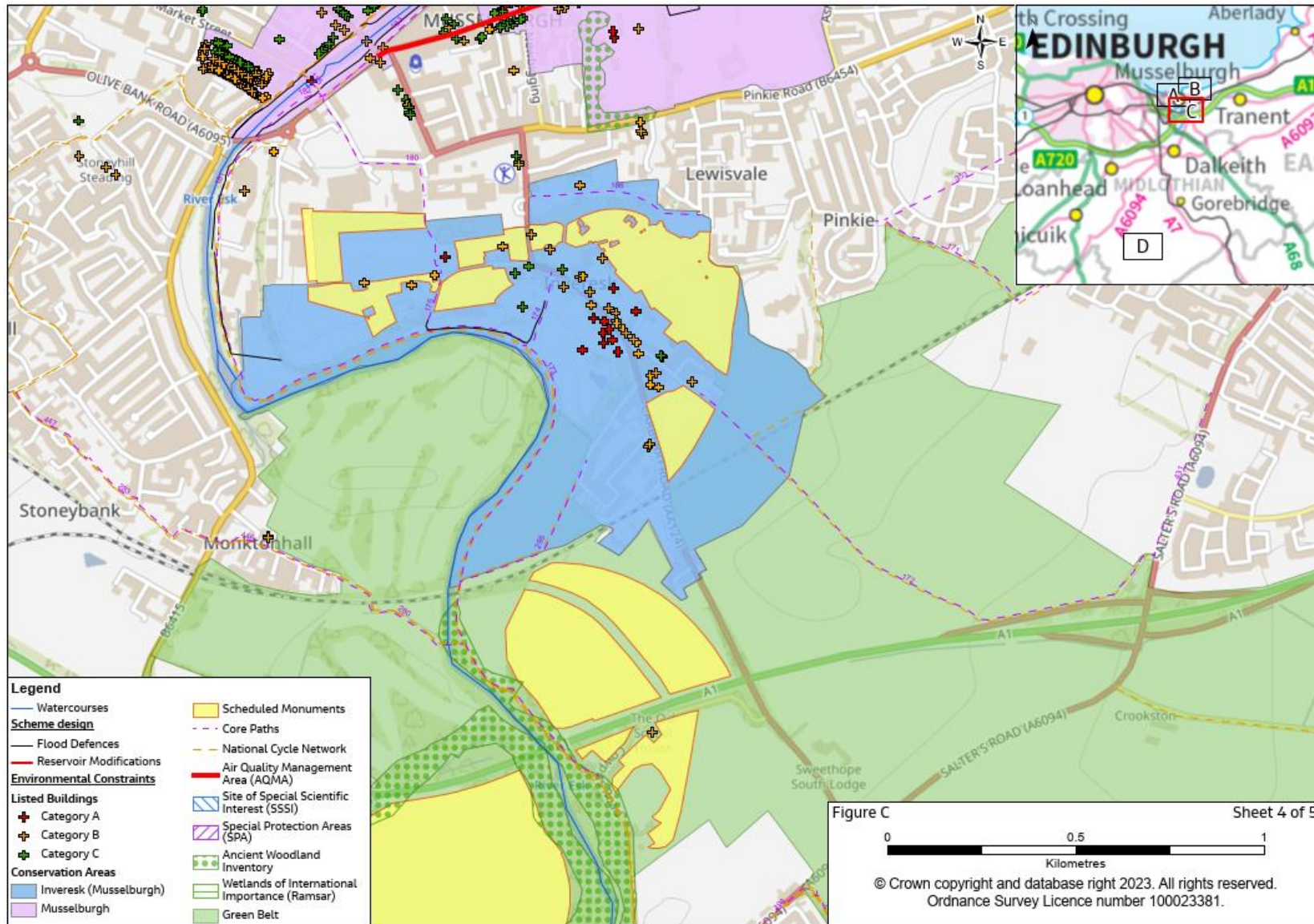


Figure 8: Desk-based environmental constraints (Area C)



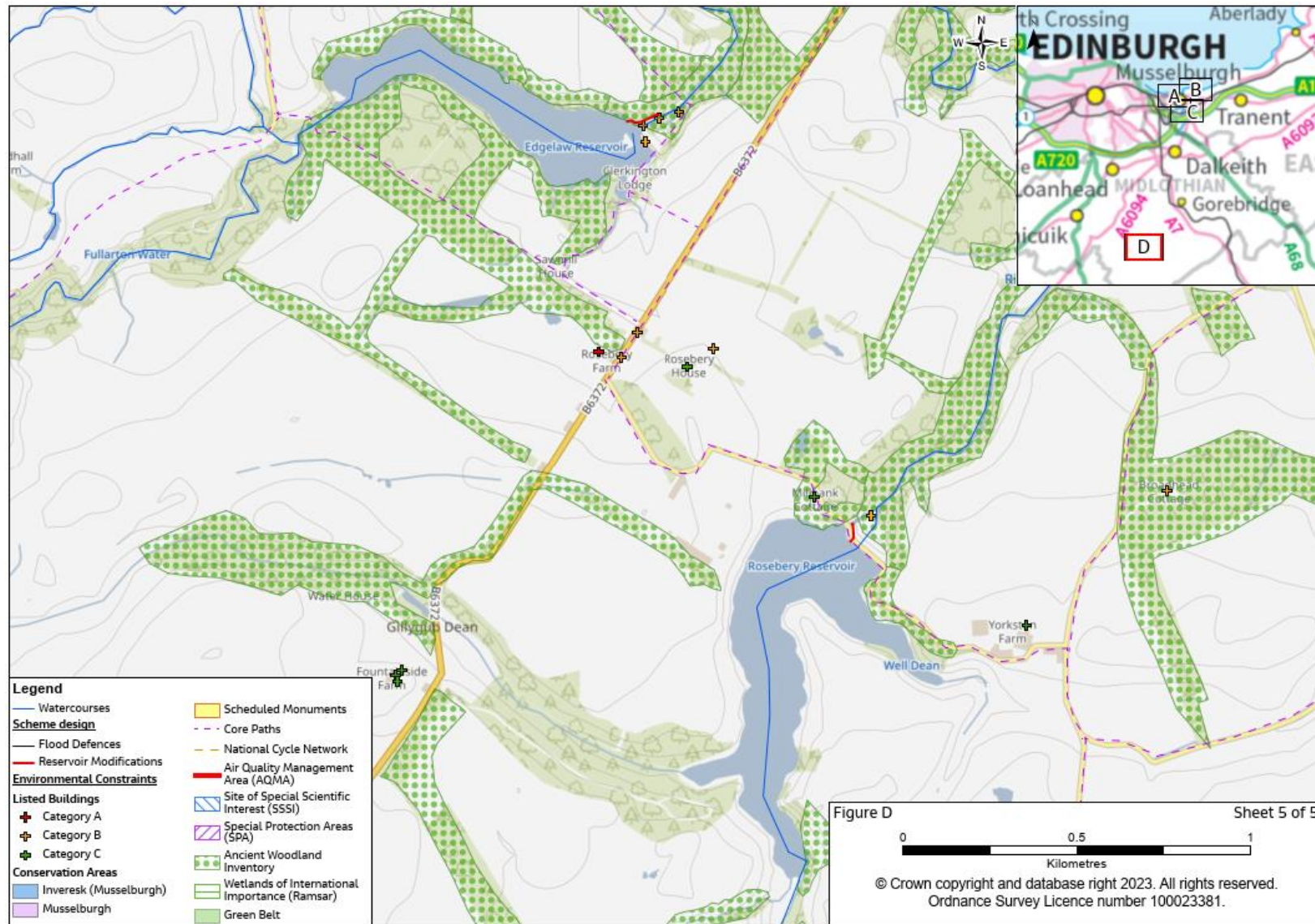


Figure 9: Desk-based environmental constraints (Area D; note: Local Biodiversity Sites present in area but not digitised in map)

## 2.5.2 Structure of the EIA Report

### 2.5.2.1 Introductory Chapters

These chapters (1-5) provide an overview of the need for the Scheme and background, the policy and legislative context, the EIA methodology, the outline design and its evolution (including a summary of the process undertaken to consider reasonable alternatives), and the consultation undertaken to influence the design and EIA methodologies adopted.

### 2.5.2.2 Technical Chapters

These chapters (6-14) include the separate environmental discipline assessments of construction and operation as follows:

- **Population and Human Health:** The assessment of how the Scheme could affect social, environmental and economic conditions, which in turn can affect the health and wellbeing of people in the community.
- **Biodiversity:** Assesses potential impacts of the Scheme on terrestrial, marine and freshwater species, habitats and ecosystems throughout all stages of the development (construction and operation).
- **Noise & Vibration:** Assesses potential effects on humans (disturbance) and buildings (damage).
- **Townscape and Visual Effects:** The assessment addresses potential impacts on townscape (as the resource, reviewing the character of the area, and the interplay between the physical, natural and

cultural elements of the townscape), and visual effects (specific views and on the general visual amenity experienced by people).

- **Water Environment:** assesses the potential impacts on the attributes of surface water quality and water supply, geomorphology (coastal, estuarine and fluvial), flood risk, and groundwater.
- **Land Contamination:** assesses the potential effects associated with its industrial legacy including Magdalene Chemical Works, Levenhall Ash Lagoons, Inveresk Paper Mill, Esk Net Mills, Musselburgh Wire and Wire Rope Works, Musselburgh Gas Works, coal mining, other mineral extraction activities and a range of other activities including breweries, tanneries and dyeworks.
- **Air Quality and Climate Change:** Assesses the potential for the release of pollutants to the atmosphere during construction and operation that may lead to adverse effects on local air quality (dust and vehicle exhaust fumes) and / or those that would contribute to climate change (greenhouse gases).
- **Cultural Heritage:** The assessment considers the potential impacts and effects of the Scheme on the historic environment including archaeological remains, historic buildings and other structures and historic landscapes.
- **Traffic and Transportation:** The chapter assesses impacts on the road network from construction related traffic and the impact of Scheme construction and operation on active travel routes. An assessment of the post construction impacts of making Eskside West (from Market Street to Bridge Street), Hercus Loan (from South Street to Eskside West), and South Street (from Bridge Street to Hercus Loan) into one-way streets.



### 2.5.2.3 Cumulative Effects

The technical chapters assess the potential for cumulative effects on individual receptors, e.g. the effect of multiple impacts associated with Scheme construction or operation on water bodies or sites designated for nature conservation. Chapter 15: Cumulative Effects summarises the assessment of impacts that may occur as a result of the combination of impacts from the Scheme (same project) as well as those of the Scheme combined with those of other projects and plans (other project).

### 2.5.2.4 Concluding Chapters

The first concluding chapter (16) summarises the key assessment outcomes of the EIA for each environmental discipline listing the potential significant effects, the proposed mitigation to address such effects and the residual effects once the mitigation is applied. It also lists the monitoring measures that will be required to check whether significant effects may occur that were not identified with enough certainty at the time of the EIA.

The final chapter (17) list the committed mitigation and enhancement measures that are to be adopted during the detailed design, procurement, construction and operation (maintenance) phases of the Scheme including any monitoring measures.

### 2.5.2.5 Non-Technical Summary

Under the EIA Regulations (SG 2010), the minimum requirements of this Non-Technical Summary report are to provide:

- a description of the Scheme including information on the site, design, size, and other relevant features,
- description of the likely significant effects on the environment,
- a description of the measures envisaged to avoid, prevent or reduce and, if possible, offset likely significant adverse effects on the environment, and
- a description of the reasonable alternatives relevant to the Scheme and its specific characteristics, and an indication of the main reasons for the option chosen, taking into account the effects of the project on the environment.

Given the scale of the Scheme and the assessment undertaken, only a brief summary of the Scheme is provided above with the key effects, mitigation and residual effects being presented in the following section.

## Section 3: Summary of Environmental Assessment

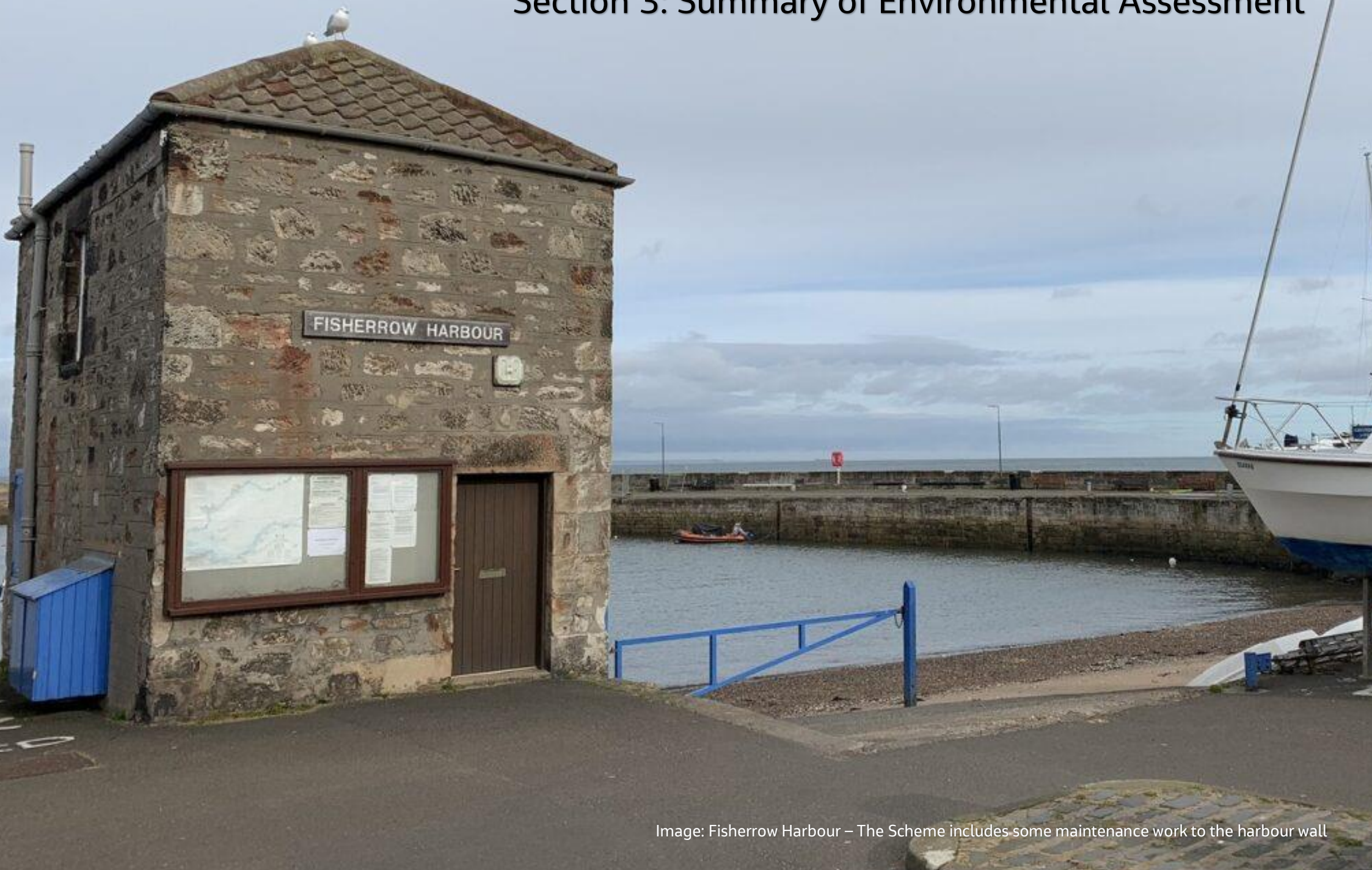


Image: Fisherrow Harbour – The Scheme includes some maintenance work to the harbour wall



## 3 Summary of Environmental Assessment

### 3.1 Introduction

The EIA for each environmental discipline identified all the environmental receptors - including human beings - that may be affected by the scheme construction and operation (the baseline). The value or sensitivity of each receptor was considered in relation to the magnitude (character, scale and duration) of likely impacts, which identified all adverse and beneficial effects. In the EIA Report, all effects are identified as being significant or not significant.

This section summarises only the potentially significant effects identified by each of the environmental disciplines (i.e. impacts or effects of negligible or minor significance are not listed – please refer to the EIA Report for details).

The committed mitigation and monitoring measures are then listed in summary along with a summary of any residual potentially significant effects (i.e. those that cannot be fully mitigated).

### 3.2 Population and Human Health

#### 3.2.1 Potentially significant effects

During construction, the following potentially significant effects may occur:

- Risk to health from major flood event
- Risk of contamination from liquified ash due to storm surge overtopping defences

- Safety risks posed by construction site and activities (public including children)
- Higher than average risk of suicide (Construction workers)
- Short to medium term reduction in access to recreational space (particularly children)
- Disturbance during construction relating to noise, dust, visual intrusion and construction traffic (particularly sensitive individuals such as those with autism)

No significant adverse effects are anticipated during operation.

#### 3.2.2 Mitigation and monitoring

Mitigation measures to address potentially significant effects include:

- Emergency response planning
- Improvements to the sea wall
- Construction health & safety plans. Sites to be fenced off. Use of banksmen. Information to schools on risks
- Mental health support included in Health & Wellbeing Plan
- Community Liaison Officer and consultation with community
- Noise and dust mitigation measures in place

#### 3.2.3 Potentially significant residual effects

Significant residual effects remain in the unlikely event of a major flood event during construction (medium risk) and the health effects of reduced access to green and recreational space and disturbance to residents due to construction impacts (noise, dust, traffic etc.).

During operation significant effects include the positive impact on health through improved flood protection and enhanced opportunities for physical activity due to the new footways and cycleways included in the Scheme design.

A community liaison manager will also be required during the construction phase to understand community concerns as they arise and to make sure they are appropriately responded to.

### 3.3 Biodiversity

#### 3.3.1 Potentially significant effects

Potentially significant effects were identified in relation to the following:

- Habitat loss (20.3 ha of vegetated areas), disturbance and pollution to Firth of Forth SPA/RAMSAR/SSSI, Outer Firth of Forth and St Andrews Bay Complex SPA and the River Esk Valley Local Biodiversity Site.
- Habitat disturbance and loss including woodland/ancient woodland, standing/running water habitats.
- Protected species including Bats, Otter, Kingfisher, Wetland Birds and fish species.
- The potential spread of invasive plant species during construction.

#### 3.3.2 Mitigation and monitoring

Mitigation measures to be implemented during the construction phase of the Scheme include visual and noise screening, soft start piling techniques, timing of works to avoid sensitive periods, preparing protected species plans where required and incorporating pollution

prevention measures within a Construction Environment Management Plan.

Compensatory measures are proposed to offset the adverse effects of temporary and permanent habitat loss, including a 3:1 ratio replacement for lost woodland areas (~2.0 ha). The replacement planting covers approximately 22.0 ha (including ~7.5 ha new woodland), representing a gain in area for habitats of high biodiversity value such as woodland, scrub, wetlands, dune grassland and hedgerows.

One of the key requirements introduced in Scotland through the National Planning Framework 4 was that new developments must achieve *Positive Effects for Biodiversity* (SG 2023). As such, in addition to providing appropriate planting to compensate for vegetation lost, further enhancement measures for habitats and species important to conservation have been adopted.

The biodiversity enhancement proposals currently include converting approximately 4.6 ha of land currently dominated by habitats of low biodiversity value (such as amenity grassland) into habitats of higher biodiversity value, such as woodland or species rich grassland. Measures aimed at providing positive effects for species, such as bees, bats or birds, are also proposed.

An Outline Landscape and Habitat Management Plan shall be prepared to specify all the landscaping and habitat measures to be adopted (see Table 1 and Figure 10 to Figure 13 for indicative planting scheme).

A monitoring plan will also be implemented to determine the effectiveness of the mitigation and compensation measures, thereby



allowing for modification or improvement of the proposed measures to improve their success where required and/or feasible.

### **3.3.3 Potentially significant residual effects**

Significant residual adverse effects during the construction and operational phases are predicted in relation to the loss of woodland habitat (temporary; positive in long-term) and ancient woodland (long term; irreplaceable).

Once replacement planting becomes established, there will be a long-term positive effect.

## **3.4 Noise and Vibration**

### **3.4.1 Potentially significant effects**

Potentially significant effects are predicted in relation to vibration effects adversely affecting buildings (cosmetic damage) during vibratory construction activities.

### **3.4.2 Mitigation and monitoring**

Mitigation measures to reduce the impacts of vibration upon buildings and structures include:

- use of 'soft-start' piling techniques to reduce the vibration impacts generated by start-up and ramp down of the piling rig;
- pre-augering or pre-excavation of pile route to remove obstructions and reduce the potential for high vibration events and increase the rate of pile insertion; and,

- where vibratory piling is proposed, use an alternative method of piling (such as press piling) for piling near to sensitive buildings or structures.

A noise and vibration monitoring plan shall be prepared and implemented during the construction phase, which would include standard industry methods for avoiding noise and vibration including the use of temporary noise screens where appropriate.

### **3.4.3 Potentially significant residual effects**

With effective mitigation, there are predicted to be no significant residual effects.

## **3.5 Townscape and Visual Impact Assessment**

### **3.5.1 Potentially significant effects**

Potentially significant effects are predicted in relation to the impacts on the townscape and views from key viewpoints during construction (and some years during operation) associated with construction works (the presence of construction plant and features) and the removal of roadside and riverside vegetation, loss of woodland and amenity trees, the loss of vegetative screening in certain locations and the finished works.

### **3.5.2 Mitigation and monitoring**

In addition to standard construction practice of screening construction sites, a Landscape and Habitat Management Plan will be implemented to detail the soft landscaping requirements for the Scheme and inform

the associated maintenance and management operations (see Table 1 and Figure 10 to Figure 13 below for interim planting proposals).

### **3.5.3 Potentially significant residual effects**

Significant effects on the townscape, landscape and views are unavoidable during construction, with some significant effects persisting until vegetation becomes established and the LHMP measures become embedded in the landscape.

In some areas, it is also due to the size of the flood defences and their associated impact on views. Again, once any screening vegetation matures, such effects are predicted to no longer be significant, while in some areas where additional areas of planting, improved biodiversity, improved quality of paths and better connectivity are provided, residual effects will be beneficial over time.

## **3.6 Water Environment**

### **3.6.1 Potentially significant effects**

Potentially significant effects were identified for surface waters (geomorphology, water quality and water supply) during the construction phase due to activities such as near water or in-channel working and accidental spillages. For groundwater, significant effects are associated with removing groundwater (dewatering) from excavations along the riverbanks or from discharges of contaminated groundwater. Flood risk during construction may be exacerbated by in-channel working in the fluvial and estuarine sections of the Scheme due to loss of channel capacity and floodplain storage.

During operation, significant effects to fluvial geomorphology may occur due to permanent changes to the channel width and depth leading to alterations in flow velocities and discharges.

### **3.6.2 Mitigation and monitoring**

Mitigation measures during construction would be provided within a Construction Environmental Management Plan (CEMP) which would include measures for surface water (quality and supply), geomorphology, flood risk and groundwater.

Monitoring is recommended prior to, during and post-construction for water quality in locations affected by the Scheme.

### **3.6.3 Potentially significant residual effects**

With the implementation of mitigation measures during construction and operation, all potential significant effects would be avoided or reduced.

## **3.7 Land Contamination**

### **3.7.1 Potentially significant effects**

Potentially significant effects were identified in relation to Land Contamination as follows:

- Harm to Human Health
- Pollution of Groundwater
- Pollution of Surface Water (Firth of Forth, River Esk, River South Esk, Redside Burn)
- Pollution of Firth of Forth SSSI (Ecological Receptor)



- Damage to integrity of Scheme infrastructure

### 3.7.2 Mitigation and monitoring

Prior to construction, detailed risk assessments and, where appropriate, additional targeted ground investigations to determine the extent and type of contaminants present and ground gas/ groundwater monitoring will be specified. Where required, contaminated land will then be remediated. During construction, training will be delivered to contractors along with appropriate monitoring. The contractor will also be required to produce a Site Waste Management Plan (SWMP) in consultation with SEPA, which will inform how waste materials are managed, stored or reused, how standing water is managed and how any asbestos that may be present is managed.

### 3.7.3 Potentially significant residual effects

Assuming the effective delivery of the proposed mitigation, monitoring and adherence to industry standard practices, no significant residual effects are anticipated.

## 3.8 Air Quality and Climate Change

### 3.8.1 Potentially significant effects

The assessment identified potentially significant effects in relation to construction dust emissions (affecting amenity, human health and vegetation) and greenhouse gas emissions affecting global climate.

### 3.8.2 Mitigation and monitoring

A Dust Management Plan shall be prepared by the appointed contractor(s), while a Carbon Management Plan (to PAS2080 industry

standard) shall be adopted to influence the detailed design, procurement, construction and operation (maintenance) phases of the Scheme.

### 3.8.3 Potentially significant residual effects

Assuming the effective implementation of the proposed mitigation, it is assessed that dust and greenhouse gas emissions shall be reduced to ensure no residual effects of significance remain.

## 3.9 Cultural Heritage

### 3.9.1 Potentially significant effects

The cultural heritage assessment identified potentially significant effects during construction at:

- two archaeological remains sites (disturbance),
- nine historic buildings (vibration), and
- three historic landscapes (setting).

During operation, significant adverse effects are anticipated on the setting of three historic landscapes.

### 3.9.2 Mitigation and monitoring

Mitigation includes maintaining a watching brief (monitoring of heritage assets on site) for the recording of buried remains along much of the river corridor. In other areas, archaeological investigation will take place to determine the need for and scope of mitigation. Historic building mitigation is described in Section 3.4.2 to soften vibration impacts.

### 3.9.3 Potentially significant residual effects

The mitigation measures applied will reduce or remove any damage to historic assets such that no significant adverse effects remain. Significant positive effects are reported for built heritage and historical landscapes once the Scheme is constructed and potential long-term flood related impacts are removed.

## 3.10 Traffic and Transportation

### 3.10.1 Potentially significant effects

Potentially significant effects are identified for the following:

- Pedestrian Amenity at 14 locations
- Fear and intimidation at 15 locations
- Accidents and safety at 15 locations
- Active travel at 14 locations

### 3.10.2 Mitigation and monitoring

Mitigation includes implementing a Construction Traffic Management Plan incorporating traffic management measures and temporary diversions where required.

### 3.10.3 Potentially significant residual effects

Residual effects will be minor and not significant.

## 3.11 Cumulative Effects

### 3.11.1 Potentially significant effects

The assessment of cumulative effects undertaken did not identify any potential significant effects in relation to other developments that may be constructed simultaneously with the Scheme. The potential for cumulative 'same project' effects identified potential cumulative effects, which were assessed in the discipline chapters and addressed accordingly.

### 3.11.2 Mitigation and monitoring

No additional mitigation was required to address cumulative effects. Monitoring of the development landscape will be required prior to construction to ensure no previously unidentified cumulative effects arise due to simultaneous construction in the Scheme area.

### 3.11.3 Potentially significant residual effects

No significant residual cumulative effects are predicted.



Table 1: Interim list of areas identified for landscape measures and habitat management (compensation and enhancement)

Zone and Planting Type	Area (ha)	Coverage (%)
Zone A: River Esk corridor – Low or High Riparian Planting	0.32	100%
Zone A: River Esk corridor – Low or High Riparian Planting	0.17	100%
Zone A: River Esk corridor – Low or High Riparian Planting	0.05	100%
Zone D: Haugh Park - Amenity Urban Park	0.41	30% woodland, 30% wildflower, 10% species rich grassland, 30% amenity grass
Zone C: The Valley Woodland Garden – Amenity Woodland Park	1.20	40% woodland, 20% wetland, 20% wildflower, 20% species rich grassland
Zone A: River Esk corridor – Low or High Riparian Planting	0.29	100%
Zone A: River Esk corridor – Low or High Riparian Planting	0.30	100%
Zone F: Mall Avenue/Eskside West - Streetscape Planting/ Amenity Urban Park	0.20	10% swale planting 10% herbaceous planting, 80% amenity grass, and 4 new trees
Zone F: Mall Avenue/Eskside West - Streetscape Planting/ Amenity Urban Park	0.20	10% swale planting 10% herbaceous planting, 80% amenity grass and 4 new trees
Zone E: Town Centre River Corridor – Streetscape Planting	0.08	25% swale planting 35% shrub planting, 50% amenity grass and 20 new trees
Zone A: River Esk corridor – Low or High Riparian Planting	0.11	100%
Zone E: Town Centre River Corridor – Streetscape Planting	0.14	25% swale planting 35% shrub planting, 50% amenity grass and 20 new trees
Zone E: Town Centre River Corridor – Streetscape Planting	0.20	25% swale planting 35% shrub planting, 50% amenity grass and 20 new trees
Zone A: River Esk corridor – Low or High Riparian Planting	0.10	100%
Zone E: Town Centre River Corridor – Streetscape Planting	0.15	25% swale planting 35% shrub planting, 50% amenity grass and 20 new trees
Zone E: Town Centre River Corridor – Streetscape Planting	0.23	25% swale planting 35% shrub planting, 50% amenity grass and 20 new trees
Zone E: Town Centre River Corridor – Streetscape Planting	0.23	25% swale planting 35% shrub planting, 50% amenity grass and 20 new trees
Zone G: Fisherrow Sands/Firth of Forth - Coastal Amenity Planting	1.48	20% Trees, 15% wildflower, 15% shrub planting, 50% amenity grass
Zone H: Sands/Firth of Forth – Coastal Planting	1.16	100%
Zone I: Fisherrow Links - Amenity Urban Park	1.17	50% amenity grass, 30% species rich grassland, 20% shrub/hedge planting and 20 trees
Zone G: Fisherrow Sands/Firth of Forth - Coastal Amenity Planting	0.71	20% Trees, 15% wildflower, 15% shrub planting, 50% amenity grass

Zone J: Fisherrow Harbour - Streetscape Planting	1.01	5% amenity grass, 5% shrub planting (rest hard standing) and 3 trees
Zone H: Sands/Firth of Forth – Coastal Planting	0.28	100%
Zone K: Murdoch Green - Amenity Urban Park	0.30	40% amenity grass, 30% shrub planting (30% hard standing) and 6 trees
Zone H: Sands/Firth of Forth – Coastal Planting	0.14	100%
Zone L: Brunstane Burn – Low or High Riparian Planting	0.07	100%
Zone L: Brunstane Burn – Low or High Riparian Planting	0.01	100%
Zone N: Pinkie Burn – Low or High Riparian Planting/ Ancient Woodland	0.06	100%
Zone O: Pinkie GDL - Amenity Urban Park	1.90	80% amenity grass, 20% species rich grass (on embankments), and 10 trees
Zone P: Inveresk Village - Streetscape Planting	0.24	50% amenity grass, 20% species rich grass (between 2 walls) 10% woodland (20% hard standing)
Zone P: Inveresk Village - Streetscape Planting	0.26	50% amenity grass, 20% species rich grass (between 2 walls) 10% woodland (20% hard standing)
Zone A: River Esk corridor – Low or High Riparian Planting	0.13	100%
Zone Q: Whitecraigs – Ancient Woodland	0.22	100%
Zone Q: Whitecraigs – Ancient Woodland	0.05	100%
Zone S: Rosebery Reservoir – Bankside Vegetation	12.07	100%
Zone E: Town Centre River Corridor – Streetscape Planting	0.02	25% swale planting 35% shrub planting, 50% amenity grass and 20 new trees
Zone F: Mall Avenue/Eskside West - Streetscape Planting/ Amenity Urban Park	0.26	10% swale planting 10% herbaceous planting, 80% amenity grass and 4 new trees
Zone E: Town Centre River Corridor – Streetscape Planting	0.02	25% swale planting 35% shrub planting, 50% amenity grass and 20 new trees
Zone E: Town Centre River Corridor – Streetscape Planting	0.10	25% swale planting 35% shrub planting, 50% amenity grass and 20 new trees
Zone M: Levenhall Links – Woodland and Hedgerow Planting	4.88	100 additional trees
Zone B: River Esk corridor – Woodland Planting	2.23	100%
Zone B: River Esk corridor – Woodland Planting	1.08	100%
Zone B: River Esk corridor – Woodland Planting	2.32	100%
Zone R: Edgelaw Reservoir – Bankside Vegetation/ Ancient Woodland	11.80	100%



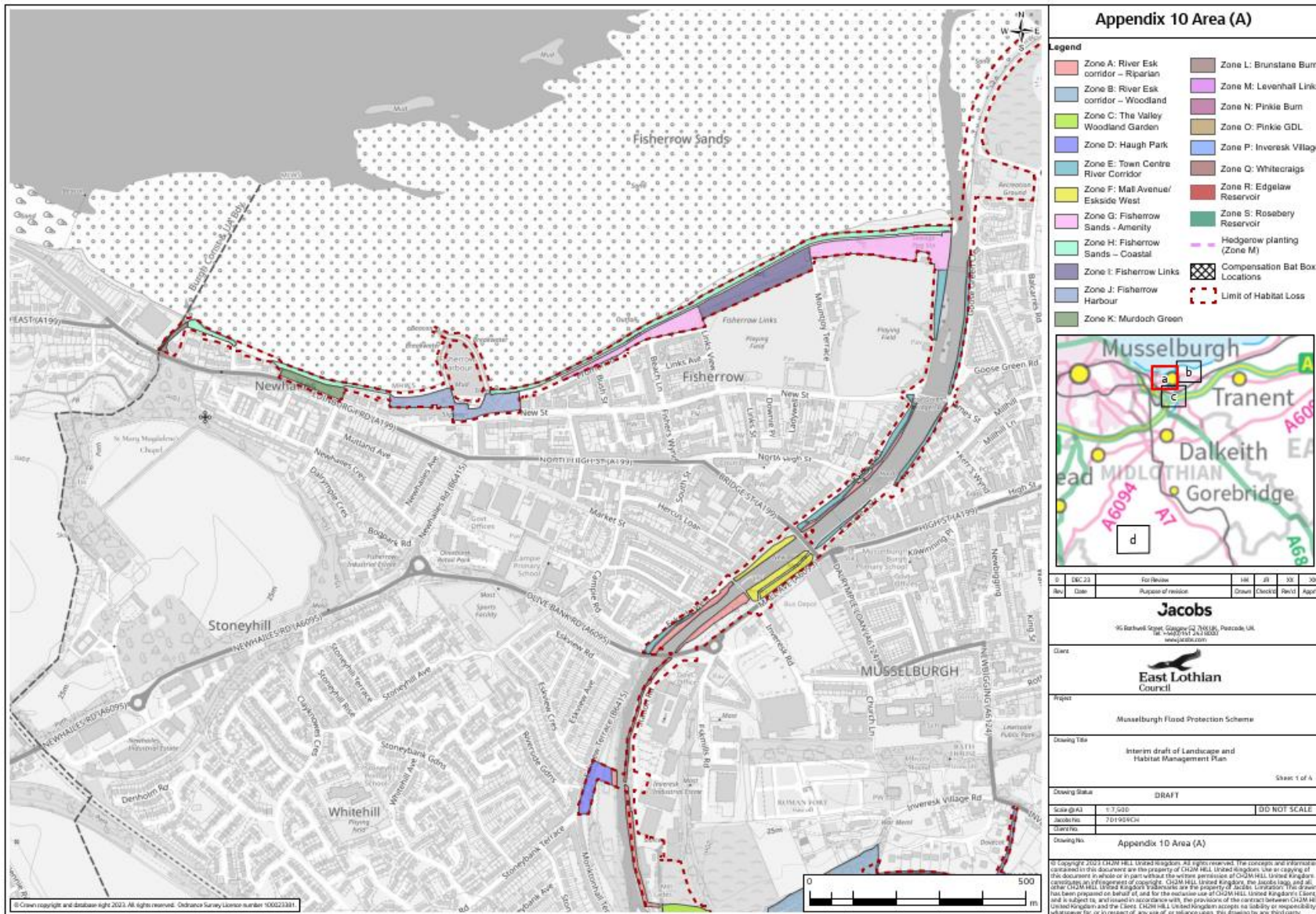


Figure 10: Plan showing zones identified for landscaping and habitat management (Area A; see Table 1 for details)

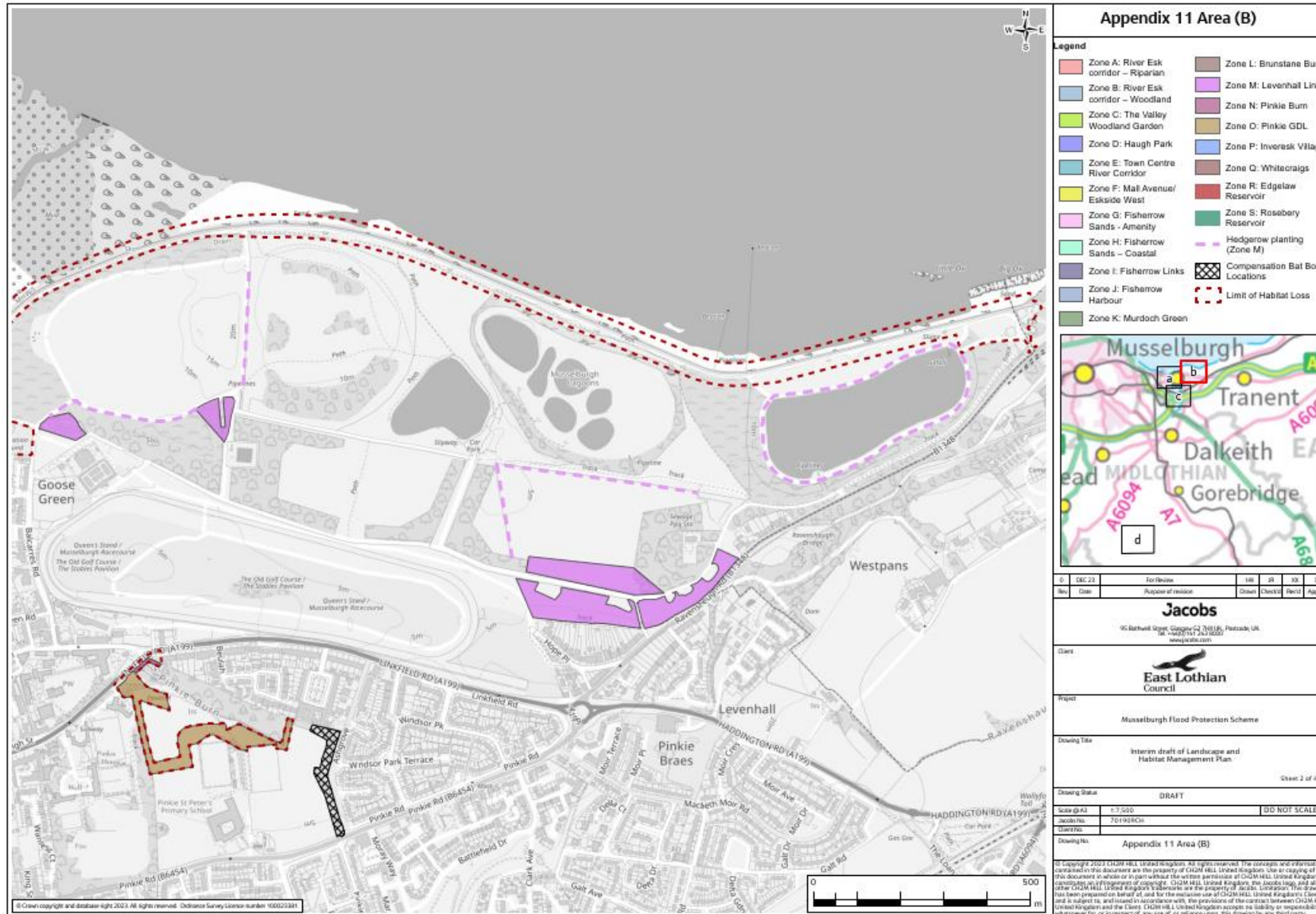


Figure 11: Plan showing zones identified for landscaping and habitat management (Area B)



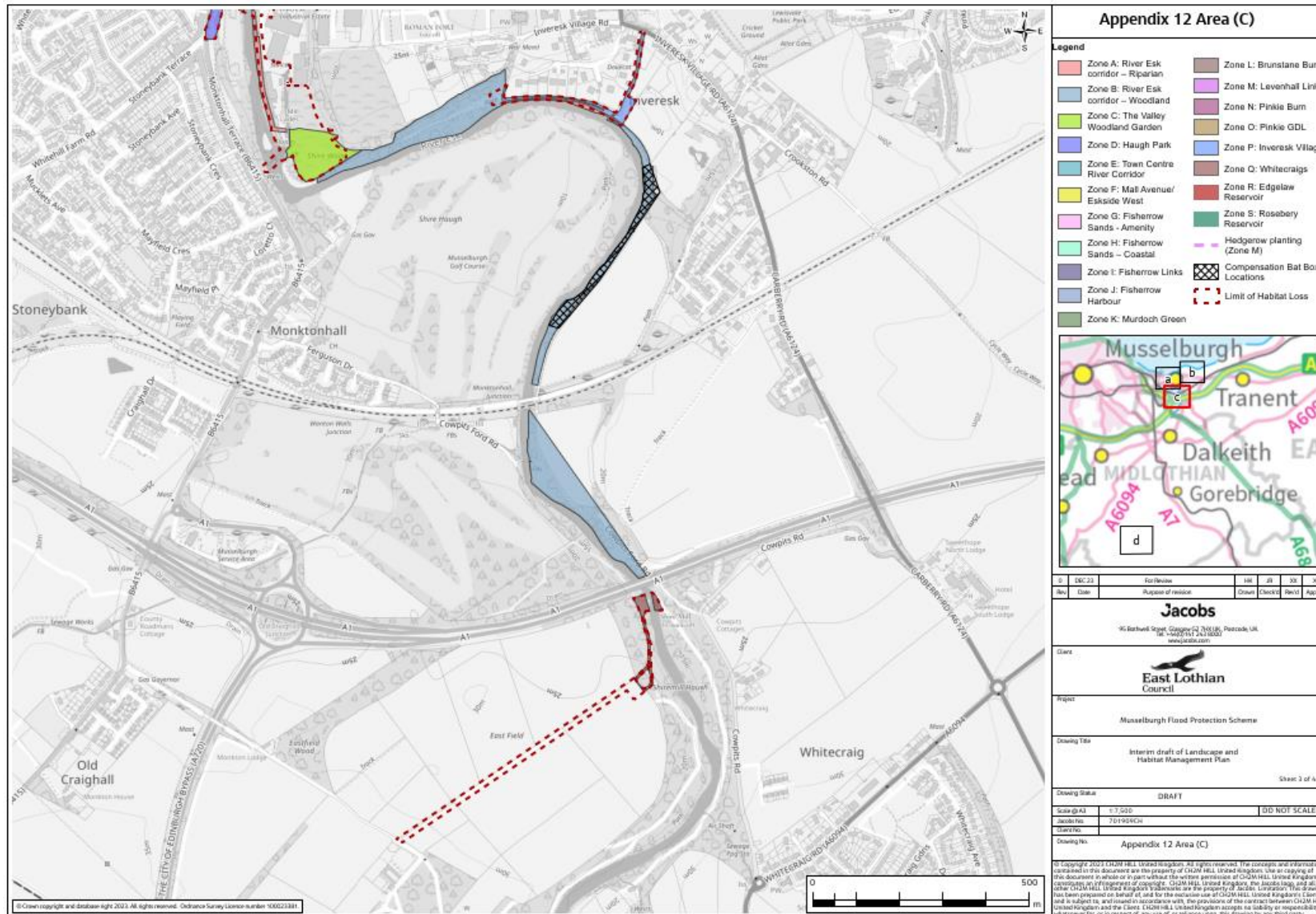


Figure 12: Plan showing zones identified for landscaping and habitat management (Area C)

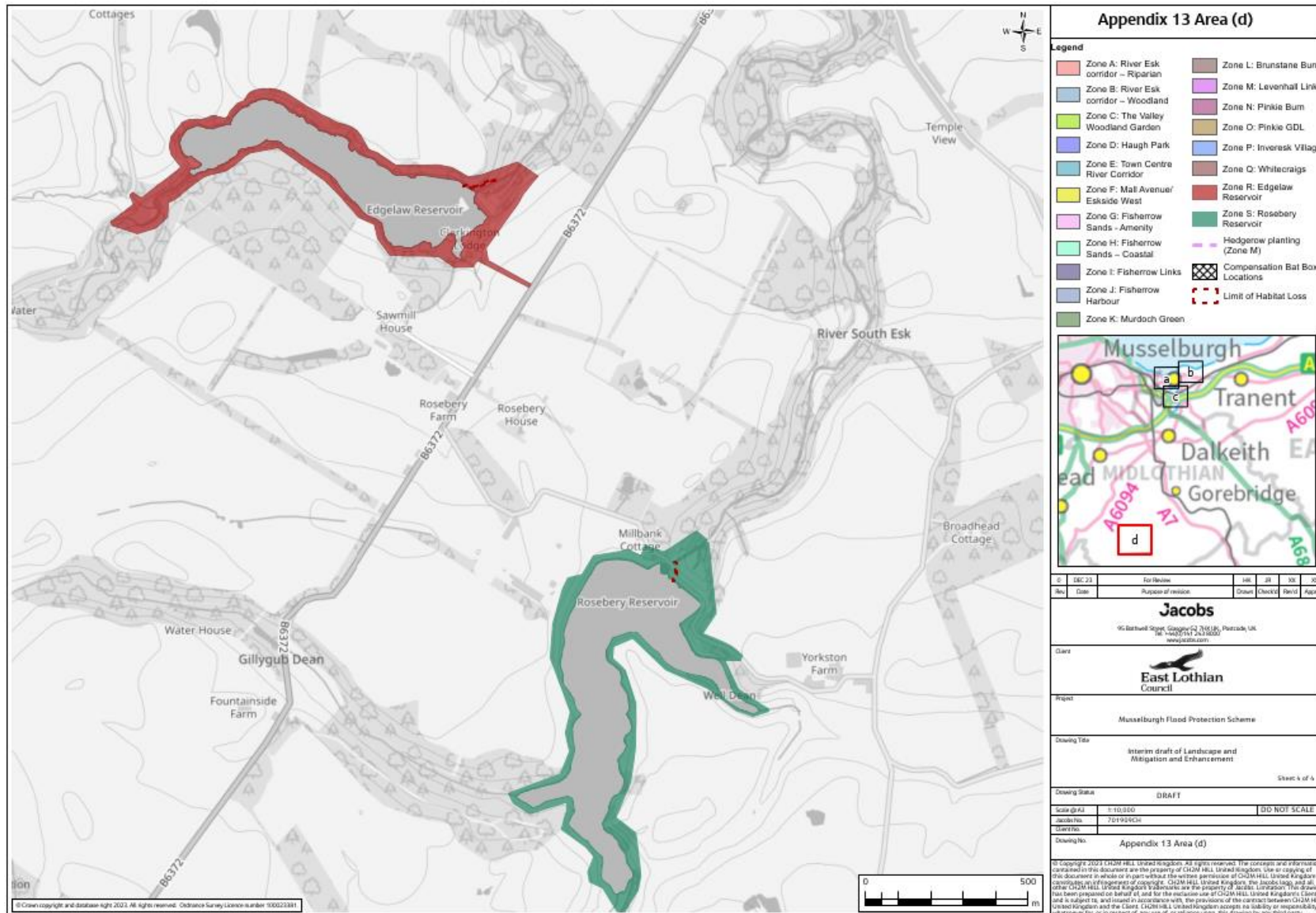


Figure 13: Plan showing zones identified for landscaping and habitat management (Area D)



## 4 References

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