Lower Darent Riverside Strategy

February 2024

DARTFORD BOROUGH COUNCIL

Environment Agency

ARUP

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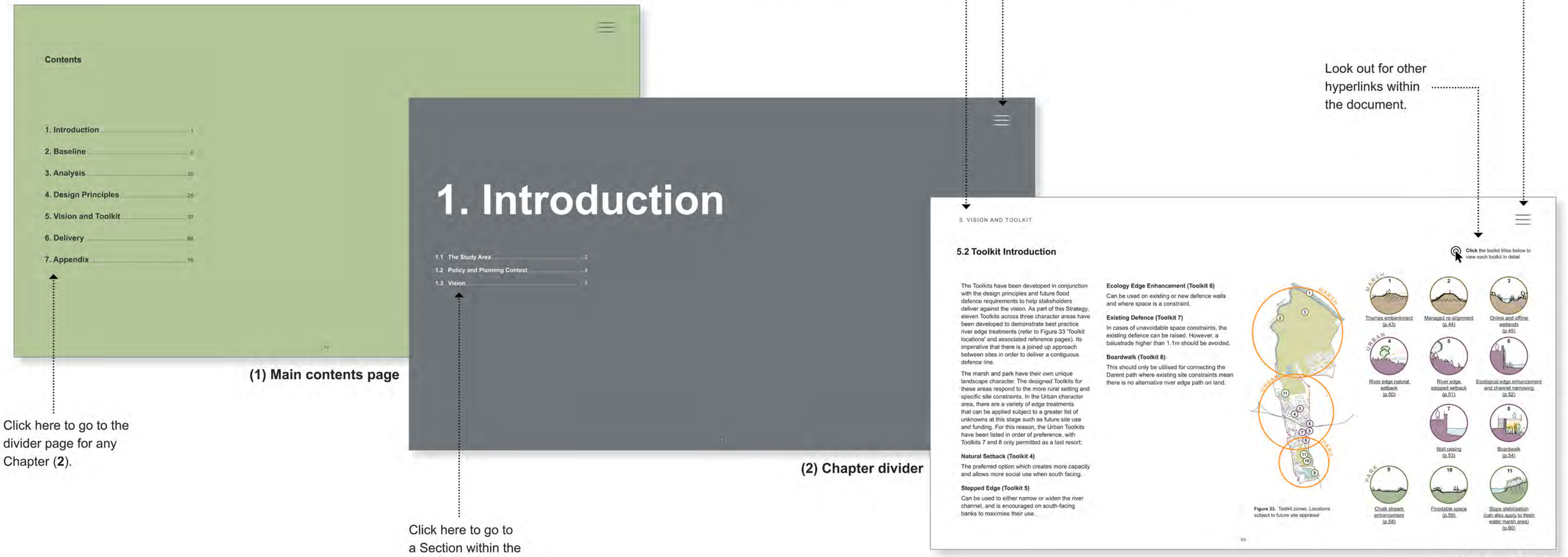

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Statement of Support

The River Strategy

The River Darent and the River Thames have been key factors in the development and prosperity of Dartford throughout its history and while they have brought many benefits and opportunities, they also bring with them the challenge of flooding. As the Thames Estuary 2100 Plan has shown, this challenge will increase with climate change and addressing it will require bold and innovative approaches to land use around the rivers.

Dartford Borough Council has recognised that new development in Dartford Town Centre presents a unique opportunity to reshape the riverside to meet the challenge of flooding and provide benefits to people, the economy and the environment. We are very pleased to have worked in partnership with them to ensure that the Lower Darent Riverside Strategy complements the wider aspirations of the Thames Estuary 2100 Plan.

The Strategy will improve Dartford's resilience to extreme weather in our changing climate, with an emphasis on integrating nature-based solutions to enable nature recovery and biodiversity net gain.

Collaboratively planning flood defence improvements with Dartford Borough Council will not only enhance flood risk management but also synergize with broader public advantages for the local economy, social wellbeing, amenities, and heritage preservation.

We commend Dartford's forward-thinking attitude in commissioning Arup to produce the Lower Darent Riverside Strategy and expect it to be a template to guide other councils in making our riversides fit for the future.

Michael Wilkinson

Flood and Coastal Risk Management Advisor

Environment Agency

Contents

1. Introduction

1.1 The Study Area

Dartford Borough is the second fastest growing borough in England, its population growing by 20% in the ten years to 2021 (Office for National Statistics) and is projected to continue to grow rapidly. Due to its location, the town of Dartford is also prone to tidal, fluvial, and pluvial flooding. The rapid growth coupled with the climate and ecological emergency highlight the importance of a resilient approach to future development.

In response to the Thames Estuary 2100 (TE2100), the Lower Darent Riverside Strategy (The Strategy), aims to shape an attractive, joined up approach to the riverside and surrounding areas to manage increasing flood risk and coordinate development. By promoting a whole system design approach where nature and human systems are integrated into place-making design, the Strategy will leverage environmental, social, cultural, and economic benefits in the river corridor.

Based on walkovers, desk-based research by a multidisciplinary team and assessments by the Environment Agency, opportunities to enhance biodiversity and natural processes have been identified. Some flood defences are nearing the end of their built lifespan and are not future proofed against anticipated sea level rises.

Dartford Borough Council (DBC) and the Environment Agency will seek to ensure that the measures illustrated in this Strategy will be implemented through the planning process.

Environment Agency access requirements must be integrated into any proposals and they must be consulted for any development within 20m of a main river.

The Strategy is a guide on best practice blue-green infrastructure for managing flood risk. Blue-green infrastructure, in the context of flood risk, involves the strategic integration of natural elements like water bodies and vegetation to mitigate flooding, manage stormwater, and enhance resilience in urban areas. The Strategy aims to work with natural processes to create a resilient landscape and ensure that where improvements to hard infrastructure are required, they are integrated into the riverside landscape. A resilient landscape is characterised by its ability to withstand and recover from disturbances or stressors, such as extreme weather events or climate change, while maintaining its functionality, biodiversity, and overall ecological health. Working to make the study area more resilient will result in a landscape that can better absorb the impacts of flood risk in this catchment area.

Figure 1. Aerial view of the Lower Darent Riverside Strategy study area

Purpose of this document

The Strategy is seen as a planning tool to guide future development in a sustainable and informed way, especially in relation to flooding. The Strategy's approach is promoted within the TE2100 Plan. There is an opportunity to bring future sites forward in a cohesive manner while also creating more space for the river.

The aims of the Strategy;

- Promote consistent local flood defence planning using nature-based approaches where appropriate (some grey engineering or a hybrid solution may be required subject to detailed site appraisal).
- Maximise environmental, social, cultural, and economic benefits in the river corridor.
- Identify the challenges and opportunities over the next decade both due to climate change and development and guide the changes to deliver a high-quality space more efficiently, and at a reduced cost.
- Create a cohesive vision for the riverside, promoting sustainable development.
- Increase active travel connections to and along the river, to maximise opportunities for leisure and utility walking and cycling.
- Rejuvenate Dartford's communities through improved connectivity between the river and the Town Centre.

Who is this Strategy for?

This Strategy seeks to demonstrate best practice design to advise DBC on the river defence improvements, requirements, and opportunities, and to inform planning applications by landowners next to or close to the river. The document can be used for stakeholder, community, and landowner liaison and to support bids for further funding by:

- Providing a study-wide river edge approach.
- Proposing best practice river edge conditions for each character area.
- Recommending how to create river capacity.
- Proposing improvements to accessibility to and across the river.
- Advising how to protect and celebrate existing built and industrial heritage.

Assumptions

- This Strategy is an adaptive landscape strategy and relevant data could be subject to change. Future iterations of the Strategy may require flood defence raising dates to move forward if monitoring of sea level rise requires. All data used to inform this Strategy used the most up-to-date data available at the time. Any new development must carry out its own due diligence and flood risk assessment.
- This Strategy is a guide for DBC, landowners, the Environment Agency, Kent County Council (KCC), the Flood Management Authority and local stakeholders. Proposals are in certain instances conceptual best practice recommendations.

1.2 Policy and Planning Context

The policy context for this Strategy extends over Dartford Borough's and Kent County Council's authorities. There is policy guidance at three levels; local, regional, and national (please refer to Appendix page 77 onwards for a comprehensive list.) The Strategy aligns with key strategic policy documents for the Dartford area, ensuring a holistic and sustainable approach to development. It is designed to complement the following key documents and policies:

The Local Plan

The Strategy integrates with the Local Plan with a Town Centre regeneration focus, and by contributing to green infrastructure and biodiversity provisions, aligning with the Local Plan's goal of balanced and sustainable development. The Local Plan sets out the Dartford Borough development strategy to 2037. This enables infrastructure providers to plan future provision so that development can be coordinated.

TE2100

In response to flood risk and climate change, the Strategy incorporates TE2100 guidance, focusing on sustainable flood risk management and the long-term resilience of the River Darent corridor.

Key guidance within these policies includes promoting green corridors and open spaces, riverfront accessibility, flood risk mitigation, and environmental sustainability. The Strategy aims to foster a well-rounded, resilient, and attractive urban environment promoting economic, environmental, and social wellbeing in the Dartford area. See page 9 for further details.

Table 1. Short summary of Key Policy. For a full list of relevant policies see Appendix page 77 onwards

Scale	Policy name & year	Summary	Category
National	Environment Strategy (2018)	Promotes sustainable growth in line with Government's 25-year plan.	Environment
National	National Planning Policy Framework (2023)	Chapter 2: Achieving Sustainable Development and Chapter 14: Meeting the Challenge of Climate Change.	Flooding
National	Flood And Water Management Act (2010)	Sets out a legislative framework that complements the NPPF including definition of national and local flood risk management strategies.	Flooding
National	Gear Change: A Bold Vision for Cycling And Walking (2020)	Sets out the vision and ambition for walking and cycling in England.	Active Travel
Regional	Kent Biodiversity Strategy (2020)	A rich and growing terrestrial biodiversity, underpinned by more resilient and coherent ecological networks and healthy, well-functioning ecosystems.	Ecology
Regional	Thames Estuary 2100 (TE2100) (2023)	A strategic plan for adapting to rising sea levels in the estuary, with 3 main aims. Draft Plan Appendix D.2 - Local Choices for Flood Risk Management - Dartford & Erith Policy Unit.	Flooding
Regional	East (2008)	Outlines the Strategy for the Thames up to 2100, as part of the TE2100 Strategy, including the approach to walking and cycling along the Thames and surrounding areas.	Active Travel
Local	Dartford Local Plan (2024)	New statutory Local Plan adoption expected 2024.	Planning
Local	Managing The Marshes Vision and Strategy (2006)	The potential of the marshes to be multifunctional sites, combining nationally significant wildlife habitats with recreational use and flood management.	Ecology

1.3 Vision

The vision for the Strategy is to promote resilient development for people, place and biodiversity along the lower Darent, while adapting to and mitigating flood risk and creating open, accessible and connected places along the river edge.

The Darent riverside shall be an attractive, accessible, secure and sustainable place, with a high-quality environment and a mix of activities.

The vision for the Strategy will be delivered by incorporating new green routes that weave through the town and connect along the river. Open spaces that are safe, resilient, engaging, and elegant, will create a place that is easy and enjoyable to use, walk around, and experience. The new open spaces along the River Darent and in the surrounding area should incorporate a clear sense and narrative of its history.

The Strategy identifies potential locations for new bridges across the River Darent to increase connectivity and active travel across the borough and between local communities.

The need for the management of an increasing risk of flooding due to climate change is proposed primarily through nature-based approaches where feasible, and flood defence treatments that encourage the community to interact with the river.

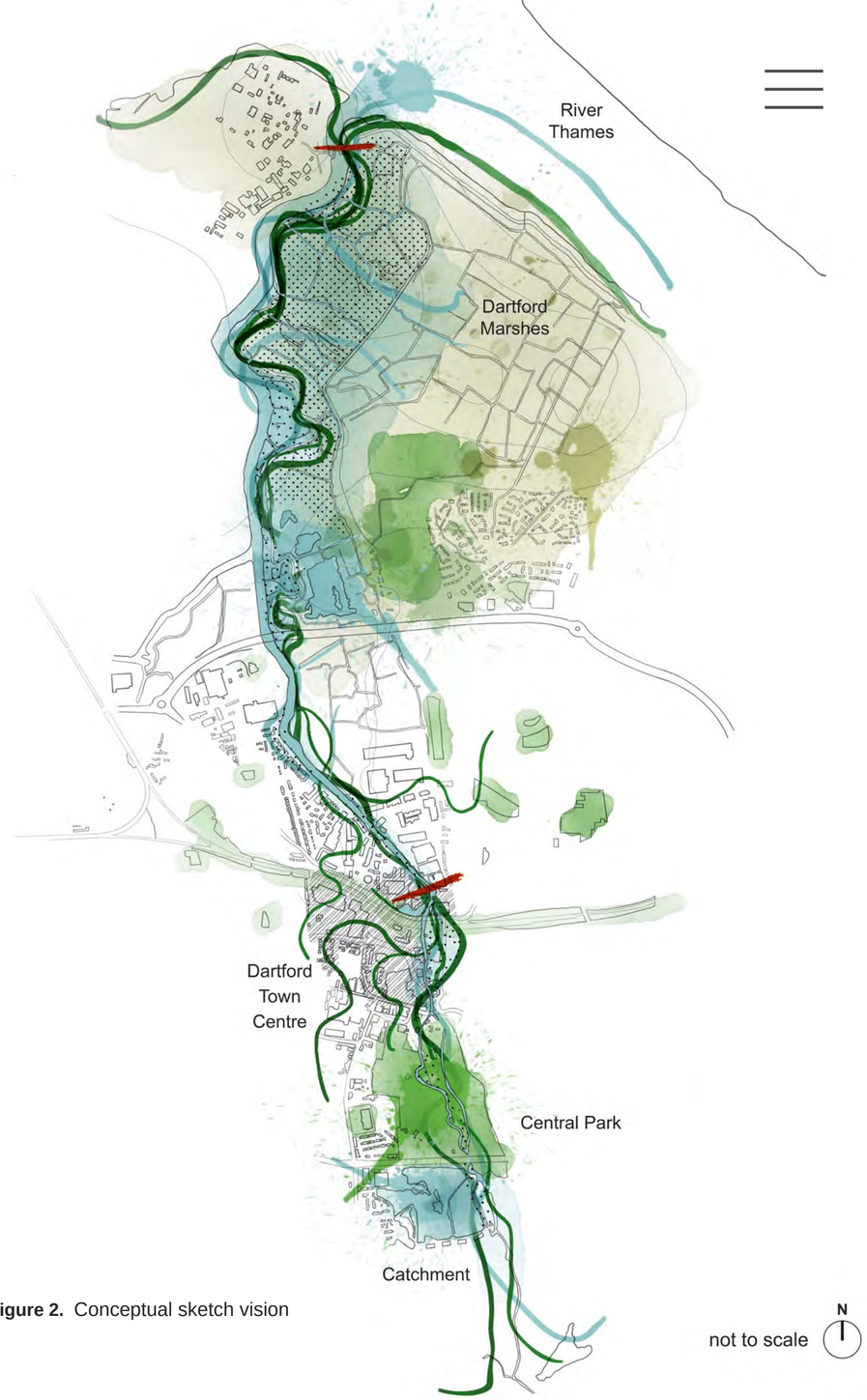

Figure 2. Conceptual sketch vision

2. Baseline

2.1 Baseline Flood Risk

Present day risk of fluvial flooding to Dartford Town Centre is quite low as it is managed by existing defences, but risk is expected to increase with climate change. The combination of high tides and high river levels can result in tidal locking of watercourses as they are unable to discharge. There is also the possibility that tidal defences could fail or be over-topped in an extreme flood event.

The Dartford Barrier is a tidal surge barrier designed to exclude tidal water from the lower reaches of the River Darent in the event of a major North Sea tidal surge. When the barrier is operated, the river is tide-locked. The storage available in the channel and floodplain to contain floodwater during such tide-locked periods directly affects flood risk to Dartford Town Centre. With net sea levels rising and river flows increasing, this flood risk will increase, unless measures are adopted to counteract these effects. The preferred adaptation strategy is to make space for water and work with natural processes wherever possible.

The Strategy assesses the specific needs for future flood defences and sets out how to meet them. What is not covered is defining the most appropriate way to manage flood risk or set future flood defence crest levels. These will be subject to detailed future appraisals by the Environment Agency or developers for each site that comes forward.

By considering flood defence holistically in the Lower Darent Riverside study area, outcomes can have multiple benefits for amenity, biodiversity, and landscape.

Dartford level 1 and level 2 Strategic Flood Risk Assessment (SFRA)

The SFRA summarises flood risk within Dartford Borough, as follows:

- Flood risk within Dartford Borough is primarily from fluvial and tidal sources, with surface water, groundwater, and sewer and reservoir flooding also a potential risk.
- The study area is bounded by the River Thames to the north and has several watercourses within the borough, including the River Darent, River Cray, and Ebbsfleet River. The River Thames and the lower reaches of the watercourses in the borough are tidally influenced.
- The Environment Agency’s Risk of Flooding from Surface Water dataset shows that surface water predominantly follows topographical flow paths of existing watercourses, dry valleys or roads, with some areas of ponding in low lying areas.
- Areas susceptible to groundwater flooding are generally along the routes of the River Darent and River Cray.

Figure 3. Photograph of the River Darent in Dartford Marshes

- There are 59 historic incidents of sewer flooding in the study area that have been identified from the Southern Water and Thames Water records.
- There are no records of flooding from reservoirs in the study area, with the Risk of Flooding from Reservoirs dataset showing only the area of Dartford Borough around the confluence of the River Darent and River Cray predicted to be at risk.
- There are currently four flood alert areas and six flood warning areas in the borough.
- The SFRA (see Signpost for further details) notes the following recorded flood incidents across the study area, with notable fluvial events recorded in 1968, 1993, and 2002/03, as well as notable tidal events recorded in 1953 and 1978.
- January 1953 – A large storm surge coincided with spring high tides, with extensive flooding recorded in the north of the borough. Approximately 1,300 properties in Dartford and Swanscombe were affected, with tidal defences in the borough breached.
- September 1968 – The Environment Agency's recorded flood outlines show the channel capacity of the River Darent and River Cray was exceeded, resulting in fluvial flooding through Dartford and in Sutton at Hone.
- January 1978 – A tidal storm surge of a similar magnitude to the 1953 event, though the construction of defences along the North Kent Coast meant the impact was reduced.
- December 1993 – The Environment Agency's recorded flood outlines show a operational failure or breach of defence resulted in fluvial flooding from the River Darent, impacting the Dartford Trade Park to the south of Dartford.
- Winter 2002 / 2003 – Fluvial flooding was recorded along the River Darent with 126 properties damaged by flooding.

Signpost

Dartford Borough Level 1 and 2 Strategic Flood Risk Assessment 7.1 Historical Flooding page 34

Figure 4. Photograph of the River Darent in Dartford Marshes

2.2 Existing Flood Defences

Thames Estuary 2100

Dartford Borough's risk of flooding primarily stems from fluvial and tidal sources. The River Darent flows from south to north, with the tidal Thames flowing west to east, adjacent to the northern extent of the study area. The River Cray is the main left bank tributary of the River Darent; with the confluence being located outside the study area.

Existing flood defences including the Dartford Creek Barrier are vital components of the landscape, safeguarding against seasonal inundation. However, the TE2100 programme has highlighted the longevity of the existing defences being finite, coupled with increasing frequency of extreme weather events and rising sea levels, necessitates a forward-looking approach to flood management.

Assessing the specific needs for future flood defences is paramount. There is a growing requirement for adaptable, sustainable, and resilient strategies to meet these needs.

Underutilised open space along the River Darent offers the opportunity to be utilised as flood storage area to capture excess flows during high water events. This emphasises the critical role of 'hard working' green infrastructure to create a more resilient river corridor adaptable to climate change.

By harmonising the principles of TE2100 with this Strategy, synergies can be harnessed, promoting efficient flood management strategies that are ecologically sensitive.

The Strategy focuses within the study area as indicated (see Figure 1). However, it is important to note, with the River Darent being a natural system, its influence is not confined to this boundary. Please see page 61 for nature-based solutions within the watershed.

Flood Risk

Flood risk zones are designated areas indicating the likelihood and severity of flooding in a particular region. These zones help local authorities and residents understand and manage the risks associated with flooding. Flood risk zones are often established based on factors such as historical flood data, topography, hydrological modelling, and climate considerations. The Lower River Darent falls under Flood Risk Zones 2 and 3 as indicated in figures 5 and 6.

TE2100 Flood Policy 4 (P4)

Following the TE2100, Flood Policy 4 (P4) states that Dartford and Erith must take further action to keep up with climate and land use change so that flood risk does not increase. This Strategy is a response to the TE2100 and seeks to address ways development along the River Darent can be brought forward with resilience and consistency, adapting to climate change.

Figure 5. Flood Zone 2

- Medium probability of flooding.
- Annual probability of river flooding between 1.0%- 0.1% and annual probability of sea flooding between 0.5%-0.1%.
- Areas in Flood Risk Zone 2 are at risk of flooding from rivers or the sea in any given year, but the probability and potential impact are not as high as in Flood Risk Zone 3.
- Development in these areas may be allowed, but additional flood mitigation measures and planning considerations are usually required.

Figure 6. Flood Zone 3

- This zone represents a high level of flood risk.
- An area that has a 1% or greater chance of flooding from rivers in a year or a 0.5% or greater chance of flooding from the sea in a year.
- Areas in Flood Risk Zone 3 are at a significant risk of flooding in any given year, and development in these areas may be restricted.
- Stricter planning regulations and flood prevention measures are typically imposed to minimise the impact of flooding on both people and property.

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The study area benefits from a range of existing defences. As shown in Figure 7, risk of flooding from the River Thames is reduced by the River Thames embankment, whilst the Dartford Creek Barrier reduces risk of flooding from tidal water levels on the Rivers Darent and River Cray. Secondary tidal and fluvial flood defences (a combination of embankments, natural, and engineered high ground, along with hard-engineered flood walls) are located along the River Darent and River Cray. Finally, there is a network of drainage ditches with outfalls which act to drain the Crayford and Dartford Marshes.

Although rare, if the Thames Estuary and River Darent were to flood at the same time as in the flood incident of January 1953, the impact of the flooding will be larger than usual and more severe (during an equinox high tide).

In response to these risks, the borough currently has four Flood Alert Areas and six Flood Warning Areas, to help manage and mitigate the potential impact of flooding events.

Key issues to address

- **Maintain and manage existing defences.**
- **Manage flood risk caused by tidal locking of outfalls.**
- **Create more space for the river, making it more resilient to climate change.**
- **Attenuate and storage of pluvial flood waters and/or groundwater.**

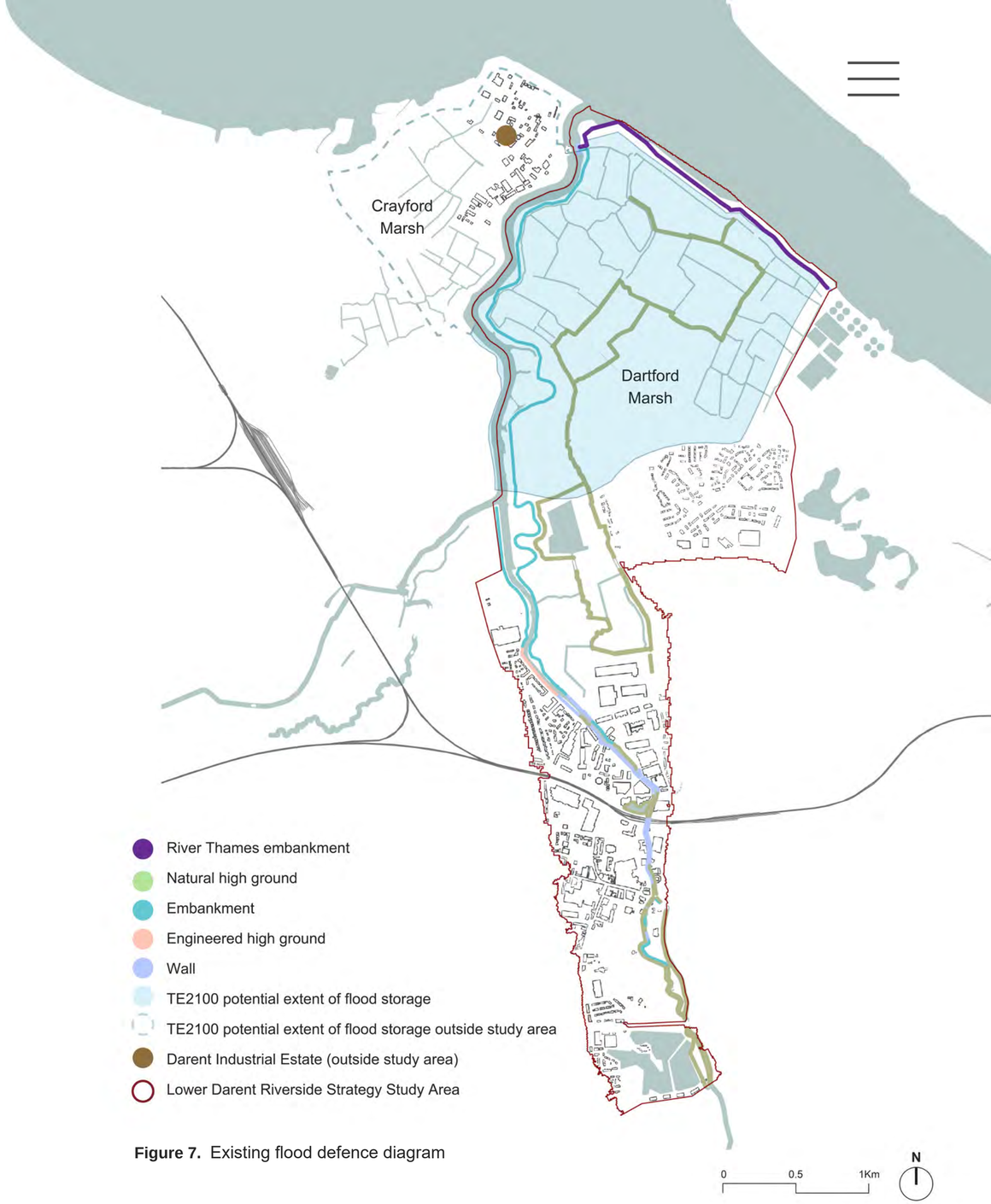


Figure 7. Existing flood defence diagram

Flood Defence in the Marshes

Managed Re-alignment

Managed re-alignment is an environmental management method that entails adjusting the position of the flood defences. The aim is to establish a more sustainable stance in addressing flood and erosion risks. This adjustment may include advancement (moving forward), setback, or breach of the current defence line.

The Dartford and Crayford Marshes represent the largest remaining areas of marsh within the Inner Thames Estuary close to London. The TE2100 states that there are seven end of century options for the future flood defence system of the Thames Estuary. One of these options is creating four tidal flood storage areas at:

- Erith Marshes
- Aveley and Wennington Marshes
- Dartford and Crayford Marshes
- Shorne and Higham Marshes

This would reduce the level of storm tides meaning the Thames Barrier upgrade could be done at a later stage.

Ecosystem Restoration

Managed realignment can contribute to the restoration of natural habitats, such as wetlands or estuaries. This approach can be beneficial for biodiversity, providing habitats for various plant and animal species.

Adaptation to Climate Change

With the increasing threats of sea-level rise and changing climate patterns, managed realignment is seen as a proactive approach to adapting to these changes. It allows coastal areas to adjust to rising sea levels and changing environmental conditions.

Cost-Effective Solution

In some cases, managed realignment may be a more cost-effective solution compared to traditional hard engineering approaches, such as building seawalls or levees. It can be more sustainable and less resource-intensive.

The TE2100 states that a decision will be made by 2040. To inform this, further detailed work to include measures to mitigate any potential negative impacts including the loss of freshwater habitat is required.

Key issues to address

- **Increase tidal storage capacity.**
- **Re-connect the floodplain to the river.**
- **Re-establish ecologically important saltmarsh habitat.**

Relevant Documents

Dartford Fresh Marshes Habitat Management Plan
Dartford East End Marshes Water Vole Survey
Managing the Marshes, Bexley Council
CIRIA Natural Flood Management Manual. 'Managed Re-Alignment'

Figure 8. Existing flood defence diagram: Marshes

Dartford Town Centre Flood Defence

Consideration should also be given to the need for flood defence lines to be contiguous between sites. There is an opportunity to set flood defences back from the river in most cases, but we recognise that the potential for this can be limited by existing developments and associated flood defence lines at adjacent sites.

Existing modelling identifies that in an extreme event fluvial floodwater would come out of the bank near Acacia Hall, then flow overland through the Town Centre before returning to the tidal reach of the river near Hythe Street. However, the ability of the water to return to the channel is limited by the tidal flood defences and the lack of capacity in the drainage system, resulting in significant depths of flooding around Hythe Street (see Figure 9 for location and Figure 47 'Development Site Sketch' on page 47 for more details).

Key issues to address

- **Existing flood defence is ageing and installation has been piecemeal.**
- **Difficult to integrate a continuous defence line.**
- **Risk of further disconnect from the river flowing through Dartford Town Centre.**
- **Extreme fluvial floodwater from Acacia Hall to Hythe Street.**

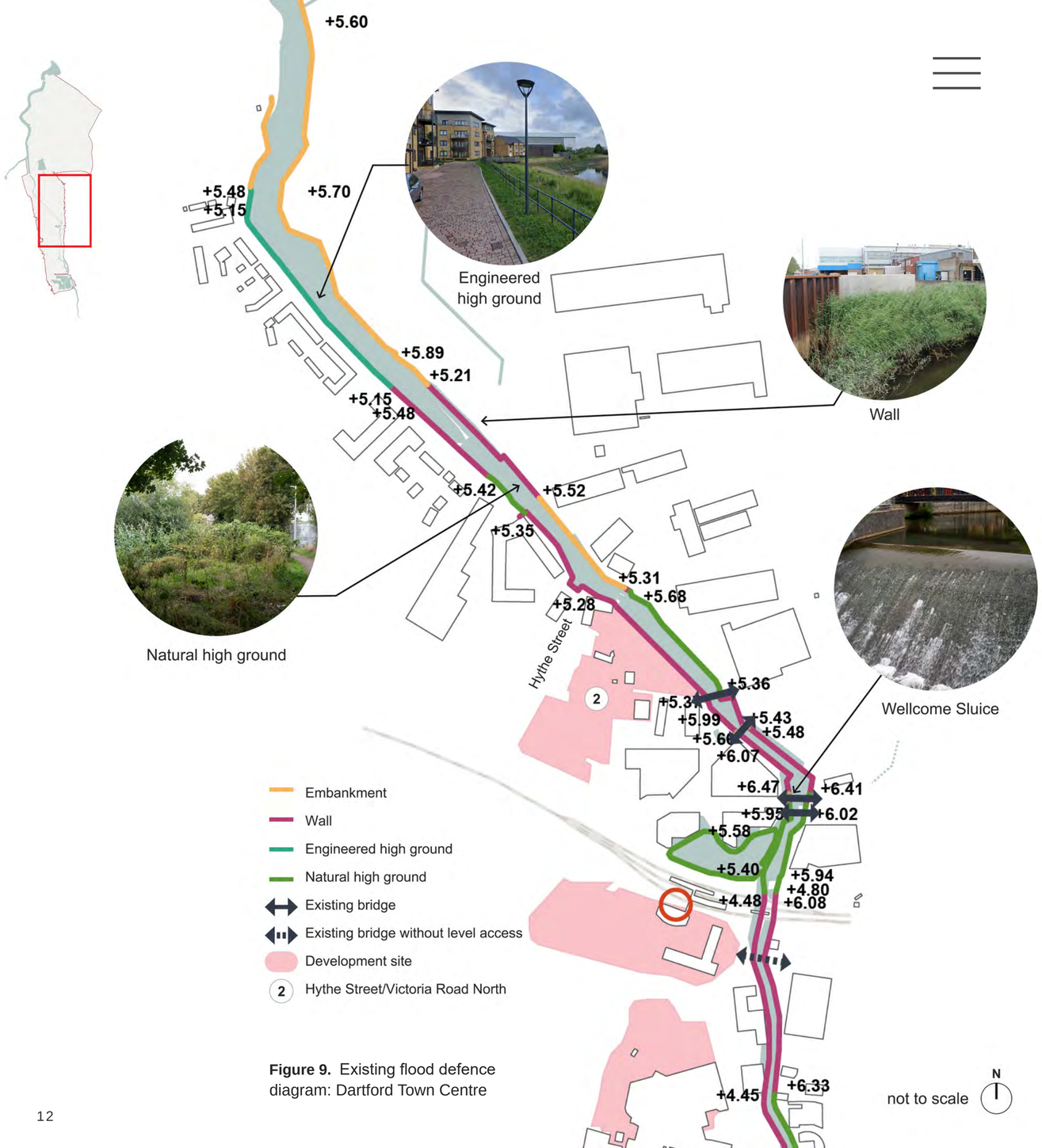


Figure 9. Existing flood defence diagram: Dartford Town Centre

2.3 Ecological Context

Adopt a catchment-wide approach

The Strategy aspires to reconnect different parts of the river including upstream chalk, urban, and downstream estuarine/marshland with the wider surroundings including the Thames Estuary. Reducing and removing key dispersal barriers and strengthening the wider ecological network will improve wildlife movement at pinch points along the river. Utilising and building on previous/current projects run by stakeholders and other catchment partnerships, will strengthen the wider ecological network by enhancing wildlife corridors.

The presence of Dartford Marsh, Crayford Marsh, and Rainham Marsh, while separated by rivers, is noteworthy due to their ecological interconnectedness. Despite their separation by watercourses, these marshes collectively form a cohesive ecological unit, and equally, offer the opportunity to function as both flood storage and wetland. There lies a valuable opportunity to enhance the ecological connectivity between these separated marshes, creating a more contiguous and resilient habitat. This is important due to the extent of the urban form in the area, as represented by the large areas of white space in the diagram opposite Figure 10. See Table 2 page 15 'Priority and Non-Priority habitats' which highlights the presence of numerous high-value ecological features in the landscape.

Impact Risk Zones

Impact Risk Zones (IRZs) are a GIS tool developed by Natural England to make an initial assessment of the potential risks posed by development proposals to a Site of Special Scientific Interest (SSSI). The study area lies within the IRZ of a number of SSSIs. The closest SSSIs include Purfleet Road and the Inner Thames Marshes.

Figure 10. Study area ecological context diagram

Ecological Baseline

Existing Ecological Designations

The Lower River Darent is an important wildlife corridor linking from the Thames south into Kent.

Dartford Marshes, adjacent to the Lower Darent, represent one of the last remaining substantial marshland areas in the Inner Thames Estuary near London. These marshes and adjacent mud flats serve as breeding grounds for important wetland birds and are internationally important for bird passage, making them a vital ecological habitat for species such as peregrine falcon, black-tailed godwit, and oystercatcher.

The study area contains three types of non-statutory designated sites, all located within the marshland area in the north of the site (See Figure 11); Biodiversity Opportunity Area, Local Wildlife Site and Nature Improvement Area.

In the fluvial section, the River Darent is a chalk stream. Chalk streams, almost unique to England, with 85% of the 200 known chalk streams in the world being in the UK, are characterised by their clear, nutrient-rich, and slightly alkaline waters. They are home to a wide range of fish species and support highly diverse assemblages of macrophytes and invertebrates. They are also a wildlife haven for iconic species such as otter and kingfisher. The chalk stream habitat is not only ecologically significant but also provides recreational opportunities for anglers and nature enthusiasts.

There has been extensive ecological work in Dartford Central Park by the DBC Countryside Team, in collaboration with South East Rivers Trust and North West Kent Countryside Partnership. The proposed Strategy builds upon the work undertaken to date and helps strengthen the ecology and habitats within the wider Lower River Darent catchment area.

Key Policy

Kent Biodiversity Strategy
Local Plan - Green and attractive environment G1

Key issues to address

- **The marshes are divided by various different land ownerships.**
- **Proposals must align with conservation initiatives to date.**
- **Re-naturalise and restore the River Darent.**
- **De-siltation and vegetation removal in the marsh ditches to avoid the drying up and loss of water vole habitat.**
- **Regeneration of saltmarsh and reduction of the scrub encroachment on the marshes.**

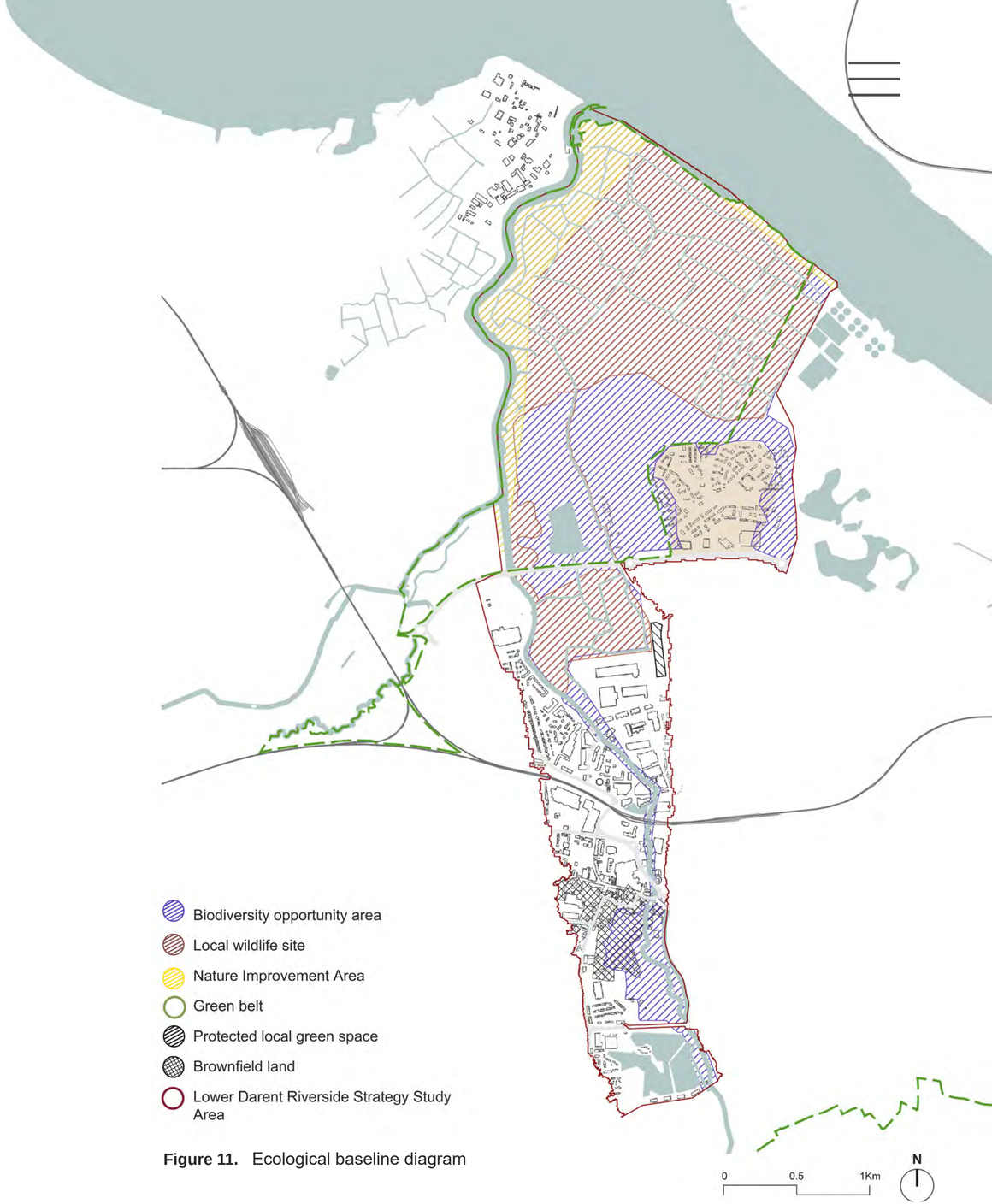


Figure 11. Ecological baseline diagram

Habitats and Species

The study area contains seven priority habitats, most of which are in the northern part of the study area.

Dartford Marshes are drying up and comprise woodland, scrub, wetland, grassland, and a parcel of traditional orchard habitat. Priority habitats in the northern area are dominated by coastal and wetland habitats (saltmarsh, mudflats, floodplain, and grazing marsh) that are known to support otter and a nationally significant population of water vole (European Protected Species). Field signs such as feeding stations and latrines have been found in many of the water bodies. However, American Mink are known to be a pressure on the population.

A known priority pond is located within the study area, supporting a diverse assemblage of invertebrates. Multiple other ponds of unknown status are dispersed throughout the study area, directly connected to the River Darent via a habitat network of woodland, scrub, grassland, and wetland habitat.

Notable habitat in the southern half of the study area largely comprise the rare chalk stream habitat of the River Darent, which flows through deciduous woodland priority habitat at the southern end. Known in-channel plant communities comprise water-crowfoot and starworts.

The area is known to be important for a range of bats, including common pipistrelle, soprano pipistrelle, and brown long-eared bat. To the south of the study area daubentons and noctules species have also been seen. Glow worms have been found at Brooklands Lakes. Dormice and great crested newts are known from the general area.

Plant species found within the study area include rare species associated with the range of specialised habitats listed, including crown vetch, henbane, deadly nightshade, and watling street thistle. Species from the Kent Rare and Scarce Species Inventory have also been recorded within the site, including divided sedge, annual beard-grass, and dittander.

Table 2. Table of priority and non-priority habitats that require consideration

	Habitat type	Habitat	Distance and connectivity to the Study Area
Priority	Coastal	Coastal Marsh	Within and immediately adjacent, along the River Thames, River Darent and River Cray.
		Mudflats	Within and immediately adjacent, along the River Thames, River Darent and River Cray.
	Grassland	Coastal and floodplain grazing marsh	Within and immediately adjacent west and north, in Dartford Marshes, Crayford Marshes and Rainham Marshes.
	Wetland	Reedbeds	West, within Crayford Marshes and the River Cray.
		Priority Pond	Within, Joyce Green Lake.
		Chalk River	Within and adjacent west, the River Darent and River Cray.
	Woodland	Deciduous Woodland	Within Dartford Marshes, and within and surrounding Ecology Island and Brooklands Lake. Multiple parcels of deciduous woodland scattered throughout the surrounding landscape.
		Traditional orchard	A small area within Dartford Marshes.
Non-Priority	Intertidal substrate foreshore	Mud, and mud and gravel	Immediately adjacent north, along the River Thames.
	Grassland	Good quality semi-improved grassland	Adjacent west in Crayford Marshes.
	Birds	Important bird areas	Immediately adjacent north, along the River Thames.
	Plants	Important plant areas	Immediately north of River Thames, the Thames Estuary, Essex & Suffolk Coast in Rainham Marshes.

Existing Connections

As described in both the ‘Future Infrastructure Statement’, the Dartford 'Local Cycling and Walking Infrastructure Plan' (LCWIP) and the ‘Sustainable Travel Strategy for Dartford’ documents, there is an active travel network already in place in parts of the borough, particularly in Dartford Town Centre. However, the River Darent creates a barrier to east - west active travel movement across the borough, reducing access for communities between local centres due to infrequent crossing locations north of the Town Centre.

Investments in infrastructure, safety measures, and community engagement initiatives to encourage more people to walk and cycle in the region is required. Improvements to walking and cycling have already been made in Dartford through the Town Centre regeneration project and throughout larger development sites.

There is potential to continue these improvements through upgrades to the Thames Path (please note outside diagram extent) and Darent Valley Path, which are identified as existing links of the strategic Green Grid network in the Local Plan and Sustainable Travel Strategy for Dartford. Improvements to these routes would prioritise active travel improvements and ensure green spaces are well connected across the borough benefiting residents through access to nature, as well as supporting sustainable travel uptake more broadly.

The Darent Valley Path is not currently fully accessible and does not meet inclusive design standards. The path has cycle gates in places, and variable widths and quality (for both cyclist and pedestrians). The surface is also inconsistent which is likely to pose a challenge for people with reduced mobility or wheelchair users.

Although the Darent Valley is a continuous route, it does not always follow the river’s edge. The Darent Valley Path allows for recreational travel along the eastern side of the river, with the other side often having limited and interrupted access along the river.

The mismatch of riverside path treatments is due to footpaths being constructed by various developments over the years as part of planning obligations. As they have all been delivered at different timescales, the paths do not always meet up.

Key Policy

Local Plan - Transport and Sustainable Travel M15 & M16
Dartford Local Cycling and Walking Infrastructure Plan (LCWIP)
A Sustainable Transport Strategy for Dartford
Thames Strategy East
LTN1/20 Cycle Infrastructure Design

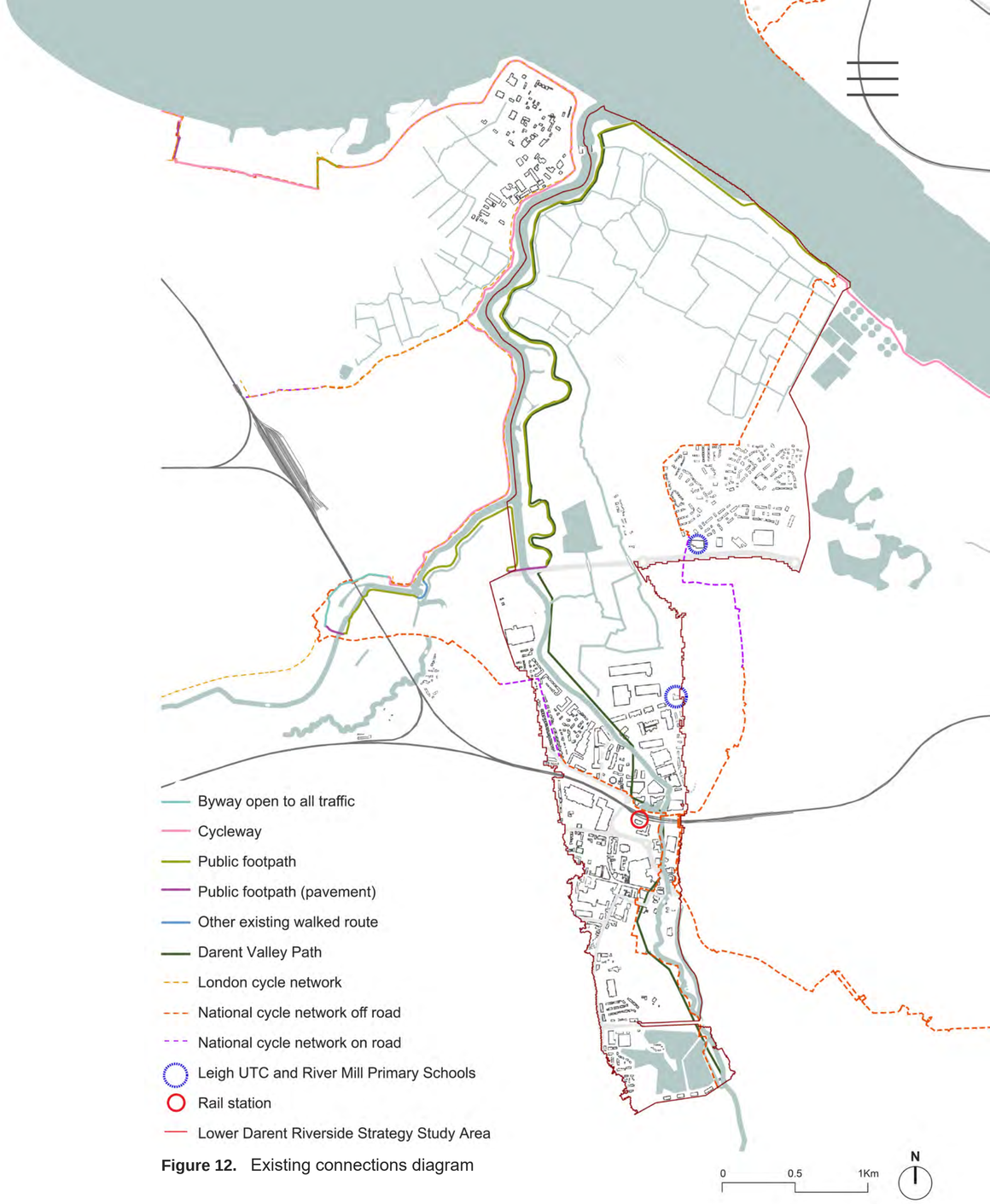


Figure 12. Existing connections diagram

There are currently very few bridges over the River Darent north of Dartford Town Centre. Bob Dunn Way is the most northerly crossing which could be utilised by people walking and cycling. However, it offers a poor environment due to high vehicle volumes and traffic speeds, which are likely to deter active travel use across the borough. Equally, current active travel routes do not maximise access to the River Darent for leisure opportunities and some existing bridges are not step-free, are not well oriented, or are closed to the public.

Key issues to address

- **Existing bridge crossings limit the ability of local communities to access local centres, public transport (Dartford railway station) and local educational facilities close to the river (River Mill Primary School and The Leigh UTC).**
- **Lack of traffic-free active travel routes can discourage active travel due to safety concerns both real and perceived.**
- **There are no bridges north of Bob Dunn Way, making the Thames Path indirect and limiting access between Crayford and Dartford Marshes.**
- **Improvements needed to station arrival and local centre distinctiveness (vitality and vibrancy).**
- **The River Darent should remain navigable for larger vessels up to Bob Dunn Way and for smaller vessels up to the Wellcome Sluice.**

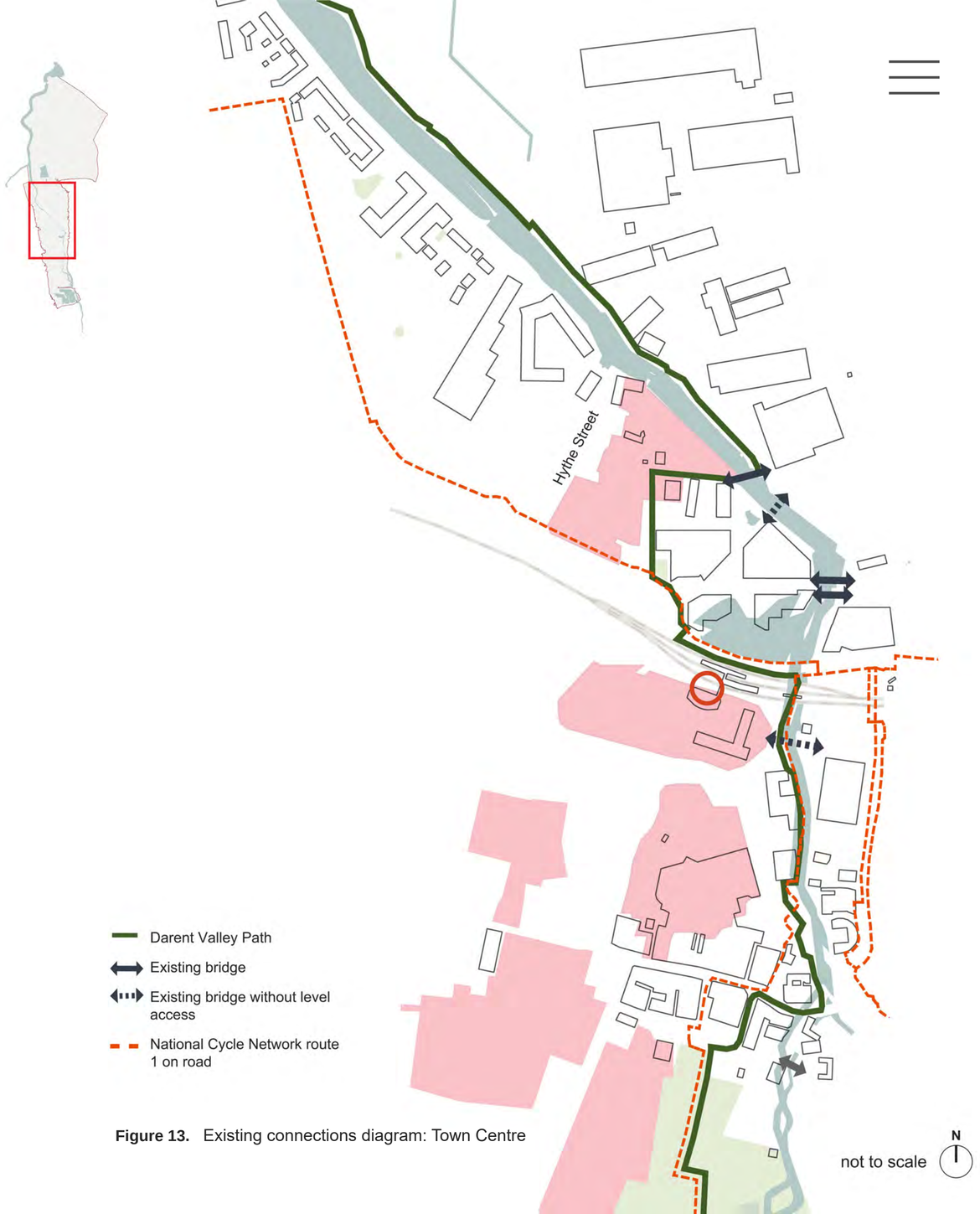


Figure 13. Existing connections diagram: Town Centre

2.4 Existing Heritage

The study area has a rich cultural and industrial heritage of listed buildings, conservation areas, and non-designated heritage assets. Dartford Town Centre comprises a range of listed buildings of different type, character, use, and listing grade. Non-designated heritage assets would comprise known and potential archaeological remains and built heritage of local interest. Sites and structures among the non-designated heritage assets are banks in the saltmarsh by the River Darent, stones and small wooden angled stakes by the Dartford Creek Barrier, the Purfleet Ferry, ring ditches and trenches, a pier, three hospitals collectively known as the River Hospitals, the Wells Firework Factory, and the Joyce Green explosives works.

People and river have been firmly connected in the Darent valley since Roman times up to the modern era. The subsequent decline of river use and the construction of large infrastructure, like the Dartford Crossing, have contributed to breaking that connection between town and river. An integrated approach to built heritage and archaeology will be key in providing an enriched narrative to highlight the heritage interest of the area, which may be archaeological, architectural, artistic, or historic. An example of this is demonstrated by the public realm work and river improvements undertaken at Acacia Hall.

Key Policy

Local Plan - Designated Heritage Assets M5
Local Plan - Historic Environment Strategy M6

Key issues to address

- **Retain, protect and celebrate a clear sense of history.**
- **Dartford Town Centre is a conservation area.**
- **Preserve or enhance industrial archaeology/ heritage assets along the river and at the marshes.**
- **There are areas of undiscovered archaeology, which should be investigated where opportunity arises.**

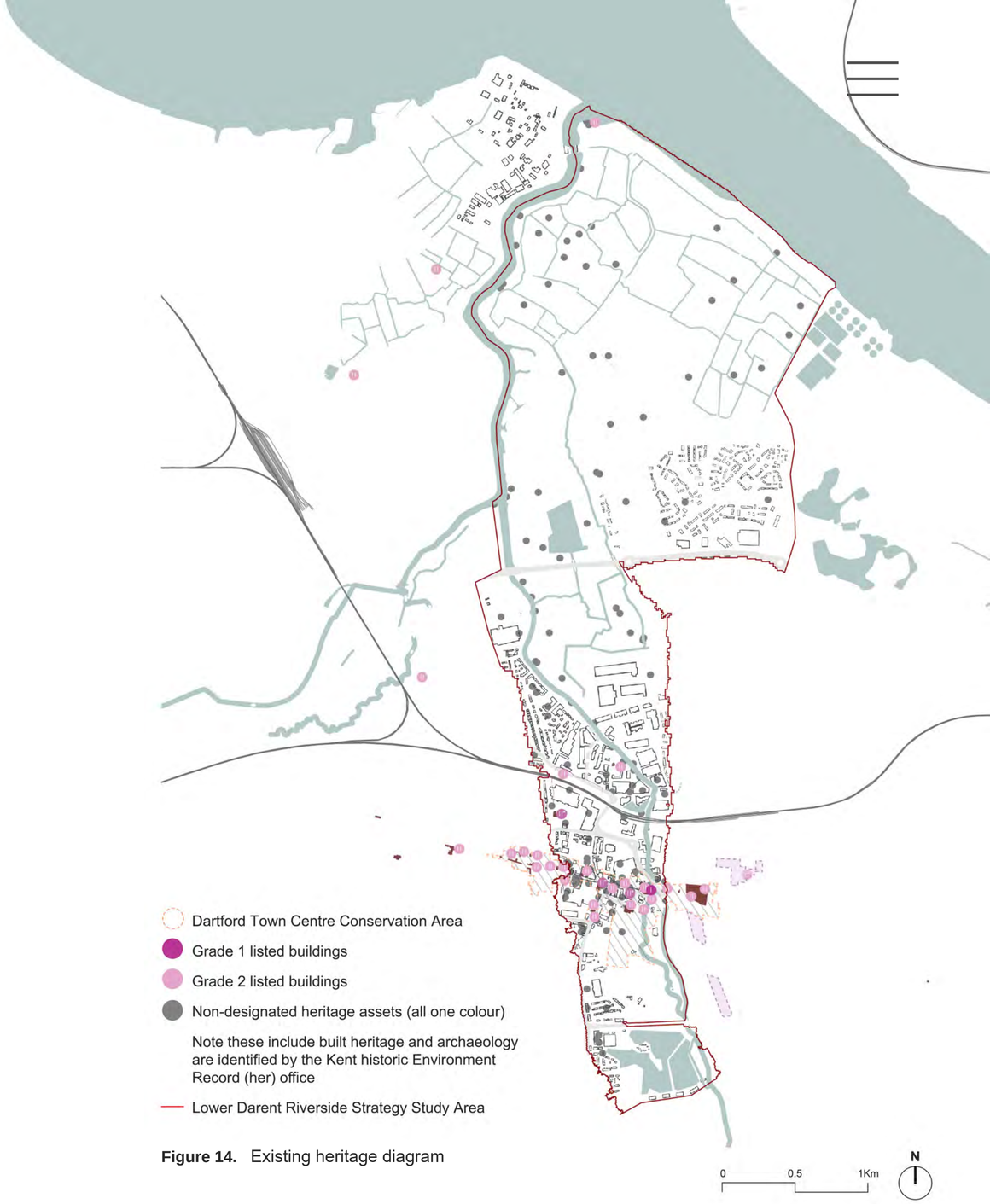


Figure 14. Existing heritage diagram

Development Sites

The Central Dartford section of the Local Plan promotes the revitalisation of an area in and around the Town Centre. There is significant scope for the regeneration of Dartford Town Centre as a shopping, leisure, and service hub for the surrounding communities, and for brownfield mixed-use or residential redevelopment to achieve major environmental enhancements.

Development sites should deliver high-quality pedestrian routes adjacent to the river edge and associated public realm spaces with active uses to enliven the rivers edge. Where possible, more capacity should be created by allowing the river edge to be naturalised.

Key Policy

Local Plan - Good Design for Dartford M1
Local Plan - Central Dartford Station Surrounds/River Darent Area D7
Local Plan - Central Dartford Strategy D1

Key issues to address

- **Development to date has been inconsistent both in terms of setback and there has been a lack of integration to date.**
- **There is no coherent flood defence approach between the different development sites.**
- **To date, there is no cohesive riverside design vision of the existing commitments.**
- **In places existing development has not allowed a setback from the river edge which has resulted in a narrow channel riverside setting, impeding river capacity and space for recreation.**

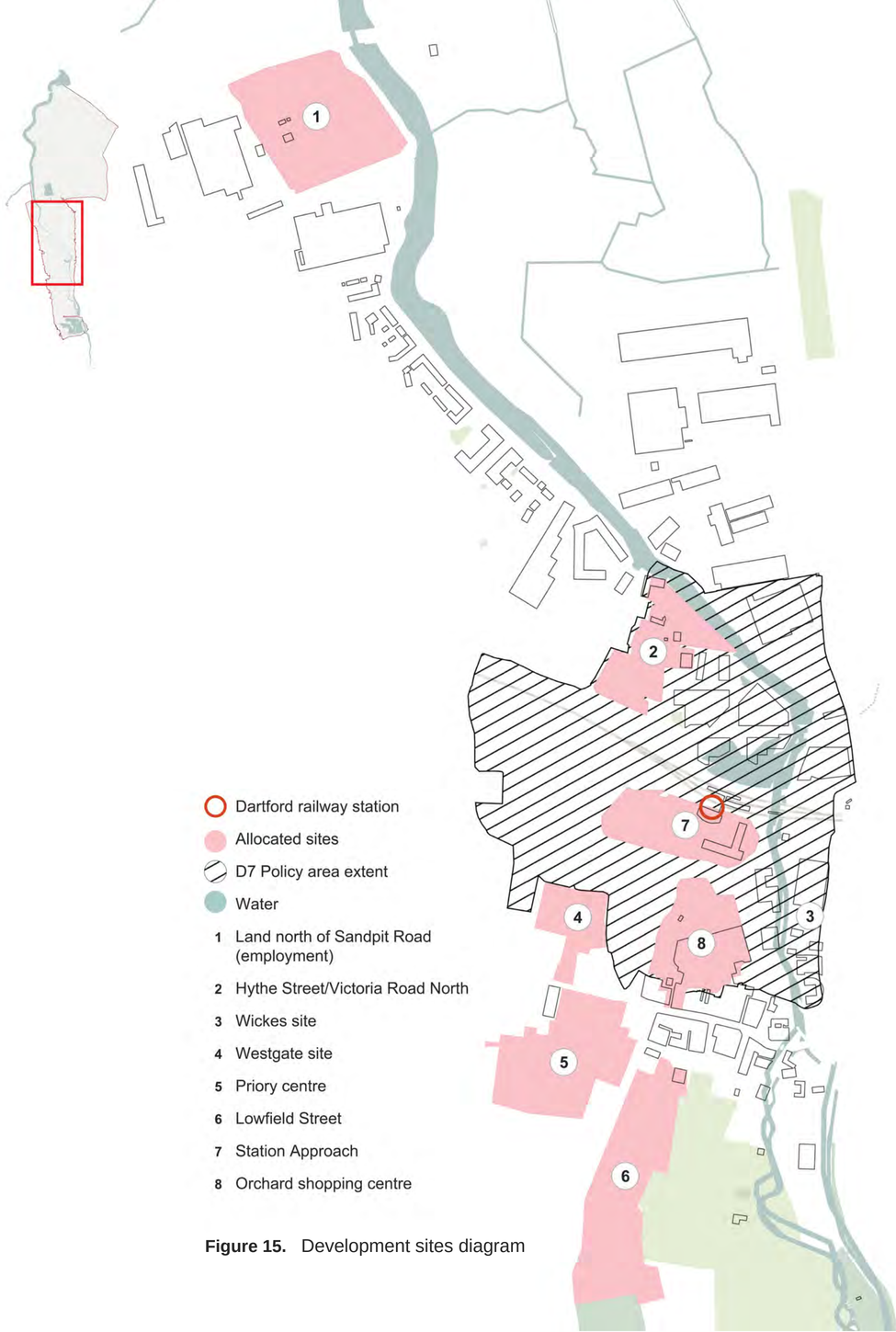


Figure 15. Development sites diagram

3. Analysis

3.1 Character Areas

Four character areas have been identified:

Study Area

- Marsh
- Urban
- Park

Outside Study Area

- Catchment (See 5.6 Catchment page 61)

As developments are brought forward, the materiality and outlined typical edge conditions developed in this Strategy should act as a Toolkit library to be drawn upon by DBC, the Environment Agency, and developers. Design Principles (refer to page 28) create a narrative to promote best practice, facilitating consistent river edge setbacks and a joined up approach to flood mitigation and finishes. An important consideration is celebrating the existing character and creating a cohesive public realm adjacent to the River Darent.

The wider catchment of the River Darent, although outside the scope of this Strategy, is included as being a natural system, interventions within the watershed have a direct impact on the Lower reaches of the River Darent.

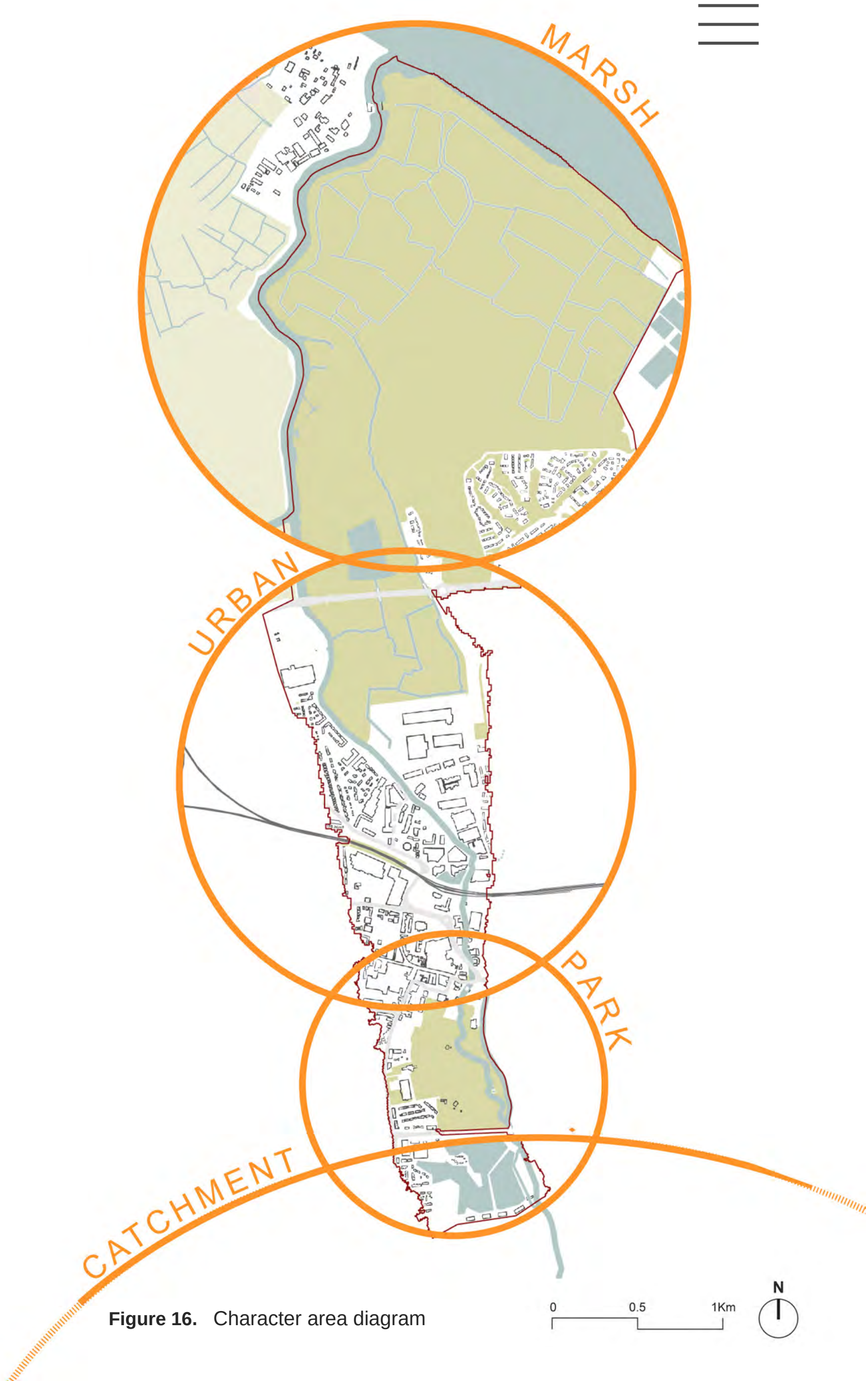


Figure 16. Character area diagram

Character Areas: Marsh

Dartford Marshes has a rural character with a sense of remoteness and expansive views with big skies. There is no immediate sense of destination due to the lack of a clear path network or any wayfinding or furniture.

Healthcare and industrial facilities had a strong presence in the area, with some buildings remaining. Identification of key areas that could potentially generate heritage opportunities are Joyce Green Hospital and the tram line, Long Reach Hospital, Priory Ward, and Temple Farm which were dominant land users in the area. There is evidence of old World War II pill boxes, angled stakes, ring ditches, and trenches.

The marshes have the potential to be/could be not just a destination for nature, but an invaluable asset to the local community, while celebrating heritage assets. Currently the Dartford Marshes are disconnected from the surrounding area and reduced access has resulted in anti-social behaviour such as fly tipping.

The marshes are underused with opportunities for improved recreational focus (walking, bird watching, navigational use).

1. Dartford Creek Barrier

2. River Thames embankment

3. Fresh water lake

4. Angled stakes

5. Bob Dunn Way underpass

Figure 17. Aerial of the marshes illustrating photograph locations

Character Areas: Urban

In the urban section of the study area, the river is often lost behind embankments, overgrowth, or high walls. Frequently access has been impeded by adjoining development leaving unwelcoming, narrow paths or sections of river edge that are completely inaccessible.

Quality of design should reflect the character of place, with a more intimate, green character closer to the marshes in keeping with the waterside and marsh context (see image 1 opposite).

Valued Views

Dartford Town Centre is a conservation area which sits in the floodplain of the River Darent, with a townscape defined by its roofline, such as the listed Holy Trinity Church, and big skies with its proximity to Dartford Marshes.

The built form, urban grain, and streetscape of any new development must be carefully considered to both frame existing views while creating key new views in and out of Dartford Town Centre. The orientation and street layout of any new buildings along the river must have their long face perpendicular to the River Darent to open up views to and from the river.

1. Residential development along the river

2. River is too silted for boat navigation

3. River path feels back of house

4. New public realm alongside the river in Dartford Town Centre

5. River in Dartford Town Centre lined by walls

Figure 18. Aerial of Dartford Town Centre illustrating photograph locations

Character Areas: Central Park

Central Park

Central Park is a prized asset for Dartford with a Royal Park quality. The park has various recreational facilities including a play area, cafe, skate park and a running track to name a few. Two tributaries of the River Darent flow through the park, both of which are hard to spot. The river is behind a buffer zone which helps to protect sensitive ecological resources from disturbance but is a missed opportunity in terms of social engagement with the river.

Brooklands Lake

The Study area extends around the perimeter of Brooklands Lake. This area is currently a well-used recreational asset for fishing and walking. Any works in this area should simply enhance existing habitats and amenity, and there is the potential to use the lake for flood risk attenuation.

1. Acacia Hall- naturalised section of the river

2. Access to river's edge in Central Park

3. Timber deck edge to river

4. Path through Brooklands Lake

Figure 19. Aerial of Central Park area illustrating photograph locations

3.2 Opportunities and Constraints

The development of the Lower River Darent faces several opportunities and constraints that must be carefully considered to develop realistic proposals to improve accessibility and ecological value, and create more river capacity.

Table 3. Constraints and Opportunities

Constraints	Opportunities
The River Darent is prone to riparian and tidal flooding putting the river and surrounding areas at risk. Water levels and flooding are expected to rise due to climate change.	Create flood storage capacity and integrate Nature-based Solutions (NbS). A system thinking approach will create a resilient solution. Introduction of Business Growth Indicator will help mitigate local climate impact.
Dartford Marshes disconnected from the surrounding area; access, ecology and anti-social behaviour.	Improvements to linear flood risk management infrastructure delivered by new development benefit the whole community
Existing habitat, particularly intertidal habitat at the marshes, are decreasing and deteriorating, impacting the ecology of the site, including protected species such as water voles.	Strengthen existing habitats and ecological corridors. Build on existing conservation and restoration already undertaken in Central Park.
Accessibility: some communities segregated by the rivers, roads and rail. River has become inaccessible in places.	Improve access to, along, and across the river for leisure and active travel through new bridge(s).
Heritage and narrative of site development has been lost. Part of the course of the River Darent flows through the Dartford Town Conservation Area.	Celebrate the Town Centre and its many heritage assets, linking them together with a signposted heritage trail; re-purpose underused buildings.
Many developments have their ‘back of house’ facing on to the River Darent.	Design for new developments to have a set back from rivers edge and active uses facing the river encouraging recreation along the river.
	Restoration of chalk stream habitat.
	River restoration (both urban and rural).
	Delivery of Water Framework Directive (WFD) mitigation measures. (See Appendix page 86 and Figure 121 WFD locations for further details).

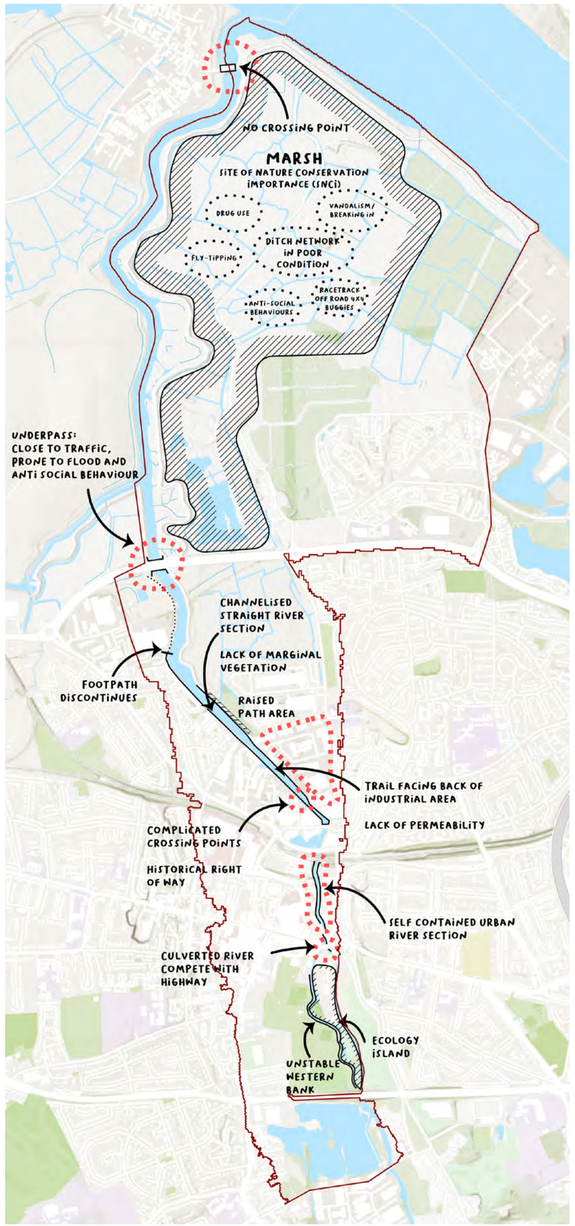


Figure 20. Annotated constraints diagram

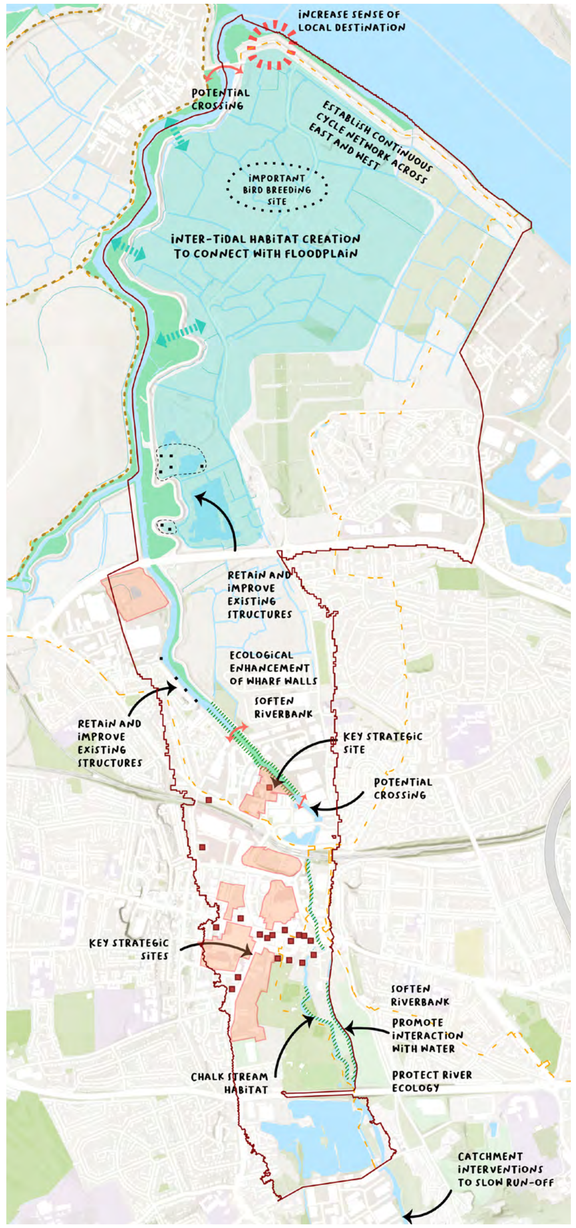


Figure 21. Annotated opportunities diagram

4. Design Principles

4.1 Nature-based Solutions (NbS)- Benefits

The successful improvement of the River Darent defence line to create a cohesive vision requires an understanding of the process that causes flooding. The impact of flooding can be mitigated through the use of both a systems thinking approach (how one design interaction will impact another further down the line) and the introduction of NbS.

NbS can mitigate flood risk by using the power of nature to manage, create, or restore a natural and/or anthropogenic habitat. NbS can be used to change the current infrastructure into a functioning system that helps mitigate the impact of problematic floods, erosion, and deposition. By understanding nature and utilising natural infrastructure on its own and alongside traditional infrastructure, a more resilient and cost-effective solution will be provided. Nature can adapt, grow, and evolve to new climate conditions.

Using NbS on the River Darent flood defence line and wider catchment will unlock the potential of the study area and provide a multitude of direct and indirect environmental, social, and financial benefits.

Direct benefits include:

- Contributing to mitigating and adapting climate emergency impacts.
- Delivering better quality places along the River Darent.
- Improving local health and wellbeing.
- Serving as a catalyst for regeneration and contribute to Biodiversity Net Gain.
- Connecting dispersed habitats.
- Meeting government objectives (see policy appendix page 77).
- Creating social value.
- Building resilience to the impact of flooding.

Figure 22 illustrates the multiple benefits provided by the improved flood defences and NbS interventions. The cost of mitigating flood impact in an area should be seen as an opportunity to create value. Environmental, social, and economic benefits should be considered and integrated as part of the design from the outset of the project.

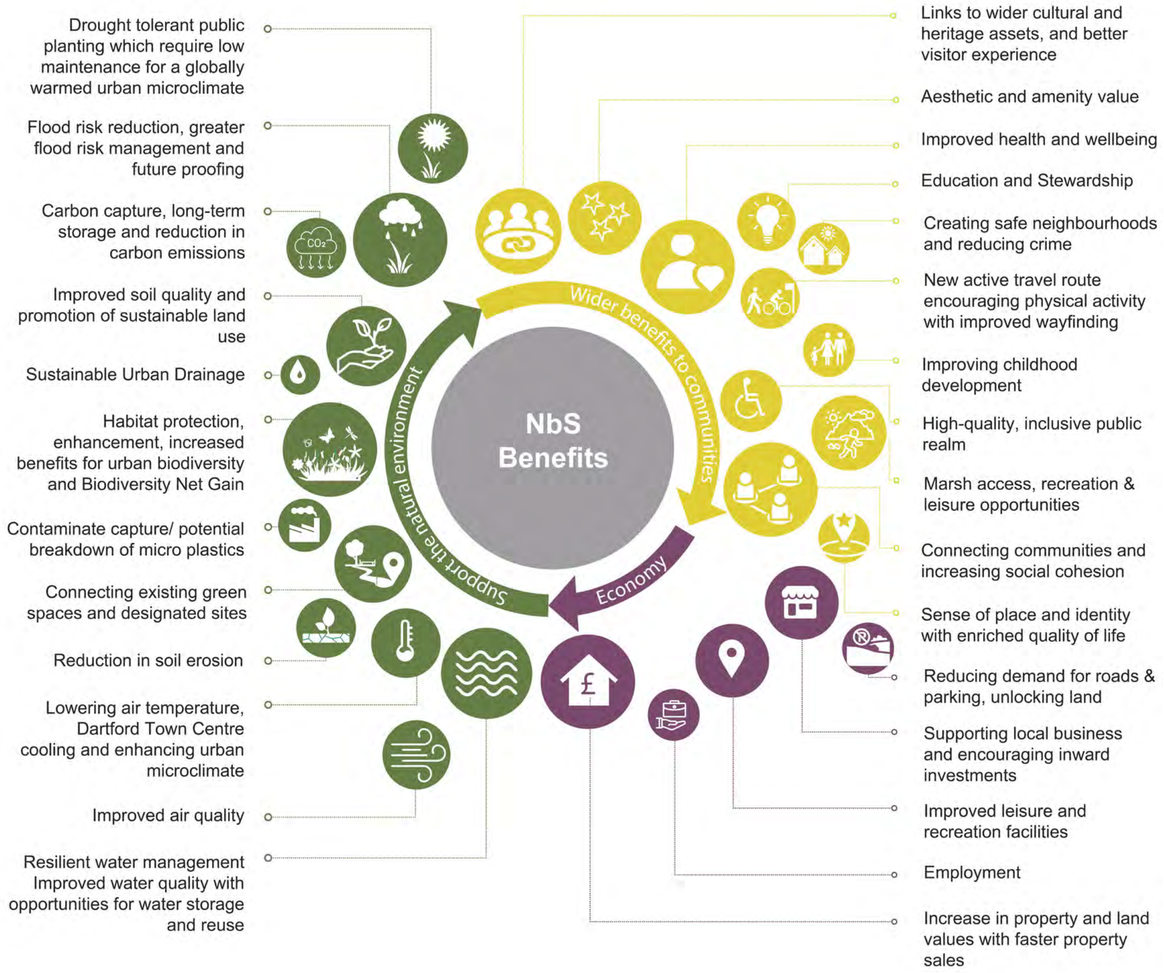
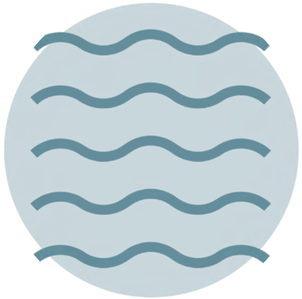


Figure 22. NbS and flood mitigation benefits diagram

4.2 Design Principles

From the baseline research, four Design Principles have been developed which each respond to the identified study area constraints. These Design Principles apply to all character areas. They are the core values of the project's vision and characterise the proposed interventions as follows:

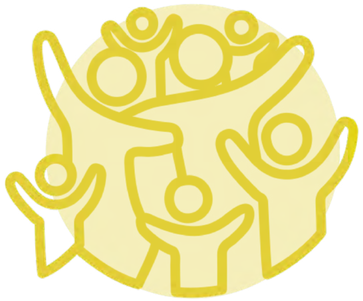


Building Resilience

Make the River Darent more resilient to fluvial flood events and rising sea levels as a result of climate change.

Regenerating Nature

Restore or enhance existing biodiversity features and create complementary habitats to increase habitat diversity and ecosystem resilience.



Connecting Communities

Improve access to, along, and across the River Darent to reduce existing severance and improve active travel opportunities for utility and leisure.

Celebrating Identity and Character

Celebrate the rich character of existing landscape and heritage to create a unique opportunity for sustainable growth and development in the area.

Building Resilience

The TE2100 plan advises that existing defences will need to be improved in the coming decades to account for sea level rise. Defences will need to be raised by approximately 0.5m by 2040 and by approximately a further 0.5m by 2090.

This Strategy seeks to re-naturalise stretches of the river where feasible, and proposes managed re-alignment in the marshes to re-connect the river with its floodplain. A set back flood defence would separate the tidal flood storage area from freshwater marsh.

In the Urban character area it is proposed that as developments are brought forward, river edges are set back where feasible, new raised flood defences are integrated into site landscaping where required, and the river is naturalised to create more capacity.

This Strategy seeks to promote connected blue and green infrastructure to reduce run-off including sustainable urban design, green roofs, permeable paving where possible, and existing infrastructure improvements to enhance resilience.

Figure 23. Existing embankment in Dartford Marshes

Key Policy

Dartford Borough Level 1 and 2
Strategic Flood Risk Assessment
Local Plan - Flood Risk and Riverside Design M4

Proposal

- **Managed re-alignment of marshes.**
- **Ditch management - Maintenance of the existing ditch network in a favourable condition.**
- **Naturalise sections of the river where feasible to re-establish river function.**
- **Set back existing flood walls in urban sections and create public realm offer such as seating and river edge access.**
- **Remove the Wellcome Sluice to create more capacity (see page 55).**
- **Slow run-off and restore natural river processes where possible with green roofs, SuDs and wider catchment interventions (see page 61 for more details).**
- **Ensure future development is sustainable and has in-built resilience to future climate change.**

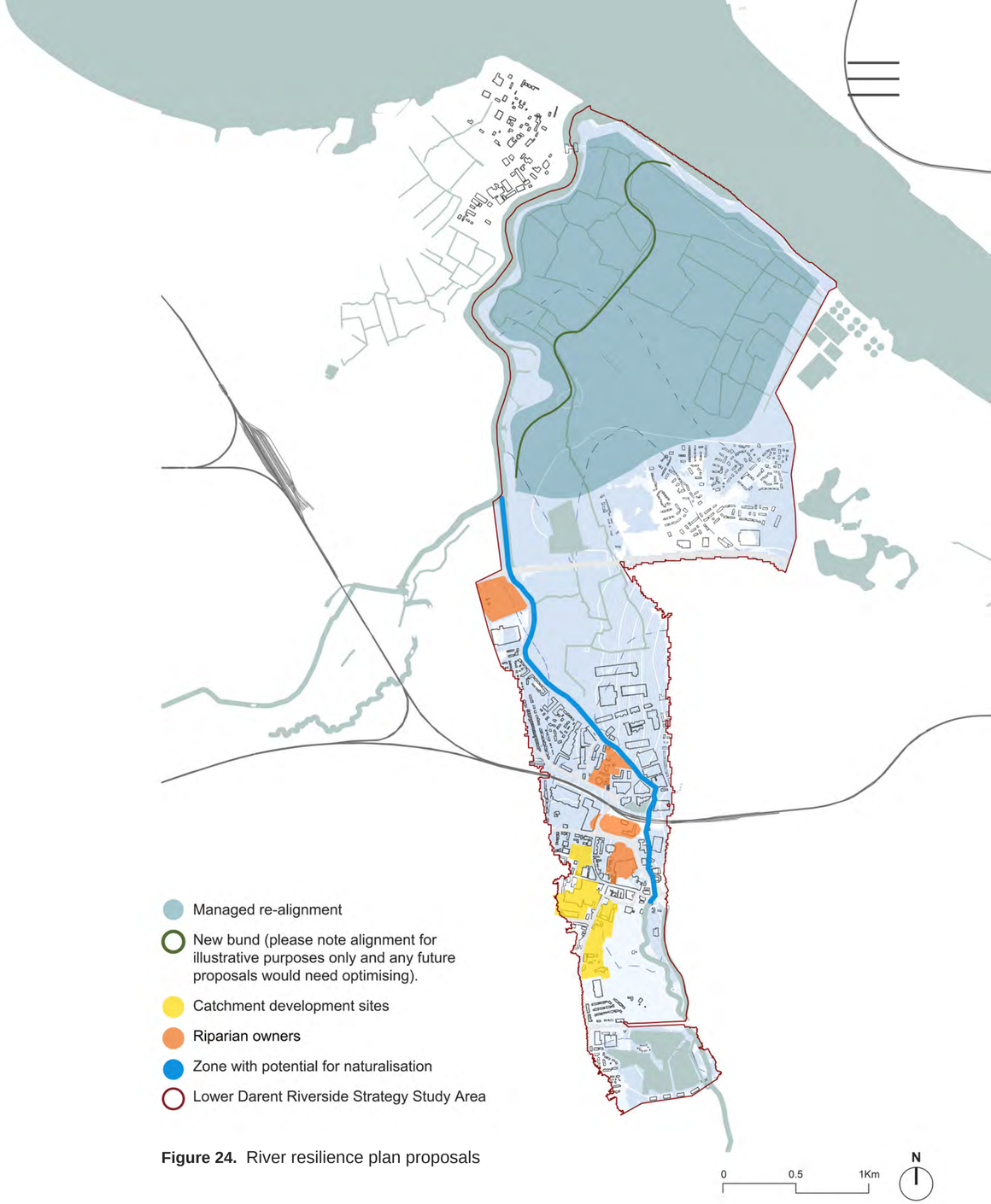


Figure 24. River resilience plan proposals

Regenerating Nature

The overarching aims of the Strategy is to restore a sustainable and climate change resilient ecosystem in the River Darent catchment while protecting the green belt and enhancing the marshes to establish an Inner Marshes Conservation Park (Crayford/Dartford Marshes and Rainham Marshes). The goals of this Strategy are the protection of species listed in the Biodiversity Action Plan, Kent Rare and Scarce Species Inventory, and Kent Biodiversity Action Plan.

A chalk stream's ecological health is determined by water quantity, water quality, and physical habitat quality. Addressing all three factors simultaneously will provide the maximum benefits to this priority habitat and enhance the River Darent as a key wildlife corridor. The works undertaken by DBC at Acacia Hall offer an excellent example of chalk stream restoration. Increased habitat and flow diversity was achieved through the reintroduction of chalk stream river habitats and function, and by increasing channel width and depth variation.

Habitat creation, restoration, and enhancement are pivotal elements that contribute to protecting wildlife from a changing climate. Interventions such as effective regulation of hydrological regimes in wetland and intertidal environments and the re-establishment of a more natural river course, will make ecosystems more resilient. This Strategy envisions a mosaic of diverse habitats with high biodiversity value, and emphasises protecting undeveloped waterfronts while maintaining certain areas as wild open spaces.

Signpost

Chalk Stream Strategy (This link is no longer available as of November 2024)
Making Space for Nature- Kent County Council

Proposal

- **Preserve and enhance important habitats and species and communicate importance of them to the public (walking route with map/ information boards).**
- **Reconnect the river with its floodplain.**
- **The river has the potential to be an educational case study with volunteering opportunities.**
- **Incorporate biodiversity and green space into public realm.**
- **Aim for environmental net gain and solutions to encourage carbon sequestration such as riverside wetlands in urban areas.**
- **Establish bankside and ditch re-profiling and vegetation management. Put in place to initiate a diverse range of habitats, including water vole and otter habitat.**

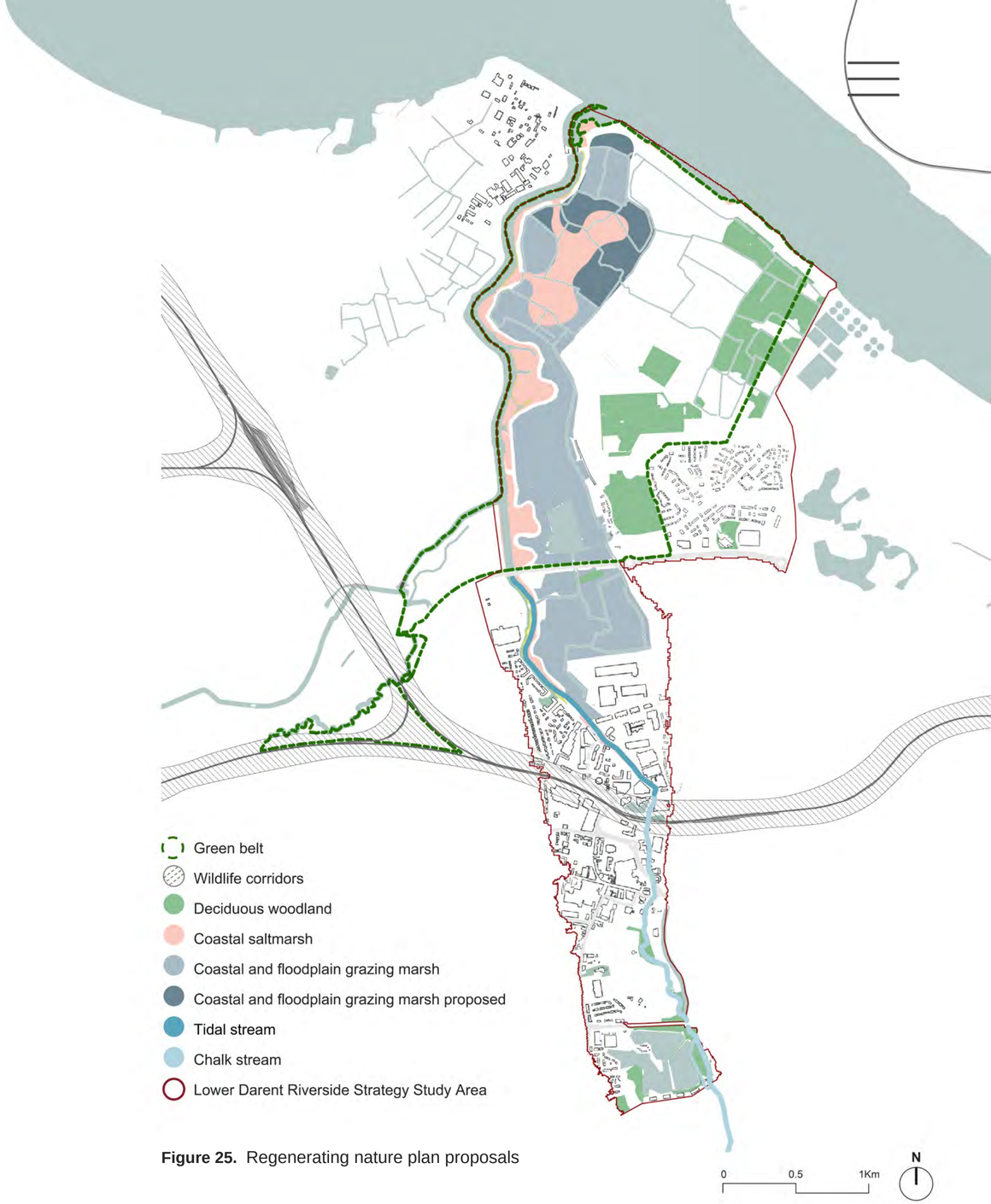


Figure 25. Regenerating nature plan proposals

Connecting Communities

The Strategy envisions accessible connections and seeks to promote recreational use between the east-west of the River Darent and north-south of both river banks in the Town Centre and to the north of this. The clearly signposted Darent Valley Path route will be accessible to all and follow the course of the river, with diversion only taking place where there is no potential to continue the route due to level difference in flood defences.

It will be important to ensure footways and shared routes meet minimum width requirements. For any shared walking and cycling routes a minimum of 3m width should be provided, in line with Local Transport Note LTN1/20 guidance. For pedestrian only routes, a minimum of 2m should be provided, which can be reduced to 1.5m for brief sections in line with Inclusive Mobility Guidance. It is also important to ensure regular places for people to sit and rest, which will also contribute to the overall amenity of the area. Existing cycle gates reduce accessibility. These should be removed along the path to enable access to all cycles.

Public parking and storage for bikes should be accommodated along the river, particularly at points of activity or new development. These should be provided in line with LTN1/20 best practice and located in areas that are well overlooked and with consistent footfall to ensure adequate security.

Key Policy

Dartford Local Cycling and Walking Infrastructure Plan
LTN1/20 Cycle Infrastructure Design
Inclusive Mobility Guidance
Gear Change a bold vision for cycling and walking

Proposal

- **Remove unnecessary barriers for cycling.**
- **Enhance access to and connectivity across the River Darent (including maintaining and enhancing Darent Valley Path).**
- **Improved access and connectivity on both sides of the river in the built-up part of the town and north of the Town Centre.**
- **Improve connectivity between the river and Town Centre with attractive walking and cycling green links.**
- **Include timber boardwalk under existing infrastructure where required to link sections of Darent Valley Path (see page 54).**
- **Provide more secure cycle storage and parking facilities.**
- **Include a clear suite of wayfinding furniture.**
- **Remove fences and deal with level differences (particularly on the west side of the river, north of Hythe Street and south of the Sandpit Road. See Figure 15 page 19).**

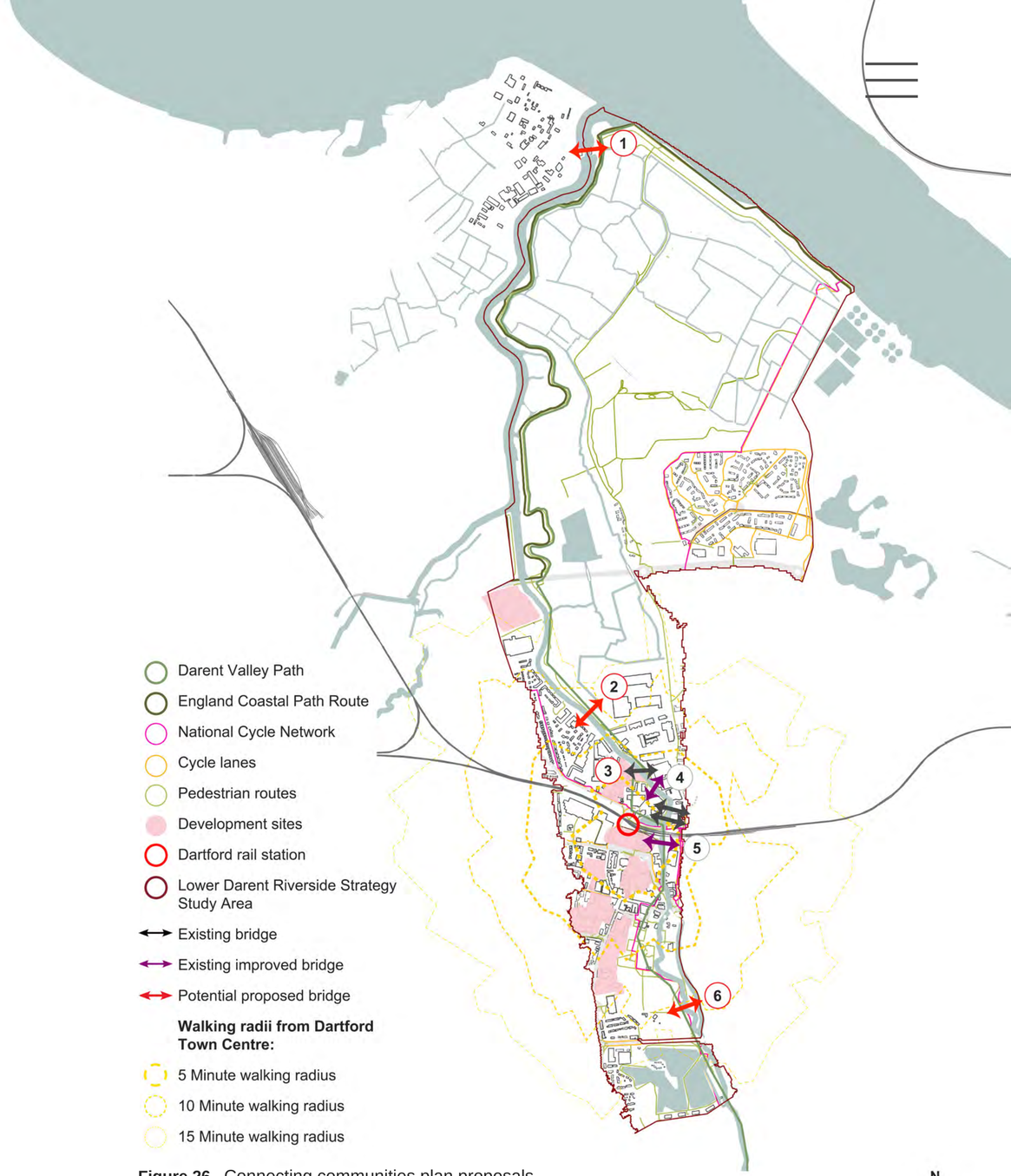


Figure 26. Connecting communities plan proposals

Connecting Communities

Bridge and path Links

The river can sometimes form a connection, but also divides, especially restricting east-west movement.

In order to improve access to the River Darent for leisure and also access between local centres, key employment areas, strategic development sites and education facilities, three possible new bridge locations and three existing bridges requiring improvements have been identified as follows:

Marsh

Bridge 1 linking Dartford and Crayford Marsh

- Allows improved continuity of the Thames Path/ East Coast Path Route, improving access to and around the river for recreation, by enabling shorter loop walks/cycles in the area. (Refer to Figure 26).

Urban

Bridge 2 Linking two development sites

- Bridge 2 would have impact on the adjacent strategic site, employment area, local centres and to River Mill Primary School. Creating a safe and segregated route in this location, which is likely to attract a significantly greater number of walking and cycling trips than existing infrastructure on A206, would reduce existing east – west severance in the area.

Bridges 3, 4

- Another potential option is to investigate opportunities around existing bridges. Some are either poorly aligned (Bridge 3), not offering the most convenient links, others are currently blocked for authorised personnel only (Bridge 4)

Bridge 5

- There is an existing lack of clear route from Overy Street. The bridge is not fully accessible, with only stepped access to the western bank of the river.

Park

Bridge 6 on to Ecology Island

- A new link to Ecology Island would improve access to, and use of this location.

Refer to Table 4 on page 33 for more details. Further detailed work is required on each of the bridge options, to determine the best means of delivery.

Key Policy

Dartford Local Cycling and Walking Infrastructure Plan

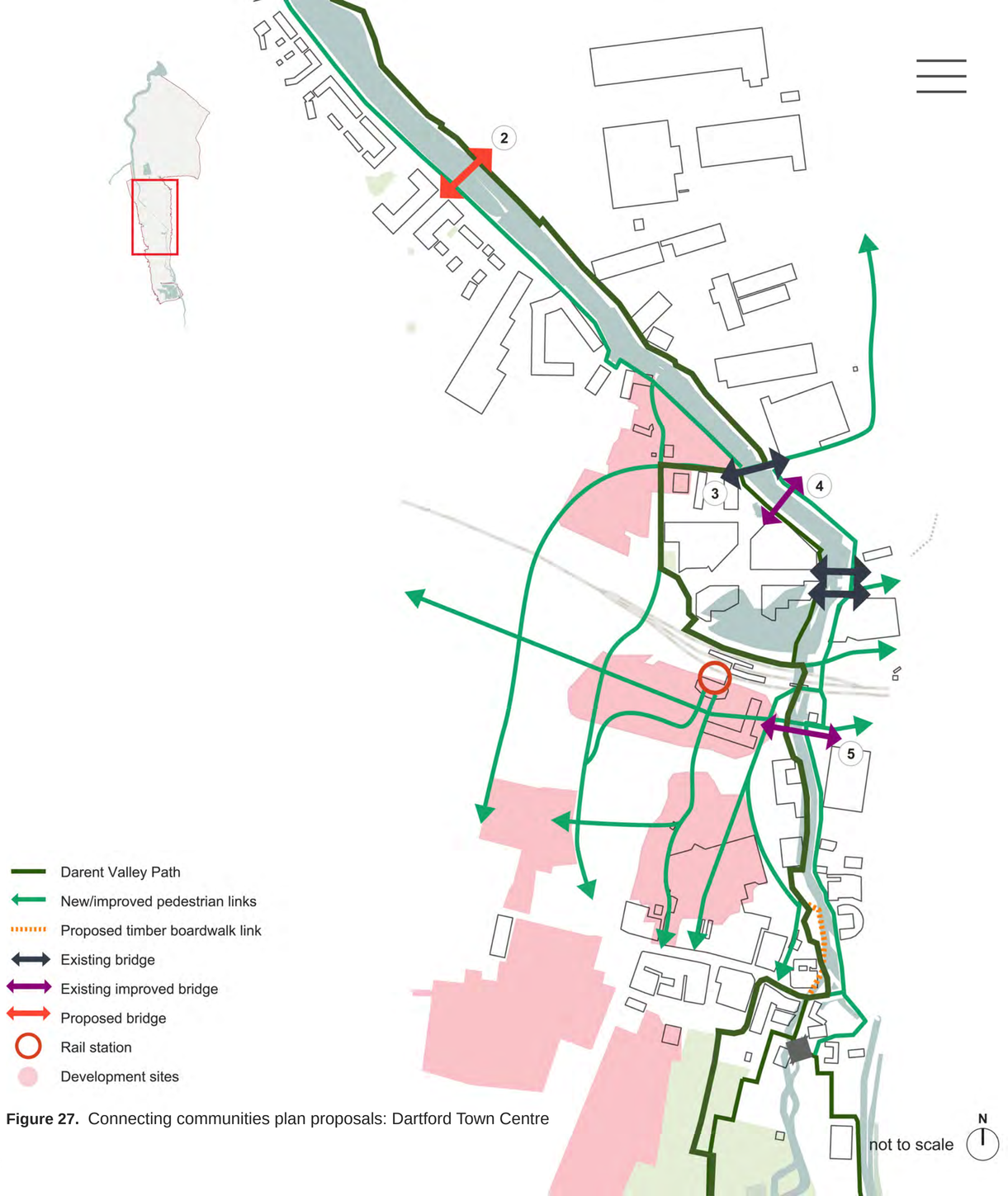


Figure 27. Connecting communities plan proposals: Dartford Town Centre

Connecting Communities - Bridge Links

Table 4. Bridge link options. Refer to Figure 26 on page 31 and Figure 27 on page 32 for locations.

Criteria	1 – new bridge. Crayford Marsh - Dartford Marsh	2 – new bridge. Development site- Development site	3 – realign bridge. James Smith Ct - Policy area (Diasorin Site)	4 – open bridge/land on east side to public. James Smith Ct - Policy area (Diasorin Site)	5 – accessibility improvements (remove steps to river). Station Approach - Wickes	6 – new bridge. Central Park - Ecology Island
Population benefits	No population living within close proximity, no benefits to severance for functional journeys likely	Some population on west side of river, low density employment to north/east	Some population on west side of river, low density employment to north/east and residential communities close beyond	Some population on west side of river, low density employment to north/east and residential communities close beyond	No impact on severance across river associated with removing steps to river	Some residential and commercial population in surrounding area
Impact on desire lines to key civic buildings (schools/medical centre/colleges)	No impact as it is far from schools, employment, shops and residential areas	Some benefit and reduced travel time to River Mill Primary School and employment sites east of the river from residential areas to the west, however, not generally well aligned to desire lines	Some benefit in meeting desire lines along the river and reduced travel time to River Mill Primary School and employment sites east of the river from residential areas to the west, although this is not significant	Some benefit and reduced travel time to River Mill Primary School and employment sites east of the river from residential areas to the west, although this is not significant	No significant change to journey times across the river	No significant change to journey times across the river
Proximity to key strategic or employment sites	Far from all the strategic sites	Relatively close to the strategic site	Very close to several strategic sites	Very close to several strategic sites	Very close to several strategic sites	Close to two strategic sites
Land ownership considerations	Land likely owned by council / public body	Agreement would be required from land owners	Agreement would be required from land owners	Agreement would be required from land owners, and public access allowed onto employment area	Land likely owned by council	Land likely owned by council
Access to river/leisure	Improves leisure access to the riverside path	Improves leisure access to the riverside path	No impact on the accessibility	By opening the east side to public, pedestrians are able to access to the river path for longer duration.	The development helps improve pedestrian's accessibility to river by removing steps	The development helps improve pedestrian's accessibility to Ecology Island and River Darent for leisure
Likelihood of achieving access for all	High - any new bridge would need to meet inclusive mobility standards and be accessible for all	High - any new bridge would need to meet inclusive mobility standards and be accessible for all	High - existing bridge includes step-free access	High - existing bridge includes step-free access	Low - Space limited for adding ramped access to bridge	High - any new bridge would need to meet inclusive mobility standards and be accessible for all
Summary	A new bridge in this location would serve a function/benefit for people accessing the river for leisure and recreation. However, this will bring few practical benefits in terms of reducing severance caused by the river between existing communities.	Due to its location close to population on the west of the river and proximity to strategic sites, this bridge location has potential to benefit many people, by improving connections across the River Darent and along the river for recreation. However, this location is on the periphery of the strategic sites, and other locations may offer greater benefit.	Realigning this bridge will bring some benefit to the sites in close proximity, however, the scale of work required may be significant, and realignment may not bring as many benefits as a new bridge in an alternative location.	By opening the east side of this bridge to public will benefit a large population, improve the connection of key civic buildings, and have significant impact on accessing strategic or employment sites. People will also be able to access the river from the east side of the bridge.	After removing the steps to the bridge, it will have huge impact on reducing the travel time to the key strategic or employment sites. It will also allow people to access the river path.	This option would have a primarily recreational and leisure function, by improving access to Ecology Island.

Connecting Communities

Lighting- sense of safety

There can be dramatic differences in how we experience Dartford during the day and night. Lighting is the most important built environment design factor in influencing people's perceptions of safety in public places. When designing lighting, the following are best practice design considerations:

- Reducing light pollution doesn't mean not lighting - it means adding the right illumination, in the right place, at the right time.
- Perception of safety depends on many qualities of lighting (brighter is not necessarily better).
- There are many benefits of reducing light pollution for health, wildlife, energy, and astronomy.
- Light pollution can be reduced and still provide illumination for night-time activities.
- Involve the community in planning and implementing lighting design projects.

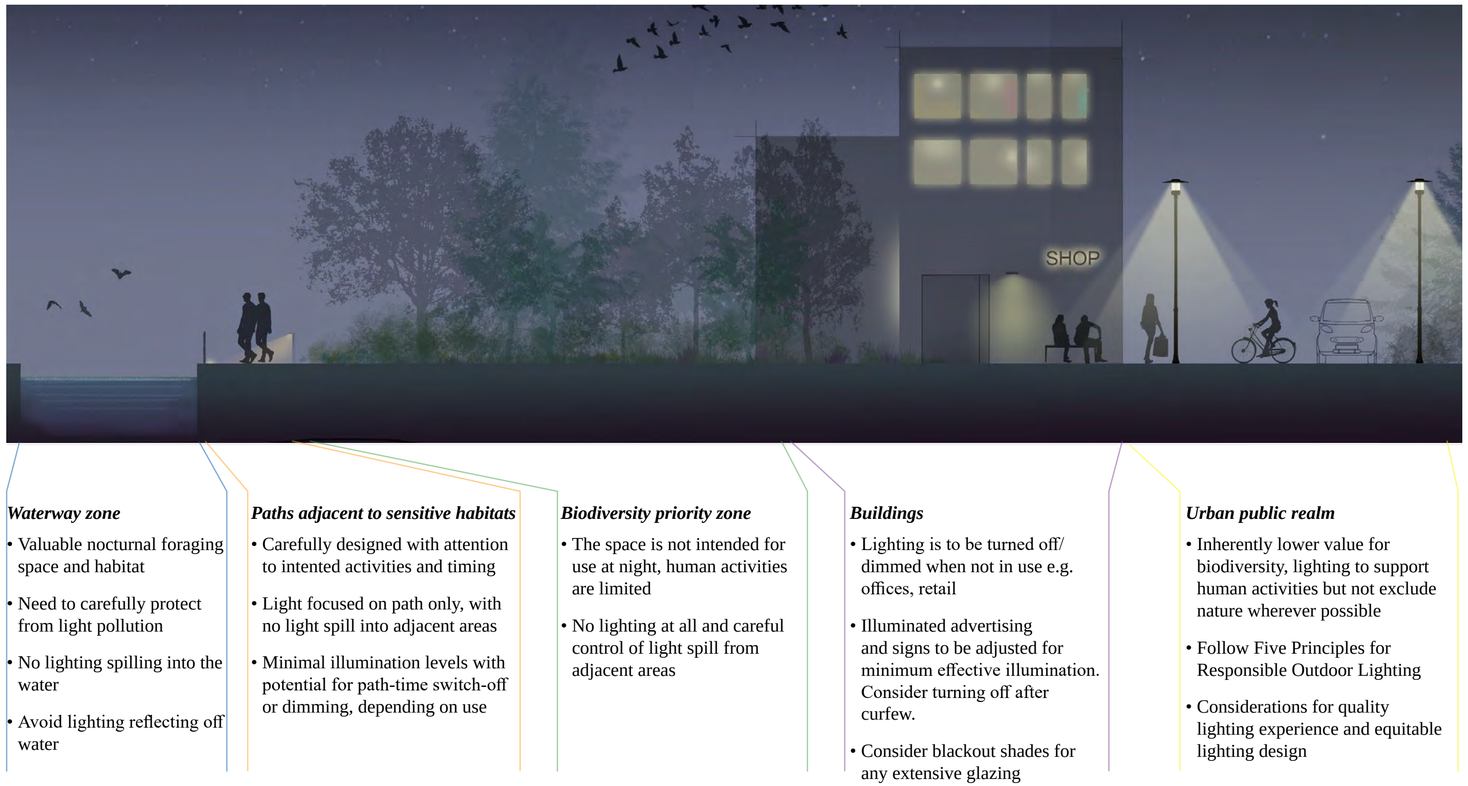


Figure 28. Lighting design principles

Celebrating Identity and Character

Quality public realm and open space provision in new developments should integrate heritage to ensure these assets are enjoyed by current and future generations.

Heritage trails can celebrate these various assets, draw visitors to the area, and instil a strong sense of identity for local residents, while providing a narrative to how the River Darent has changed over time. A trail has the opportunity to use wayfinding and information boards to guide visitors to the key heritage assets along the Darent Valley Path, within the marshes, and in Dartford Town Centre such as making the marsh tramline a new key route and highlighting small wooden angled stakes on the river edge which date back to Post Medieval to Modern - 1540 AD to 2050 AD (refer to page 18 for information on existing heritage assets).

The southern section of the study area and Dartford Town Conservation Area is particularly sensitive for Roman and Medieval settlement remains. Any developments in the Town Centre and near Central Park will likely be subject to archaeological investigation. Any proposals in the conservation area must be assessed for their impact on the existing character.

Certain design features regarding building height and street layout should be developed through close consultation with Landscape and Visual Impact Assessment (LVIA) professionals, expert masterplanners, and the Council.

Proposal

- **Heritage trails and associated wayfinding.**
- **Any proposals in the conservation area must be assessed for their impact on the existing character.**
- **Mitigation works and archaeological investigation prior to, or during, the commencement of proposed development are likely required.**
- **Re-establish historic ‘Tram line’ connection to Thames Long Reach including learning opportunities.**
- **Reflect conservation area status close to Town Centre.**
- **Protect and enhance historic riverside and marsh assets.**
- **Investigating and understanding the area’s undiscovered archaeology where opportunity arises.**

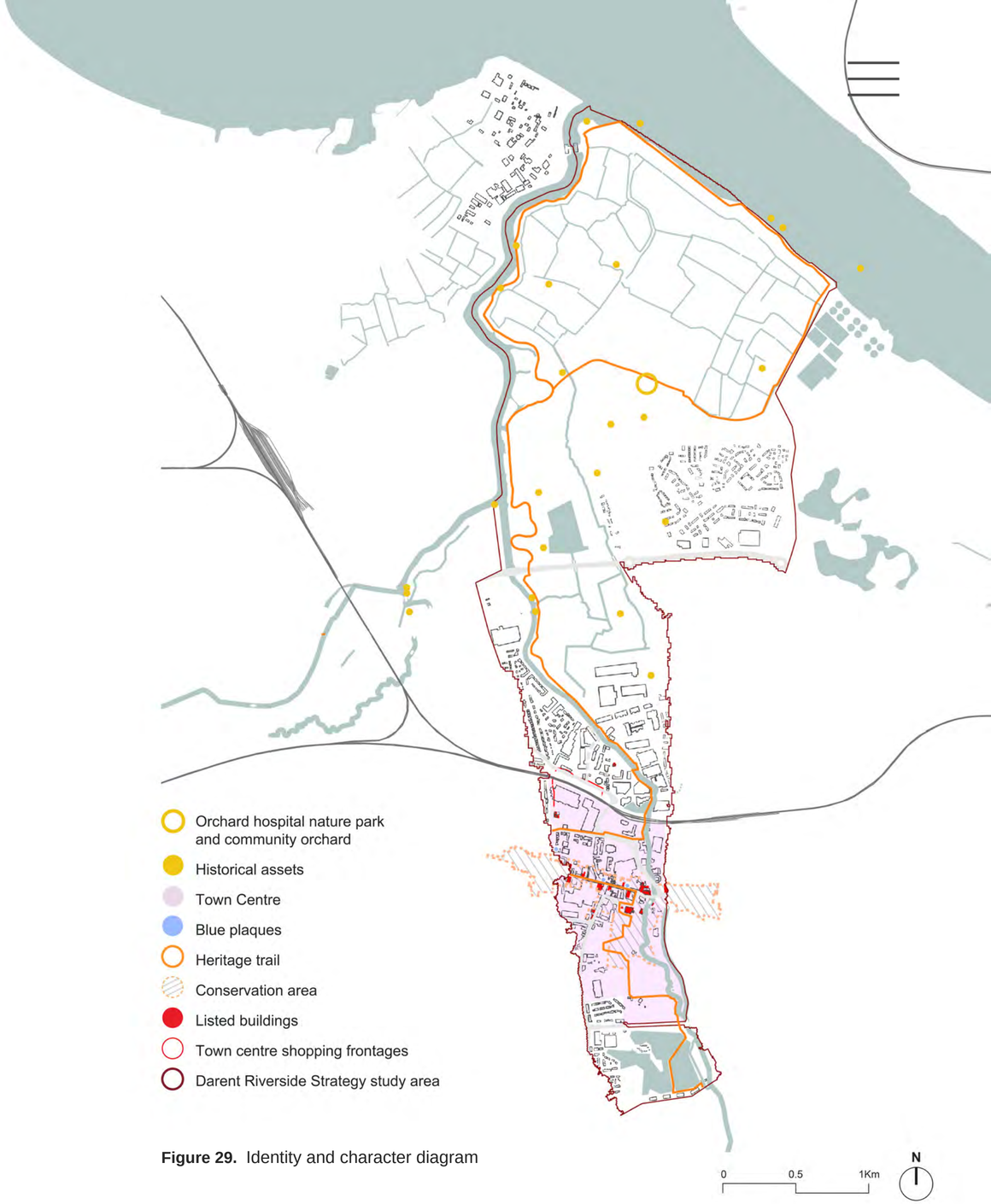


Figure 29. Identity and character diagram

4.3 Legacy

The Strategy seeks to leave a positive imprint on the lower valley for years to come. Some key aspects of its legacy include:

Building Resilience

Through targeted flood defence projects and comprehensive planning, the Strategy establishes a resilient framework for mitigating flood risks. This legacy ensures the safety of communities and infrastructure along the river, safeguarding against potential environmental and economic impacts.

Regenerating Nature

The Strategy's emphasis on biodiversity and sustainable practices contributes to the preservation and enhancement of the natural environment in the Lower Darent River study area. The introduction and maintenance of diverse plant communities and habitats, coupled with responsible flood risk management, foster a healthier ecosystem.

Connecting Communities

The Strategy's inclusive approach engages local communities, creating a sense of ownership and pride in the Darent River. The development of public spaces, recreational areas, and the encouragement of outdoor activities contribute to the wellbeing and quality of life for local residents.

Celebrating Identity and Character

Initiatives within the Strategy that promote the appreciation of the Darent Valley's cultural and historical significance contribute to the region's identity. Educational programs and interpretive elements leave a lasting impact on residents and visitors, fostering a connection to the area's heritage.

Economic Development

The Strategy's focus on sustainable development and revenue generation, such as through public spaces and associated assets, can stimulate local economies. The legacy includes the creation of economic opportunities and the potential for increased tourism and business activities.

Innovation and Best Practices

Successful implementation of the Strategy establishes a model for other regions facing similar challenges. The lessons learned and best practices developed become part of a broader legacy, influencing future approaches to environmental conservation, flood management, and community development.

Overall, the Strategy's legacy is one of sustainable development, environmental stewardship, and community resilience, setting a positive example for integrated and forward-thinking approaches to regional planning and management.

Figure 30. Site photo of the River Darent and Dartford Creek Barrier in the distance

5. Vision and Toolkit

5.1 Strategic Sketch Vision for the River Darent

The four design principles will guide regeneration towards high-quality placemaking through the use of NbS along the river. The Strategy is a guide for developers, landowners, the Environment Agency and the council to deliver a continuous defence line and river path with an improved river edge treatment which not only makes the study area more resilient to a changing climate but celebrates the river, creating a high-quality, accessible environment that caters to a rich mix of activities.

The Strategy's vision for the Lower River Darent seeks to balance the proposals so that they are sensitive to the identified character areas while instilling a sense of unity to aid wayfinding and access to, and along the river’s edge.

This chapter introduces Toolkits: a library of best practice river edge conditions (refer to the following page 39).The Toolkits aim is to aid developers, landowners, the Environment Agency, Kent County Council and the Dartford Borough Council to deliver the strategic vision.

Figure 31. Site photo of the River Darent in Dartford Town Centre

Figure 32. Strategic vision sketch

5.2 Toolkit Introduction

The Toolkits have been developed in conjunction with the design principles and future flood defence requirements to help stakeholders deliver against the vision. As part of this Strategy, eleven Toolkits across three character areas have been developed to demonstrate best practice river edge treatments (refer to Figure 33 'Toolkit locations' and associated reference pages). Its imperative that there is a joined up approach between sites in order to deliver a contiguous defence line.

The marsh and park have their own unique landscape character. The designed Toolkits for these areas respond to the more rural setting and specific site constraints. In the Urban character area, there are a variety of edge treatments that can be applied subject to a greater list of unknowns at this stage such as future site use and funding. For this reason, the Urban Toolkits have been listed in order of preference, with Toolkits 7 and 8 only permitted as a last resort:

Natural Setback (Toolkit 4)

The preferred option which creates more capacity and allows more social use when south facing.

Stepped Edge (Toolkit 5)

Can be used to either narrow or widen the river channel, and is encouraged on south-facing banks to maximise their use.

Ecology Edge Enhancement (Toolkit 6)

Can be used on existing or new defence walls and where space is a constraint.

Existing Defence (Toolkit 7)

In cases of unavoidable space constraints, the existing defence can be raised. However, a balustrade higher than 1.1m should be avoided.

Boardwalk (Toolkit 8)

This should only be utilised for connecting the Darent path where existing site constraints mean there is no alternative river edge path on land.

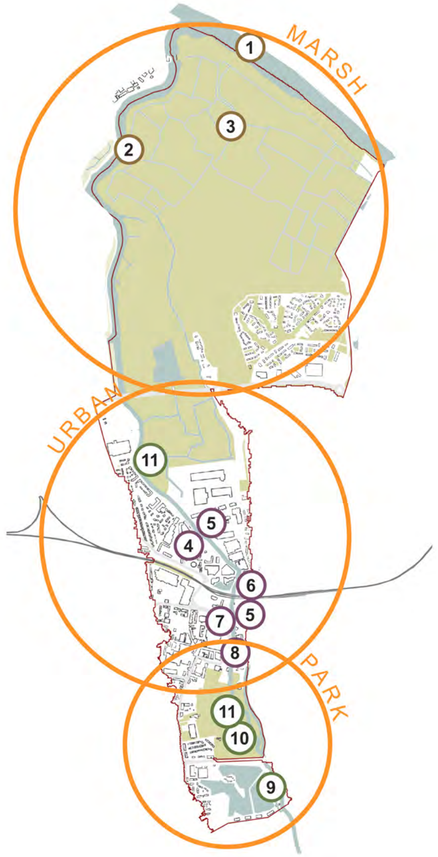
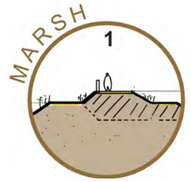
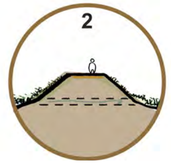


Figure 33. Toolkit zones. Locations subject to future site appraisal

Click the toolkit titles below to view each toolkit in detail



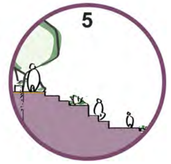
Thames embankment (p.43)



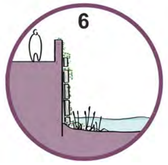
Managed re-alignment (p.44)

Online and offline wetlands (p.45)

River edge natural setback (p.50)

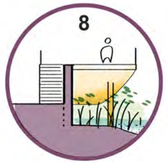


River edge stepped setback (p.51)



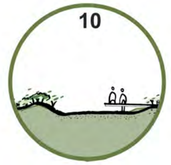
Ecological edge enhancement and channel narrowing (p.52)

Wall raising (p.53)

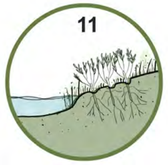


Boardwalk (p.54)

Chalk stream enhancement (p.58)



Floodable space (p.59)



Slope stabilisation (can also apply to fresh water marsh area) (p.60)

5.3 Marshes

The vision for the marshes transforms the area into a destination nature reserve reminiscent of Rainham Marshes, prioritised as a tranquil haven for wildlife, with some recreational use including walking and cycling. By building upon the existing character and employing NbS, the vision seeks to augment the River Darent's storage capacity, and over time, the River Darent flow path.

A key proposal is creating greater resilience by breaching the existing embankment with flood dispersal openings and designing in a new bund embankment to contain flood storage water at times of inundation but also enhance the existing the salt marsh/fresh water habitats. This proposal is in synergy with the TE2100 which specifically references Dartford and Crayford Marshes as potential flood storage. However, the alignment and sequencing requires detailed review and negotiation between the various landowners, and the Environment Agency.

The improvement of the existing ditch system through maintenance and re-profiling will improve the existing habitats and ecology. The marshes should be a place that contributes to the area's prosperity in terms of economy as well as people's health and wellbeing. Basic yet effective measures, including broadening pathways and integrating them into national walking, and cycling routes, and into surrounding local communities will enliven the marshes.

There is a possibility, with further funding, to create a bridge suitable for cycle and pedestrian use, to connect the Thames Path/ England Coast Path and National cycle route (Refer to Bridge 1 in table 4 on page 33).

The re-purposing of some key existing historical structures such as the old hospital footprint and tram line, can create landscape interventions and interest as well as be part of the wayfinding journey and Heritage trail. The addition of seating and viewing platforms with lighting sensitive to ecology, will not only enhance accessibility but also bolster passive surveillance.

The ambition is to catalyse a transformation shift in how the local community and beyond perceives, uses, and values the marshes as well as removing the barriers that fragment the marshes. Key for the delivery of the vision is for all landowners and stakeholders to develop a cohesive short-term and long-term management plan for the benefit of both existing, and future generations.

Signpost

Managing the Marshes
(Link no longer available as of November 2024)

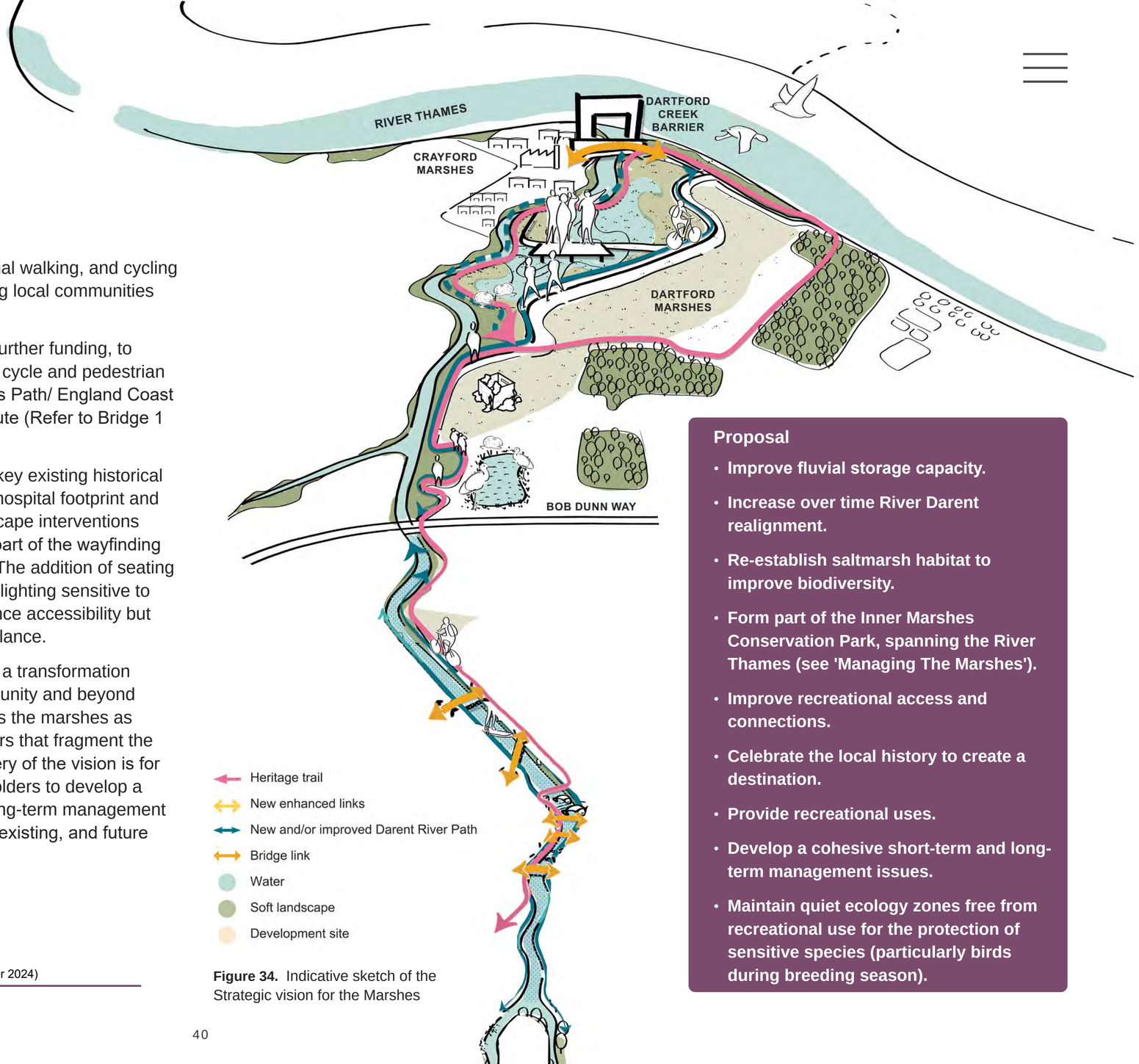


Figure 34. Indicative sketch of the Strategic vision for the Marshes

Proposal

- **Improve fluvial storage capacity.**
- **Increase over time River Darent realignment.**
- **Re-establish saltmarsh habitat to improve biodiversity.**
- **Form part of the Inner Marshes Conservation Park, spanning the River Thames (see 'Managing The Marshes').**
- **Improve recreational access and connections.**
- **Celebrate the local history to create a destination.**
- **Provide recreational uses.**
- **Develop a cohesive short-term and long-term management issues.**
- **Maintain quiet ecology zones free from recreational use for the protection of sensitive species (particularly birds during breeding season).**

Building Resilience

1 Managed realignment: Flood dispersal openings

2 New bund creating increased flood capacity while protecting freshwater habitats (please note alignment for illustrative purposes only and any future proposals would need optimised.

Regenerating Nature

3 Re-wetting of floodplain

4 Increased area of salt marsh

5 Protect green belt to maintain a distinct and enduring open environment

Connecting Communities

6 Existing Darent valley Path

7 New footpath/cycle path (achieving minimum path widths and level surfaces) linking to the Thames Path/England Coast Path and National Cycle Route 1. Bridge design has to facilitate boat navigation

Celebrating Heritage and Identity

8 Proposed new path and heritage trail

9 Viewing platform

10 River navigation up to Bob Dunn Way

Key Policy

Local Plan - Green and attractive Environment G1

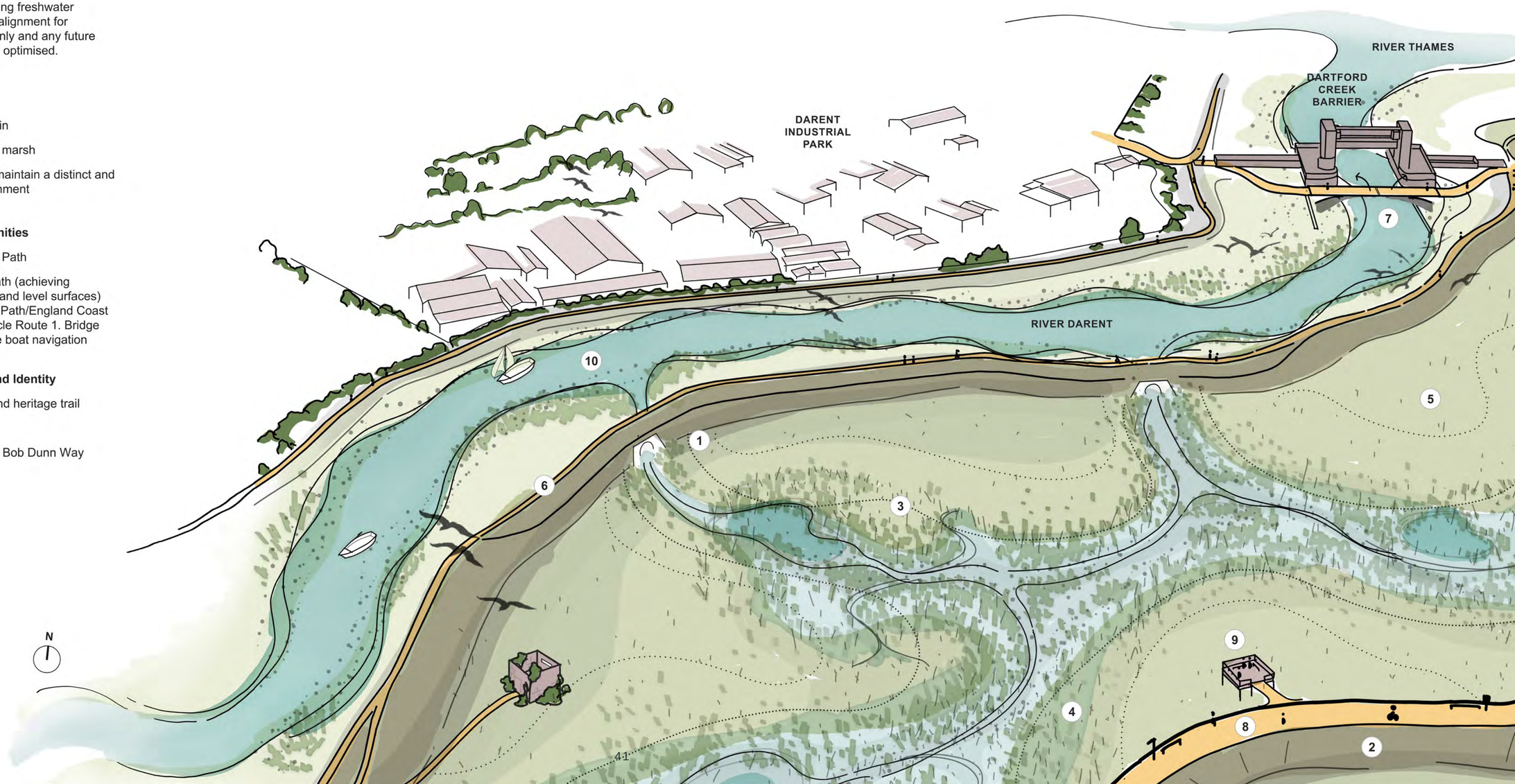


Figure 35. Indicative sketch of the strategic vision for the marshes

Marshes: Existing Sections

This Strategy, as agreed with the Environment Agency, assumes that the Dartford area will continue to be protected in future from the most extreme tidal flood events, either by an improved Dartford Creek Barrier, or by a new Thames Barrier if the latter is relocated to Long Reach or Tilbury, and to reflect the TE2100. Section A (figure 36) illustrates the current flood defence levels and how these will need to be raised to reach the required defence heights by 2040 and 2090. The defence bund closer to the River Thames is currently used as the recreational path. The new proposal and Toolkit 1 focuses on how the level of this mound will need to be raised.

Section B illustrates the typical riverbank profile for the River Darent at the marshes. The current flood defence mound allows for a 1:200 year flood event. Toolkit 2 provides an example of how the new flood defence line for the marshes should be developed. This will serve both as a flood defence and as water storage capacity.

As part of future studies, a detailed appraisal of the defence heights on the tidal River Darent will need to be carried out. See the 'Delivery' Section 6.3 'Developer Timeline for future defence raising' and 6.4 'Flood Defence Raising Implementation methodology' for further details. The west bank of the river has not been considered as it sits outside the study boundary.

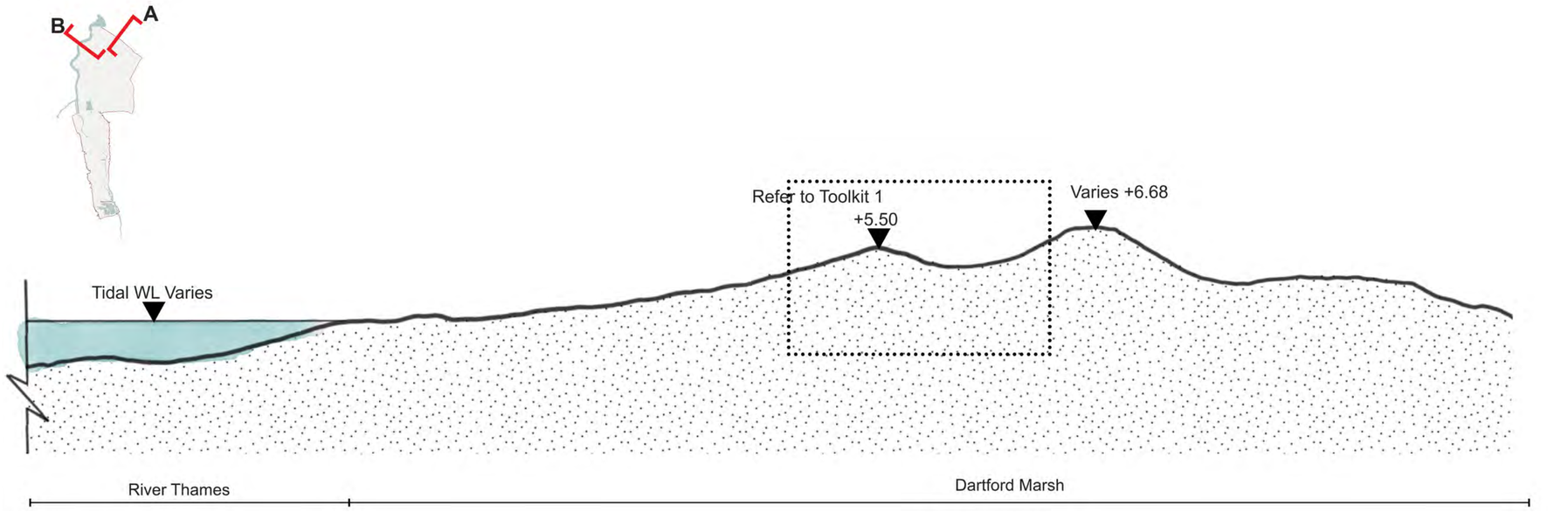


Figure 36. Section A-A existing sketch cross section
Please note: Hydraulic model for the River Thames flood data not available as part of this Strategy.

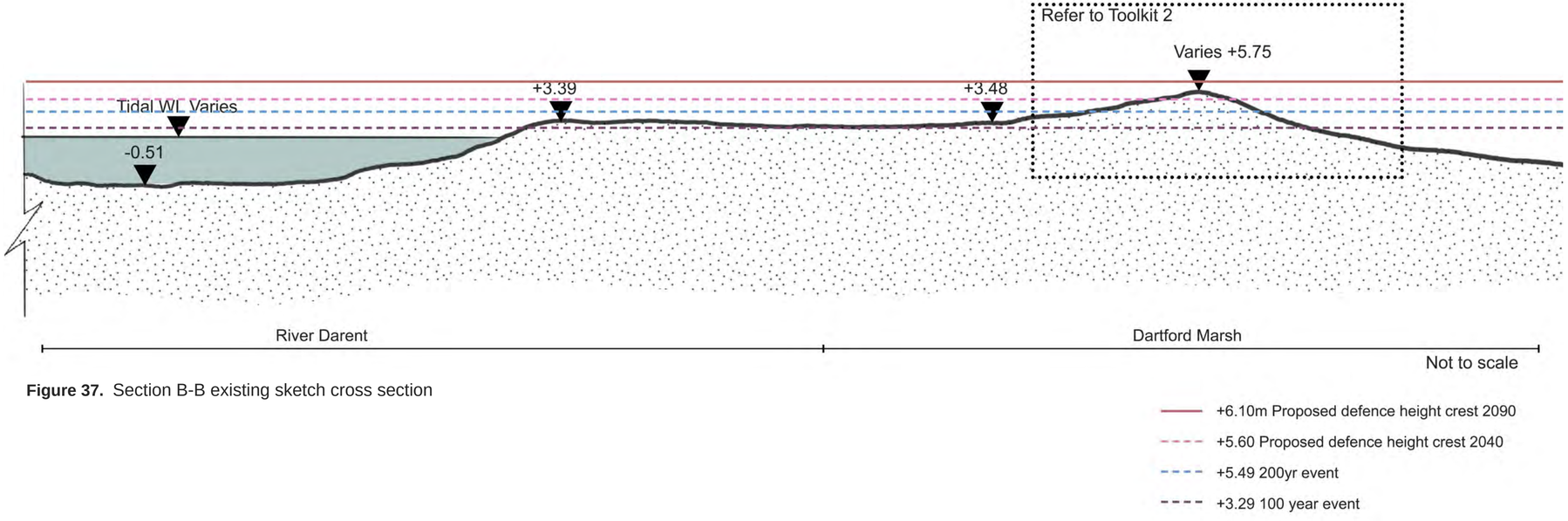


Figure 37. Section B-B existing sketch cross section

Toolkit 1: Thames Embankment raising

Description

In the event that the Thames Barrier is not relocated downstream in the future, the option of raising the embankment to 8.0m AOD at this location along the Thames frontage may become necessary. However, should a new Thames Barrier be constructed at Long Reach or Tilbury, the embankment raising would not be required, as the area would be safeguarded by the new barrier, and the existing defence level (landward bund) already exceeds the required 6.1 m AOD threshold projected for 2090. However, should the Thames Barrier remain at Woolwich, there arises the potential for this section alongside Dartford marshes to raise to 8.0 m AOD, possibly in conjunction with enhancements to the Dartford Creek Barrier.

Benefits

- **Increases water capacity within the Thames.**
- **Reduces storm tides flooding in the wetland.**
- **Retains existing character of the marshes.**
- **Creates saltmarsh habitat.**
- **Provides new recreational path opportunities.**

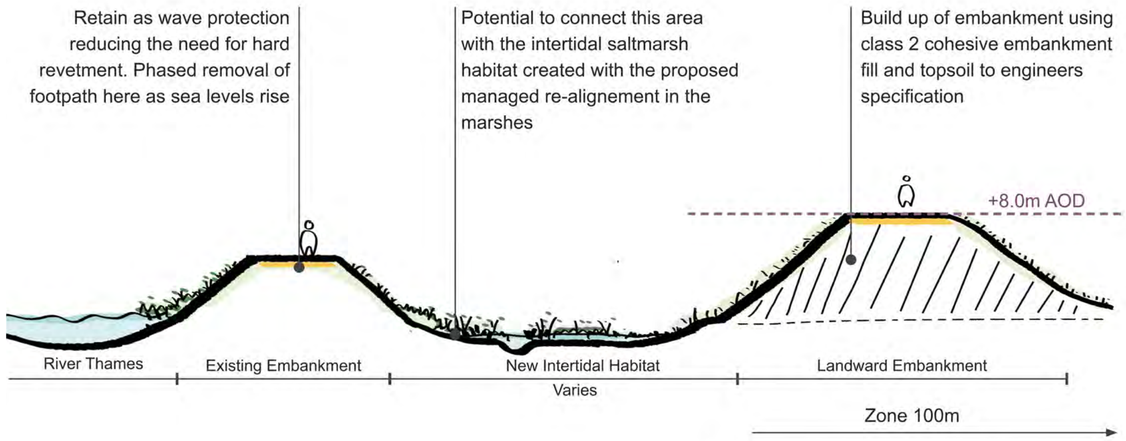


Figure 38. Thames embankment sketch cross section
Not to scale

Location

Figure 39. Site photo existing Thames edge flood defence embankment

Signpost

Estuary Edges - Thames Estuary Partnership

Design Considerations

- It's important to carefully assess whether the footpath should remain on the current embankment, especially considering the heightened risk of overtopping with rising sea levels. This could potentially pose challenges to its usability. Additionally, raising the landward embankment might obstruct views from the footpath towards inland areas.

Delivery

- Where development is permitted that requires flood protection work and those works are not programmed by the responsible agencies, the necessary protection measures will be fully funded by the developer. This will include maintenance costs for 30 years.

Maintenance

- Low maintenance requirements, inspection of bund structure and stability to be undertaken every 6 months.
- Planting will require a 5 year maintenance period to ensure new species and roots are not damaging the bund or habitats.

Toolkit 2: Marsh Managed Re-alignment

Description

The managed realignment proposes both new setback bund and flood dispersal openings in the existing defence line.

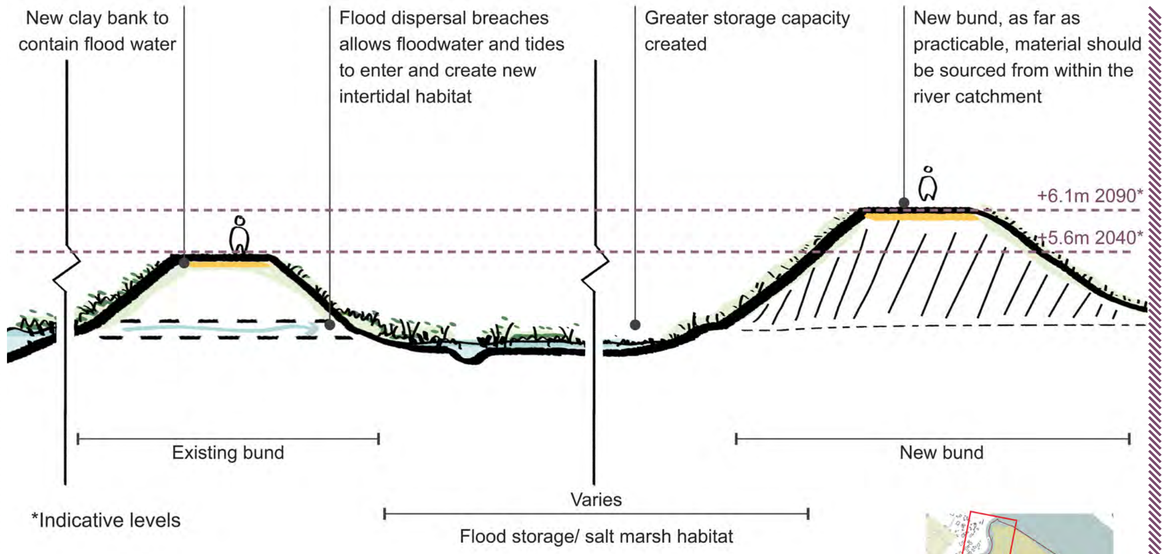


Figure 40. Thames embankment sketch cross section
Not to scale

Location

Figure 41. Site photo River Darent adjacent to the marshes

Figure 42. Site photo existing Dartford Marsh embankment

Benefits

- **Increases water capacity within the Thames.**
- **Reduces storm tides flooding in the wetland.**
- **Provide a short term solution until Thames barrier is upgraded.**
- **Retains existing character of the marshes.**
- **Creates saltmarsh habitat.**
- **Reduces erosion.**
- **Provides recreational path opportunities.**

Signpost

Estuary Edges - Thames Estuary Partnership
Natural Flood Management Manual. CIRIA.

Design Considerations

- The extent and route of the new proposed bund is indicative in this Strategy only. The route is subject to agreement from landowners, and protection of fresh water habitat.
- On the tidal reaches of the River Darent it will be necessary to maintain a 15 metre margin from the top of the bank, or within 15 metres of the landward toe where one exists and be clear of obstruction for maintenance purposes.

Delivery

- Suitability of fill material to increase bund heights (and increase future resilience) must be made against the existing materials used to form the bund. Design and materials specification must be made by a qualified engineer, accounting for site specific conditions including hydraulic action, slope stability requirements and geotechnical requirements.

Maintenance

- Low maintenance requirements, inspection of bund structure and stability to be undertaken every 6 months.
- Breeches to be checked and ensure they are unlocked every 3 months or after flooding events.

Toolkit 3: Marshes Offline and Online Wetlands

Description

In river basins, especially in the area of river mouths, wetlands occur as part of the natural process of river basin functioning. Improvements and modifications to the existing drainage ditch network, including the potential to create more diverse channel cross-sections and to create/ reinstate better riparian zones and floodplain wetlands, improves the ecology and resilience of the river.

Benefits

- **Flood management, including storage and control water flow.**
- **Provide additional aquatic habitat.**
- **Links existing isolated ditches to the wider network.**
- **Deposition of sediment in high flow events.**
- **Reduces rate of erosion.**
- **Improved habitat diversity and water purification.**
- **Creates nesting and foraging habitat for birds.**
- **Co2 sequestration and storage.**

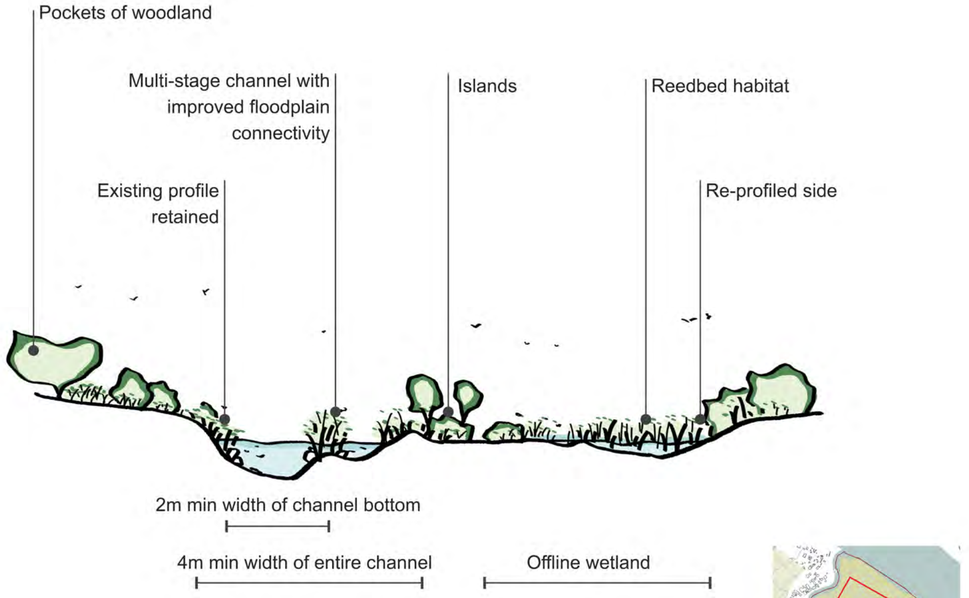


Figure 43. Proposed marsh ditch sketch cross section
Not to scale

Figure 44. Site photo existing ditch network in the marshes

Figure 45. Wetland

Signpost

Urban Wetland Design Manual
DB fenland document
The Saltmarsh Creation Handbook

Design Considerations

- A variety of depths should be maintained, grading to a shallow wet marginal fringe to support the greatest variety wildlife.
- Small timber dams should be considered to compliment ditches but be sensitive to natural features and minimise disturbance.
- Design should restore the function of these areas as flood buffer zones while fostering wetland processes that are thought to contribute the most to the improvement of water quality.

Delivery

- Negative impact on existing wetlands should be avoided by analysing their extent at various times of the year.
- The intervention proposal must be validated by the environmental specialist.

Maintenance

- Ditch maintenance should be carried out in the late summer or early autumn every 3 years after plants have seeded, post bird breeding season, pre-wintering bird arrival and when water levels are low.
- Maintenance regime should consider hydrological conditions.

5.4 Urban

The vision celebrates the River Darent corridor at the heart of Dartford, transforming the town and its community. As well as protecting the town, the use of various types of river defence systems (refer to the Toolkit pages 50 onwards) will increase interaction with the river by improving adjacent public realm, access and visibility. Changing the river's defence treatment, widening sections and where possible incorporating nature, will create an attractive waterfront, which in turn can entice local people, and businesses.

Dartford has a unique setting, a chalk stream habitat running through an urban area, meeting a tidal river section. This juxtaposition of habitat needs to be celebrated and enhanced by mimicking how the river would be integrated into its original floodplain. This can be done by de-canalising and integrating nature at the river's edge, while providing a fish and eel passage at the Welcome Sluice. The incorporation of green infrastructure into both the river and the public realm, particularly alongside development sites, will help improve terrestrial and aquatic habitats. This will help mitigate the impacts of climate change through improved filtration rates, reduced temperatures, and carbon sequestration. The long-term plan to remove the Wellcome Sluice (see page 55), would increase capacity and aid establishment of the original waterflow and currents (although limited by the built environment).

Central to the vision is creating a continuous recreational path connecting pedestrians and cyclist to various areas along both sides of the river in the built up area north of the historical Town Centre, through to the marshes, and the parkland. These paths are to be complemented with seating, cycle stands, lighting and wayfinding, as well as suitable flood defence treatment to allow a visual connection to the river.

In areas of new development, the addition of public realm adjacent to the river, will create areas for meeting, eating, drinking and cultural leisure uses, helping to deliver walkable neighbourhoods and strengthening the local character. Development should open up more visual and physical connection to the river. The potential of providing new bridges across the River Darent, will connect the existing fragmented communities.

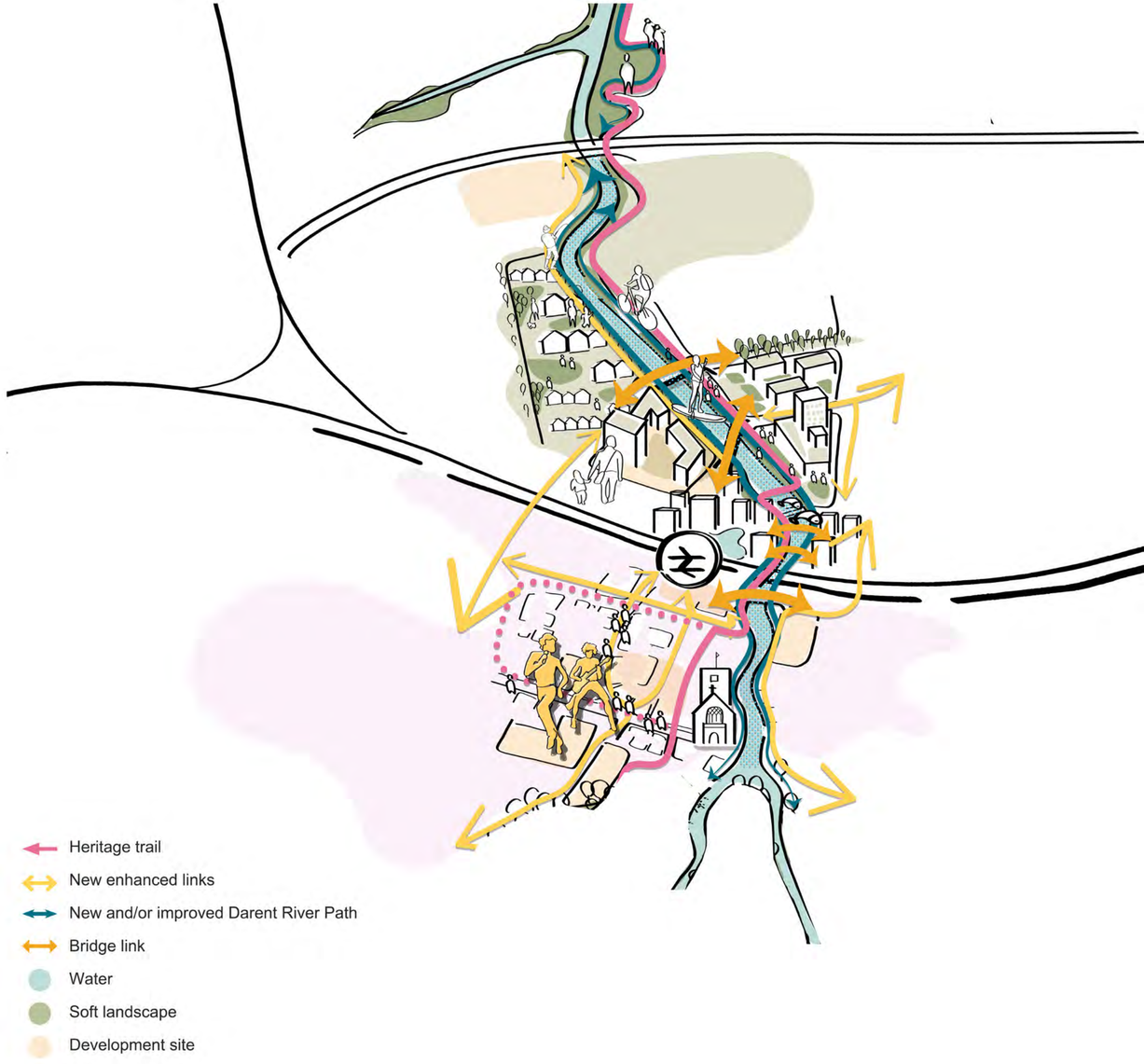


Figure 46. Indicative sketch of the Strategic vision for the urban area

Development Site Sketch

The proposed increase in flood defence wall height by 500mm to +6.1m OD, creates an opportunity to re-look at the river walls as terraces, platforms, walkways rather than concrete, fortress walls. The vision seeks to improve the river and the quality of its surrounds within its main constraints in built up areas, by creating a continuous flood defence line, made from various types of flood defence treatments. Key to unlocking the river edge character of Dartford, is identifying places with historical value that need to be enhanced and conserved against sections for opportunity, including future developments.

Redevelopment of Hythe Street/Victoria Road North, for example, offers an opportunity to mitigate the existing fluvial flood risk by reconnecting the river with its floodplain to allow fluvial floodwater which is already out of bank to return to the tidal river channel (See Figure 47). In any tidal river section, where oversized drainage is proposed, protection from tidal flooding must be maintained through the use of effective non-return valves. The size and location of individual outfalls is subject to site specific constraints and development layouts. Flood risk assessments and drainage strategies supporting development proposals will be required.

Signpost

Dartford Borough Level 1 and 2 Strategic Flood Risk Assessment Page 10 Paragraph H. Provision of buffer strips

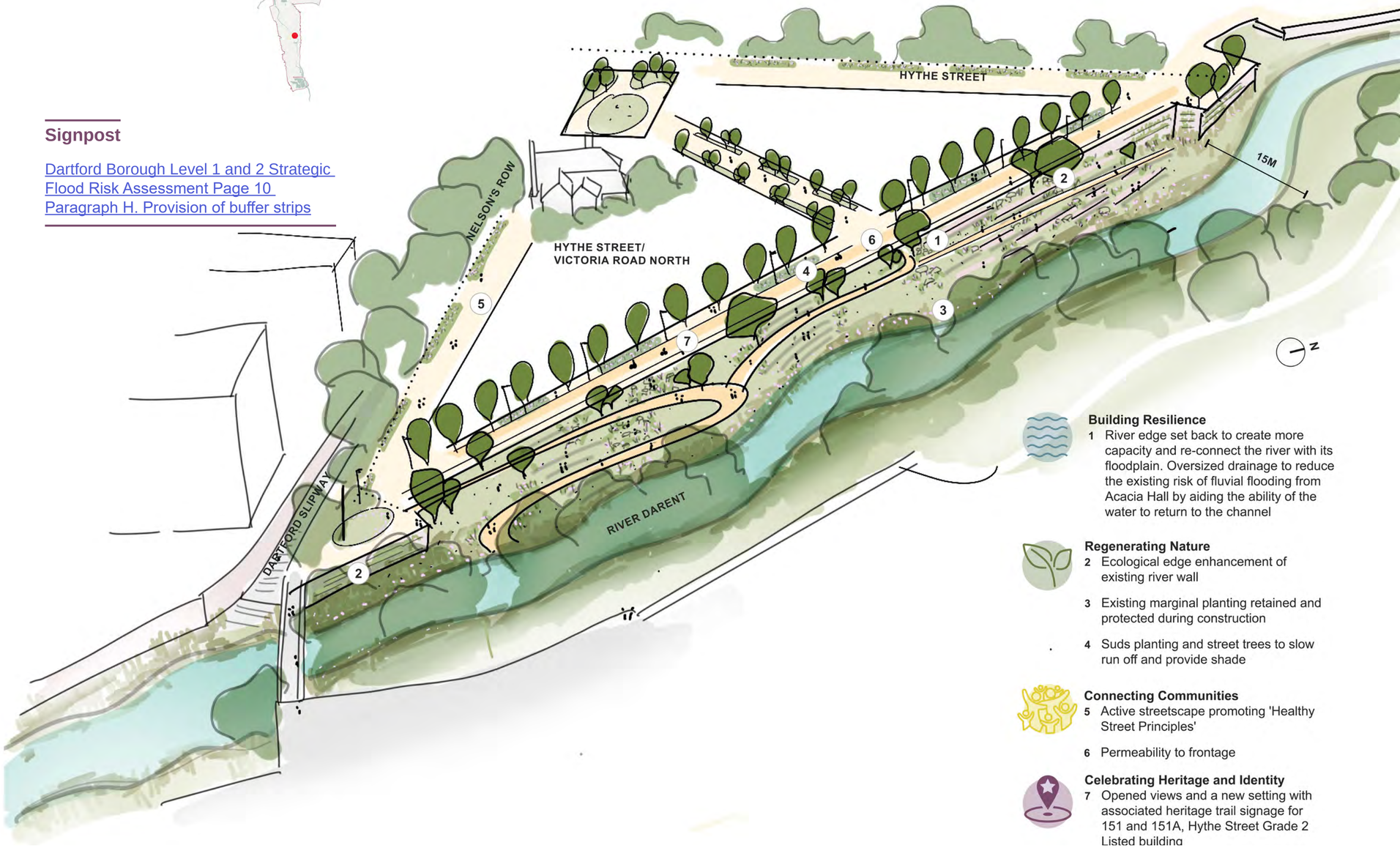


Figure 47. Indicative sketch illustrating a variety of possible river edge treatments that could be delivered alongside development sites.

Urban: Existing Sections

Sections D and E are located north of the Town Centre and have a more natural river edge condition; however, bank heights are below the levels that will be required in 2040 so raising is likely to be required relatively soon. As the riverbanks are not constrained by existing development or pinch points, future flood defence should be designed for both ecological benefits, and social uses as well as integrating with future development (refer to Toolkit 4 and 5).

Signpost

The River Restoration Centre Manual of Techniques

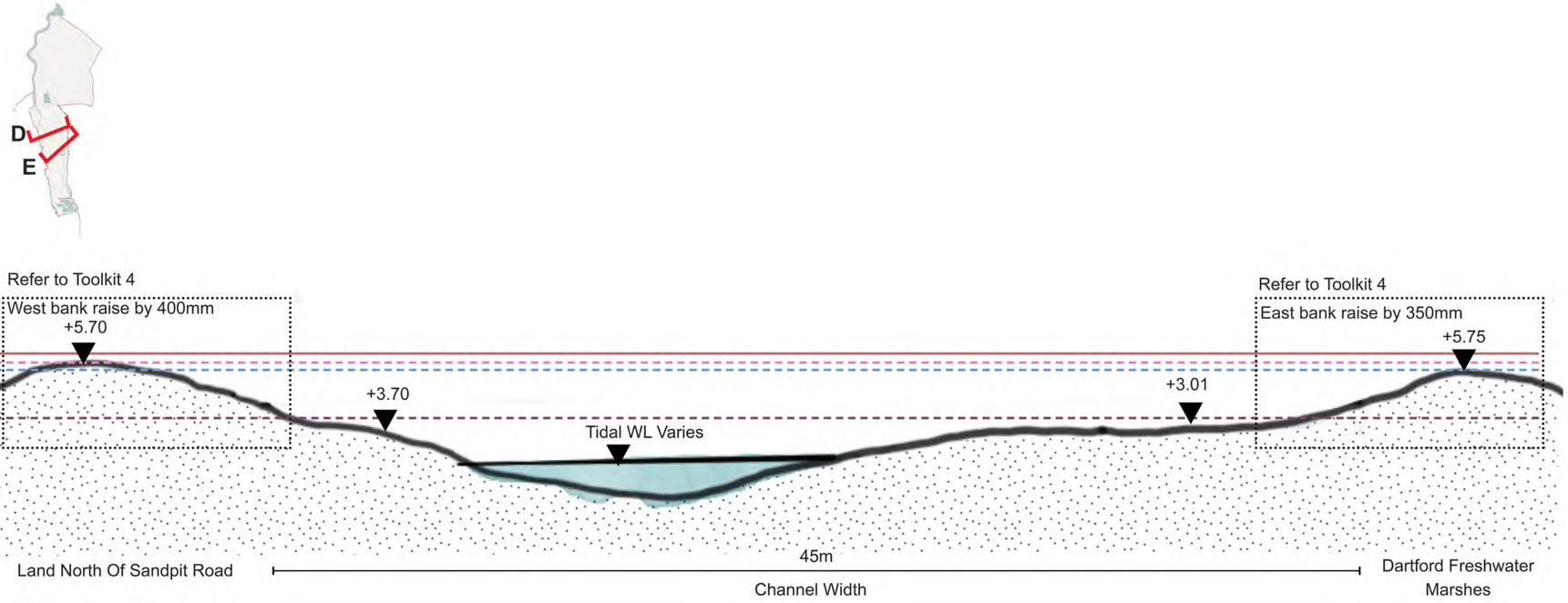


Figure 48. Section D-D existing sketch cross section

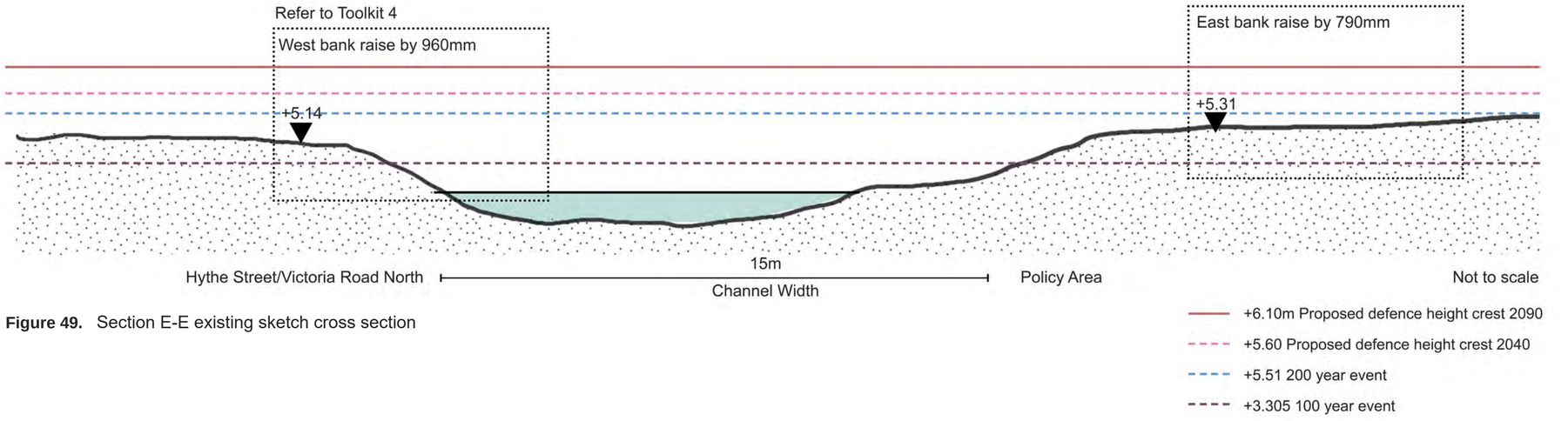


Figure 49. Section E-E existing sketch cross section

Sections F and G illustrate how Dartford Town Centre is protected by flood defence walls, the types of walls and height varies due to development being undertaken at different times. In the context of river wall defence, wall raising should be discouraged and only considered as a last resort when alternative Toolkit strategies are not feasible. Consideration should be given to the need for flood defence lines to be contiguous between sites. The new defence walls will require raising to meet the +6.1 OD by 2090. The type of future flood defence wall will vary depending on existing levels and existing building locations. Where possible new development should allow ecological improvement, social interaction and seamless level change between the flood defence wall and the new development. Landowners and developers should prioritise the flood defence walls that do not meet the 1:200 year flood events, at sites including Wickes and, the land west of Central Road, (refer to Toolkits 4-8). Where possible the new river edge should be at the same level of adjacent sites to allow for the continuous connection of the Darent Valley Path and complimentary seating areas.

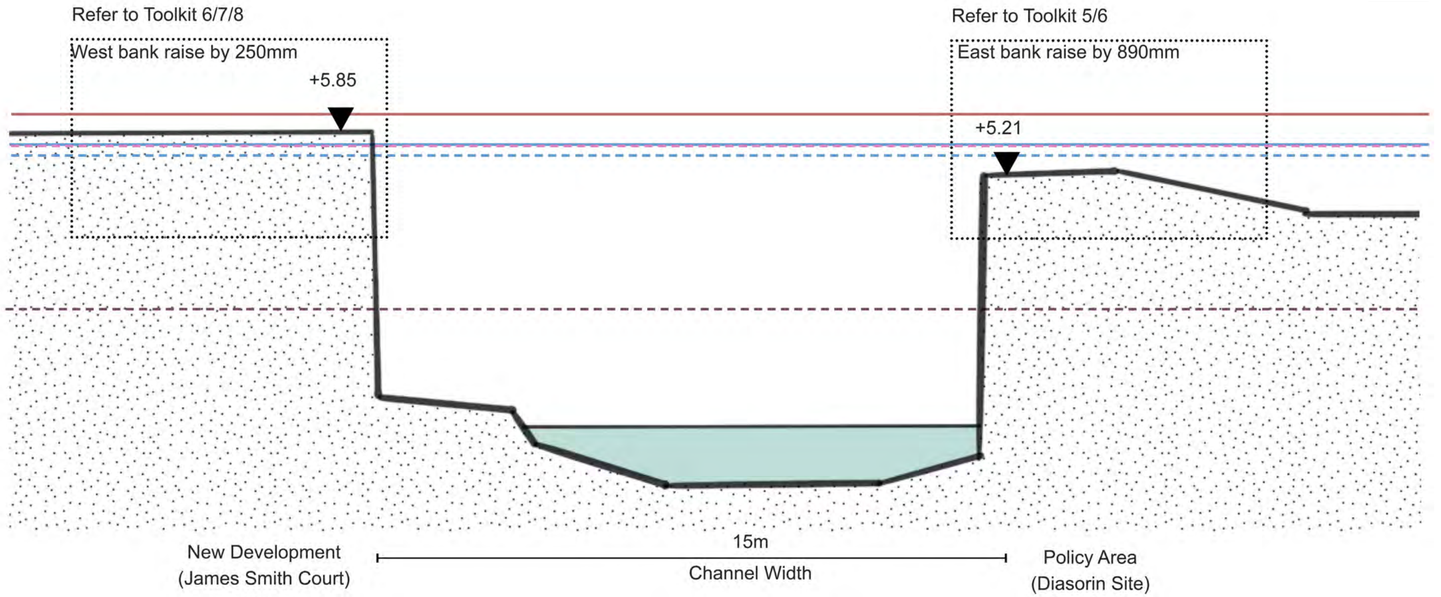


Figure 50. Section F-F existing sketch cross section

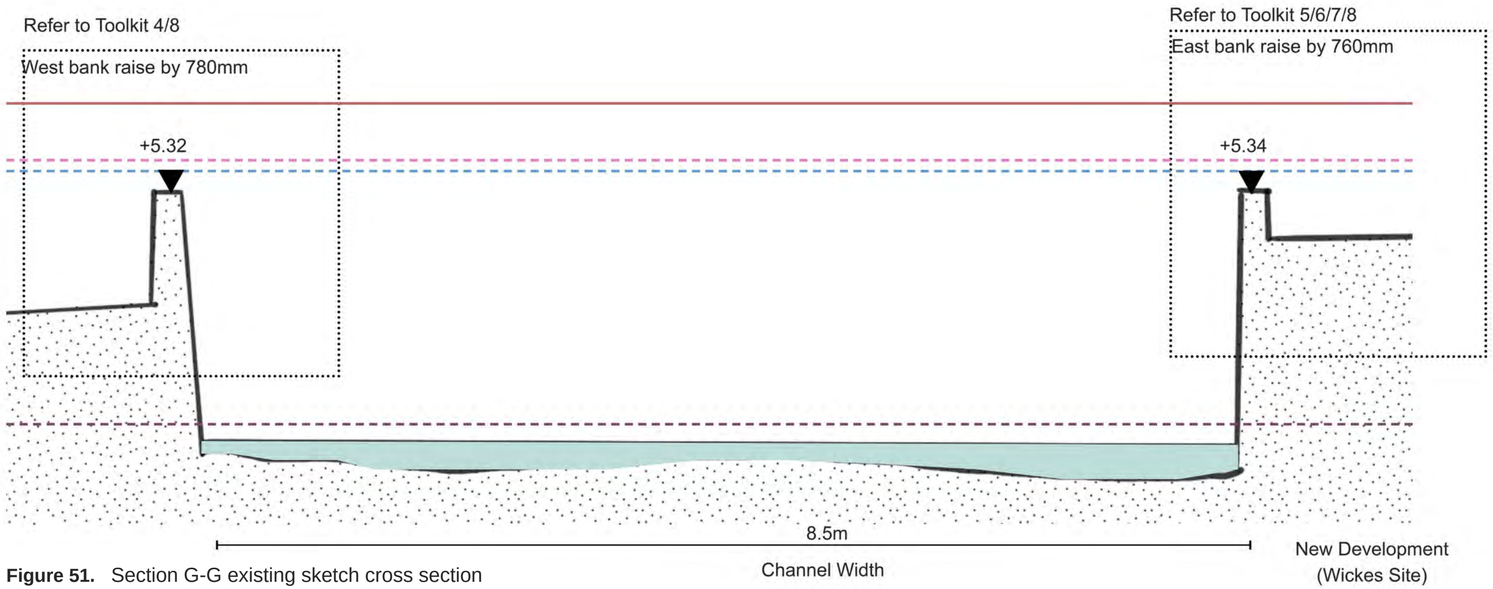


Figure 51. Section G-G existing sketch cross section

Toolkit 4: Urban River Edge Natural Setback

Description

Where space allows, setback typically involves the reconstruction or removal of existing hard engineered flood wall metres inland to create shallow terracing and to the required +6.1m level. Embankments may be subject to erosion, nature-based solutions for tackling this are favoured. Riverbank vegetation acts as a flood zone and can be part of the flood containment solution.

Benefits

- **Natural setback has the greatest benefits to ecology, water quality and also river capacity.**
- **Reconnection of channel and floodplain.**
- **Resilience to climate change.**
- **Creation of public spaces.**
- **Restoration of natural function and form of the river.**
- **Improved landscapes and views of waterways can increase land and property values.**
- **Suitable planting will reduce erosion and improve water quality.**

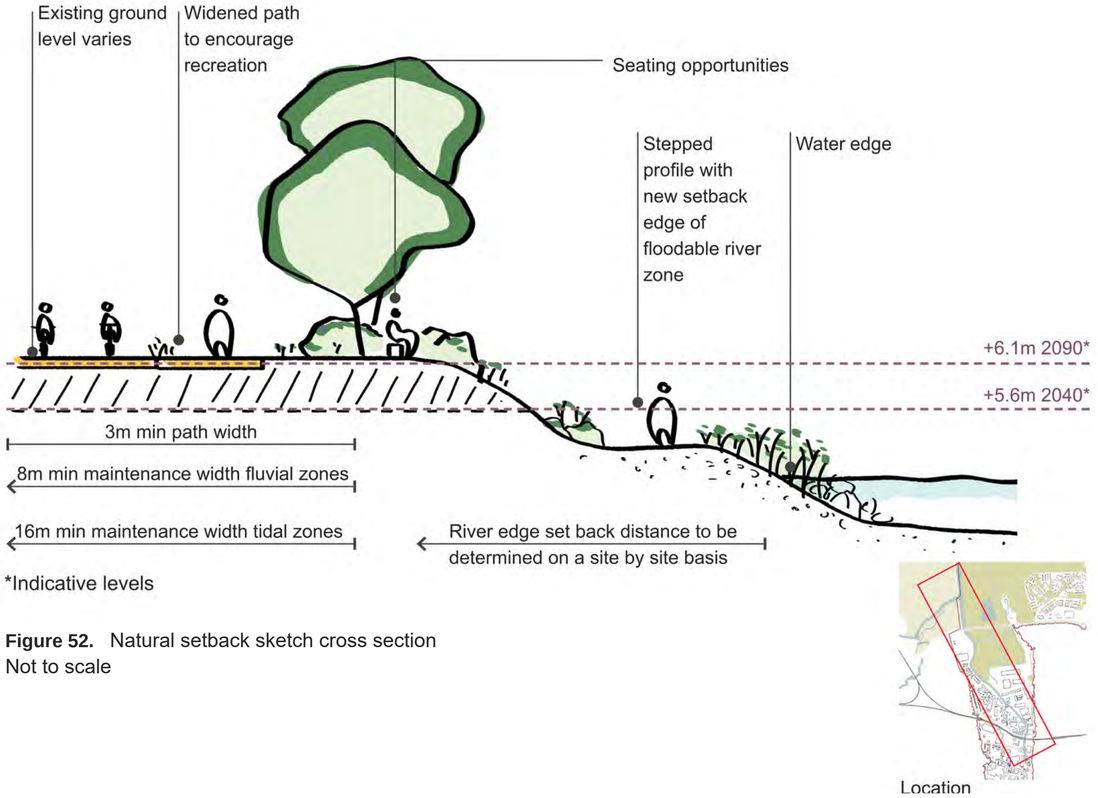


Figure 52. Natural setback sketch cross section
Not to scale

Figure 53. Cut down wall with installed terracing

Figure 54. Bank softening

Signpost

The River Restoration Manual; The River Restoration Centre
Dartford Borough Level 1 and 2 Strategic Flood Risk Assessment

Design Considerations

- Priority should be given to areas where there is sufficient river width and capacity.
- Opportunity to integrate design features to benefit target species such as water vole. As far as possible, avoid affecting existing vegetation.
- The proposal must be directly linked to adjacent structural defence.

Delivery

- Involve experienced contractors and consultants from an early stage to steer the design of an appropriate scheme.
- In most cases the authority will require flood protection measures to be implemented before development can proceed.
- Engage with the local community to foster working partnerships and gain local insights.

Maintenance

- Develop links with local people who may be able to act as stewards on your behalf.
- Monitor for litter collection and remove non-native species monthly.

Toolkit 5: Urban River Edge Stepped Setback

Description

Terrace seating provides interaction with the river's edge. This will create an active frontage while also creating more river capacity. This type of intervention is only suitable where there is a straight river channel and is not to be located in places where an existing soft edge exists.

Benefits

- **Allows for 'relative' natural restoration, that is compatible with constrained urban environments.**
- **Creates an active river's edge.**
- **Offers functions such as seating, performance, planting, river access all while making the river more resilient.**
- **Can be used to controls channels width: narrowing the channel creates a self-sustaining coarse substrate due to accelerated water velocity, which in turn reduces siltation.**
- **Slows and filters run off with appropriate planting and in turn reduces Co2, and improves local climate.**
- **Increased ecological footprint with opportunities to integrate habitat features.**

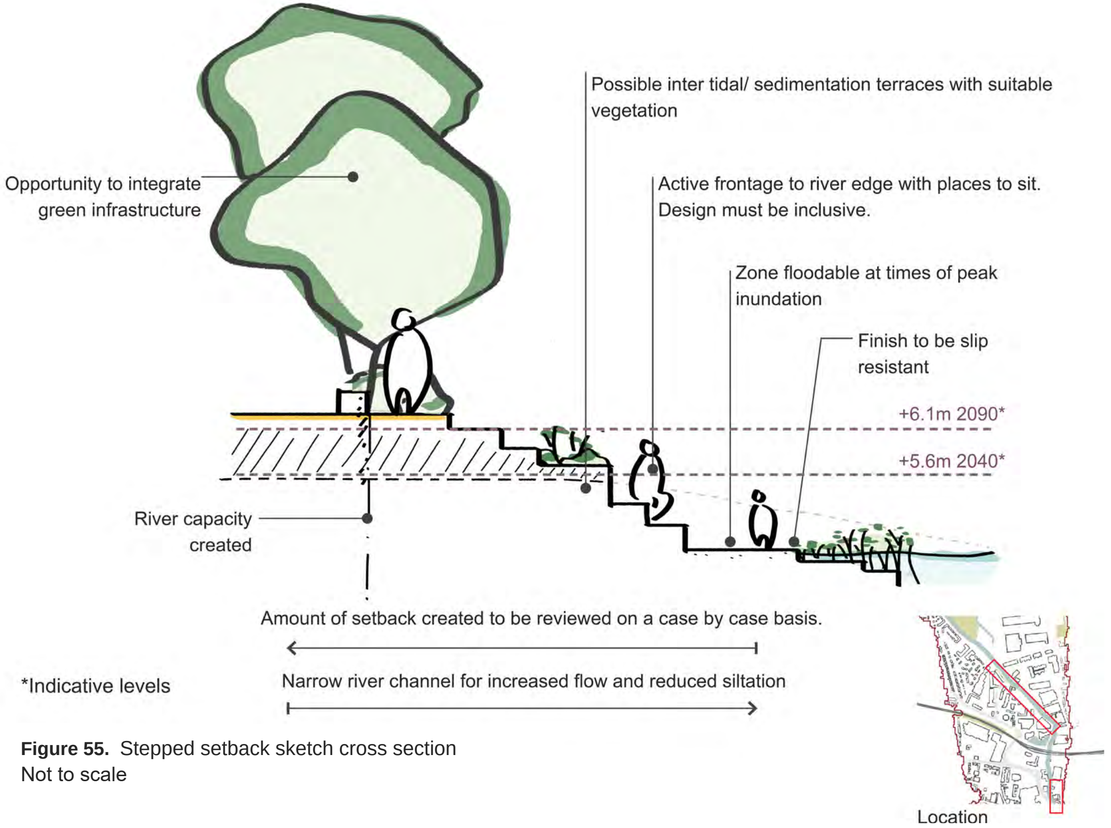


Figure 55. Stepped setback sketch cross section
Not to scale

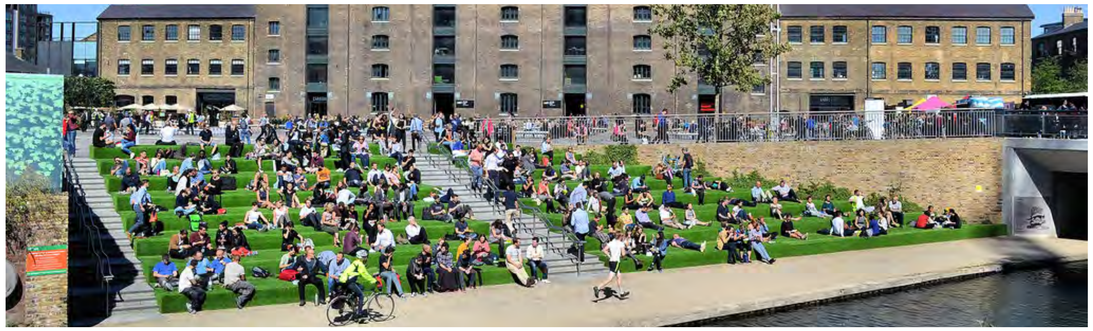


Figure 56. Granary Square seating terrace, London

Design Considerations

- They can be located in urban areas with high public access to the river, but allow for suitable health and safety (i.e. life floats).
- Consider orientation to ensure there is enough sunshine for day use.
- Allow for an adequate integration between the defence solutions and the immediate surroundings, providing possibilities for the use of the riverbank in low river tides and defence at high tides.

Delivery

- Where an existing flood wall is being replaced, consideration must be given to temporary flood protection measures during the works.
- Consideration should be given to proposals in proximity to soft or hard defences as these might be constrained by the space needed to raise those defences in future (the Environment Agency and Council should be consulted).

Maintenance

- Allow for suitable maintenance access.
- Common maintenance activities should include: Cleaning and repairing of retaining structures and replanting of associated vegetation cover (may be required up to once a year), and removal of litter and debris.

Toolkit 6: Urban ecological edge enhancement and channel narrowing

Description

When vertical or near vertical walls are the only option, ecological and visual interest using wood panelling can be applied to both existing or new walls. The timbers are backfilled with a rubble substrate forming a vertical beach habitat.

Enhancements to existing walls will only be appropriate where it can be shown that the residual life of the wall exceeds the anticipated lifetime of the proposed development.

Benefits

- **Resilience to climate change.**
- **Water security and flood defence mitigation as well as increased flood capacity.**
- **Control of water velocity: vegetation at the base will reduce water flows.**
- **Creation of public spaces improves river-city integration.**
- **Timbers promote silt accumulation and plant growth increasing the ecological value of canalised rivers where there is not space for re-naturalising the river.**

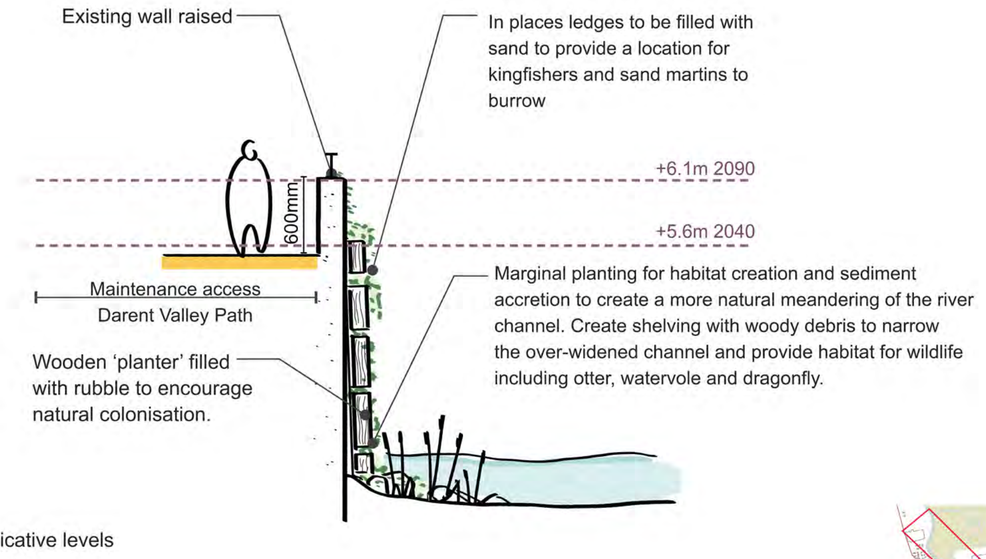


Figure 57. Proposed sketch urban ecological edge enhancement
Not to scale

Location

Figure 58. An example of an ecological treatment to a vertical river wall

Figure 59. Example of channel narrowing using rocks and marginal planting

Signpost

Retrofit sheet piling such as using Nature Bricks Estuary Edges - Thames Estuary Partnership

Design Considerations

- Where wall inspections are required partial panelling can be applied. Panelling should not cover anything functional such as anchor bolts.
- Design for safety and navigation, considering the navigational use at the location.
- Review whether narrowing will have an impact on flood risk by reducing flow conveyance.

Delivery

- Ensure structural survey of the wall has been taken to allow for panelling and raising the wall.
- Ensure defects liability covers the river wall edge.
- Where appropriate, developments may be expected to incorporate a raised defence in line with TE2100 recommendations. Any new defence should also seek to deliver biodiversity net gain on the frontage and be the same material as existing with a minimum 600mm capping.

Maintenance

- Monitor for litter collection and remove non-native species monthly.
- The lifetime of the structure needs to be the same as the projected lifespan of the development.

Toolkit 7: Urban Wall Raising

Description

This Toolkit seeks to provide consistency to future flood defence raising , though it should be emphasised that this is not the Council's preferred option. Where there is no space to create river capacity or ecological enhancement of existing river walls, the existing defence must be raised to meet the +6.1 OD 2090 flood defence level.

Raising in this way must include any necessary remedial works to the existing river wall to ensure that it remains structurally sound for the lifetime of the development and with the increased loading from the new flood wall.

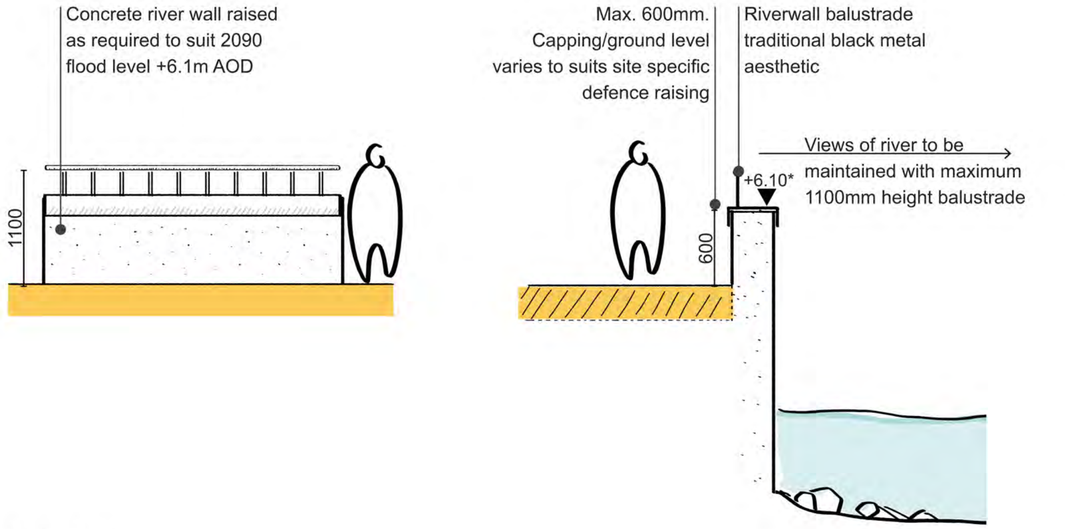


Figure 60. Urban wall raising sketch cross section
Not to scale

Figure 61. Existing black metal railings

Benefits

- **By adopting this design principle, views of the river will be maintained.**
- **The consistent edge condition will aid wayfinding and a joined up approach will improve the character of the river valley.**
- **Provides a continuous barrier against rising water levels.**

Design Considerations

- Review raising of ground level to reduce height of balustrade
- Ensure levels along the river are accessible

Delivery

- If flood defences are not delivered to +6.1 OD 2090 level, it should be demonstrated that the height of defences can easily be increased in future.
- It should be demonstrated that other Toolkits (4, 5 and 6) cannot be delivered at the location where Toolkit 7 is proposed.
- Ensure seamless integration with existing flood defence and infrastructure, such as roads, utilities, and buildings.
- **Maintenance**
- Design flood defence structures with accessibility in mind, allowing for easy inspection, maintenance, and repairs.
- Establish a regular maintenance schedule to address wear and tear, ensuring the ongoing effectiveness of the flood defence system.

Toolkit 8: Urban Boardwalk

Description

The urban section of the River Darent has been canalised with build form and infrastructure impeding river edge access in places. Providing cantilevered river edge access will link previously inaccessible sections of the river.

Where this would cause detriment to riverine habitats the extent of the boardwalk should be minimised and any impacts to habitat mitigated through improvements elsewhere.

Benefits

- **Extension of the Darent Valley Path by connecting previously inaccessible sections.**
- **Activation of the rivers edge.**
- **Improved wayfinding.**
- **Capacity can be created by setting the river wall back but surface area is not lost.**
- **Access can be created without losing existing river capacity.**

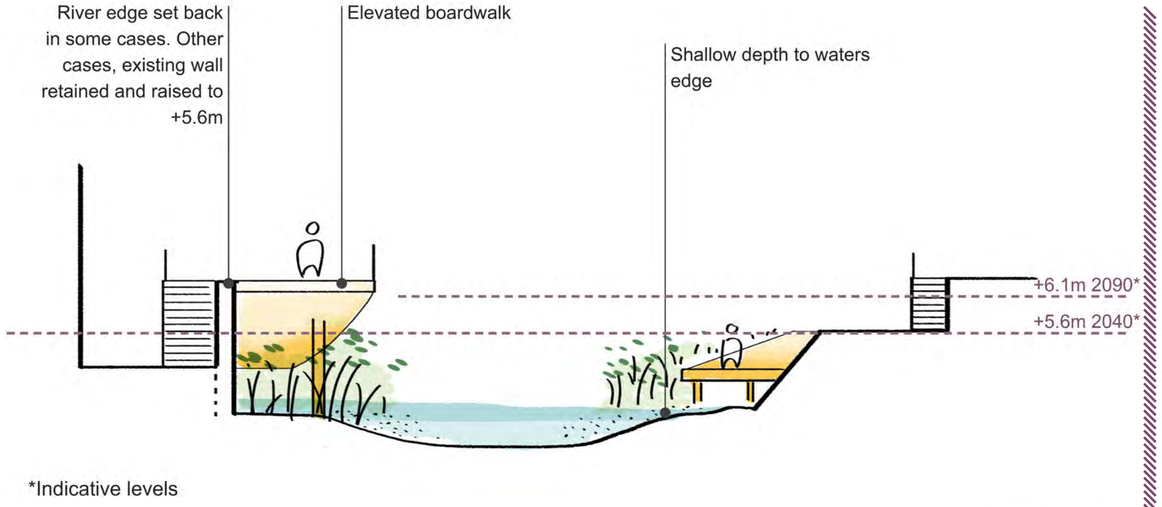


Figure 62. Proposed boardwalk edge treatment

Figure 63. Site photo existing board walk character

Figure 64. Site photo existing railing character

Signpost

Estuary Edges - Thames Estuary Partnership

Design Considerations

- Only short sections to be used to avoid shadowing the water channel for extended sections.
- Where defences are not being raised to the full +6.1 OD 2090 height, developers will be expected to demonstrate that their proposals do not constrain options for future raising or other flood risk management works and that Toolkits 4 and 5 are not deliverable.
- Foundations and timbers should be waterproofed and finish surface should be slip resistant.

Delivery

- Permission will be required from not only the local council but from the appropriate Risk Management Authority (RMAs) to carry out work in and around the water course such as the Environment Agency.

Maintenance

- Regular inspection to ensure the structure is safe for the general public to use. Timber should not be used due to ongoing maintenance and slip resistance issues in the public realm.

Wellcome Sluice

Wellcome Sluice Proposed Removal

Through the Town Centre, the fluvial River Darent is a highly modified riparian corridor. The flow regime is impounded by the Wellcome Sluice (which forms the tidal limit downstream of the Town Centre). Simply removing the Wellcome Sluice is likely to leave quite an unattractive silty bed within the existing vertical concrete defence. To create an ecological rich and attractive place, the river course will need to be treated and where possible naturalised. Narrowing the river channel approximately 1.5km upstream, will restore the natural process of sediment transportation.

Any changes to the river corridor through the Town Centre would need to be compatible with the Wellcome Sluice impoundment in the short term, but also be adaptable when the impoundment is reduced or removed in the medium term. Long term proposals should seek to emulate the river restoration which was carried out at Acacia Hall, albeit within a more constrained corridor.

Careful and considered design is required to mitigate any potential increased flood and/ or erosion risk with the weir removal. This risk should be managed as part of the design process and be as advised by professionals. Equally, due to the heavily constrained nature of the river corridor, other 'urban' river restoration techniques should be reviewed in the context of the pros and cons of the sluice removal.

Signpost

Acacia Hall Project

Benefits

- **Greatly benefit fish and eel passage.**
- **Beneficial for flood risk by creating more capacity.**
- **Restore the natural process of sediment transport.**

Location

Figure 65. Site photo of the Wellcome Sluice

Figure 66. Site photo of Acacia Hall river restoration

Figure 67. Site photo of the Wellcome Sluice

5.5 Park

Central Park is a 26 acre park in the centre of Dartford. Its vast size, multi-uses from amphitheatre, playgrounds, sports facilities, formal gardens to informal spaces, and its urban surroundings are reminiscent of a Royal Park.

In the summer 45,000 plants are used to create stunning bedding displays. The river improvements at Acacia Hall are a prime example of how chalk rivers can be re-naturalised, with varying river bed profiles and a stone river base.

Biodiversity as well as flood defences is at the forefront of the vision for the park. There are, key opportunities to improve Ecology Island.

The island is currently obscured behind dense planting that encourages vandalism and drug use in the park. Simple things such as clearing vegetation and allowing better permeability in places will facilitate passive surveillance and visually integrate the river with the wider park. The aspiration is to make Ecology Island harder working for both people and wildlife by balancing the needs of both. The intent is to have a more open western tributary while still retaining quiet ecology zones and buffer strips for wildlife, and to further enhance the eastern tributary with buffer strip planting.

Within the park there may be potential for additional overland flow/runoff attenuation (pluvial flooding) using nature-based solutions. Potential to incorporate additional fluvial flood mitigation within Central Park should also be considered in order to protect the centre of Dartford (see Toolkit 10 page 59).

The eastern channel allows fluvial floodwater to bypass historic constrictions around Acacia Hall which substantially reduces flood risk to Dartford Town Centre. As such the ability of the flood relief channel to convey floodwater should be prioritised in its management.

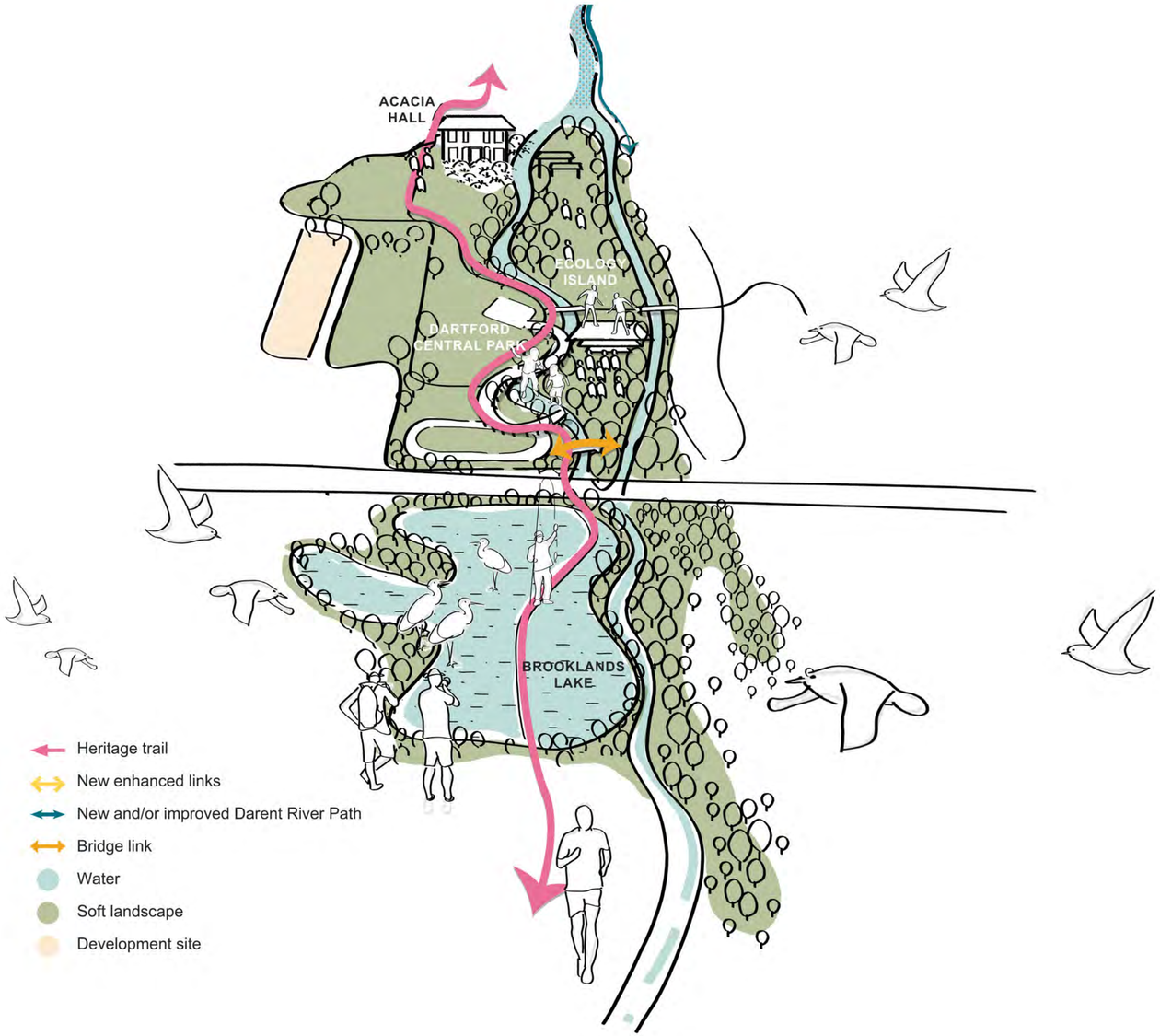


Figure 68. Indicative sketch of the strategic vision for the park

Ecology Island

Building Resilience

1 Potential to integrate floodable spaces.

Regenerating Nature

2 Enhance eastern tributary for quiet ecology.

3 Slope Stabilisation to western bank should be limited, and sensitive to ecology.

4 Buffer zones either side of the streams retained and enhanced with water voles/ otters in mind, but focus on using the western stream as the one for public use (though bearing in mind these are rare habitats, access should be limited, and sensitive to ecology).

Connecting Communities

5 Western side of island opened up to be more visible to its surroundings to discourage vandalism and drug use in the park.

6 New bridge connection utilising existing foundation.

Celebrating Heritage and Identity

7 Utilising existing event space for year round programming.

Figure 69. Illustrative sketch of Ecology Island

Toolkit 9: Central Park Chalk Stream Enhancement

Description

Chalk Streams are globally unique and are classed as a priority habitat. Climate change is causing additional pressures that restoration should address such as increased temperatures and changing flow regimes risks local species population decline.

Benefits

- **Water purification as water moves through stone base and planting.**
- **Improves biodiversity and wildlife habitat, supporting invertebrates, amphibians and reptiles.**
- **Increases capacity by widening the river.**
- **Improves river natural water flow.**
- **Improves connectivity and views with surrounding area, reduction of anti-social behaviours through active surveillance.**
- **Reduces Co2 emissions.**
- **Reduces erosion while providing a cost effective natural solution to slow the water flow, reducing erosion.**
- **Improves climate change resilience.**
- **Creation of walking path adjacent to the river.**

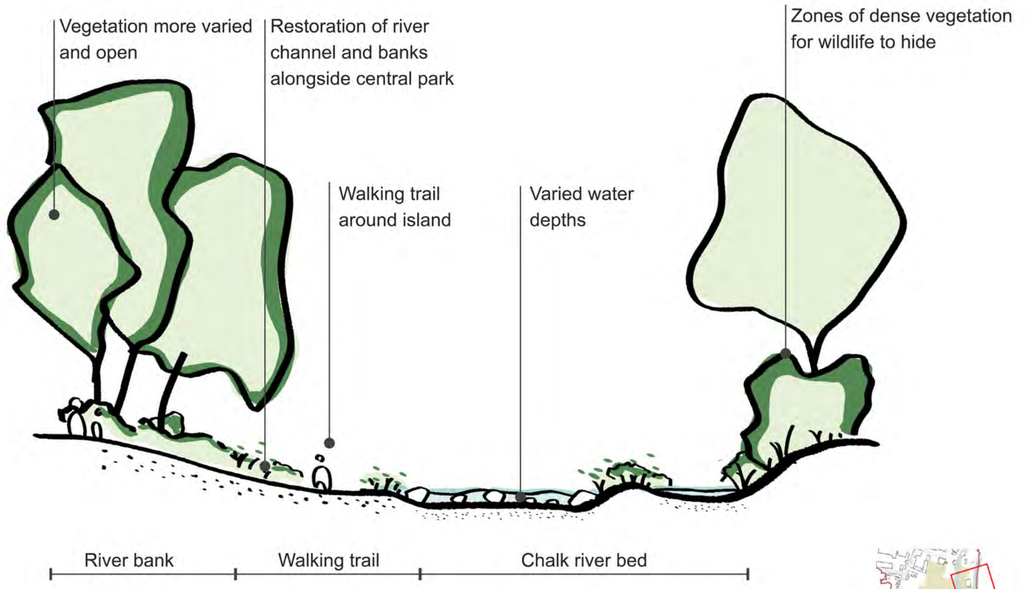


Figure 71. Stream enhancement sketch cross section
Not to scale

Figure 70. Chalk stream Hemel Hempstead

Figure 72. Chalk stream Hemel Hempstead

Signpost

The River Restoration Manual (section 5): The River Restoration Centre

Design Considerations

- Balance social interaction with quiet zones for ecology
- Introduce features typical of natural hydromorphological processes, such as gentle meanders and natural bank profiles, which will promote biodiversity.

Delivery

- Ahead of delivery, review any sources that negatively impact the rare chalk stream such as agricultural pollution further upstream or private sewerage systems.

Maintenance

- Maintain dappled shade over chalk streams to prevent rapid growth of aquatic ‘weeds’
- Weed management- leave enough aquatic plants to provide wildlife habitat, but enough gaps to encourage vigorous flow. This helps to manage water levels and keep the gravelly bed clear of fine sediment, which is essential for trout and salmon spawning, as well as the interstitial invertebrate community composition.
- Remove litter and control pests as part of normal park maintenance.

Toolkit 10: Floodable Spaces

Description

Natural and temporary flood areas to be used during high magnitude flood events to release flooding pressures in Dartford Town Centre. Floodable spaces are designed to control flow rates and decrease flow peaks by storing excess flood water and releasing it slowly once the risk of flooding has passed.

Benefits

- **Provides a net zero solution.**
- **Increases water capacity and storage.**
- **Creates resilience to climate change.**
- **Improves biodiversity and ecology.**
- **Uses existing park topography and does not change ecological enhancement or river bank.**
- **Reduces filtrations, increases water storage, and removes flow water, in turn reducing flood risk in the Town Centre.**
- **Improves biodiversity, leisure and recreation opportunities.**

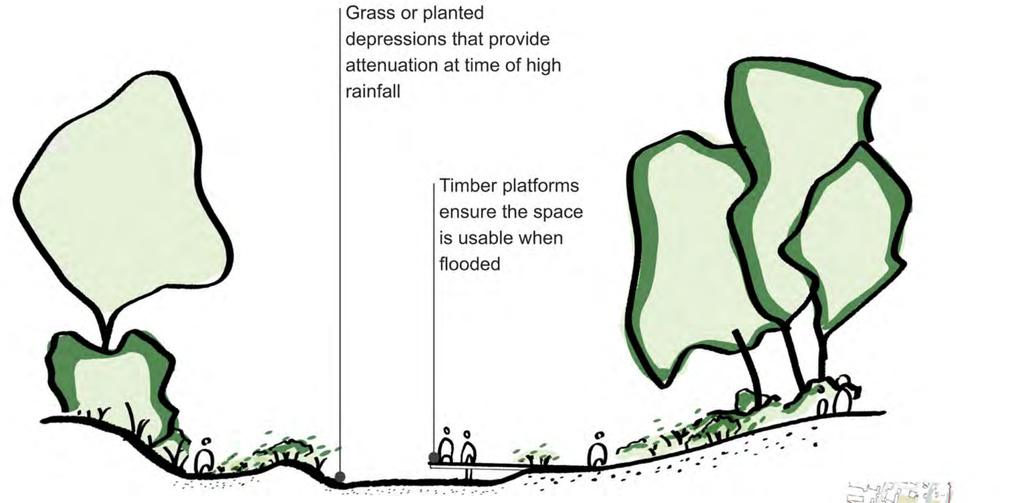


Figure 73. Bank stabilisation sketch cross section
Not to scale

Figure 74. Timber boardwalk over a gravel planted attenuation basin

Figure 75. Amphitheatre grass basin with seating

Signpost

The Suds Manual; CIRIA
Natural Flood Management Manual. CIRIA

Design Considerations

- Location to be carefully considered to avoid impacts on existing park uses.
- Consider harvesting of rain and flood water for watering trees and plants in dry spells.

Delivery

- Topography needs to be considered and reviewed to ensure that once the water is stored it does not escape to the surrounding area
- The intervention proposal must be validated by the environmental specialist.

Maintenance

- Low maintenance requirements, inspect following flood storage event and remove debris and litter as required.
- Ensure outlets and inlets to the area are cleared of debris.

Toolkit 11: Slope Stabilisation Live Willow Staking and root wads

Description

There are a number of natural river bank stabilisation techniques. The process involves re-profiling to connect the river with its floodplain and softening the river's edge to minimise erosion. Using willow in particular is a cost effective solution that is quick to establish and can withstand flood events.

Benefits

- **Long lasting, environmentally sound product.**
- **Bank softening and re-profiling enables a large variety of habitats to establish, increasing the potential for high biodiversity.**
- **Beneficial for flood risk alleviation.**
- **Increases diversity of flow types.**
- **Decreases soil erosion rates.**
- **Blends in with vegetation and becomes part of surroundings.**
- **Where applicable, removing walls in places connects the river to its floodplain and allows natural hydromorphological processes to shape the river.**

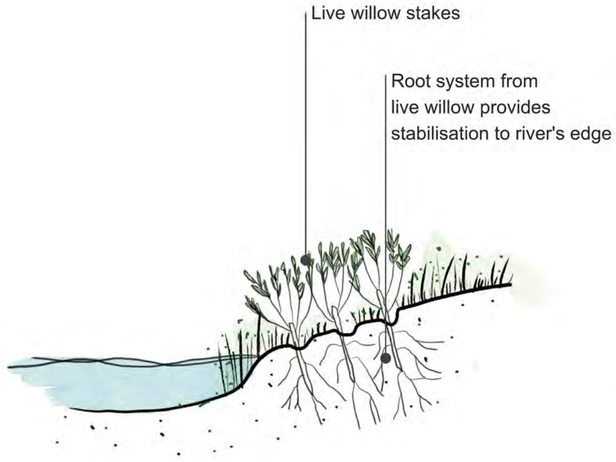


Figure 76. Live willow staking
Not to scale

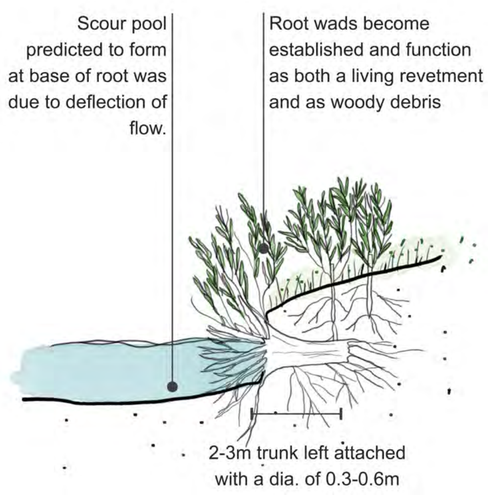


Figure 77. Live willow staking root wads
Not to scale

Figure 78. Brushwood mattresses restore river edge

Figure 79. Angle of slope decreased using brushwood mattresses

Design Considerations

- Each site will have different considerations including tidal range, water depth, channel width and proximity to flood defences.
- Seek professional advise to help select the most appropriate design.
- Designs should take account of the source of the bank erosion.
- Designs should not impede existing uses such as navigational use.

Delivery

- Plant source: if possible source native willow from the local area.
- Frequent site meetings with the contractor during installation, establishment and maintenance are essential.

Maintenance

- Inspect regularly after high flows in the first few years and quickly repair any developing issues.
- Ongoing maintenance obligations to prevent excessive growth from blocking the river channel should be considered prior to implementation.

5.6 Catchment

The source of the River Darent is in Westerham, 21 miles upstream of its confluence with the river Thames. The study area of this Strategy is a very small proportion of the River Darent watershed. Being a natural system, this Strategy must address positive interventions that can alleviate flood risk beyond the red line.

Flooding in the lower sections of the river occur both due to the surrounding context, but also due to the high volume of water reaching from further up the river catchment. River catchment design needs to be considered as a system, flooding occurs due to the cumulative water collected after the storm. By analysing the wider catchment and identifying possible areas for NbS and man-made initiatives to improve infiltration, and water storage, the impact of the flooding in Dartford from fluvial water will be greatly reduced.

The wider catchment looks at the areas higher in the valley and outside the study area.

Examples of Wider Catchment Interventions:

- Buffer Strips: areas adjacent to rivers, which are also referred to as ditches, dykes, becks, watercourses, where woody planting or grass buffers can be created to increase roughness and slow runoff.
- Soil Management: avoid bare soils, no or low tillage cultivation methods and contour ploughing leads to improved soil health for better infiltration and carbon storage through greater organic matter content.
- Tree planting/woodland: roots stabilise and strengthen soils, trap and filter run off, increase surface roughness, store carbon, improve water quality.
- Grip Blocking: a series of dams in the upper headwaters of a catchment restores natural drainage pattern, reduces erosion and flow velocities, restores the carbon sink function of peat/heathland.
- Gulley Stuffing: Gullies filled with brash (upper branches) to impede erosion and slow flow.
- Offline flood storage reduces downstream flood risk and helps mitigate bank erosion.

Dartford Borough Council and the Environment Agency will engage with Sevenoaks District Council to promote these catchment wide interventions.

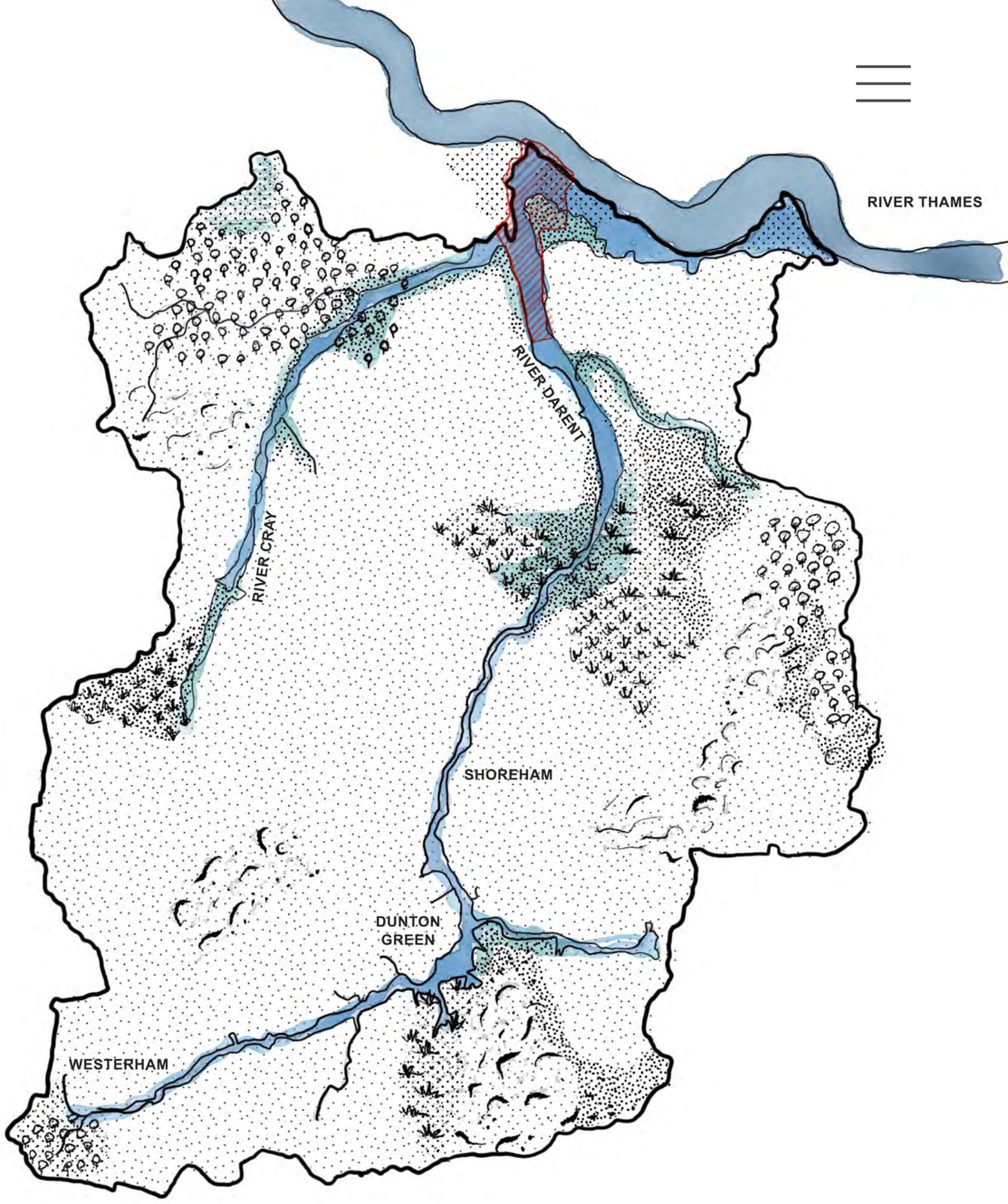


Figure 80. Sketch of the River Darent watershed

Urban Catchment

This section considers the Urban catchment within the study area. This includes any non-porous surfaces that will increase pluvial flooding, in particular in the immediate areas of Dartford Town Centre. Much of Dartford's surface water is pumped into the River Darent which is not sustainable. Present day surface water flood risk is not particularly high but better implementation of NbS could help mitigate increases in rainfall intensity due to climate change and improve the resilience of the River Darent in times of change to high flows.

Groundwater source protection zones are in place to protect water supplies from contamination, including one in Dartford Town Centre. SuDS proposals in these areas will have to consider that infiltration could pose a risk to groundwater and may instead have to implement lined SuDS features to capture, treat and attenuate runoff before discharge to a watercourse. Consultation with the Environment Agency in the early stages of drainage design is recommended. Interventions such as street trees, planted rain gardens and other SuDS, pocket gardens, green roofs and porous paving all help to slow and capture run-off before it meets the River Darent. Where constraints allow, these should encourage infiltration of surface water to promote groundwater recharge. Elsewhere, development should seek to attenuate discharge to the greenfield runoff rate in natural SuDS features to benefit water quality, ecology, amenity and flood risk, and to minimise pumped discharges to the River Darent.

Note: Interventions must be targeted to the most effective locations in the catchment.

Signpost

NBS interventions
Delivering SUDS in Kent; Susdrain
The Suds Manual; CIRIA
Natural Flood Management Manual. CIRIA
Blue Green Infrastructure and
Nature Based Solutions Framework
The Environment Agency's approach to groundwater protection (under review)

Figure 81. Green roof

Figure 82. SuDs planting

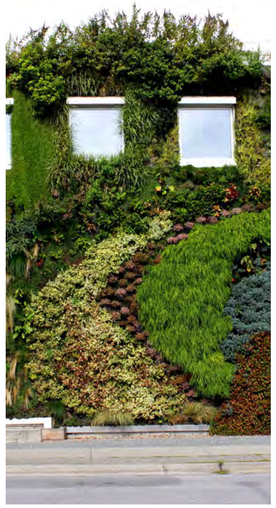


Figure 83. Green wall

Figure 84. Rain garden

Figure 85. Community pocket garden

5.7 Hard material palette

As different developments are brought forward, a joined up approach to the hard finishes material palette is required to aid wayfinding and set a high standard with an environmental focus for future regeneration projects. A carefully curated selection of durable and sustainable materials can serve as the backbone of this transformation, ensuring longevity and a joined up approach.

While having elements of consistency, there is an opportunity to celebrate the variety in the identified character areas. The materials in the Marshes and Park should be more rustic such as self-binding gravel and timber. A neutral coloured granite should be used for new public realm pieces in the Peri-urban section associated with the River Darents's edge.

The Urban centre of Dartford should work with the existing Town Centre improvements and utilise a higher percentage of natural stone. By developing an agreed palette of materials, the regeneration can establish a cohesive visual identity for the Lower River Darent.

Key Policy

Local Plan - Green and attractive Environment G2

Marsh and Central Park Palette

Figure 86. Porous Granite for public realm next to the River Darent 300 x 100mm

Figure 87. Buff coloured tarmac for roadways through new developments

Figure 88. Self binding gravel for Darent Valley Path extension

Figure 89. Timber deck

Urban Palette

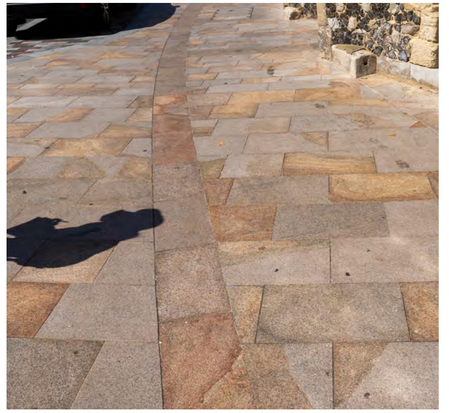


Figure 90. Yorkstone slab for urban public realm 900 x 600mm

Figure 91. Buff coloured Tarmac for urban sections of Darent Valley Path

Figure 92. Yorkstone setts for Urban public realm 300 x 100mm

5.8 Furniture palette principles

The rural character of the marshes is in contrast to the Urban centre of Dartford. The material palette for the furniture and fixings can reflect and celebrate this variety. The marshes are more suited to a rustic timber aesthetic, in keeping with the natural more wild setting. In the Urban centre the furniture must be robust, easy to clean and reflect the existing high-quality public realm improvements. The illustrative palette gives a sense of the character desired and uses existing examples as a benchmark in order to work with existing finishes and therefore minimise variety.

Equally there will be elements that transcend the character areas such as wayfinding including the Darent Valley Path markers and signposting.

Marsh Palette

Figure 93. Simple timber bench seating. Benches with back and arm rest also to be provided.

Figure 94. Timber viewing platforms

Figure 95. Timber waymarker posts

Figure 96. Darent Valley Path wayfinding

Urban Palette

Figure 97. River edge black metal railings

Figure 98. Urban Heritage trail signage

Figure 99. Stainless steel light bollards

Figure 100. Feature cycle stand

Figure 101. Feature seating

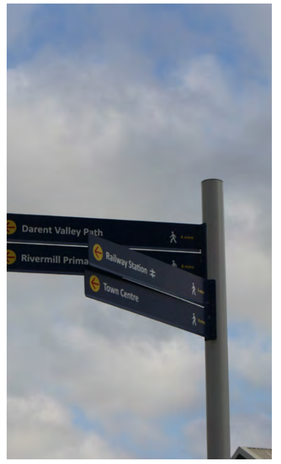


Figure 102. Wayfinding post

5.9 Soft material palette

The planting strategy aims to enhance biodiversity by diversifying plant communities, fostering a varied range of habitats.

New planting should be resilient and low maintenance with a focus on habitat creation. The exclusive use of native plants is advocated to mitigate the potential introduction of invasive species and ensure the genetic pool is of local providence. Encouraging natural colonisation is the most effective means of establishing resilient species along a river edge. If outsourcing is required to secure native vegetation for translocation, collaboration with statutory nature bodies or non-governmental organizations/charities, such as the Rivers Trust, is recommended. These entities can facilitate the sourcing of suitable seed or plant matter from exemplar local sites, ensuring that the translocation process aligns with biosecurity standards. This approach not only contributes to the restoration of diverse ecosystems along the River Darent but also safeguards against the unintended ecological consequences associated with the introduction of non-native plant species.

Key Policy

Local Plan - Green and attractive Environment G3

Figure 103. Lower River Darent mud flat

Figure 104. Meadow

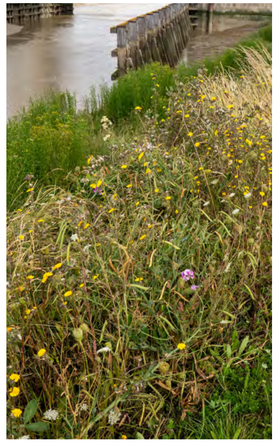


Figure 105. Wildflower edge

Figure 106. Weeping Willow

Figure 109. Riparian tree planting

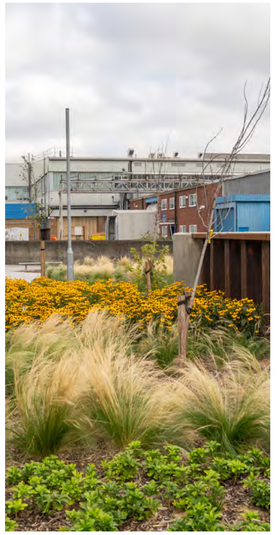


Figure 107. Herbaceous planting

Figure 108. Marginal edge

Figure 110. Reeds

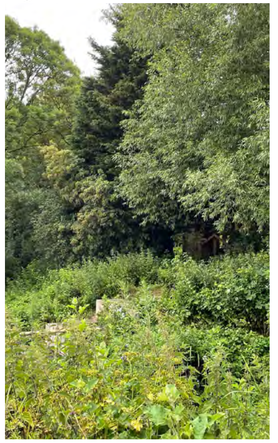


Figure 111. Woodland understorey

Figure 112. Mixed marginal shrubs

Figure 113. New naturalised planting

6. Delivery

6.1 Next Steps

The Strategy identifies key projects and initiatives that can be undertaken to ensure the River Darent, and the benefits it provides, are at the heart of future growth. These opportunities can be undertaken by developers, landowners, the Environment Agency and DBC with the guided support of DBC and the Environment Agency to create a more resilient, and profitable project that provides environmental, social, and ecological benefits. Developers and landowners incorporating this approach to their plot, will start a cumulative effect, and an overall improvement to their site, Dartford Town Centre, and the surrounding area (refer to Legacy page 36).

Key steps to enable delivery of resilient proposals are:

Embedding Policy

DBC will continue to regularly review and update their Planning Policy and Local Plan to ensure it continues to align with the TE2100 Plan (and any future revisions). DBC will continue to work closely with the adjacent councils and the Environment Agency, in order to understand what neighbouring areas are doing and how this will affect the Lower Darent. A robust policy will ensure future developers or work adjacent to the River Darent will raise the river defence to the required level, and demonstrate that any development will help mitigate climate impact and not have a direct negative impact on the river and adjacent areas.

While this Strategy illustrates some guidance on the type and feasibility for future defence raising, policy can complement this by ensuring future development also considers continued access to the River Darent, as well as safety, lighting, ecology and any other major works.

Prioritising projects

Future development should be evaluated against local priorities and be supported against the principles in this Strategy (Chapter 4 'Design Principles page 26). Further feasibility analysis for bridges over the Darent, as well as redevelopment opportunities will be prioritised. Proposed development sites need to consider their impact on the river, the environment and the community and what benefits and co-benefits they can provide to create a River Darent legacy. Sites not adjacent to the river, should also consider implementing the Strategy as they will also have an impact on the catchment wide design and affect both the wider Dartford area and the River Darent.

Supporting development

DBC will work to ensure this Strategy is agreed and actively used by all interested parties to inform their developments, by embedding the key message and the importance of creating a resilient Dartford. This Strategy does not only support local plans but goes one step further by identifying future trends and mitigating climate change locally. It will create a strong sense of place as well as provide a wide range of benefits for the local community.

Engagement Plan

Large future developments will require a stakeholder/ engagement strategy in place from the outset of the project to ensure statutory and non-statuary consultees have been consulted and their responses captured and responded to accordingly. The consultation process will help set project parameters, guide design as well as meet planning obligations. The design process and consultation can form the first step into the future development partnering with local community groups and identify how they can support each other.

Creating partnerships

Enhancing communication and partnership working between DBC, landowners and key stakeholders (for example the Environment Agency and Kent Wildlife Trust) will provide an opportunity to deliver the Strategy, exchange project information and lessons learnt, in order to support each other. Adaptation Planning (section 6.2) is a method of working collaboratively to agree and deliver a shared vision of the future.

Signpost

Wild West End

Case Study

A case study of where developers, land owners and businesses have already established, a working group is the Wild West End, an incentive to bring London’s largest property owners together, to improve biodiversity and habitats in Central London, whilst creating greater connections with nature for residents, visitors and workers (see Signpost for further details).

At an educational level, there is an opportunity for DBC and the Environment Agency to create a hub for citizen science: the river has the potential to be an educational case study site to support a coming together of minds (i.e. a destination for school trips, university research projects, community groups, charities and NGOs carrying out citizen science). Developers can support this by sharing information or allowing visits to their public and private green open spaces.

Comprehensive site analysis

A thorough baseline assessment for any proposals for change is imperative and should include the heritage, flood zones, ecology, travel, current and adjacent land uses among other assessments.

Sitewide Review

Developers are encouraged to engage with DBC and the Environment Agency at an early stage in pre-application discussions, to ensure wider impacts are considered. This will help provide guidance to developers, streamline future decisions, and understand how the community, environment and the River Darent are evolving with time. Developers can undertake lessons learnt which will ensure that their land uses and in turn their value, will evolve with time whilst continuing to identify ways to manage, maintain and create a legacy in Dartford.

Having a long-term, wider monitoring system in Dartford will help identify and assess how the area is improving for example, improved habitat, improved health and wellbeing through active travel or increased footfall and in-turn retail value adjacent to the River Darent.

Robust Methodology for proposals

The delivery of any new development, incorporation of flood defences and active travel will require the correct team and be supported by a robust methodology. Refer to section 6.4 for Flood Defence Raising Implementation Methodology and section 6.5 for Active Travel Implementation and Delivery methodology.

Programme/ Timeline

This Strategy is a partnership plan between Dartford Borough Council and the Environment Agency to review, maintain and update the River Darent flood defence for the study area (see Figure 1). Within this, the TE2100 plan, sets out key periods to deliver the long-term plans for flood defence improvements.

This Strategy identifies short, medium and long term opportunities to coordinate flood defence raising, help prioritise decisions and plan these changes in order to reduce cost and overall disruption, while prioritising placemaking, connectivity and ecology. Figure 117 provides an overview of these.

6.2 Adaptation Planning

Adaptation planning vs. adaptation pathways

Adaptation planning is an overarching collaborative process to effectively navigate uncertainty based on a clear direction and shared vision for the future. This process is illustrated in Figure 114 which is a variant of the British Standard 8631 ‘wheel’ (Adaptation to climate change – using adaptation pathways for decision-making – Guide, BSI, 2021). The process includes establishing partnership agreements and governance arrangements, developing objectives, and a collective vision, as well as understanding what stakeholders value to help formulate suitable future scenarios and adaptation actions. Pathways should then be developed to inform higher-level strategic or more detailed local investment plans. These plans can then be monitored, reviewed and updated, if the situation changes.

Adaptation pathways are a component of the adaptation planning process (Figure 115.) Within the context of an uncertain long-term future, pathways set the direction towards desired outcomes and frame clear steps to action. The scale and detail at which they are framed is critical to securing buy-in between multiple stakeholders.

The Adaptive Planning process is most useful where there is significant uncertainty related to the direction or timing of future changes.

Communities, businesses, industry, and the natural environment in places like the Dartford Marshes and Thames Estuary face an uncertain long-term future. Adaptive Planning facilitates better planning in such circumstances by shifting the approach from ‘predict and act’ to ‘monitor and adapt’. Adaptive Planning ensures that all adaptations involved align with an overarching vision, informed by a scenario planning process. So, rather than reinforcing uncertainty, this process aims to:

- Inform more robust investment decision-making, by making sure that the decisions we make now take account of a range of possible future scenarios.
- Ensure that our monitoring systems ultimately tell us is the most accurate. The associated adaptation actions remain in the adaptive space and support sustainable, climate resilient development.

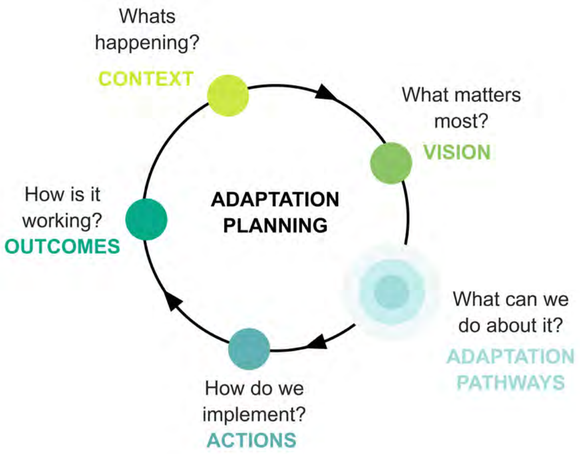


Figure 114. The AP 'wheel' developed from BS8631

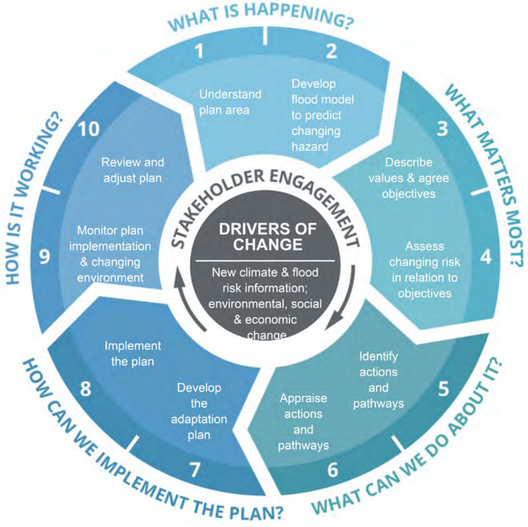


Figure 115. High level AP process illustrating where pathways 'sit' within the AP process

Timescales

The adaptation planning cycle takes place at range of spatial scales and time frames, each of which requires differing levels of information and data.

Pathway types and utility

There are several different possible interpretations of Adaptive Planning by which an adaptation pathway could be produced. The Thames Estuary adaptation pathway (Figure 116) is perhaps the most well-known. When considering the strategic scale of the River Darent Catchment, and with the desire to involve multiple stakeholders with varying aspirations, a multi-stakeholder-oriented interpretation is, perhaps, most relevant. However, when considering a focus on flood risk management expressed through managing risk, improving resilience or through other actions, the performance-threshold oriented approach may be more useful.

Signpost

The Thames Estuary adaptation pathway

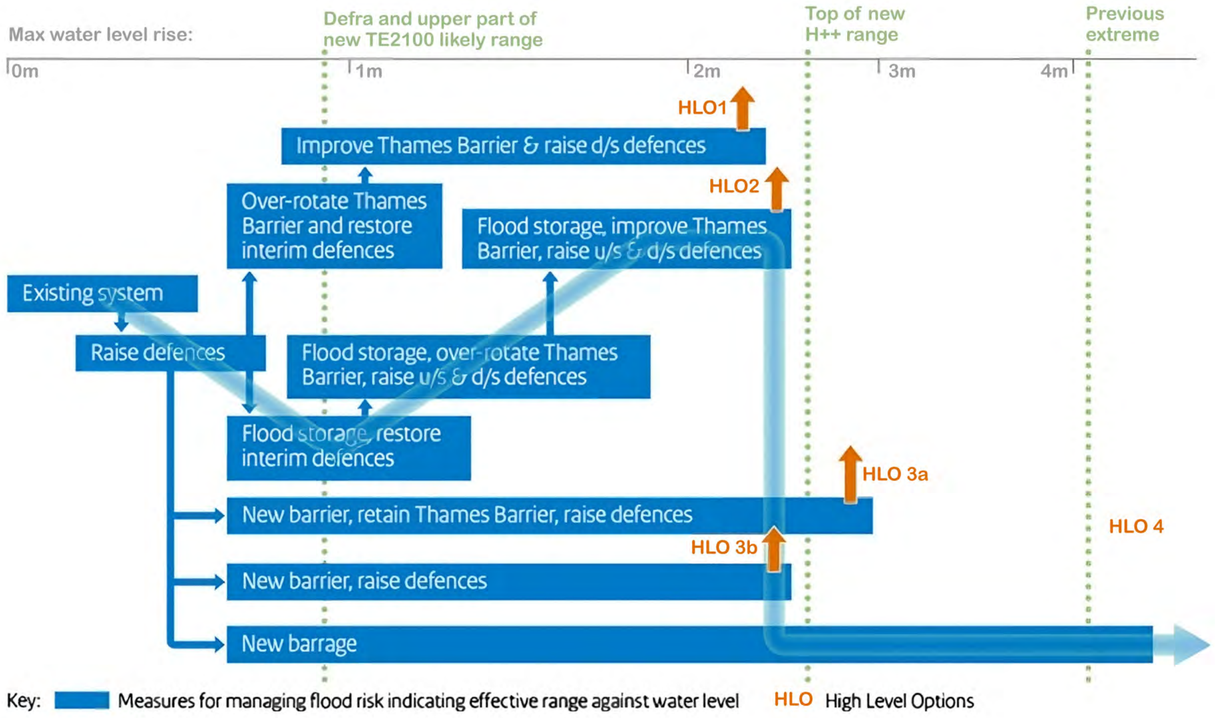


Figure 116. The Thames Estuary adaptation pathway

6.3 Risk Management Authorities (RMA) and Developer Timeline for future defence raising

Signpost

Link management authorities list

2024-2035

- RMA (Environment Agency, DBC, Kent County Council and water company's etc.) to coordinate approach to flood defence raising, in accordance with this Strategy document and other relevant planning policy.
- In accordance with the TE2100, by 2030, the Environment Agency will improve accuracy of tidal forecasting in the Thames Estuary and confirm plan for maintenance and operation of the Thames Barrier, until an end-of-century option is in place by 2070.
- Routine inspections of existing defences to be undertaken by the Environment Agency and/or DBC. Environment Agency and landowners to maintain/rebuild existing defences, as appropriate, using funding from central government National Flood and Coastal Erosion Risk Management Grant in Aid (FCERM), Department for Communities and Local Government and/or Partnership funding.
- New development that interfaces with the river must consider existing and current flood risk, in accordance with the NPPF (see section 7.4 page 85), this Strategy and the latest version of the TE2100 Plan. This will include potential to set back existing defences and/or raising defences, as appropriate.
- RMAs to collaboratively develop implementation methodology to plan future defence raising in an iterative manner (lowest defence heights aren't always the highest risk areas), in accordance with the latest flood defence levels (currently assumed to be +5.6m OD by 2040 and +6.1m OD by 2090. This will include considering plans to realign and set back defences within the Dartford Marshes, as defences reach the end of their design life.
- Local scheme level. Outcomes-led detailed appraisal and design steered by overall partnership vision and responding to local community needs. Appropriate local actions that achieve threshold performance levels within adaptive space. Monitor place-based impact and outcomes.

2035-2050

- By 2035, the areas with the lowest defence heights should have been upgraded. Implementation tasks from 2024-2035 to be continued. Baseline and future hydraulic flood modelling to be updated as required to account for changing baselines (i.e. new development), emerging climate change guidance and policy and proposed flood defence changes; both national and local.
- Establish existing defences and/or those identified to be close to end of design life (from 2024-2035) should have been prioritised to meet the target defence height (+5.6m OD by 2040 and +6.1m OD by 2090). Any outstanding priority flood defences should be upgraded (to at least +5.6m OD) by 2040.
- Subject to funding and/or design requirements, measures to set back defences and/or raise defence heights to the 2090 standard should be made for efficiency. Only where this is not possible, should an iterative approach be taken (i.e. raising to only +5.6m OD).
- Consideration of additional ‘new interventions’ (fluvial and/or tidal) flood defences should be made, based on updated modelling and the end-of-century Thames Barrier option (determined by the Environment Agency, by 2040).
- RMA’s to ensure that existing defences are being upgraded and/or new defences are being constructed in a coordinated fashion, in-line with this Strategy. This must also consider Strategic Environmental Assessment and Habitat Regulations Assessment requirements, as per the TE2100.
- By 2040, all defences along the River Darent should be managed and upgraded as appropriate in accordance with a detailed appraisal determining the best way to manage flood risk on the tidal Darent.
- Embedding Adaptive Planning into local planning. Integration into local plans and schemes, aligned with strategic environmental assessments (SEA) sustainability appraisal (SA) and local planning policy. Navigating local 'adaptive space’, aligning actors on local responses, linked to strategic outcomes.

2050-2070

- Implementation tasks from 2035-2050 to be continued. Baseline and future flood modelling to be updated (as required) to account for changing baselines (i.e. new development), emerging climate change guidance and policy and proposed flood defence changes; both national and local.
- Ensure any changes to preferred options and or timelines identified by strategic objective 3 of the TE2100 (to be published in 2040) have been accounted for by this implementation methodology.
- Review of all defences within the study area, to identify which remaining defences need to be raised to the target height of +6.1m OD by 2090.
- Identify any additional funding (various sources) to ensure that any reaches where defences will not reach their 2090 target height, can be delivered.
- RMA’s to ensure that defences are being upgraded/constructed in a coordinated manner within the study area and confirm that maximum managed realignment opportunities have been undertaken within the study area, especially within the Dartford Marshes.

2070-2100

- Implementation tasks from 2050-2070 to be continued. Baseline and future flood modelling to be updated (as required) to account for changing baselines (i.e. new development), emerging climate change guidance and policy and proposed flood defence changes; both national and local.
- By 2090, all defences along the River Darent should be at the target defence height of +6.1m OD, as a minimum.
- Note that, as per the TE2100, the Environment Agency will continue to review options for managing sea level rise beyond 2100. This will include investigating a barrier with locks. Based on current climate projections (as of 2024), this solution is anticipated to be needed by 2120.
- Implications of post-2100 flood risk management under the TE2100 strategy and/or fluvial flooding upstream along the River Darent will need to be considered.
- RMA’s should continue to collaborate to deliver sustainable flood risk outcomes, which reduce future risk of flooding beyond 2100.
- Integrated long-term, catchment-scale strategy based on policy-level adaptation pathways agreed at local government scale. Collective response based on narrowing the uncertainty / decision space enabling local action based on local data and insight. Iterative assessment of system wide impacts.
- Estuary or catchment-wide strategic direction and climate response. Establish agreement and trust through resilient governance. Agree risk, future scenarios and strategic policy approaches. Develop shared vision. Agree values and outcomes to enable a strategic decision-making framework.

6.4 Flood Defence Raising Implementation Methodology

The implementation methodology for identifying how future raising is anticipated to occur follows 13 key steps (see Figure 119). The methodology is indicative and has been loosely based on existing policy and guidance and should not be taken as a definitive. This methodology should be interpreted by the user and must be iteratively updated to account for emerging and/or revised flood risk guidance, policy and data/information. It should be noted that the proposed target defences heights of +5.6m OD by 2040 and +6.1m OD by 2090, respectively, have been advised by the Environment Agency at the time of writing this Strategy. These levels are subject to change. For this reason, regular consultation with the Environment Agency is required in delivering this implementation methodology.

Key consideration when undertaking flood risk work are;

- Developers etc. to engage with the relevant statutory bodies early, to ensure developments progress smoothly and in-line with the Strategy. Parameters and requirements of the design need to be established early on as these will guide final solution.
- Climate change allowances/guidance changes over time must be factored into any development proposals.
- Designing with adaptive management is useful as it better accounts for changing baselines and/or risk over time.
- During the construction phase, it is important to work closely with the specialist contractor to ensure that any changes are highlighted as soon as possible from design to material, as this may require reserved matters submission as well as Environment Agency approval.

Figure 117. Dartford Creek Barrier

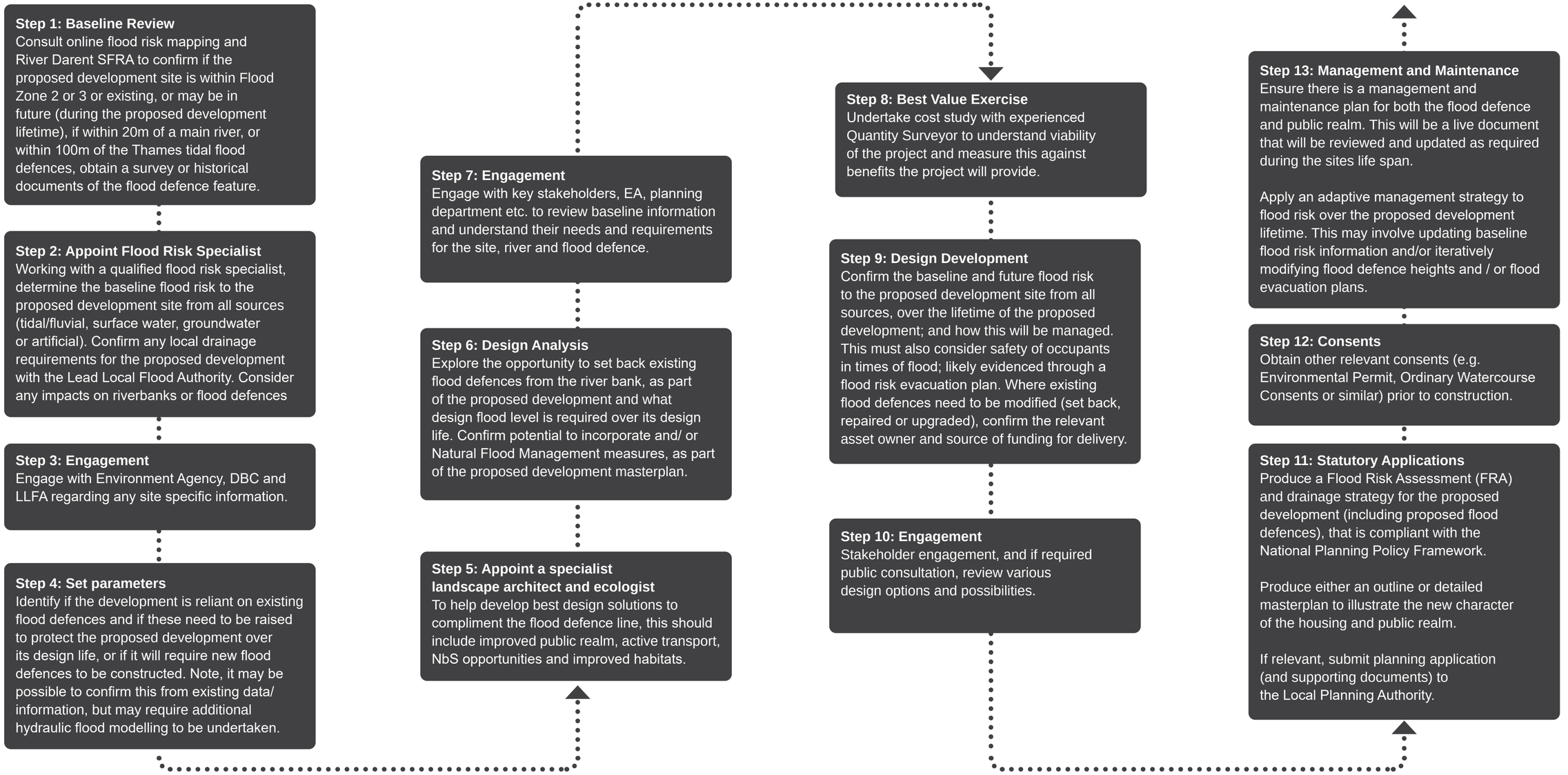


Figure 118. Flood defence raising implementation methodology

6.5 Connectivity across the River Darent

Suitable delivery of improved community connectivity through the introduction of active travel routes and pedestrian/cycle bridges across the River Darent, requires a robust implementation methodology that is complimentary to future defence raising. Refer to Figure 120 opposite.

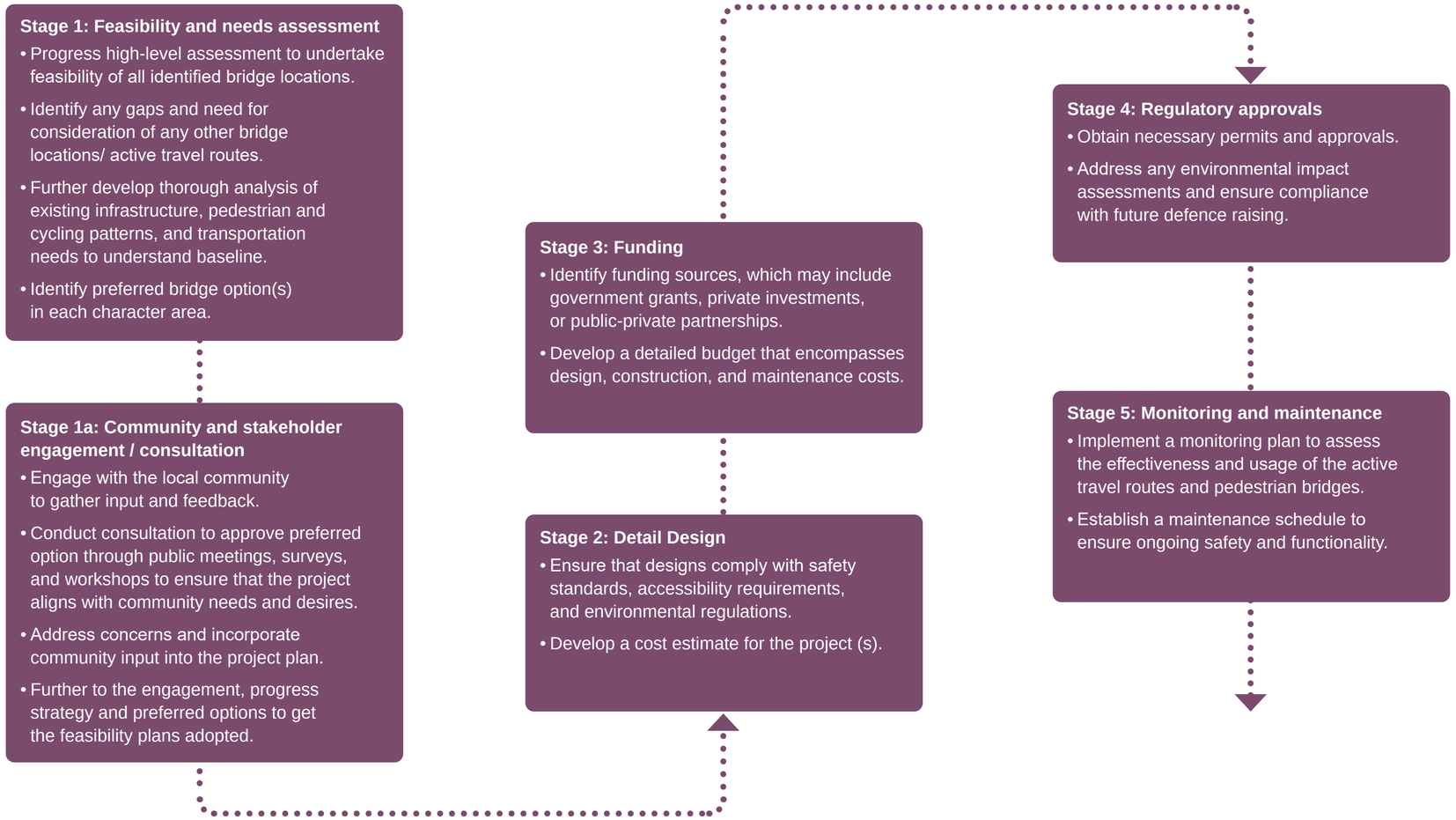


Figure 119. A methodological approach to implementation and delivery

6.6 Funding possibilities

Both the River Thames and the River Darent are main rivers, with the Environment Agency being responsible for managing the flood risk. However, the Environment Agency's powers are permissive and landowners are usually responsible for riverbanks they own including any flood defences. Developers and DBC are expected to contribute and help fund defences to make their sites safe and resilient over their lifetime, this includes flood risk. Active travel is integral to the Dartford vision and creating walkable neighbourhoods. Funding new and existing river defences as well as active travel, is an opportunity to improve the health and wellbeing of the community, improved public realm and land value and in turn increased financial benefits. Below is a list of some key funding mechanisms at the time of writing the Strategy. Other funding options are also available and may become available in the future.

Flood defence funding central government funding:

- The Department for Environment, Food and Rural Affairs (Defra) allocates funding to the Environment Agency, responsible for England's flood risk management.

Local government contribution:

- Kent County Council (KCC) as Lead Local Flood Authority (LLFA) contribute to flood defence funding through council tax and other levies, reinforcing community-based financial support.

Additional revenue-capture opportunities:

- Explore possibilities such as capturing land value uplift, leading to business rate retention. This is particularly relevant in areas experiencing significant development, unlocked by flood defence investments.

Private investment incentives:

- Developers could contribute to on-site or off-site flood defence costs when constructing homes in high-risk zones.

Revenue-generating assets:

- Explore the creation of assets, like cafés, kiosks, and moorings, as part of the investment, offering sustained income opportunities for the Council.

Regional Flood and Coastal Committee (RFCC)

- Note; only RMAs can apply for RFCC or DEFRA GiA funding), not private developers.

Biodiversity Net Gain credits

- These can be bought and sold so developments which deliver a lot of BNG through river restoration could gain income.

Funding active travel

Central government:

- Funding through the Department for Transport (DfT), allocated to local authorities and to Active Travel England (ATE), an executive agency of the DfT.

Local government:

- Local authorities also contribute to active travel funding, through council tax and other levies linked to developers contributions such as S106 or Community Infrastructure Levy.

Businesses:

- Businesses could also sponsor or support active travel initiatives. For example, they may provide funding for cycle training or for the installation of secure cycle parking.

Community groups:

- Community groups can also play a role in funding active travel interventions. For example, they may raise money through crowdfunding or through grant applications.

Key Policy

Local Plan - Infrastructure and economic investment 11, 12, 12, 14

7. Appendix

7.1 Relevant Policy: National

Table 5. Relevant National policy

Scale	Policy name & year	Policy	Narrative/ summary / key actions	Category
National	National Planning Policy Framework (2023)	Legislation	Chapter 2 Achieving Sustainable Development and Chapter 14 Meeting the Challenge of Climate Change, Flooding and Coastal Change set out requirements to ensure that new development is sustainable and resilient in the face of current and future flood risk from all sources (fluvial, tidal/coastal, surface water, groundwater, artificial sources and infrastructure).	Flooding
National	Flood and Water Management Act (2010)	Legislation	Sets out a legislative framework that complements the NPPF including definition of national and local flood risk management strategies. The FWMA created clearer roles and responsibilities and helped to define a more risk based approach to managing flooding. This included creating a lead role for some LAs, as LLFAs, to have a strategic overview of local flood risk (from surface water, groundwater and ordinary watercourses) and provide a national overview role of all flood risk for the EA.	Flooding
National	The national flood and coastal erosion risk management strategy for England (2011)	Legislation	This strategy builds on existing approaches to flood and coastal risk management and promotes the use of a wide range of measures to manage risk. Risk should be managed in a co-ordinated way within catchments and along the coast and balance the needs of communities, the economy and the environment. This strategy will form the framework within which communities have a greater role in local risk management decisions and sets out the Environment Agency's strategic overview role in flood and coastal erosion risk management (FCERM).	Flooding
National	Marine Management Organisation South-East Inshore Marine Plan June 2021			Flooding
National	Government's 25 year Environment Strategy			
National	Chalk Stream Strategy		A restoration strategy re-naturalising flow and improving water quality while using landscape-scale physical-habitat improvements to consolidate the beneficial impacts of both and thus deliver maximum ecological improvement. Developed and published by Catchment-based Approach (CaBA) in 2022.	Ecology
National	LTN1/20	Guidance	Cycle infrastructure design guidance	
National	Inclusive mobility	Guidance	A Guide to Best Practice on Access to Pedestrian and Transport Infrastructure	

7.2 Relevant Policy: Regional

Table 6. Relevant Regional policy

Scale	Policy name & year	Policy	Narrative/ summary / key actions	Category
Regional	Kent Biodiversity Strategy (Action Plan)		A rich and growing terrestrial biodiversity, underpinned by more resilient and coherent ecological networks and healthy, well-functioning ecosystems. • Clean, plentiful and biologically diverse freshwater and intertidal ecosystems underpinned by implementation of a catchment based approach. • A reverse in the loss of marine biodiversity and delivering clean, productive and biologically diverse oceans and seas through good management. • Communities benefiting from the mental and physical health benefits of the natural environment and inspired to take on guardianship of the county's biodiversity.	Ecology
Regional	TE2100		A strategic plan for adapting to rising sea levels in the estuary, with 3 main aims. • Take an adaptive approach to manage tidal flooding and create climate resilient communities. • Protect and enhance the value of the Thames, its tidal tributaries and floodplain. • Tackle the climate and nature crises by restoring ecosystems, reducing carbon emissions, and delivering environmental and biodiversity net gain. Draft Plan Appendix D.2 - Local Choices for Flood Risk Management - Dartford & Erith Policy Unit.	Flooding
Regional	The Thames Strategy East			
Regional	The Thames Gateway Parklands Vision			
Regional	'Natural Signatures - London Landscape Framework'			
Regional	The Thames River Basin Management Plan			
Regional	Kent Design Guide		Document laying out principles of what creating attractive and successful places that work well in Kent requires. Sections relating to sustainability, landscape, open space,ecology, and health.	Planning
Regional	North Kent Rivers Catchment Flood Management Plan (2009)	Policy s4 and 6	Policy 4 – Dartford and Ebbsfleet. Areas of low, moderate or high flood risk - where flood risk is currently managed effectively but further action may be needed to keep pace with climate change. Policy 6 – Upper River Darent and tributaries. Areas of low to moderate flood risk where action will be taken to store water or manage runoff to provide overall flood risk reduction or environmental benefits.	

Relevant Regional policy (cont.)

Scale	Policy name & year	Policy	Narrative/ summary / key actions	Category
Regional	Dartford Surface Water Management Plan Stage 2 (2016)		The Stage 2 SWMP identified a range of recommended actions for the reduction of flood risk across the Dartford area. The Action Plan collates all information undertaken and collated as part of this SWMP study and: • Outlines the actions required and where and how they should be undertaken; • Sets out which partner or stakeholder is responsible for implementing the actions and who will support them; • Provides indicative costs; and • Identifies priorities. Please note, this considers this action plan considers the relative priority of actions across Kent as a whole. As Dartford has relatively few flood incidents reported, it is a lower priority area then other areas of the county.	Flooding
Regional	Kent Local Flood Risk Management Strategy 2017-2023 (2017)			
Regional	Thames Strategy East (2008)		Outlines the Strategy for the Thames up to 2100, as part of the Thames 2100 Strategy, including the approach to walking and cycling along the Thames and surrounding areas. This highlights the need to prioritise completing footpath and cycle paths, with a focus on improving the Thames Path, and connections to it from the hinterland. Alongside the requirements for improving legibility of routes that deviate inland (such as along the River Darent) and the need to minimise ramps to ensure accessibility for all and reducing obstacles for people cycling.	Recreation

7.3 Relevant Policy: Local

Table 7. Relevant Local policy

Scale	Policy name & year	Policy	Narrative/ summary / key actions	Category
Local	Local Plan - Borough Spatial Strategy	S1		
Local	Local Plan - Climate Change Strategy	S3		Planning
Local	Local Plan - Central Dartford Strategy	D1		
Local	Local Plan - Westgate Allocation	D4		
Local	Local Plan - East of Lowfield Street Allocation	D5		
Local	Local Plan - Priority Centre	D6		
Local	Local Plan - Central Dartford Station Surrounds/ River Darent Area	D7	2. Development will be permitted where it includes the following key elements: a) Transforming the riverside environment into an attractive, safe, vibrant and resilient place, promoting outdoor leisure and onwards connections wherever possible. Applicable sites shall deliver high-quality pedestrian routes along both sides of the River Darent, new landscaped public spaces, and seek to naturalise the River and its banks, where providing flood risk and ecological benefits, and, where appropriate, should include business uses which activate these spaces. Its reasoned justification commentary ('supporting text') states • Re Hythe Street and Victoria Rd North: Available land with Significant potential to improve linkages to the river and the street scene, and a prominent entry point to the Town Centre. Steam Crane Wharf east of Hythe Street should provide active ground floor uses to the riverfront. Adjoining redevelopment on Upper Hythe Street should be sympathetically brought forward without impinging on realising the regeneration potential of the gasometer on Victoria Road. • Re Wickes [& similar]: Redevelopment should provide attractive and safe pedestrian routes across the site and an improved safe, activated and accessible river frontage, including to improve the river as a green corridor for ecology and wildlife movement.	Planning

Relevant Local policy (cont.)

Scale	Policy name & year	Policy	Narrative/ summary / key actions	Category
Local	Local Plan - Good Design for Dartford	M1	Development Management policy - aligning with Kent Design Guide setting out principles of good design.	Planning
Local	Local Plan - Flood Risk and Riverside Design	M4	Flood Risk and Riverside Design.	Flooding
Local	Local Plan - Designated Heritage Assets	M5		Heritage
Local	Local Plan - Historic Environment Strategy	M6		Heritage
Local	Local Plan - Residential Amenity Space Provision	M9		Landscape
Local	Local Plan - Green and Blue Infrastructure and Open Space Provision	M13		Landscape
Local	Local Plan - Biodiversity and Landscape	M14		Landscape
Local	Local Plan - Transport and Sustainable Travel	M15 & M16		Transport
Local	Local Plan - Community Uses	M7		Planning
Local	Local Plan - Identified Employment Areas	M19		Planning
Local	Local Plan - Green and attractive environment	G1	Protecting Green Belt land to maintain a distinct and enduring open environment for the borough.	Ecology
Local	Local Plan - Green and attractive environment	G2	Securing quality and sustainable built design...and good open and amenity space provision...and recognising green assets.	Ecology
Local	Local Plan - Green and attractive environment	G3	Ensuring the borough is able to adapt to the effects of climate change...through...promoting environmental resilience, new green space and tree planting.	Ecology
Local	Local Plan - Green and attractive environment	G4	Promoting sustainable local environments and habitats, achieving biodiversity net gain and active and healthy living, at new developments and through green space and landscape protection and provision, enhancing the green grid of footpaths, public rights of way, cycle routes, wildlife corridors, rivers and countryside links.	Ecology
Local	Local Plan - Green and attractive environment	G5	Acting to ensure no increase in flood risk in the borough, and creating attractive and accessible riversides, encouraging sensitive recreation and travel on and alongside the Rivers Thames, Darent and Ebbsfleet.	Ecology
Local	Local Plan - Wellbeing for Communities	W1	Achieving cohesive, safe, walkable and attractive neighbourhoods, with a real sense of place and vitality that reflects the area's heritage and potential, and whose residents enjoy a choice of homes suited to their needs and easy access to local everyday facilities, including education and healthcare.	
Local	Local Plan - Wellbeing for Communities	W2	Improving health and wellbeing, and air quality arising from congestion, through reducing the need to travel by private vehicle, particularly by retaining and providing jobs, services, shops, community facilities and open space at suitable locations close to residential areas and where good public transport services are within easy walking distance.	

Relevant Local policy (cont.)

Scale	Policy name & year	Policy	Narrative/ summary / key actions	Category
Local	Local Plan - Wellbeing for Communities	W1	Achieving cohesive, safe, walkable and attractive neighbourhoods, with a real sense of place and vitality that reflects the area's heritage and potential, and whose residents enjoy a choice of homes suited to their needs and easy access to local everyday facilities, including education and healthcare.	
Local	Local Plan - Wellbeing for Communities	W2	Improving health and wellbeing, and air quality arising from congestion, through reducing the need to travel by private vehicle, particularly by retaining and providing jobs, services, shops, community facilities and open space at suitable locations close to residential areas and where good public transport services are within easy walking distance.	
Local	Local Plan - Wellbeing for Communities	W3	Providing well-designed new housing that is genuinely mixed, affordable and of varied tenure, sustainable, and promotes healthy living, to secure the quality of life of residents and the ability for them to continue residing at their home or within the borough.	
Local	Local Plan - Wellbeing for Communities	W4	Realising whole lifetime residential accommodation options and facilities, with accessible types and designs of living environments catering for people as their circumstances change.	
Local	Local Plan - Wellbeing for Communities	W5	Encouraging development that provides a wide range of opportunities for residents to enjoy good quality cultural, art, leisure and sports pursuits.	
Local	Local Plan - Infrastructure and economic investment	I1	Continuing urban regeneration through optimising the re-use of accessible and suitable brownfield land primarily within the north of the borough to meet future local housing and employment needs, and delivering new infrastructure for travel, schools/ skills, health, and other local services.	
Local	Local Plan - Infrastructure and economic investment	I2	Facilitating a range of upgrades to the transport network, and a choice of sustainable and active travel options, with rapid and reliable public transport linking existing neighbourhoods and developments to key destinations and facilities, together with a high-quality and comprehensive walking and cycling network.	
Local	Local Plan - Infrastructure and economic investment	I3	Achieving a vibrant Dartford Town Centre with an attractive public realm in an enjoyable and accessible environment, new residential communities, improved connections and services, and a flourishing day and evening economy with an enticing cultural, retail and leisure offer.	
Local	Local Plan - Infrastructure and economic investment	I4	Retaining a prosperous economy with a good choice of jobs per resident, increasing high-quality, accessible, local employment opportunities, maintaining a diverse supply of premises and supporting existing business needs, with Ebbsfleet providing a productive mix of new commercial, community and residential activities.	

Relevant Local policy (cont.)

Scale	Policy name & year	Policy	Narrative/ summary / key actions	Category
Local	Dartford Borough Level 1 and 2 Strategic Flood Risk Assessment (2021)		Identifies areas of Dartford Borough are at high risk of flooding from, tidal, surface water and fluvial sources, where the Sequential Test and/or Exception Tests apply, and where there are data gaps in baseline flood risk. The level 2 SFRA identifies sites that are suitable for future development.	Flooding
Local	Kent County Council Drainage and Planning policy statement		Sets out policies for drainage and SuDS.	Flooding
Local	Kent County Council Land Drainage Policy	1	KCC will undertake enforcement of the maintenance of watercourses where there is an obvious need to prevent significant flooding from the ordinary flow in a watercourse and after the riparian owner has refused to undertake the necessary work themselves within a reasonable timeframe.	Flooding
Local	Kent County Council Land Drainage Policy	2	KCC will consent works where all of the following conditions are met: • A fully complete application is received with the appropriate fee; • The proposed works are appropriate for the watercourse such that they do not increase the risk of flooding or damage habitats or vertebrates; and • Appropriate pollution and erosion control measures will be employed work themselves within a reasonable timeframe.	Flooding
Local	Kent County Council Land Drainage Policy	3	KCC will commence enforcement of unconsented works where the works cause a significant risk of flooding or lead to the significant detriment of aquatic habitats.	Flooding
Local	Town Centre Framework		SPD setting out objectives for regeneration of Dartford Town Centre including: movement, leisure, perception & quality of place, economy, creativity, and innovation.	Planning
Local	Drainage and Wastewater Management Plans (Southern Water / Thames Water) - not yet published, due 2023			Flooding
Local	Dartford Local Cycling and Walking Infrastructure Plan (LCWIP) (2023)		Outlines existing walking and cycling routes. The LCWIP does not propose any improvements to walking and cycling infrastructure adjacent to the River Darent, however, a 2km area of influence which is considered a priority for walking and cycling improvements is identified around Dartford Town Centre.	Recreation
Local	Future Infrastructure Statement		Describes an active travel network already in place in parts of the borough, in particular in Central Dartford.	Recreation

Relevant Local policy (cont.)

Scale	Policy name & year	Policy	Narrative/ summary / key actions	Category
Local	SHLAA (Strategic Housing Land Availability Assessment), 2021		Identified 231 sites with capacity for 5+ dwellings. 87 assessed as deliverable/develop-able within the next 5 years 30 of these within Dartford Town Centre 5 further Town Centre Sites identified as suitable locations for housing development, but not currently available There are various sites that have been identified for development adjacent to the river. The next stages of the project will consider river defence interactions for some the following sites; 10 Steam Crane Wharf/ Hythe Street 14 Lowfield Street 17 Station Approach 24 Wickes Site 29 RBT Trust Land 86 Hythe street and Victoria Road North	Residential / river defence
Local	Darent Action Plan		The river should support a mosaic of habitats with high biodiversity value to: • Develop sustainable water management within the catchment and support communities that enjoy, engage with and protect the river • Restore the river to a more naturally functioning watercourse, improve water quality and support an appropriate self-sustaining fish population.	Ecology
Local	Managing the Marshes Vision and Strategy from 2006		The potential of the marshes to be multifunctional sites, combining nationally significant wildlife habitats with recreational use and flood management.	Ecology
Local	Bexley Local Flood Risk Management Strategy		Ensure flood risk works are designed to achieve multiple benefits and enhance the location by adding amenity and biodiversity value.	Ecology

7.4 Role of National Planning Policy Framework (NPPF)

Green Infrastructure and Open Space

Under the National Planning Policy Framework (NPPF) (2023), local planning authorities must prepare a robust and evidence-based Local Plan which seeks to deliver sustainable development. As part of the statutory requirement to produce a Local Plan, national policy has placed a greater responsibility on local planning authorities to plan for the delivery of various forms of infrastructure required to support future growth.

Paragraph 20 of the NPPF states that:

Strategic policies should set out an overall strategy for the pattern, scale and design quality of places, and make sufficient provision for:

e) housing (including affordable housing), employment, retail, leisure and other commercial development;

f) infrastructure for transport, telecommunications, security, waste management, water supply, wastewater, flood risk and coastal change management, and the provision of minerals and energy (including heat);

g) community facilities (such as health, education and cultural infrastructure); and

h) conservation and enhancement of the natural, built and historic environment, including landscapes and green infrastructure, and planning measures to address climate change mitigation and adaptation.

Relevance to this Strategy

The NPPF defines Green Infrastructure as a network of multi-functional green and blue spaces and other natural features, urban and rural, which is capable of delivering a wide range of environmental, economic, health and wellbeing benefits for nature, climate, local and wider communities and prosperity. It states the need for strategic policies to set out an overall strategy for the pattern, scale and design quality of places, and make sufficient provision for green infrastructure (page 70 of the NPPF), while new development should be planned for in ways that avoid increased vulnerability of the range of impacts arising from climate change, managing risks through the planning of green infrastructure (Paragraph 159).

Natural England's Green Infrastructure Framework (2023) sets out the '15 Principles of Green Infrastructure'(See Signpost 'Green Infrastructure Principles'), Green Infrastructure Planning and Design Standards, and includes an online Green Infrastructure Mapping Database for public use. The Framework also provides a recommended 'process journey' to develop and deliver green infrastructure for local planning authorities, developers and neighbourhood planning groups respectively.

Signpost

Green Infrastructure Framework
Green Infrastructure Principles
NPPF

7.5 The Water Framework Directive (WFD)

The Water Framework Directive (WFD - EU Water Framework Directive: 2000/60/EC of the European Parliament and of the Council; of 23 October 2000; Establishing a framework for Community action in the field of water policy) has been in force since 2000 and is currently the largest and most influential piece of European Union (EU) legislation relating to the water environment. The Directive was transposed into UK law by the Water Environment (Water Framework Directive) (England and Wales) Regulations 2017 (Statutory Instruments, 2017 No.407, The Water Environment (Water Framework Directive) (England and Wales) Regulations 2017) and therefore still applies following Britain's exit from the EU. The Environment Agency is the regulatory body for the WFD in England.

The WFD requires regulatory bodies to identify and set objectives to improve 'water bodies'. Water bodies comprise rivers, streams, lakes, estuaries, transitional and coastal water bodies, canals and groundwater. The key environmental objectives are to:

- Prevent deterioration in the status of aquatic ecosystems, protect them and improve the ecological condition of waters; and
- Aim to achieve at least 'Good' status for all water bodies by 2021. Where this is not possible and subject to the criteria set out in the Directive, aim to achieve Good status by 2027.
- The Strategy Study Area coincides with following WFD water body catchments:
- Middle and Lower River Darent water body (ID TQ5522071870); and
- THAMES transitional water body (ID GB530603911402).

Further baseline information on these water bodies is available via the Environment Agency Catchment Data Explorer website.

WFD mitigation measures would contribute to delivery of Good status for the water bodies within the Strategy Study Area are described in Table 7 and illustrated opposite. Opportunities to deliver, or contribute to delivery of, these mitigation measures should be explored as part of any relevant development as part of the Strategy. Any developments within these parts of the catchment (or at catchment scale) should liaise with the Environment Agency to confirm suitability, at the earliest opportunity of the project.

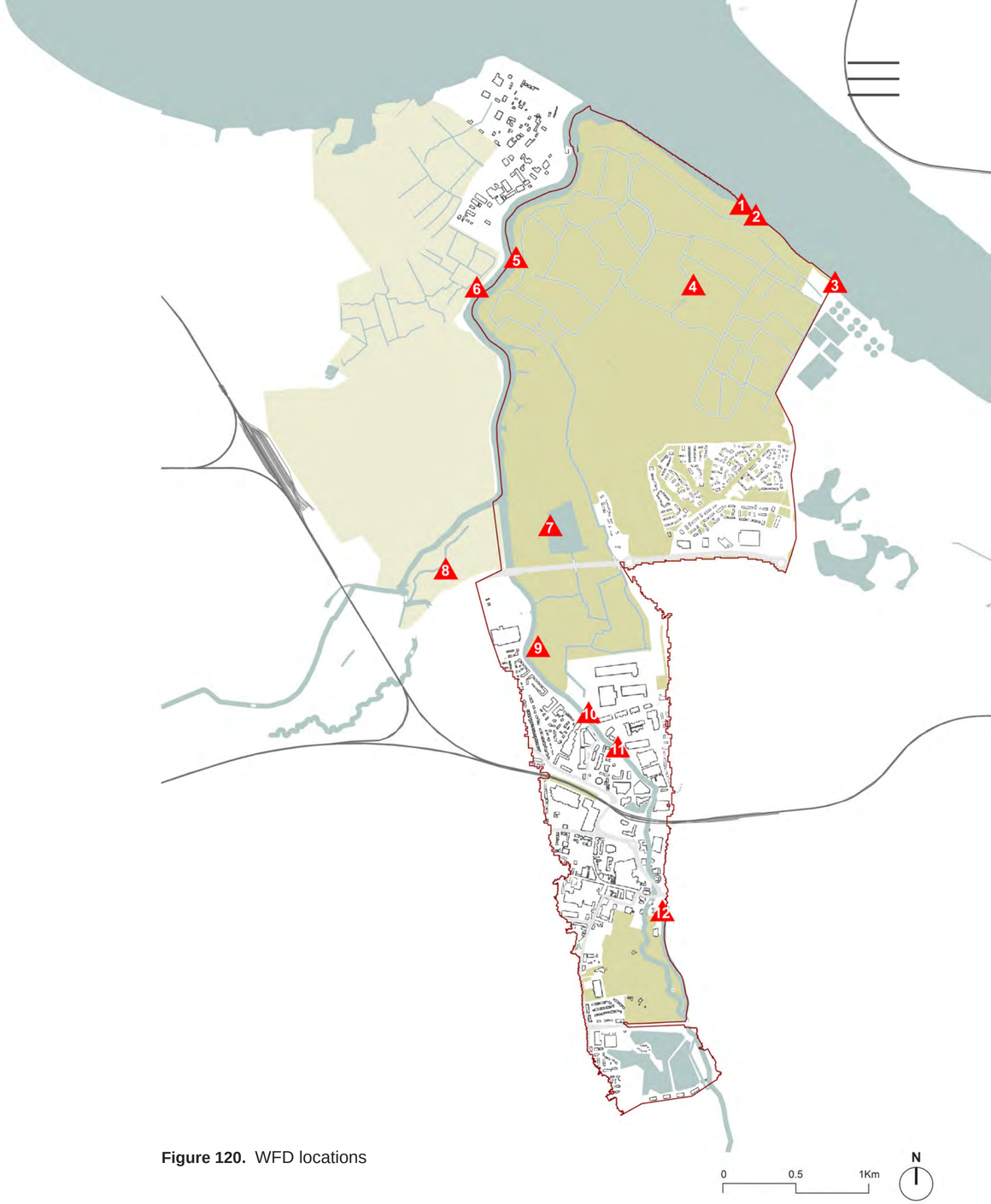


Figure 120. WFD locations

7.6 WFD mitigation measures

Table 8. WFD mitigation measures

Number	WFD Mitigation Measure	WFD Water Body (and ID)	Description	Approximate National Grid Reference (NGR)
1	Improvement to condition of channel/ bed and/or banks/shoreline	THAMES (ID GB530603911402)	Dartford Marshes outfall - set back with managed realignment and make fish and eel friendly.	TQ5488377559
2	Managed realignment of flood defence	THAMES (ID GB530603911402)	Dartford Marshes - at end of life, set back defence using a bioengineered design from estuary edges.	TQ5498877470
3	Improvement to condition of channel/ bed and/or banks/shoreline	THAMES (ID GB530603911402)	West of Dartford STW - Intertidal planters, Vertical Beach and Eco fenders/green walls to be installed – at end of use, use a structurally engineered Estuary Edges Guidance design.	TQ5532377153
4	Managed realignment of flood defence	THAMES (ID GB530603911402)	Dartford Marshes - managed realignment to infrastructure.	TQ5467477171
5	Preserve and where possible enhance ecological value of marginal aquatic habitat, banks and riparian zone	THAMES (ID GB530603911402)	West Dartford Marshes - at end of design life, undertake managed realignment of flood defences by approximately 10m (to the road).	TQ5376977241
6	Crayford Marshes - at end of life manage realign 10m	THAMES (ID GB530603911402)	Improvement to condition of channel/ bed and/or banks/shoreline.	TQ5350677088
7	Managed realignment of flood defence	THAMES (ID GB530603911402)	Joyce Green Farm - at end of design life, undertake managed realignment of flood defences by approximately 10m.	TQ5385175837
8	Managed realignment of flood defence	THAMES (ID GB530603911402)	Bob Dunn Way - at end of design life, undertake managed realignment of flood defences by approximately 10m.	TQ5335475693
9	Managed realignment of flood defence	THAMES (ID GB530603911402)	Dartford Fresh Marshes - at end of design life, undertake managed realignment of flood defences by approximately 10m (protecting pylons).	TQ5385275345
10	Managed realignment of flood defence	THAMES (ID GB530603911402)	Riverside Industrial Estate - at end of design life, undertake managed realignment of flood defences by approximately 10m.	TQ5405474965
11	Operational and structural changes to locks, sluices, weirs, beach control, etc.	THAMES (ID GB530603911402)	Victoria Industrial Park - Eco fenders/green walls - maintain location of defence, use a structurally engineered Estuary Edges Guidance design.	TQ5423874744
12	Managed realignment of flood defence	Middle and Lower Darent (ID TQ5522071870)	Flood relief channel, south Dartford. Investigate options to improve fish passage.	TQ5449073840

*It should be noted that additional WFD mitigation measures are prescribed for the wider catchment and surrounding water bodies. Values in the above table have been cropped to the Study Area.

7.7 Modelling Disclaimer

This Strategy has been informed by existing flood modelling studies, including baseline and ‘with climate change’ flood risk data from the River Darent and River Cray Modelling Study (JBA, 2019) and the Dartford and Crayford Creeks Flood Risk Mapping Study (JBA, 2020). Likely future defence heights for the study area have been advised by the Environment Agency. Future defence heights are assumed to be similar to those which have been derived for areas upstream of the Thames barrier, which are 5.6m OD by 2040 and 6.1m OD by 2090. There is likely to be some variation due to the tidal prism effect; however, for the purposes of the Strategy it is reasonable to assume these levels.

It should be noted that this Strategy does not define the most appropriate way to manage flood risk or set future flood defence crest levels. These decisions, and associated hydraulic modelling, will be determined following detailed future appraisals, likely led by the Environment Agency. Any proposed changes, upgrades to existing flood defences and/or construction of new flood defences must be subject to detailed assessment, accounting for the relevant climate change scenarios and guidance, applicable at the time of assessment.

Finally, it should be recognised that the TE2100 plan is adaptive and that any development coming forward should obtain the most up to date defence levels from the Environment Agency at the time and seek to incorporate these in any development proposals, in a way which meets the aims of the Strategy.

Any third-party flood defence asset information and/or hydraulic modelling data included in this document is for illustrative purposes only. Arup accepts no responsibility or liability for any use of this information for any purpose.

7.8 References

Websites:

Acacia Hall Project

Blue Green Infrastructure and Nature Based Solutions Framework

Chalk Stream Strategy (Link no longer available)

Dartford Borough Level 1 and 2 Strategic Flood Risk Assessment

Delivering SUDS in Kent; Susdrain

Estuary Edges - Thames Estuary Partnership

Gear Change a bold vision for cycling and walking

Green Infrastructure Framework

Green Infrastructure Principles

Inclusive Mobility Guidance

Link management authorities list

Making Space for Nature- Kent County Council

Natural Flood Management Manual. CIRIA NBS interventions

NPPF

Office for National Statistics (Link no longer available)

Retrofit sheet piling such as using Nature Bricks Estuary Edges - Thames Estuary Partnership

The Environment Agency's approach to groundwater protection (under review).

The River Restoration Manual; The River Restoration Centre

The Suds Manual; CIRIA

Natural Flood Management Manual. CIRIA

The Thames Estuary adaptation pathway

Wild West End

Documents:

Adaptation to climate change – using adaptation pathways for decision-making – Guide, BSI, 2021

Dartford Borough Level 1 and 2 Strategic Flood Risk Assessment, Final Report, JBA Consulting, February 2021

Dartford Borough Level 1 and 2 Strategic Flood Risk Assessment, Appendices Part 1 and Part 2, JBA Consulting, February 2021

Dartford and Crayford Creeks Flood Risk Mapping Study, Final Report, May

Dartford Fresh Marshes Habitat Management Plan Produced for Exton Estates by Applied Ecology Ltd, June 2015

Dartford East End Marshes Water Vole Survey by NWKCP, September 2012

EU Water Framework Directive: 2000/60/EC of the European Parliament and of the Council; 'Establishing a framework for Community action in the field of water policy' 23 October 2000.

Final Report for the Grant Agreement: River Improvements, Central Park, Dartford, July 2021 Statutory Instruments, 2017 No.407, The Water Environment (Water Framework Directive) (England and Wales) Regulations 2017.

7.9 Further Information

Relevant Documents

Dartford Borough Council

Dartford Development Polices Plan July 2017

Dartford Local Plan Green Infrastructure Paper September 2021

Dartford Town Centre Framework SPD Dartford

Local Plan (This link is no longer available as of November 2024)

Bexley Council

Draft Local Plan LBB May 2021

Managing the Marshes Vision and Strategy March 2006 (This link is no longer available as of November 2024)

Other

Kent Nature Partnership Biodiversity Strategy 2020-2045

Thames Estuary 2100

The Thames Strategy East

The Thames Gateway Parklands Vision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