Weymouth Harbour & Esplanade Flood and Coastal Risk Management Strategy

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Dorset Council

Document history

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Dorset Council

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Executive Summary

This is a non-technical report intended for a general readership.

Weymouth already floods and is impacted by coastal erosion. With a robust prediction of an acceleration in sea level rise and more intense weather events as a result of climate change, the problems facing Weymouth will increase significantly. Without investment in managing this flood and erosion risk, Weymouth faces increasing direct losses through flooded assets and infrastructure and indirect impacts such as a failing property market due to blight and increasing social deprivation.

Dorset Council as;

(i) The principal asset owner of harbour and seafront infrastructure,
(ii) The Local Planning Authority,
(iii) The defined Lead Local Flood Authority, and
(iv) Coast Protection Authority;

now need to promote a coherent plan for the long-term sustainable flood and coastal risk management of Weymouth Harbour and the Esplanade. This document sets out the Council's preferred strategic approach; bringing together the findings and recommendations from numerous recent studies undertaken by both the Council and the Environment Agency. It should be noted that this strategy excludes river and surface water flood risk.

The preferred strategic approach is to undertake a comprehensive programme of wall replacement and wall raising around both the Harbour and Esplanade frontages. This will both reduce flood risk and replace deteriorating walls, some of which are already at the end of their design life. It is a phased and adaptive approach which provides the opportunity to keep under review a number of factors including rates of climate change, asset deterioration and changes in spatial planning needs and requirements.

The scale of engineering works is significant and will require investment from multiple funding sources in line with Government's Partnership Funding approach. Investment in excess of £115million in cash cost terms will be required over the next one-hundred years.

Through economic appraisal, it can be clearly demonstrated that a robust case can be formed with Present Value Benefits totalling in excess of £750million (PVb). The wider financial benefits to Dorset and the South West Region will be several times greater. Economic benefit alone will return a Benefit Cost Ratio in excess of 14:1.

1 Background

This document aims to bring together the findings and recommendations from a number of recent studies undertaken by Weymouth & Portland Borough Council (now Dorset Council) and the Environment Agency, namely:

- Weymouth Bay Coastal Processes Study (Jackson-Hyder, 2015 to March 2018).
- Weymouth Model Updates (JBA, August 2016)
- Weymouth Inundation Modelling Study (JBA, February 2019)
- Weymouth Harbour & Esplanade Flood & Coastal Risk Management Strategy Update (WSP, March 2019)
- Masonry Harbour Walls Condition Assessment (JBA, June 2019)
- Sheet Pile Harbour Walls Condition Assessment (JBA, June 2019)
- Weymouth Beach Management Plan (Jacobs, July 2019).

The above studies have all built upon the original Weymouth Flood Risk Management Strategy (Royal Haskoning, 2010) which itself aligns to the long-term policy to continue to defend Weymouth Harbour and seafront through 'Hold the Line' policy adoption defined in the South Devon & Dorset Shoreline Management Plan (Halcrow, 2011).

Section 2 of this report sets out the risks faced in Weymouth from coastal flooding and erosion if no action is taken to maintain or improve the current harbour and esplanade defences and assets. This is considered in the context of the challenges posed from climate change over the next 100 years and beyond, particularly sea level rise and more extreme weather events.

Sections 3 to 5 consolidate the recent reports into a preferred strategic pathway to managing coastal flooding and erosion risks. Short term implementation can be defined with a reasonable level of confidence given the recent studies and reports, whilst the longer-term approach needed in the second half of this century should allow for a range of possible scenarios whilst still achieving the overall objective. Factors which could influence the longer-term approach in the coming decades include;

- Availability of national funding to deliver different possible future options.
- Availability of local funding / partnership funding contributions.
- The rate of sea level rise.
- The frequency of flooding and erosion incidents.
- The rate of beach narrowing along the seafront.
- The rate of degradation in the condition of harbour walls.
- Willingness/acceptability for specific future options.

- Spatial planning direction and drivers.
- Future economic need and tourism.

This report has been reviewed and is supported by the Environment Agency who maintain strategic oversight on flood and coastal risk matters in England and who also manage the majority of government investment into reducing flood and coastal risk.

Weymouth has the attention of the Wessex Regional Flood and Coast Committee and features as a priority location within its committee strategy.

2 Flood and Erosion Risk

2.1 Sea Level Rise and Climate Change Projections

Coastal management schemes must account for accelerated sea level rise caused by global warming. This is normally informed by the latest climate change projections, which are currently those released in November 2018 by the UK Climate Predictions 2018 (UKCP18) project. That project was undertaken by the Met Office and funded by Defra, with the purpose of reviewing and updating climate change projections for the UK. Figure 2.1 shows how sea level rise is expected to affect high water levels in Weymouth in comparison to the current 2.3m Ordnance Datum (OD) crest level over the next 100 years.

The target Standard of Protection (SoP) against coastal flooding at Weymouth is 1 in 200 years (0.5% annual probability of exceedance).

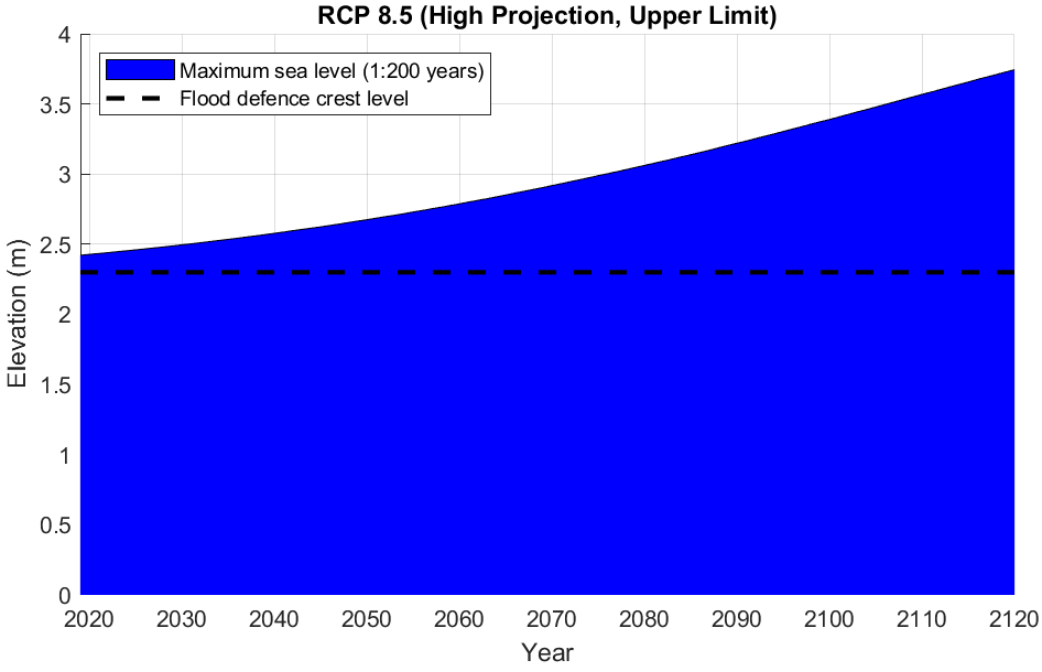

Figure 2.1 Projected rise in the 1 in 200-year water level at Weymouth to 2120 under the UKCP18 'High' emissions projection (WSP, 2019).

The water level is shown rising with the upper limit of the UKCP18 'High' emissions scenario (RCP 8.5 95th Percentile) and this represents a conservative estimate.

Over this time period, the 1 in 200-year level can be seen to increase from a present-day level of +2.43m Ordnance Datum (OD) to a level of +3.74mOD; a rise of 1.3m over the next 100 years in the worst case UKCP18 projections. The current typical defence level is +2.30mOD around the harbour and between +3.0mOD and +3.5mOD along the esplanade frontage. Current harbour walls below the desired standard of protection means increased level of risk and stifles development without specific mitigation measures.

2.2 Existing Flood Defences

The most recent flood protection scheme constructed in Weymouth Harbour was that built in 2001/2002 by the Environment Agency. It was designed to a 1 in 200-year Standard of Protection which at that time required a crest level of +2.30mOD.

The wall heights around the harbour vary and some are higher, and some are lower than the original scheme level. There are multiple construction forms and types of wall assets built over centuries and are accordingly in variable condition. Corresponding residual asset life for wall sections range from less than a year up to greater than 60 years. Residual life refers to the length of time before the asset is deemed to have reached failure/unserviceable state and is based on individual condition assessment surveys undertaken. However, even walls with reasonable residual life may require raising or replacement in order to achieve the required crest level to afford flood risk protection. There needs to be a consistent wall height throughout the town to safeguard against the risk.

2.3 Properties at Flood Risk

If a 1 in 200-year flood event were to occur, various technical reports (which include computer flood modelling simulations) have estimated the number of residential and non-residential properties around the harbour and behind the esplanade to be at risk of flooding. The flood risk mechanism could be either, or a combination of, extreme still water level and/or wave overtopping. Extreme still water level refers to an exceptionally large tidal event independent of any waves. In addition, the flood risk impacts from any failure of individual sections of harbour wall have been analysed.

In the present day (2020), this could be as many as 440 properties at flood risk (JBA, 2019c), in turn rising to over 2,000 properties by 2120.

Figure 2.2 is an example of the mapped outputs produced to depict flood extents across Weymouth – in this case, 1 in 50, 100 and 200 year still water events in the year 2065.

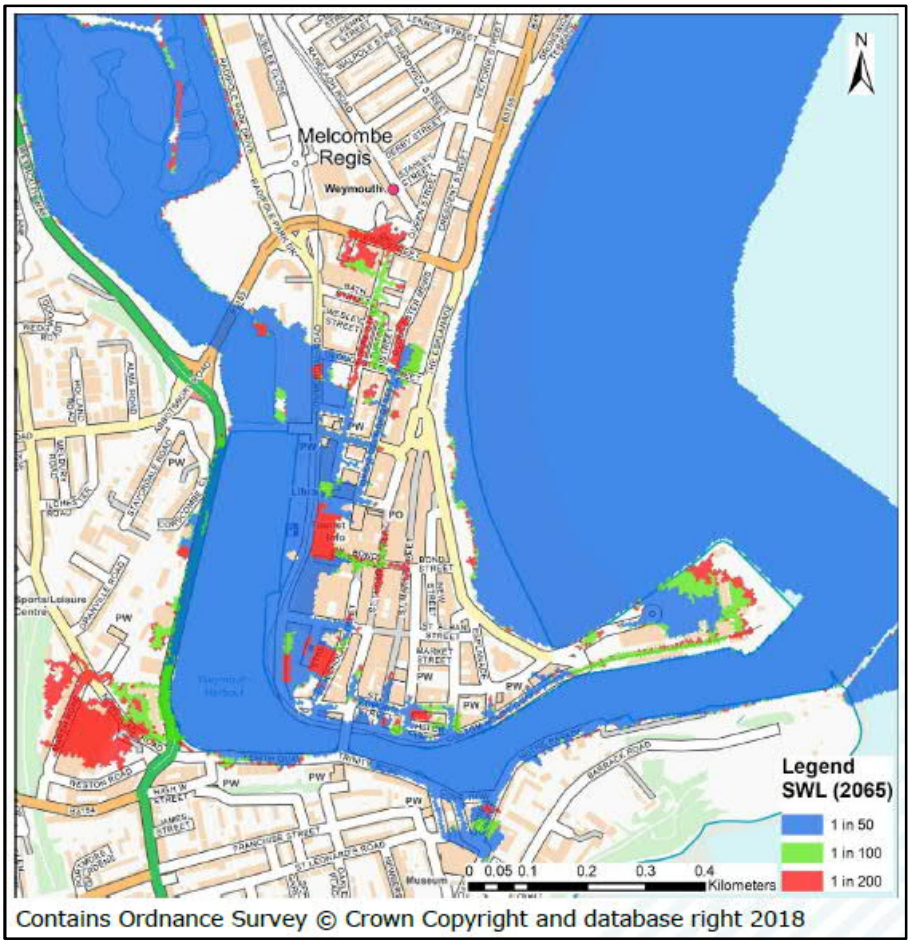

Figure 2.2 Map of still water scenarios for 2065 (JBA, 2019c)

2.4 Coastal Erosion Risk

Within the strategy area, erosion risk is most prevalent to the northern part of the Weymouth seafront area, between the Pier Bandstand and the Greenhill Groyne. The risk would increase if the seawall were to fail as a result of being undermined, particularly during storm events.

Once defences have failed and coupled with sea level rise, a period of initial 'coastal catch-up' would most likely occur. Coastal catch up describes the behaviour of the coast which can exhibit an increased level of short-term shore retreat in the immediate period following the loss of coastal protection before recession falls to a lower and more constant rate.

Coastal erosion at rates between 0.5-1.0m/year poses risk to properties (Jacobs, 2019), Greenhill Gardens and the B3155 highway which runs parallel to the shoreline.

Figure 2.3 displays that should the existing defences fail, erosion loss of between 25 and 50m could be expected after 50 years. This would rise to between 50 and 100m after 100 years. An erosion loss of just 25m would render the loss of the promenade as well as the majority of properties located between the beach and the B3155 road.

Figure 2.3 Map of Coastal Erosion Risk Zones (Jacobs, 2019)

The narrowing or loss of the beach would not only increase erosion risk but would also exacerbate flood risk through increased wave overtopping.

3 Strategic Pathways

3.1 The Adaptive Pathway Approach

The basic idea behind adaptive planning is to generate a wide array of "pathways" through which policy objectives are achieved under changing climate and socio-economic conditions. Three key elements are central to the adaptation pathways concept:

1. responses to changes that are effective under the widest set of all plausible future scenarios;
2. responses do not foreclose future options or unnecessarily constrain future choice;
3. relevant changes are foreseen through targeted monitoring and scenarios of the future are continuously being reassessed.

Proposed strategic adaptive pathways were considered in recent studies (WSP, 2019), all seeking to provide a 1 in 200-year standard of protection from sea flooding and preventing erosion until at least 2120. This time horizon is important to allow development to be brought forward with adequate flood and coast risk management.

Pathways were made up of grouped interventions, optimised to ensure that the standard of protection is maintained for the 100-year duration. Financial and economic impacts of such pathways were assessed to look for an optimal approach.

All harbour and esplanade assets have undergone further recent condition inspection and appraisal (JBA, 2019a&b and Jacobs, 2019) to determine anticipated residual life and detailed crest heights. The scheduling of interventions has then been calculated by the earlier of either; the exceedance of the existing crest level by the corresponding 1 in 200 year flood level; or, the existing structure reaches the end of its residual life. All assets and their respective interventions can be found within the detailed tables contained in Appendix A.

The pathways included phased approaches to wall raising, wall replacements and the possible inclusion of a future tidal barrier. Further consideration of these options has resulted in a leading strategy pathway as shown overleaf in Figure 3.1. The specific detail as to which wall section and in what phase an intervention is made can be found in Appendix C.

WEYMOUTH FCRM HARBOUR & ESPLANADE ADAPTIVE PATHWAY

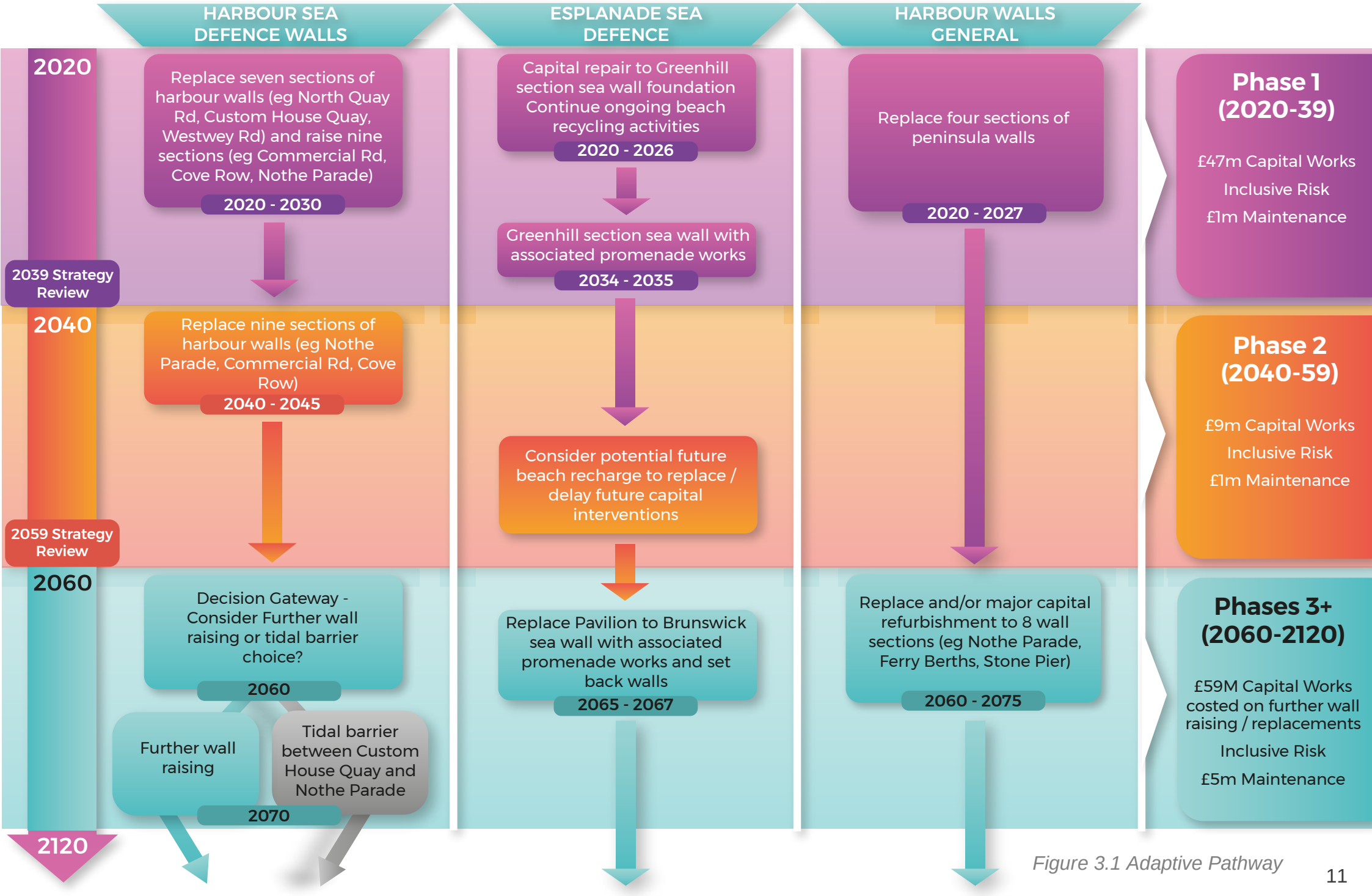

Figure 3.1 Adaptive Pathway

3.2 Categorisation of Assets

To fulfil the identified adaptive pathways, it is essential that clear responsibilities and liabilities are understood, and it is necessary to categorise the assets requiring ongoing management and upgrade. The harbour and esplanade assets can be split into three categories as follows;

3.2.1 Harbour Sea Defence Walls

A significant number of harbour walls (approximately 2.5km in plan length) form not only a functional harbour quay wall but also provide a flood risk function to mitigate tidal flooding to residential and commercial property.

It is therefore essential that these walls are replaced and/or raised at the appropriate intervention timings to ensure the desired standard of protection is maintained. In addition, a number of locations are known to suffer from tidal water rising up behind the defences contributing to the flood risk.

An example of such an asset is Wall 7 (spanning part Commercial Road and part Custom House Quay) as show in Figure 3.2. Whilst the concrete flood wall was added in the early 2000's by the Environment Agency, the supporting harbour wall itself has a residual life of around twenty years. In addition, the current crest height of 2.30mOD would be exceeded even in a present day (2020) 1 in 200-year tidal flood event. It should be noted that the present-day flood levels are based on the most up-to-date guidance which has changed significantly since the Environment Agency scheme was designed in 2001.

Figure 3.2 Typical existing 'Harbour Sea Defence Wall' (Wall 7, adjacent to Lifting Bridge abutment)

3.2.2 Harbour Walls General

A further number of harbour walls (approximately 2.0km in plan length) provide limited Flood and Coastal erosion Risk Management (FCRM) benefit. However, in order to consider the total harbour wall requirements and to ensure coherent and efficient delivery, they should be included within the strategic approach.

An example of such an asset is Wall G (northern side of the Pavilion Peninsula) as shown in Figure 3.3. The condition of this wall is poor and has reached the end of its effective design life. When it is replaced, it will not need its crest level raising for flood defence purposes. However, should development be brought forward on the peninsula, mitigation measures funded by developers may be required.

Figure 3.3 Typical existing 'Harbour Walls General' (Wall G, northern side of Pavilion Peninsula)

3.2.3 Esplanade Sea Defences

The Esplanade Sea Defences provide a dual purpose in terms of offering flood risk benefit and also mitigating erosion risk. They are important to protect against wave overtopping for the low-lying areas of the town set behind the Esplanade frontage.

An example of such an asset is the seawall and beach along the frontage of the Esplanade within Section 2 (Jubilee Clock to the Pier Bandstand) as shown in Figure 3.4. Here, future interventions are anticipated in approximately 45 years with the installation of set-back defences to manage flood risk. If the beach levels lower, further structural measures may be required including potential replacement of the Promenade seawall.

Figure 3.4 Typical existing 'Esplanade Sea Defences' (Esplanade Section 2, looking north from the Jubilee Clock)

Other Esplanade assets such as Section 3 (Pier Bandstand to Greenhill Groyne) are impacted to a greater extent by coastal erosion. As such, interventions here include for considering undermining and erosion of the wall structures.

Current beach management activities should continue which includes recycling of sand and reprofiling of the beach. This provides a cost-effective measure of delaying more significant capital interventions.

4 Financial Case

4.1 Cost Assessment

The capital costs for each of the interventions to deliver the adaptive pathway were calculated using the rates provided in the Environment Agency's 'Long-Term Costing Tool'. This provides unit costs for FCRM measures based on previously undertaken schemes. The rates within the tool were uplifted to present day value using the Consumer Price Index.

A number of variations for costing options were undertaken to provide a sensitivity analysis around potential cost estimates. These include simple or defined approaches and lower, average and upper percentiles.

Cost outputs from the Environment Agency's 'Long-Term Costing Tool' have been benchmarked and validated against recent works at Wall C of Weymouth harbour. Good correlation was found, adding to the confidence of the cost assessment.

Maintenance costs have been considered to ensure whole life costs are inclusive of routine repairs and inspections.

In line with HM Treasury guidance and FCRM industry best practice, an 'Optimism Bias' uplift of 60% has been added to all costs.

A summary of the high-level costing exercise for the 100-year adaptive pathway can be found tabulated in Appendix B.

4.2 Funding - General

At the present time, Department for Environment, Food & Rural Affairs (Defra) allocates funding to FCRM projects through the Environment Agency.

Flood and coastal erosion resilience partnership funding or 'partnership funding' (Environment Agency, 2020a) aims to share the costs between national and local sources of funding. This approach allows any worthwhile project (where benefits are greater than costs) to qualify for Government money, known as Flood Defence Grant-in-Aid (FDGiA).

The success of this approach depends on:

- creating strong partnerships;
- clearly defining roles for responsible organisations and their partners; and
- securing and managing contributions to help reduce flood and coastal erosion risks and achieve more benefits for the economy, local people and the environment.

It is a condition from Defra that the Government's FDGiA funding settlement will realise a minimum of 15% 'Partnership Funding' contributions to its overall FCRM capital investment programme.

In addition, the current rationale is that those that are set to benefit from FDGiA scheme investment should likewise contribute to scheme cost. Contributions are considered from all groups and organisations that will benefit the most from the project. Private or third sector contributors (voluntary organisations) are encouraged, as this reduces the amount of funding needed from other local government spending.

Accordingly, the Grant Memorandum for Local Authorities (Environment Agency, 2018) sets out the prerequisite to secure reliable commitments from funding partners.

A tool, known as the partnership funding calculator (PF Calculator), is used to work out the amount of FDGiA a project is entitled to and the minimum amount of contribution it needs to obtain.

4.3 Funding – Weymouth Specific

Dorset Council would be expected to be a significant contributor in the development and delivery of this strategy. For example, the harbour wall component identified under Section 3 has wider benefits for the Council and therefore Dorset Council's contribution should be at least equal or exceed the capital cost of the 'Harbour Walls – General' in addition to the routine maintenance costs that are usually incurred directly.

The significant value of tourism and amenity benefit realised locally from harbour and esplanade works would also support the need for investment by Dorset Council or other major beneficences. The Council has recognised the need for flood defence investment and mechanisms are already in place for collecting and contributing to projects such as this. One such example is the Council's Community Infrastructure Levy which collects money as a result of new development.[1]

Completion of the PF Calculator demonstrated that the delivery of the strategy could attract in excess of £50m PVc (Present Value Cost) of FDGiA (WSP, 2019).

Updated PF arrangements and a revised calculator were released by Defra on 17/04/20 (Environment Agency, 2020b). The latest changes increase the funding payment rates available and allow for the inclusion of specific additional benefits not previously eligible for quantification. This will only help to strengthen the case for FDGiA investment in Weymouth at the point of individual business case submissions. The revised PF Calculator will be utilised in all future business cases and investment making decisions.

4.4 Forecast Cost Profile

The adaptive pathway, shown in Figure 4.1, should be considered in phases to ensure cohesive delivery packages whilst still providing opportunity for further future adaptation and

[1] https://www.dorsetcouncil.gov.uk/planning-buildings-land/planning/community-infrastructure-levy/west-dorset-and-weymouth-and-portland-community-infrastructure-levy/how-will-the-community-infrastructure-levy-cil-be-spent-in-west-dorset-weymouth-portland.aspx

variability. Appendix C contains a suite of maps indicating the asset interventions to be considered in each of the delivery phases, an excerpt of which is shown in Figure 4.1 below.

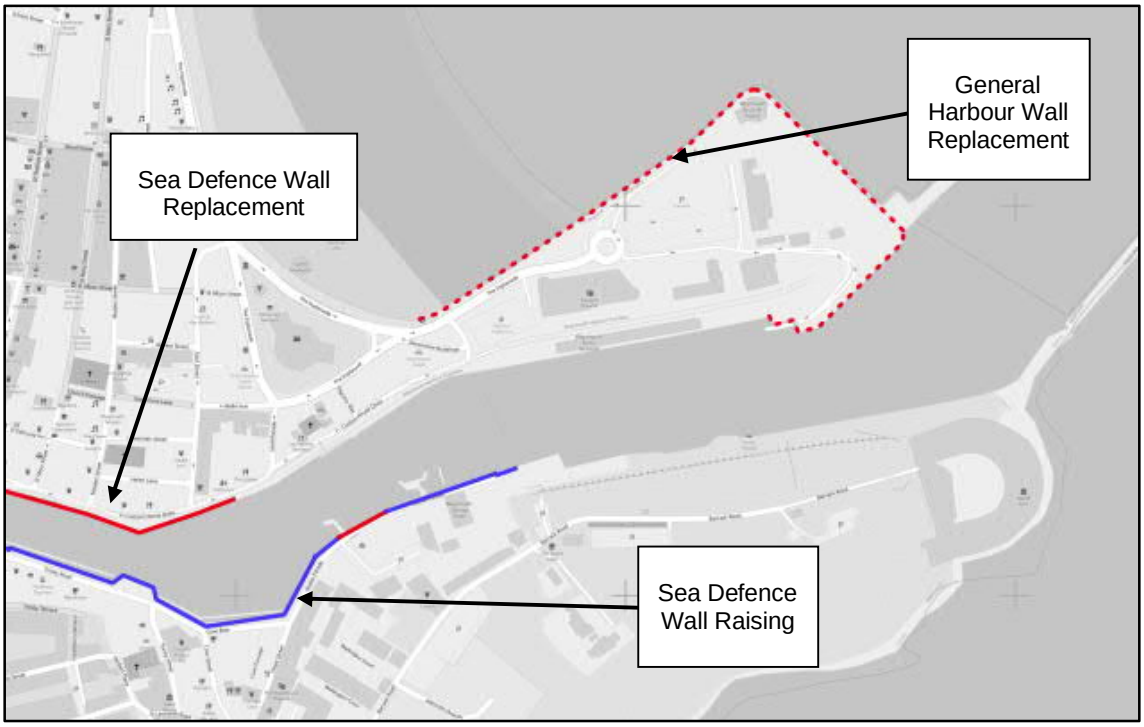

Figure 4.1 Excerpt of Phase 1 (2020-39) Intervention Map (see Appendix C for full suite)

It is intended that the strategy be reviewed at least twelve months prior to the commencement of each future phase of the pathway. In addition, it is anticipated that a light touch 'refresh' of the strategy be undertaken every five years. Table 4.1 indicates the anticipated cost profile across the phases and potential scale of contributions required.

Table 4.1 Phased Forecast Cost Profile

Years		Estimated Dorset Council Contribution (£m)	Estimated FDGiA / Local Levy / Other (£m)	Estimated Total Costs (£m)
Phase 1	2020-2039	£7m	£40m	£47m
Phase 2	2040-2059	£2m	£7m	£9m
Phase 3+	2060-2120	£17m	£42m	£59m
TOTALS		**£26m**	**£89m**	**£115m**

To provide a comparison against additional costs associated with a tidal barrier option, Table 4.2 presents a similar phased approach but with the inclusion of a barrier from 2070.

Table 4.2 Phased Forecast Cost Profile – Provided for comparison with inclusion of Phase 3 barrier costs

Years		Estimated Dorset Council Contribution (£m)	Estimated FDGiA / Local Levy / Other (£m)	Estimated Total Costs (£m)
Phase 1	2020-2039	£7m	£40m	£47m
Phase 2	2040-2059	£2m	£7m	£9m
Phase 3+	2060-2120	£43m	£42m	£85m
TOTALS		**£52m**	**£89m**	**£141m**

4.5 Spatial Planning & Delivery

Following local government re-organisation in April 2019, Dorset Council has started work on preparing a new local plan which will replace those adopted local plans of the predecessor District and Borough Councils.

The Council intends to undertake a consultation on the emerging plan in autumn/winter 2020, publish a pre-submission draft of the local plan in autumn/winter 2021 and adopt the new local plan in spring 2023. As part of preparations for the new local plan the Council will be undertaking a Level 1 Strategic Flood Risk Assessment (SFRA) that covers the entire Council area and a Level 2 SFRA for Weymouth.

The risks from flooding and coastal erosion around Weymouth Town Centre need to be effectively managed and mitigated in order to secure re-development of parts of the town, and to encourage regeneration and investment. The policies in the emerging local plan that relate to Weymouth will take account of both the Level 1 and 2 SFRA, in addition to this Harbour and Esplanade FCRM strategy.

The local plan is likely to;

- identify the parts of the town that need to be safeguarded to allow coastal and flood defences to be constructed,
- require that the design of development adjacent to flood risk and coastal erosion defences should take account of future plans (as outlined in this Strategy) to alter or replace these defences,
- require that the Council or developers explore the opportunities to improve the quality of the public realm as part of any flood risk or costal erosion defence works, and;
- require that the design of coastal and flood defences takes account of Weymouth's heritage assets (including conservation areas, listed buildings and scheduled monuments).

The Council will also be preparing an updated charging schedule for the Community Infrastructure Levy (CIL), and the priorities for spending on infrastructure.

5 Economic Case

5.1 Appraisal Introduction

The economic performance of a FCRM scheme is determined through its Benefit Cost Ratio (BCR). Benefits are measured in terms of the present value (PV) of economic damages avoided over the lifespan of the scheme, with the present value of scheme capital and maintenance costs also being estimated over the same period.

The economic appraisal period is typically taken as 100 years and all damages and costs are discounted according to The Green Book, HM Treasury, 2018.

5.2 Appraisal Findings

A recent economic appraisal (WSP, 2019), identified that through the provision of a 1 in 200 standard of protection adaptive pathway over a 100-year economic appraisal period, in excess of £750m present value benefit (PVb) can be realised.

The appraisal calculates the economic damages to property, amenity and transport infrastructure caused by flooding and erosion and includes the following;

- The direct flooding damage to properties and vehicles;
- The cost of evacuation and clean-up;
- The cost to emergency services;
- Traffic loss assessment;
- Direct damage to road infrastructure;
- Recreation amenity assessment;
- The impact of flooding on human health: and
- Direct loss of assets due to erosion.

Whilst the economic benefit (benefit to the UK) of a coherent Harbour and Esplanade FCRM adaptive pathway are significant at more than £750m, the local financial benefit to the town, wider Dorset and the South West region are likely to be many times greater.

This can be summarised in Table 5.1 below.

Table 5.1 Economic Summary

Total Benefits (£m PVb)	Total Costs (£m PVc)	Benefit Cost Ratio (BCR)
£768m	£54m	14.2

6 Conclusion

Through consideration of previous studies and information, the adaptive pathway approach proposes a comprehensive phased programme of asset replacements, raising and upgrades. Excerpts from the adaptive pathway and supporting maps shown below in Figure 6.1 provide an example of a clear and practical way through Phase 1.

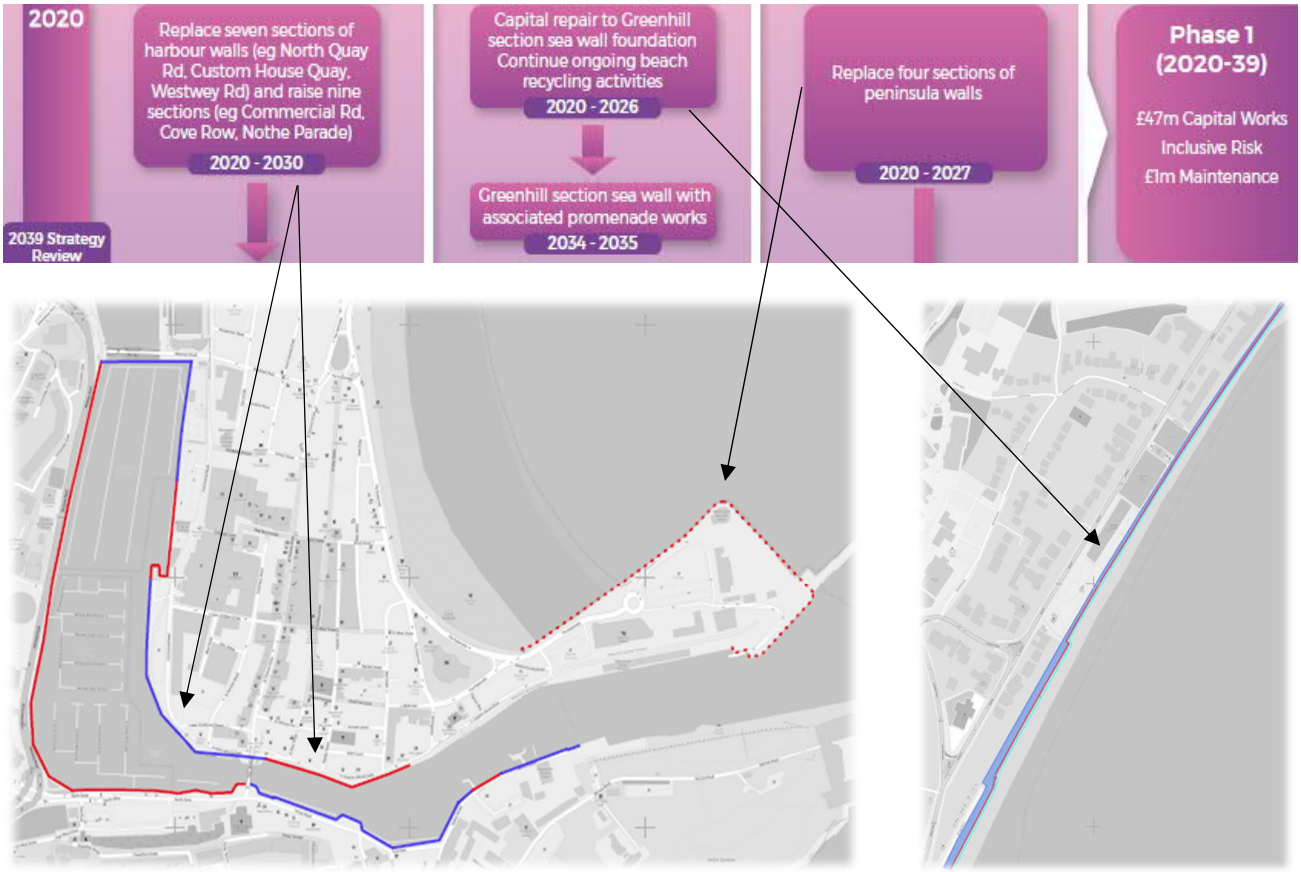

Figure 6.1 Excerpts from the adaptive pathway and maps showing example delivery through Phase 1

The implementation of the pathway will ensure that flood and coastal erosion risk is managed whilst ensuring that other wider benefits to Weymouth such as commercial, amenity and recreation can be enhanced. The approach remains flexible and can be adjusted to manage any future change.

The next steps in progressing Phase 1 of the pathway (2020-2039) should begin immediately with the forming of appropriate project governance and management structures to direct the project. Development and production of an appropriate HM Treasury compliant business case should follow as a priority activity.

Ambition and commitment from all stakeholders is required to ensure that this vital scheme is progressed. Dorset Council and the Environment Agency need to give their full support to the pathway and endorse its progression. The significant capital investment need will act as a catalyst for delivery of a multi-functional scheme, cementing Weymouth's reputation as a safe and attractive place to work and visit.

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Appendix A Adaptive Pathway Interventions

HARBOUR SEA DEFENCE WALLS

				Intervention 1			Intervention 2			Intervention 3			
Asset Identifier	**Structure Type**	**Crest Level**	**Residual Life**	**Phase**	**Work**	**Reason**	**Phase**	**Work**	**Reason**	**Phase**	**Work**	**Reason**	**Length (m)**
A	SSP	2.48	5	1	Replace	Condition	3	Raise	Level				115
Ai	SSP	2.48	15	1	Replace	Condition	3	Raise	Level				55
B	SSP	2.27	5	1	Replace	Condition	3	Raise	Level				218
C	SSP	1.98	5	1	Replace	Condition	3	Raise	Level				40
Ci	SSP	2.3	20	1	Raise	Level	2	Replace	Condition	2070	Raise	Level	25
D	SSP	4	50	3	Replace	Condition							110
2	Blockwork & Conc	2.1	20	1	Raise	Level	2	Replace	Condition	2070	Raise	Level	30
2i	Blockwork & Conc	2.1	20	1	Raise	Level	2	Replace	Condition	2070	Raise	Level	30
3	Masonry Brickwork	2.3	20	1	Raise	Level	2	Replace	Condition	2070	Raise	Level	250
3i	RC Wall	2.3	20	1	Raise	Level	2	Replace	Condition	2070	Raise	Level	50
4	Masonry Blockwork	2.2	10	1	Replace	Condition	3	Raise	Level				82
4i	Concrete Panel	2.2	0	1	Replace	Condition	3	Raise	Level				132
6	Mass Concrete	2.5	20	1	Raise	Level	2	Replace	Condition	2070	Raise	Level	80
6i	Masonry Wall	2.5	20	1	Raise	Level	2	Replace	Condition	2070	Raise	Level	80
7	RC Panels	2.3	20	1	Raise	Level	2	Replace	Condition	2070	Raise	Level	315
8	Mass Concrete	3.1	30	2	Replace	Condition	3	Raise	Level				149
11	Concrete Panel	2.45	0	1	Replace	Condition	3	Raise	Level				730
5	Concrete caissons with culverts & sluice gates	2.4	50	1	Raise	Level	3	Replace	Condition				115

HARBOUR WALLS GENERAL

				Intervention 1			
Asset Identifier	**Structure Type**	**Crest Level**	**Residual Life**	**Phase**	**Work**	**Reason**	**Length (m)**
E	SSP	3.36	5	1	Replace	Condition	163
F	SSP	4.1	10	1	Replace	Condition	30
Fi	SSP	4.1	0	1	Replace	Condition	137
G	SSP	3.27	0	1	Replace	Condition	349
1	Masonry Stone & timber	3.4	40	3	Replace	Condition	433
1i	Masonry encapsulated in concrete	3.4	40	3	Replace	Condition	150
2	Blockwork & concrete	2.1	40	3	Replace	Condition	140
2i		2.1	40	3	Replace	Condition	
2ii	Blockwork & concrete	2.1	40	3	Replace	Condition	150
2iii	Blockwork & concrete	2.1	40	3	Replace	Condition	185
9	Embedded Concrete	3.1	40	3	Replace	Condition	143
10	SSP & Tube Combi	3.1	50	3	Replace	Condition	58

Appendix B High Level Cost Summary

	Cost for economic appraisal (PV) £k	Whole life cash cost £k
Costs to OBC:		
EA & LA staff costs		75
Site investigation & survey		100
MMO Fees		5
Consultant fees		180
Early Contractor Involvement (ECI)		15
Cost consultant fees		1
Sub-total		**1,000**
OBC to Construction:		
EA & LA staff costs	100	100
Site investigation & survey	150	150
Consultant fees	918	918
Early Contractor Involvement		
Cost consultant fees	15	15
Other costs (consultation)	15	15
Sub-total	**1,000**	**1,000**
Construction:		
Construction costs	30,598	62,331
Inflation		
EA & LA Staff Costs	306	306
Site supervision	153	153
Cost consultant fees	76	76
Other costs (ECC PM)	76	76
Sub-total	**31,000**	**63,000**
Future Costs		
Maintenance	**2,000**	**7,000**
Risk Contingency		
Risk for approval (Optimism Bias 60%)		
Risk for appraisal (Optimism Bias 60%)	**20,000**	**43,000**
Contributions		
Total	**54,000**	**115,000**

**NB. All summed values have been rounded to the nearest £1000k.

Appendix C Adaptive Pathway Phase Maps

-273500 -273000 -272500 -272000

6553000 6552500 6552000

N

5 6i 6 A Ai 11 7 4i 4 3i 3 B Ci C 2 2i 2 (additional) 8 D 9 10 E F G 1

250 0 250 500 750 1000 m

KEY:

Harbour Walls Naming Convention

- Harbour Sea Defence Walls
- Harbour Walls General

REV	DATE	DRW	DESCRIPTION	CHK	APP
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TITLE: HARBOURSIDE WALLS NAMING CONVENTION

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-273500 -273000 -272500 -272000

6553000

6552500

6552000

N

250 0 250 500 750 1000 m

KEY:

Harbourside Phase 1

- Harbour Sea Defence Walls - Raise
- Harbour Sea Defence Walls - Replace
- Harbour Walls General - Replace

REV	DATE	DRW	DESCRIPTION	CHK	APP
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-273500 -273000 -272500 -272000

6553000

6552500

6552000

N

250 0 250 500 750 1000 m

KEY:

Harbourside Phase 2

- Harbour Sea Defence Walls - Replace
- Harbour Walls General - Replace

REV	DATE	DRW	DESCRIPTION	CHK	APP
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-273500 -273000 -272500 -272000

6553000

6552500

6552000

N

250 0 250 500 750 1000 m

KEY:

Harbourside Phase 3

- Harbour Sea Defence Walls - Replace
- Harbour Sea Defence Walls - Raise
- Harbour Walls General - Replace

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-273000 -272500 -272000 -271500

6555500 6555000 6554500 6554000 6553500 6553000 6552500 6552000

250 0 250 500 750 1000 m

KEY:

Esplanade Sections

- 1 - Pavillion Peninsula to Jubilee Clock
- 2 - Jubilee Closk to Pier Bandstand
- 3 - Pier Bandstand to Greenhill Groyne

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TITLE: ESPLANADE SECTIONS

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-272500

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6555000

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6554000

KEY:

Esplanade Phase 1

- New Seawall
- Sheet Pile Toe Protection
- Resurface Promenade

Esplanade Sections

- 1
- 2
- 3

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ESPLANADE INTERVENTIONS
PHASE 1 2020-2039
SECTION 3

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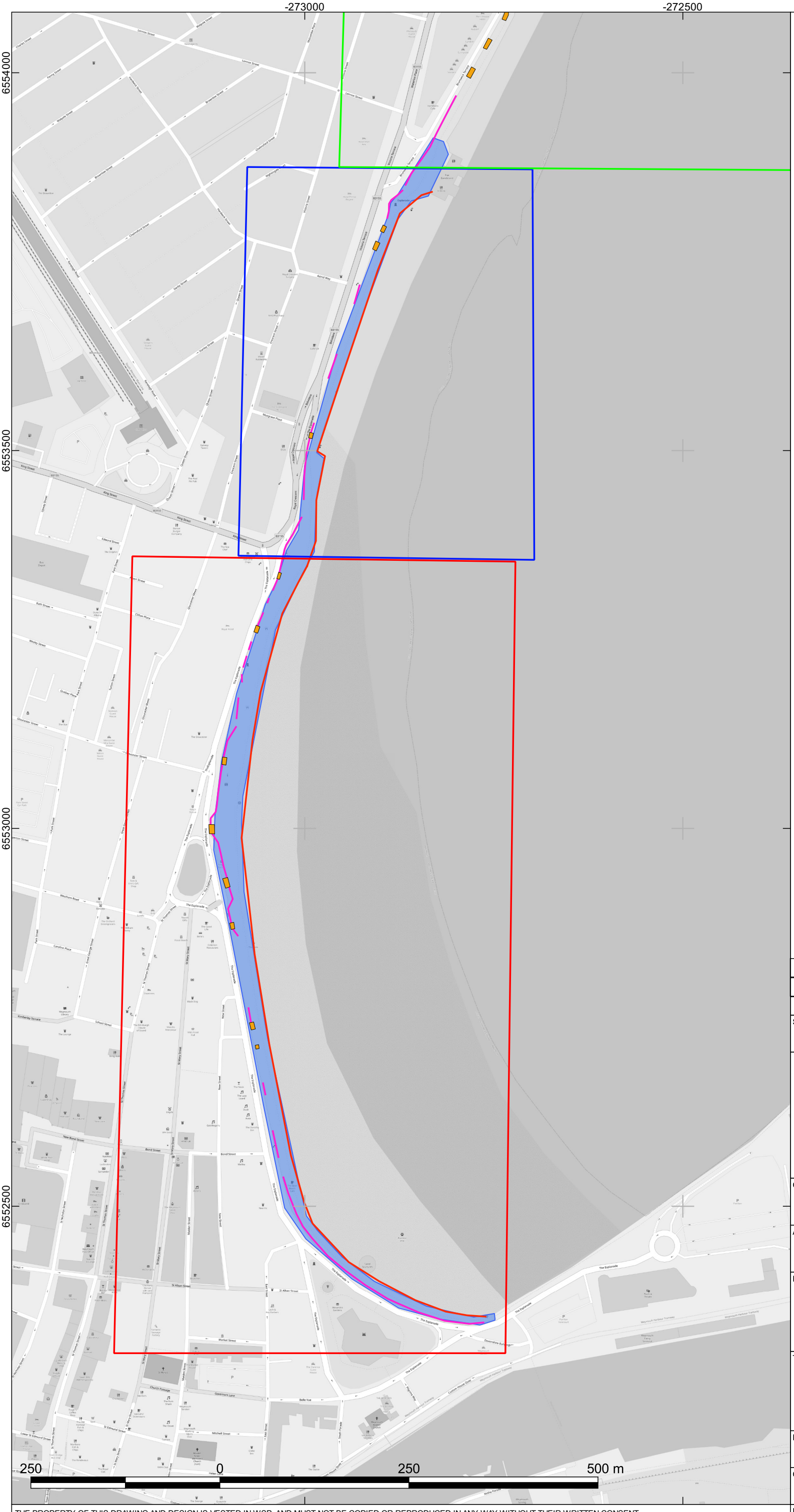

KEY:

Esplanade Phase 3

- New Seawall
- Ramps
- Set-Back Walls Between Existing Planters
- Resurface Promenade

Esplanade Sections

- 1
- 2
- 3

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PHASE 3 2060-2120
SECTIONS 1 & 2

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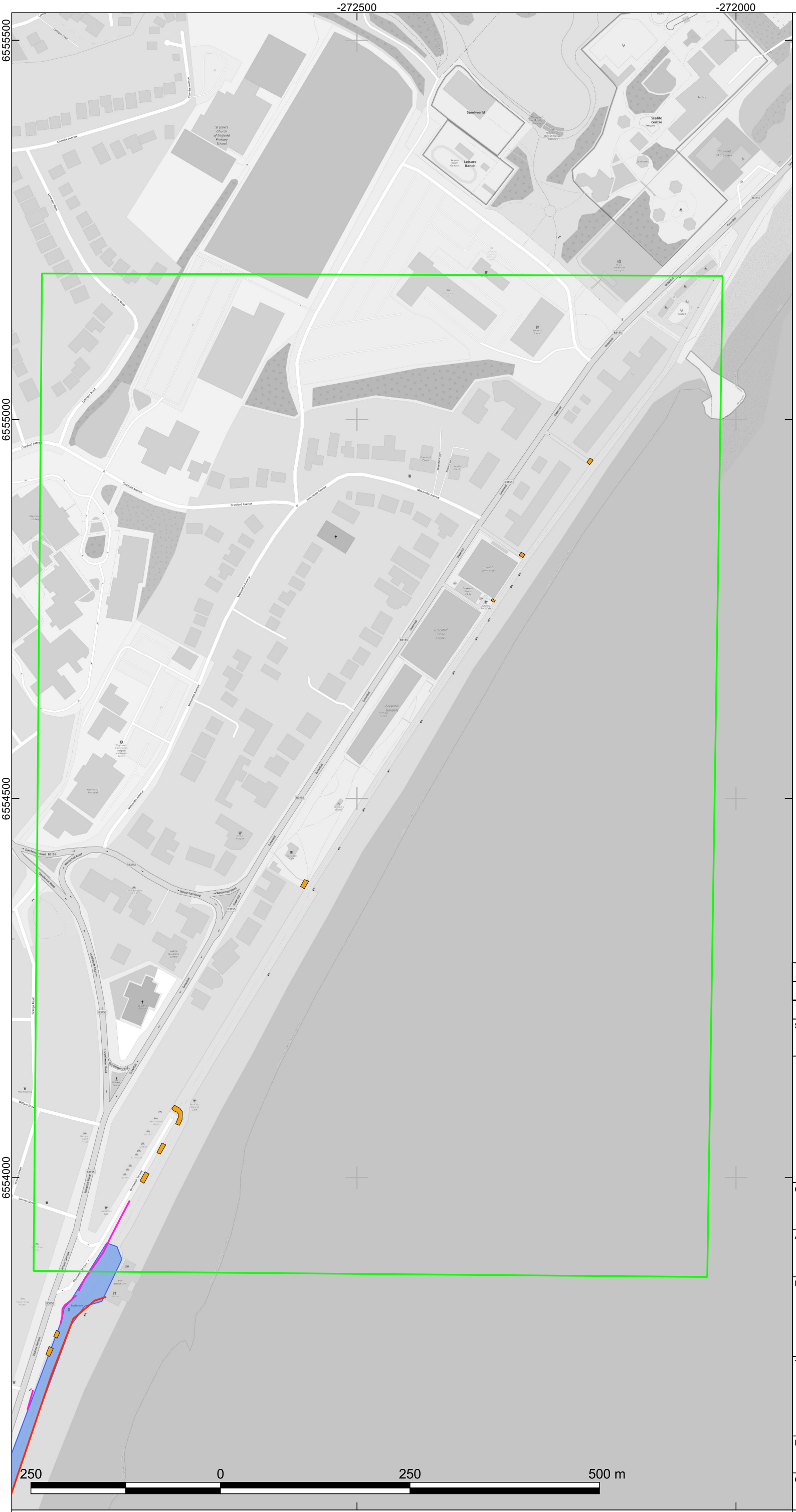

KEY:

Esplanade Phase 3

- New Seawall
- Ramps
- Set-Back Wall Between Existing Planters
- Resurface Promenade 2065

Esplanade Sections

- 1
- 2
- 3

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