Appendix C

Technical Assessment of Intervention Options

The following tables detail an assessment of potential improvement options for each of the defences under consideration. The tables consider the technical advantages and disadvantages associated with the provision of a 0.5% APF standard of protection.

Environmental advantages and disadvantages are considered in the 'Portsea Island Coastal Strategy Study Strategic Environmental Assessment Environmental Report, Halcrow 2008' (SEA). Details relating to the Economic Assessment of options are included in the Economics Report.

Sub Cell 2f

<table>
<thead>
<tr>
<th>Typical Proposals: Sub-cell 2f, Defence lengths 571/3223 and 3224</th>
</tr>
</thead>
<tbody>
<tr>
<td>It is considered that a failure of the defences in this location could result in a breach of the spit protecting the entrance to Langstone Harbour and potentially result in a widening of the channel entrance. Should a widening occur then there would be the potential for large waves to propagate into Langstone Harbour potentially changing the coastal conditions at the face of the defences along the Langstone Harbour Shoreline. It is considered therefore that during PAR stage, further assessments are undertaken to investigate the reliance of coastal defence within Langstone Harbour (and flood cells 3 and 4) on the continued maintenance of the defences along this frontage. For this stage of the assessment process however, it is considered that the works proposed for this frontage form a stand alone scheme.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Description of proposed works</th>
<th>Description of proposed works</th>
</tr>
</thead>
<tbody>
<tr>
<td>The existing seawall/revetment is replaced with a similar structure at the end of its structural life. Under a do-nothing scenario, failure of this defence is expected to occur in 5-10 years placing the hinterland at risk to increased erosive forces. The hinterland is sparsely populated and therefore erosion is unlikely to have a significant effect on property in the area. However, erosion of the hinterland could result in a widening of the Langstone Harbour entrance channel potentially resulting in increased wave propagation into Langstone Harbour exposing the shoreline within Langstone Harbour to increased wave heights.</td>
<td></td>
</tr>
</tbody>
</table>

There is no historic evidence to support a case that continued management of the defences along this frontage is necessary for continued protection within Langstone Harbour itself since the shoreline in this location has been protected over a long period. It is however suggested that these defences are closely monitored in the result of defence works within Langstone Harbour progressing in advance of the works along this frontage.

<table>
<thead>
<tr>
<th>Recommendations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Due to the existing area of landfill in the hinterland of the defences, the preferred option for this frontage is to improve the existing defences by:</td>
</tr>
<tr>
<td>• Sea defence length 571/3223 – replace gabions where required</td>
</tr>
<tr>
<td>• Sea defence length 571/3234 – construct new seawall and revetment when it reaches the end of its life.</td>
</tr>
</tbody>
</table>
### Sub-cell 2g

**Typical Proposals: Sub-cell 2g, Defence lengths 571/3220 to 3222 – 690m**

**Raise crest level in response to sea level rise to provide 0.5% APF SoP over 100 year planning horizon**

**Description of proposed improvement works**

The existing defences are raised to provide an improved 0.5% APF standard of protection over the 100 year planning horizon. This will involve full replacement of the existing defences at the end of their residual life and replacement with a new higher structure.

**Recommendations**

- **Sea defence length 571/3220** – construct new revetment
- **Sea defence length 571/3221 and 571/3222** – reprofile embankment and replace revetment

Unlike the defences in sub-cell 2f, failure of these defences is unlikely to have an impact on the proposed improvement works for other adjacent defences within Langstone Harbour.

### Sub-cell 3h

**Typical Proposals: Sub-cell 3h, Defence lengths 571/3217 and 3219 – 380m**

<table>
<thead>
<tr>
<th>Option 1 – Construct Sheet Piled Wall</th>
<th>Option 2 – Replace Wall with New Embankment</th>
</tr>
</thead>
<tbody>
<tr>
<td>The existing wall is replaced at the end of its residual life with a new vertical wall.</td>
<td>The existing wall is replaced by a new embankment.</td>
</tr>
</tbody>
</table>

**For**

- Protection provided to the hinterland over the 100-year life of the strategy
- Wall would have a smaller footprint than an embankment
- Proposed work would not increase the footprint of the existing defence and would not encroach upon Langstone Harbour SPA, Ramsar site, SAC and SSSI.

**Against**

- Concrete extension to the wall could be considered more unsightly than a grassy embankment
- Construction could prove more difficult than the construction of an embankment
- Large footprint of embankment (up to 17.4m wide), but majority of this would be constructed under the car park.

**Recommendations**

It is likely that the preferred option will comprise a mixture of the two options (for defence lengths 571/3217 and 571/3219) shown above with a new earth embankment proposed in locations where there is sufficient space and a concrete wall proposed along length where there is insufficient space for the embankment to be built without encroaching into the environmentally designated features.
Description of the Proposed Works

This option involves a combination of maintenance activities and replacing structural elements at the end of their life. The existing defences consist of a brick clad lock walls that are considered to be in a fair condition. The existing crest level and line of defence will be maintained over the 100 year life of the scheme. It is considered that this can be achieved through regular repair works to the existing structure and periodic replacement of lock gates.

Recommendations

Preferred methods of maintaining/improving this structure involve undertaking significant repair works to the structure in 18 years’ time and the provision of a new lock gate.

Sub-cell 4i

Option 1 – Construct new wall to higher level than existing

This option involves replacing the existing seawall with a new wall with a higher crest level

For

• Defence will prevent flooding of the potentially contaminated land (former landfill and depositing ground for Baffins Waste Destructor materials) reducing the risk of contaminants leaching into Langstone Harbour
• Work could be undertaken at the end of the residual life of the existing wall. Constructing a new slightly higher wall would cost only slightly more than replacing the existing wall with a wall of the same dimensions
• Would not encroach upon Langstone Harbour SSSI, SPA and Ramsar site.
• Opportunities exist to develop informal recreational facilities along this stretch e.g. nature trails, cycle paths and Public Rights of Way

Against

• The view of the sea for children on the footpath currently varies from no view to open view due to changes in the level of the footpath but would be totally restricted by Year 100. Views of the sea for adults would only be partially restricted in Year 100 due to changes in the level of the footpath.
• Could be more difficult to construct than option 2

Option 2 – Build Splash Wall
This option involves the construction of a new splash wall at the edge of the busy trunk road

For
- Construction should be simple and inexpensive
- Would not encroach upon Langstone Harbour SSSI, SPA and Ramsar site.
- Opportunities exist to develop informal recreational facilities along this stretch e.g. nature trails, cycle paths and Public Rights of Way

Against
- During flood the potentially contaminated land would be exposed and contaminants could leach into the environmentally designated areas of Langstone Harbour.
- Potential damage to wall should it be hit by road users. May be perceived as a health and safety risk.
- Wall would need to be tied in with the adjacent defence improvements at Milton bund. This would involve the construction of a long length of wall or revetment through the centre of Milton Common at a considerable cost.
- The existing defences are in a poor condition and it is considered that major refurbishment/replacement of the existing wall would be required in the near future. This would be an additional cost to the construction of the new splash wall
- Defence would cause some visual intrusion for footpath users and result in a minor deterioration of visual amenity afforded by vehicle travellers
- Footprint of the splash wall would result in the loss of an area of footpath or road
- It is concluded that this option is likely to be the least preferable.

Recommendations
Due to the poor condition of the existing seawall, Option 1 is considered the preferred option. Option 2 would still require improvements to be made to the existing seawall and due to its existing poor condition, these improvements would be required in the first 10 years of the strategy. This would be at a considerable costs and hence eliminate this as a suitable option.

Typical Proposals: Sub-cell 4i, Defence length (571/3216) – 1030m

Option 1 – Construct new wall to higher level than existing

This option involves the construction of a new wall. The new wall would be constructed along the alignment of the existing embankment so that it would not encroach within Langstone Harbour.

For
- Defence will prevent flooding of potentially contaminated land (from infilled areas on Milton Common/Lake) reducing the risk for contaminants to leach into Langstone Harbour
- The new hard defence will reduce the possibility for contamination to leach into Langstone Harbour
- Would not encroach upon Langstone Harbour SSSI, SPA and Ramsar site.
- Opportunities exist to develop informal recreational facilities along this stretch e.g. nature trails, cycle paths and Public Rights of Way

Against
- Proposal would change a soft defence edge into a hard defence edge.
- May prove to be more costly than Option 2
- Working within an area of contaminated land could cause problems
- Some visual intrusion
Option 2 – Re-profile existing embankment

This option involves re-profiling the existing embankment to provide a clean edge to the defences and provide a standard crest level along the length.

For
- Defence will look natural although there will be some minimal visual intrusion
- Soft edge maintained along the frontage, in line with Natural England’s recommendations
- Opportunities exist to develop informal recreational facilities along this stretch e.g. nature trails, cycle paths and Public Rights of Way
- Improvement works will be undertaken on the landward side of the existing defence and therefore will not encroach into the environmentally designated land with Langstone Harbour

Against
- Contaminants could leach through the embankment into Langstone Harbour
- Working within an area of contaminated land could cause problems
- Some visual intrusion
- Reprofiling and raising the embankment would result in encroachment upon Langstone Harbour SSSI, SPA and Ramsar site. Amounts will vary depending on existing embankment profile.

Recommendations
The most cost effective solution for this frontage involves Option 2 ‘reprofiling the existing embankment’ to a higher level. It should be noted however that the construction of a new wall would have the additional advantage of eliminating the risk of contamination leaching into the environmentally designated areas within Langstone Harbour. However, the embankment will provide a softer edge to the island, will have less of a visual impact and is a more environmentally sympathetic solution. The removal of the large section of potentially contaminated land reduces the risk of contamination leaching into Langstone Harbour and this is considered substantial enough to reduce the risk of leaching of contaminants. Option 2 is therefore considered the preferred option for this section of the frontage.

Sub-cell 4j

Typical Proposals: Sub-cell 4j, Defence lengths 571/3207 & 3208 – 100m & 630m

Option 1 – Construct new revetment to replace existing and raise crest level using an embankment

This option involves raising the crest level of the existing defence so that it is at 4.46m ODN along the full length.

For
- Work would have little or no effect on the existing look of the area
- Work could be undertaken at the same time as maintenance works on the existing structure providing the opportunity to extend the life of the existing structure and reduce construction costs
- Proposals would provide the required standard of protection over the whole life of the strategy
- Views of the sea are already compromised by the existing seawall and the low level of the hinterland. The proposals would therefore have little effect on the outlook from the road.
- Would not encroach upon Langstone Harbour SSSI, SPA and Ramsar site.
- Opportunities exist to develop informal recreational facilities along this stretch e.g. nature trails, cycle paths and Public Rights of Way

Against
- Proposals would have an adverse visual impact for vehicle users.

Option 2 – Build Splash Wall
Appendix C

This option involves the construction of a new wall at the back edge of the busy road

For

• Proposals would provide the required standard of protection over the whole life of the strategy
• Would not encroach upon Langstone Harbour SSSI, SPA and Ramsar site
• Opportunities exist to develop informal recreational facilities along this stretch e.g. nature trails, cycle paths and Public Rights of Way

Against

• Unsightly
• Costly
• Work would still be required to maintain the existing revetment else the road will be lost
• Road would have to be closed during sever storm events

Recommendations

It is recommended that Option 1 is implemented for this section of the frontage. This will be considerably less expensive and easier to build. It is also considered that it will have less environmental impacts than Option 2 – see the SEA.

Typical Proposals: Sub-cell 4j, Defence lengths 871/3209 - 250m

Description of proposed works

The existing defences in this location are considered in a poor condition with a residual life of less than 10 years. The proposed works for this frontage involve replacing the existing sheet piled wall in 10 years’ time. The existing crest level of defence provides a standard of protection in excess of 0.5% APF and it is therefore considered that the defence level will not need to be raised to sustain the existing SoP in response to sea level rise as this would continue to provide a standard of protection well in excess of the indicative range for this area.

Recommendations

A like for like replacement of the existing structure will provide suitably high standards of flood protection with minimal environmental impacts.
Appendix C

Typical Proposals: Sub-cell 4j, Defence length 571/3213, 571/3212, 571/3211 & 571/3210 – 230m, 250m, 460m & 490m

Option 1 – Raise Crest Level of Existing Seawall

The most sensible option for this frontage involves raising the crest level of the existing wall to provide the required standard of protection. Since the land behind the seawall is generally at a lower level there are very few options for a setback alignment of the defences or any secondary defences.

For
- Defence would prevent flooding of potentially contaminated land in the hinterland reducing the risk of contaminants leaching into Langstone Harbour
- Work could be undertaken at the end of the residual life of the existing wall. Constructing a new slightly higher wall would cost only slightly more.
- Views of the sea are already compromised by the existing seawall and the low level of the hinterland. The proposals would therefore have little effect on the outlook from the road.
- Would not encroach upon Langstone Harbour SSSI, SPA and Ramsar site.
- Opportunities exist to develop informal recreational facilities along this stretch e.g. nature trails, cycle paths and Public Rights of Way

Against
- Proposals would have an adverse visual impact as the flood wall would be between 1.3m and 2.8m higher than the existing ground levels.
- A hard edge would be maintained at this point on the perimeter of Portsea Island

Recommendations

It is recommended that the option presented above is adopted for this section of the frontage where improvement is economically and environmentally viable.

Typical Proposals: Sub-cell 4j, Defence length 571/3214 (sub-cell 4j) – 250m

Option 1 – Construct new wall

This option involves replacing the existing seawall with a new wall with a higher crest level

For
- Defence will prevent flooding of the potentially contaminated land (former landfill and depositing ground for Baffins Waste Destructor materials) reducing the risk of contaminants leaching into Langstone Harbour
- Work could be undertaken at the end of the residual life of the existing wall. Constructing a new slightly higher wall would cost only slightly more than replacing the existing wall with a wall of the same dimensions
- Would not encroach upon Langstone Harbour SSSI, SPA and Ramsar site.
- Opportunities exist to develop informal recreational facilities along this stretch e.g. nature trails, cycle paths and Public Rights of Way

Against
- Visual intrusion from the path and the view would be limited for vehicle travellers - proposed flood wall would be approximately 2m higher than existing ground level.
- Could be more difficult to construct than option 2.

Option 2 – Build Splash Wall

Recommendations

The diagram illustrates the construction of a splash wall along the frontage.
This option involves the construction of a new splash wall at the edge of the busy trunk road.

**For**
- Construction should be simple and inexpensive.
- Would not encroach upon Langstone Harbour SSSI, SPA and Ramsar site.
- Opportunities exist to develop informal recreational facilities along this stretch e.g. nature trails, cycle paths and Public Rights of Way.
- Does not interfere with visual amenity afforded by pedestrians on footpath of the sea.
- Creates a barrier between pedestrians and traffic making a safer and more pleasant environment.

**Against**
- During flood the potentially contaminated land would be exposed and contaminants could leach into the environmentally designated areas of Langstone Harbour.
- Potential damage to wall should it be hit by road users. May be perceived as a health and safety risk.
- Wall would need to be tied in with the adjacent defence improvements at Milton bund. This would involve the construction of a long length of wall or revetment through the centre of Milton Common at a considerable cost.
- The existing defences are in a poor condition and it is considered that major refurbishment/replacement of the existing wall would be required in the near future. This would be an additional cost to the construction of the new splash wall.
- Defence would cause some visual intrusion for vehicle travellers.
- Footprint of the splash wall would result in the loss of an area of footpath or road.

**Recommendations**

Option 2 'build a splash wall' has been selected as the preferred option as it does not restrict views of the sea for pedestrians on the footpath. However, due to the poor condition of the existing seawall shown in option 1, the existing seawall would still require some maintenance.

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**Sub-cell 4k**

Typical Proposals: Sub-cell 4k, Defence length (571/3205) – 1350m

**Option 1 – Raise Crest Level of Embankment**

This option involves raising the level of the existing earth embankment.

**For**
- Defence would fit in with the existing landscape character of the area.
- Protection of land designated within Hilsea Lines Conservation area.
- Construction should be straightforward.
- Minimal visual intrusion (Hilsea Lines Scheduled Monument already impairs views from the low-lying hinterland).
- Defence would protect Hilsea Lines Scheduled Monument, which follows the entire length of Ports Creek between Langstone Harbour and Tipner Lake.
- Proposal would protect Hilsea Lines Natural History Trail and would provide opportunities for developing informal recreational activities in this area including walking and angling.

**Against**
- Availability of suitable material (although material could be imported).
- Suitability of existing embankment to be built on (May need to re-profile whole embankment. SI required).
- Excavation in this area may encounter potential contamination associated with Hilsea Lines military base and ammunition storage and Portsmouth airfield, which was constructed at the eastern end of Hilsea Lines.
- Construction works may adversely impact upon angling in the brackish/freshwater moat of Hilsea Lines.
- Construction works may disturb the established wildlife and protected species present at Hilsea Lines, which is considered by Portsmouth City Council to comprise the most varied wildlife haven at Portsea Island.

**Option 2 – Raise Crest Level of Wall**
Appendix C

This option involves the construction of a new wall at the crest of the existing embankment

For
- Required standard of protection provided

Against
- Suitability of existing wall to be built on unknown – potential stability problems
- Likely to be a more costly option than the embankment improvements
- Excavation in this area may encounter potential contamination associated with Hilsea Lines military base and ammunition storage and Portsmouth airfield, which was constructed at the eastern end of Hilsea Lines.
- Construction works may adversely impact upon angling in the brackish/freshwater moat of Hilsea Lines.
- Construction works may disturb the established wildlife and protected species present at Hilsea Lines, which is considered by Portsmouth City Council to comprise the most varied wildlife haven at Portsea Island.
- Some adverse visual impacts

Recommendations

The preferred option for this section of the frontage is Option 1 due to the lower construction costs and the more environmentally sympathetic materials being used. Option 1 also provides less visual intrusion. There are also opportunities for a footpath on the crest of the embankment.

Option 1 – Raise Crest Level of Embankment

For
- Defence would blend in with the existing landscape character of the area
- Construction should be straightforward
- Standard of protection provided over the 100-year life of the scheme
- Improvements would reduce the view of the nearby M27
- Would provide protection to the flooding of the fresh water interest to the west of this section of the defences
- Planting new shrubs and trees along the line of the new defence could enhance the existing environment

Against
- Availability of suitable material
- Some shrubs and trees would have to be removed and then replanted during the construction stage
- Suitability of existing embankment to be built on
- Some adverse visual impacts as the crest level would be 1.3m higher
- Footprint of the defences would be increased to accommodate rise in crest level.

Option 2 – Build Splash Wall
Appendix C

This option involves the construction of a new wall at the crest of the existing embankment.

**For**
- Improvements will reduce the view of the nearby M27
- Required standard of protection provided
- Splash wall would have a limited footprint

**Against**
- Suitability of existing embankment to be built on unknown – potential stability problems
- Proposals will change the existing look of the area and reduce visual amenity afforded by residential properties
- Could prove to be a costly option

**Recommendations**

The draft preferred option for this section of the frontage is Option 1. This is due to the lower construction costs, there being space available to raise the embankment and Option 1 would be more aesthetically pleasing for adjacent property owners than a new wall on the crest of the embankment.

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**Sub-cell 4i**

Typical Proposals: Sub-cell 4i, Defence length 571/1263 – 1450m

<table>
<thead>
<tr>
<th>Option 1 – Construct new seawall to higher level</th>
<th>Option 2 – Build Flood Embankment</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1" alt="Option 1 Diagram" /></td>
<td><img src="image2" alt="Option 2 Diagram" /></td>
</tr>
</tbody>
</table>

The existing wall will be replaced to account for ongoing sea level rise providing the indicative standard of protection over the 100-year strategy life.

**For**
- Protection provided to the hinterland over the 100-year life of the strategy
- Work could be combined with maintenance of the existing seawall to reduce costs
- At some point over the 100-year life of the strategy the existing seawall will need replacing. Replacing with a slightly higher wall would be a minimal additional cost.
- Wall will have a smaller footprint than an embankment
- Proposed work does not increase the footprint of the existing defence and will have a minimal effect on the environmentally designated areas within Portsmouth Harbour and Ports Creek.

**Against**
- Concrete extension to the wall could be considered more unseemly than a grassed embankment
- Construction could prove more difficult than the construction of an embankment
- Visual intrusion (0.5m – 1.7m up-stand)

**Recommendations**

The preferred option for this frontage would involve the construction of a new seawall as shown in Option 1, as it would have a smaller footprint than the embankment and would have an appearance similar to the existing defence.
Appendix C

Typical Proposals: Sub-cell 4l, Defence length 571/3264 – 300m

<table>
<thead>
<tr>
<th>Option 1 – Increase Revetment Level</th>
<th>Option 2 – Build Splash Wall</th>
</tr>
</thead>
<tbody>
<tr>
<td>The existing revetment is raised to account for ongoing sea level rise providing the indicative standard of protection over the 100-year strategy life.</td>
<td>A new wall is constructed at the top of the existing revetment with a crest level at a height required to provide the indicative standard of protection over the 100-year life of the strategy.</td>
</tr>
<tr>
<td><strong>For</strong> Protection provided to the hinterland over the 100-year life of the strategy.</td>
<td><strong>For</strong> Protection provided to the hinterland over the 100-year life of the strategy.</td>
</tr>
<tr>
<td>Work could be combined with maintenance of the existing revetment to reduce costs.</td>
<td>Construction methods may be more simple.</td>
</tr>
<tr>
<td>At some point over the 100-year life of the strategy the existing revetment will need replacing.</td>
<td>Work could be combined with maintenance of the existing revetment to reduce costs.</td>
</tr>
<tr>
<td>Work will not change the existing appearance of the area.</td>
<td>Proposed work does not extend into the Portsmouth Harbour SPA and SAC and will therefore have a minimal effect on the environmentally designated areas within Portsmouth Harbour.</td>
</tr>
<tr>
<td>Minimal effect on the environmentally designated areas within Portsmouth Harbour and Ports Creek.</td>
<td><strong>Against</strong> Would involve raising the level of the land behind the revetment which could prove to be costly.</td>
</tr>
<tr>
<td>Raising existing revetment requires increasing land level directly landward of the defence.</td>
<td><strong>Against</strong> Construction could prove more difficult than the construction of a new wall.</td>
</tr>
<tr>
<td><strong>Recommendations</strong></td>
<td><strong>Recommendations</strong></td>
</tr>
<tr>
<td>Option 1 'increase the level of the revetment' is the preferred option for this defence length as it would not result in a new structure in the landscape and is considered to be more attractive in appearance than a concrete wall.</td>
<td>Options to improve the standard of flood protection are not relevant to this flood cell where the key aim is to provide continued protection against leaching of contaminants into the environmentally designated areas within Portsmouth Harbour. The preferred option is therefore to provide long term protection along the line of the existing defence by intensivemaintenance/replacement of the existing flood defences.</td>
</tr>
</tbody>
</table>

Sub-cell 5m

Typical Proposals: Sub-cell 5m, Defence lengths 571/3260 - 1100m

<table>
<thead>
<tr>
<th>Description of proposed works</th>
</tr>
</thead>
<tbody>
<tr>
<td>This option involves the replacement of the existing revetment with a new revetment in 12 years time. This will ensure that the existing line of defence is maintained and ensure that the potentially contaminated landfill that the defences protect can not leach into Portsmouth Harbour.</td>
</tr>
<tr>
<td><strong>Recommendations</strong></td>
</tr>
<tr>
<td>Options to improve the standard of flood protection are not relevant to this flood cell where the key aim is to provide continued protection against leaching of contaminants into the environmentally designated areas within Portsmouth Harbour. The preferred option is therefore to provide long term protection along the line of the existing defence by intensivemaintenance/replacement of the existing flood defences.</td>
</tr>
</tbody>
</table>
Sub-cell 5m

<table>
<thead>
<tr>
<th>Typical Proposals: Sub-cell 5m, Defence lengths 571/3261 – 3262 – 1010m</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Option 1</strong> – Provide secondary defence at M275</td>
</tr>
<tr>
<td><strong>Option 2</strong> – Maintain existing defences: repair existing seawall and re-profile embankment</td>
</tr>
</tbody>
</table>

**For**
- Flood protection provided to the major area of population over the 100-year life of the strategy
- Minimal works required, therefore costs may be lower
- Wall will have a smaller footprint than an embankment
- Proposed work does not increase the footprint of the existing defence and will have a minimal effect on the environmentally designated areas within Portsmouth Harbour and Ports Creek.

**Against**
- Disruption during storm events to the MoD area
- Tipner Ranges is a landfill site and flood events could result in contaminants being washed into the environmentally designated areas within Portsmouth Harbour.

**Recommendations**
It is recommended that Option 2 is taken forward as the preferred option for this section of the frontage. This will protect against leaching of potentially contaminated land at Tipner into Portsmouth Harbour.

Sub-cell 6n

<table>
<thead>
<tr>
<th>Typical Proposals: Sub-cell 6n, Defence length 571/3257 – 50m</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Option 1</strong> – Increase quay height</td>
</tr>
<tr>
<td><strong>Option 2</strong> – Raise Wall</td>
</tr>
</tbody>
</table>

**For**
- Protection provided to the hinterland over the 100-year life of the strategy.
- Access to the quayside would be maintained.
- Protection provided to the busy M275 slip road.
- Proposed work would not encroach upon Portsmouth Harbour SSSI, SPA and Ramsar site.

**Against**
- Could prove to be a costly option
- Some visual intrusion

**Recommendations**
The preferred option for flood defence for this frontage is to raise the existing wall (option 2). Both of the possible options have similar environmental impacts and therefore option 2 has been selected as it is the least cost solution.
Appendix C

Typical Proposals: Sub-cell 6n, Defence lengths 571/3256 – 410m

<table>
<thead>
<tr>
<th>Option 1 – Raise wall</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>

Comments
There is really only one practical solution for the provision of an improved standard of defence for this frontage as shown above. The improvements would provide an improved standard of protection over the 100-year life of the strategy, protecting the continental ferry port and a number of warehouses from flood events.

It should be noted, however, that access to the quayside would be restricted by the proposals and there would be a requirement to provide ramps and steps. The proposed improvements would not encroach on the internationally designated conservation sites within Portsmouth Harbour and there would be a minimal change in footprint of the defences. The area is not currently used by the public for recreation and there are no residential properties located within the vicinity of the proposed works. As such the visual intrusion of the proposed works would be minimal.

<table>
<thead>
<tr>
<th>Option 2 – Secondary Defence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Proposed location of secondary defences</td>
</tr>
</tbody>
</table>

Comments
This option involves the construction of a secondary defence along the alignment of the M275 slipway. Flood gates would be constructed such that they could provide temporary protection over the carriageway of the roundabout during periods when the flood risk is high and an embankment would be constructed over the centre of the roundabout. The embankment of the M275 would then be used to form the remainder of the flood barrier. The existing defences for the continental ferry port would be maintained in their existing condition for the full 100-year life of the strategy promoting a hold the line policy but the effects of sea level rise will reduce the standard of protection afforded to the continental ferry port to protection against the 1 year storm event by year 100.

This option has the following advantages and disadvantages over option 1:

For
- Low cost option
- Protection provided to main area of population
- Normal day to day activities of the continental ferry port unaffected

Against
- Reduced standard of protection with time to the continental ferry port could affect the running of the port and result in flood damages to a number of the ports buildings and assets
- Protection not provided to all assets located behind the existing alignment of the defences

Recommendations
Both options were considered in the economic assessment; option 1 as an improve option and option 2 as a secondary defence option. It was found that option 2 was more expensive than option 1 since it was considered that the existing defences would need to be maintained due to key assets located close to the shoreline (e.g. the Continental Ferry Port). Due to the extensive area of contaminated land present within this defence length, option 2 is not considered viable on environmental grounds.

The preferred option for this defence length is therefore to raise the existing wall (option 1).
The standard of protection against overtopping is increased by raising the existing level of the quay. Access to the quayside is maintained by the provision of a ramp up to the newly raised level.

**For**
- Access to the busy quayside is maintained along the whole length
- The improved standard of protection is provided over the 100-year life of the strategy
- The improvement works would not encroach upon the internationally designated conservation areas within Portsmouth Harbour
- Works would not adversely change the look of the area

**Against**
- Could be a costly option
- Construction could be difficult
- Some visual intrusion as height of defence would be raised by 1.02m over 100 years.

**Recommendations**
- The preferred option is to increase the crest level of the existing seawall (option 1) as it will maintain access along the quayside.

---

The standard of protection against overtopping is increased by constructing a new splash wall at either location A or B shown on the diagram.

**For**
- For location B access to the frontage would be maintained so long as the water level does not exceed the crest level of the existing quay
- The improved standard of protection is provided over the 100-year life of the strategy
- The improvement works would not encroach upon the internationally designated conservation areas within Portsmouth Harbour
- Visual intrusion would be minimal
- Cost for the works should be considerably less than option 1
- More simple construction methods
- Works would not adversely change the look of the area

**Against**
- Direct access to the quay frontage would only be maintained at specified locations for A and access to the main frontage would be limited for location B by ramps or flood gates.
- General operations within the area would therefore be hampered

**Recommendations**
- Raising the defences along their existing line has minimal environmental impacts and is considered the least cost method of improving the existing standard of protection.
### Sub-cell 7q

**Typical Proposals: Sub-cell 7q, Defence length 571/3254 – 520m**

<table>
<thead>
<tr>
<th>Option 1 – Raise crest wall</th>
<th>Option 2 – Alternative alignment of defences</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1.png" alt="Diagram" /></td>
<td><img src="image2.png" alt="Diagram" /></td>
</tr>
</tbody>
</table>

Consider the use of new defences in the locations shown. Defences could consist of raised sections of roads (ramps) flood gates and walls. It is expected that the defences would not need to be any higher than 0.65m.

**The aim of this option is to improve the standard of protection by raising the outer wall (Portsmouth Harbour side) of the jetty.**

**For**
- Protection is provided to the whole of the naval base over the life of the study.
- Works would not adversely change the look of the area.

**Against**
- Could be a costly option.
- Construction could be difficult.
- Works would limit operational activities within the naval base.
- Some visual intrusion as height of defence would be raised by 1.4m over 100 years.
- Old Jetty could adversely affect the stability of the proposals.

**Recommendations**
It is recommended that option 1 is adopted for this section of the frontage under the improve option. This will secure important MoD assets as well as provide long term flood protection to Portsea Island.

---

**Typical Proposals: Sub-cell 7q, Defence length 571/3252 – 70m**

<table>
<thead>
<tr>
<th>Option 1 – Build Splash Wall along the Roadside</th>
<th>Option 2 – Raise Existing Wall</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image3.png" alt="Diagram" /></td>
<td><img src="image4.png" alt="Diagram" /></td>
</tr>
</tbody>
</table>

This option involves improving the standard of protection by constructing a new splash wall at the back end of the viewpoint/promenade area.

**For**
- Less visually intrusive than option 2 and would be constructed in same location as existing fence.
- Easier to construct than option 2.
- Should be less costly than option 2.
- Would protect land designated within HM Naval and St Georges Square Conservation Area.
- Minimal visual impact on vehicle travelers or pedestrians as defence would be raised by 1m over 100 years.

**Against**
- Promenade/viewpoint area would flood during storm events.
- May restrict access to slip way area currently used for vehicle parking during construction works.

**Recommendations**
Option 1 is considered the preferred option for this frontage due to reduced visual impacts and similar construction costs.
The seawall in this location is in a poor condition and is therefore at risk of future failure under the do nothing option. The existing crest level of defence however provides an adequate standard of protection against overtopping. It is therefore considered that the most cost beneficial option to provide continued flood protection to the hinterland for this frontage is to periodically repair the existing seawall.

**Recommendations**

The preferred option for this section is as described above.

---

The existing defences in this location are considered to be in a good condition and provide an adequate standard of protection. It is considered that the most appropriate course of action for these defences is to continue to maintain them. This will involve periodic repair works and general maintenance activities.

**Recommendations**

The preferred option for this section is as described above.
Sub-cell 1b

**Typical Proposals: Sub-cell 1b, Defence lengths 571/3230 a and b – 280m and 360m**

**Option b1 – Build wave return wall and raise level of promenade by approximately 1.2m**

- The existing bullnosed section of seawall would be replaced with a larger structure. In order to maintain sea views from the promenade, an increase in the level of the promenade would also be required.

  **For**
  - Increased protection provided to the promenade, road and common including protection of recreational facilities and historic features such as the Royal Naval War Memorial
  - Closure of the promenade and road would occur less frequently
  - Increased safety would be provided to pedestrians under extreme events
  - Protection of land designated within Southsea Frontage Conservation Area
  - The wall and promenade raising works could be combined or phased over a number of years

  **Against**
  - The additional weight may create stability problems for the existing structure
  - A greater footprint may be required
  - The reduction in overtopping may lead to scour at the toe of the seawall
  - Expensive
  - Sea views for recreational users on the promenade would be totally restricted

**Option b2 – Build Flood Embankment**

To prevent the landward migration of flood water, the embankment proposed for Clarence Esplanade (571/3231) could be extended to the Westerly limit of the existing defences, at the terminus of Serpentine Road. Note this option could only be promoted if the preferred option for defences 3231 and 3232 involved the construction of the secondary embankment also.

  **For**
  - Creation of a secondary flood defence
  - The views of the sea from the promenade and road would remain unchanged
  - The embankment would blend in with the surrounding natural environment once seeded

  **Against**
  - Structural damage to the promenade still likely to occur
  - Flooding allowed to propagate a long way inland and would adversely impact upon common and the Royal Naval War Memorial
  - Closure of the promenade and road would occur more frequently
  - Possible interruption of the sea view from ground floor properties

**Option a1 – Raise Promenade by 1m and build a Wave Return Wall**

Note that option a1 is in a different location along this defence length than option b1

- Standard of defence (years) = 50 (based on 50 l/s/m run)

Although overtopping is unlikely to propagate landward of the Battery it should be considered that the effect of sea level rise will decrease the standard of defence below tolerable limits and risk structural failure. For this reason an extension of the seawall proposed for the Sealife Centre would be the most obvious option.

  **For**
  - Increased protection provided to the promenade and parkland
  - Closure of the promenade and road would occur less frequently
  - Increased safety would be provided to pedestrians under extreme events
  - The wall and promenade raising works could be combined or phased over a number of years

  **Against**
  - The additional weight may create stability problems for the existing structure
  - Expensive
  - Sea views would be restricted from the promenade
The preferred option for this section of frontage is:

- Sea defence length 571/3230a - building a wave return wall and promenade.
- Sea defence length 571/3230b - building a wave return wall.

The defences will provide protection to a large flood area comprising a wide variety of residential and commercial properties in addition to the promenade, recreational facilities and a Conservation Area. It is therefore considered that this scheme will be given a high priority and improvements will form part of the medium term investment plan for Portsea Island.

**Appendix C**

**Typical Proposals: Sub-cell 1b, Defence length 371/3231 – 420m**

<table>
<thead>
<tr>
<th>Option 1 – Build Wave Return Wall</th>
</tr>
</thead>
<tbody>
<tr>
<td>For</td>
</tr>
<tr>
<td>- Increased protection provided to the promenade, road and common including protection of recreational facilities and historic features such as the Royal Naval War Memorial</td>
</tr>
<tr>
<td>- Closure of the promenade and road would occur less frequently</td>
</tr>
<tr>
<td>- Increased safety would be provided to pedestrians under extreme events</td>
</tr>
<tr>
<td>- Protection of land designated within Southsea Frontage Conservation Area</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Against</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Obscure the existing uninterrupted views of the sea from the promenade, road and common</td>
</tr>
<tr>
<td>- Reduce the amenity value of the promenade and road</td>
</tr>
<tr>
<td>- The additional weight may create stability problems for the existing structure</td>
</tr>
<tr>
<td>- A greater footprint may be required</td>
</tr>
<tr>
<td>- The reduction in overtopping may lead to scour at the toe of the seawall</td>
</tr>
<tr>
<td>- Potential access restrictions to the hovercraft terminal during the construction works</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Option 2 – Build Splash Wall</th>
</tr>
</thead>
<tbody>
<tr>
<td>Provide rock toe protection to stabilise existing wall</td>
</tr>
<tr>
<td>Promenade 6m</td>
</tr>
<tr>
<td>Road 16m</td>
</tr>
<tr>
<td>Common 22m</td>
</tr>
<tr>
<td>Yr 50= 4.82</td>
</tr>
<tr>
<td>Yr 100= 6.18</td>
</tr>
</tbody>
</table>

Please note: All levels in mODN.
Appendix C

For
- Increased protection provided to the road and common including protection of recreational facilities and historic features such as the Royal Naval War Memorial
- Closure of the road would occur less frequently
- Cheap and effective
- No visual intrusion along the promenade to the sea
- The creation of a clear division between the promenade and road, and improved safety for pedestrians

Against
- Reduced visual amenity for small/low vehicles as the views of the sea would be restricted
- Access between the road and promenade would be reduced
- Structural damage to the promenade still likely to occur
- Street Furniture such as tall street lights and chairs would need to be removed or sympathetically realigned around the defences
- Potential access restrictions to the hovercraft terminal during the construction works

Option 3 – Build Flood Embankment

For
- Creation of a secondary flood defence
- The views of the sea from the promenade and road would remain uninterrupted
- The embankment would blend in with the surrounding natural environment once seeded
- Option works with natural processes allowing the sea/intertidal habitats to migrate inland

Against
- Structural damage to the promenade still likely to occur
- Possible structural damage to the road
- Flooding allowed to propagate a long way inland and would adversely impact upon common and the Royal Naval War Memorial
- Potential loss of terrestrial/freshwater habitats
- Possible interception of the sea view from ground floor properties

Recommendations
The preferred option for this section of frontage is to improve the existing defences along the current alignment of defence by constructing a wave return wall (option 1). Option 1 is considered preferable to the other alternative options as it provides protection from flooding to the promenade, road and Southsea Common.

Typical Proposals: Sub-cell 1b, Defence length 371/3232 – 200m

Option 1 – Provide Flood Boards (Provide Demountable Defence)

For
- Increased protection provided to the promenade, road and common including protection of recreational facilities and historic features such as the Royal Naval War Memorial
- Closure of the promenade and road would occur less frequently
- Increased safety would be provided to pedestrians under extreme events
- Protection of land designated within Southsea Frontage Conservation Area

Against
- Reduce the amenity value of the promenade and road
- The additional weight may create stability problems for the existing structure
- A greater footprint may be required
- The reduction in overtopping may lead to scour at the toe of the seawall
- Potential access restrictions to the hovercraft terminal during the construction works
- Technical suitability of flood boards in area with strong wave climate.

Option 2 – Build Flood Embankment

For
- Increased protection provided to the promenade, road and common including protection of recreational facilities and historic features such as the Royal Naval War Memorial
- Closure of the promenade and road would occur less frequently
- Increased safety would be provided to pedestrians under extreme events
- Protection of land designated within Southsea Frontage Conservation Area

Against
- Reduce the amenity value of the promenade and road
- The additional weight may create stability problems for the existing structure
- A greater footprint may be required
- The reduction in overtopping may lead to scour at the toe of the seawall
- Potential access restrictions to the hovercraft terminal during the construction works
- Technical suitability of flood boards in area with strong wave climate.
Appendix C

For
- Creation of a secondary flood defence
- The views of the sea from the promenade and road would remain uninterrupted
- The embankment would blend in with the surrounding natural environment once seeded

Against
- Structural damage to the promenade and street furniture still likely to occur
- Possible structural damage to the road
- Flooding allowed to propagate a long way inland and would adversely impact upon common and the Royal Naval War Memorial
- Possible interruption of the sea view from ground floor properties

Recommendations
Both options are considered suitable for assessment in the economic analysis. However, the preferred option for this section of frontage is to improve the existing defences along the current alignment of defence by constructing a demountable defence (option 1).

As option 1 will protect the promenade and historical assets, it is considered environmentally preferable.

The defences provide protection to a large flood area comprising a wide variety of residential and commercial properties.

Typical Proposals: Sub-cell 1b, Defence lengths 571/3233 and 571/3234 – 140m and 210m

Option 1 - Raise Crest Level of Seawall

For
- Increased protection provided to the promenade, car park and Clarence Pub
- Closure of the promenade and car park would occur less frequently
- Increased safety would be provided to pedestrians under extreme events

Against
- Sea views would no longer be possible from the promenade
- The additional weight may create stability problems for the existing structure
- A greater footprint may be required
- The reduction in overtopping may lead to increased scour at the toe of the seawall
- Expensive

Option 2 – Build New Splash Wall

For
- Increased protection provided to the promenade, car park and Clarence Pub
- Closure of the promenade and car park would occur less frequently
- Increased safety would be provided to pedestrians under extreme events

Against
- Sea views would no longer be possible from the promenade
- The additional weight may create stability problems for the existing structure
- A greater footprint may be required
- The reduction in overtopping may lead to increased scour at the toe of the seawall
- Expensive
For
- Increased protection provided to the car park and Clarence Pub
- No restriction on views from the promenade to the sea
- Closure of the car park would occur less frequently
- Cheap and easy to maintain

Against
- The standard of defence for the promenade would remain unchanged and may lead to structural damage during an extreme event
- The defence line would be moved further inland
- Closure of the promenade would occur more frequently

Recommendations
The preferred option is:
- Sea defence lengths 571/3233/3234 - building a new splash wall

Either of the two alternative options would prove to be effective for the required improvements. It is however thought that the construction of option 2 ‘build new splash wall’ with the reduced capital costs and the non-reliance on the structural stability of the old seawall is likely to be a more effective solution for both sea defence lengths. This solution would also not affect the existing views of the sea for recreational users on the promenade.

Sub-cell 1c

Typical Proposals: Sub-cell 1c, Defence length 571/3228c – 1.2km

Option 1 – Raise Crest Level

For
- Increased protection provided to the promenade, road, Rock Gardens and the densely populated area fronting South Parade
- Increased safety would be provided to pedestrians under extreme events

Against
- Obscure the existing uninterrupted views of the sea from the promenade, road and common by year 100.
- Reduce the amenity value of the promenade and road
- Reduced access to the beach

Option 2 – Construct new wall landward of the promenade

For
- Increased protection provided to Rock Gardens and the densely populated area fronting South Parade
- Seaview from the Promenade is maintained

Against
- Obscure the existing uninterrupted views of the sea from the road and common by year 100.
- Amenity value of the promenade is not preserved against sea level rise
- Reduced access to the beach and promenade
Either of the options shown above could be selected as the preferred option for this frontage. However, constructing a new wall landward of the promenade (option 2) is the preferred solution as it provides protection from flooding to the road but would also be more sympathetic to visual amenity as it would not restrict views of the sea for pedestrians on the promenade.

Description of proposed works

- The existing defences in this location are considered to be in a fair condition and they provide an adequate standard of protection against overtopping. Proposals for this length of defence involve the continued maintenance of the existing defences and replacement of elements at the end of their structural life.

Recommendations

An improved standard of protection can be achieved through the maintenance activities described above.

The preferred solution for this frontage is to maintain the existing defences through normal maintenance activities and replace the existing seawall and revetment at the end of the structure’s life (likely to be after 50 years).

Typical Proposals: Sub-cell 1c, Defence length 571/3229 – 450m

- The existing defences in this location are considered to be in a fair condition and they provide an adequate standard of protection against overtopping. Proposals for this length of defence involve the continued maintenance of the existing defences and replacement of elements at the end of their structural life.

Recommendations

An improved standard of protection can be achieved through the maintenance activities described above.

The preferred solution for this frontage is to maintain the existing defences through normal maintenance activities and replace the existing seawall and revetment at the end of the structure’s life (likely to be after 50 years).
Sub-cell 1d

Typical Proposals: Sub-cell 1d, Defence lengths 571/3228a and 571/3228b

<table>
<thead>
<tr>
<th>Option 1 – Build Wave Return Wall</th>
</tr>
</thead>
<tbody>
<tr>
<td>A wave return wall could be constructed at the seaward limit of the promenade either on top of the existing seawall or occupying the same footprint.</td>
</tr>
<tr>
<td><strong>For</strong></td>
</tr>
<tr>
<td>• Increased protection provided to the promenade, road and nearby recreational, historical and residential assets</td>
</tr>
<tr>
<td>• Increased safety would be provided to pedestrians under extreme events</td>
</tr>
<tr>
<td>• Closure of the promenade and road would occur less frequently</td>
</tr>
<tr>
<td><strong>Against</strong></td>
</tr>
<tr>
<td>• Obscure the existing uninterrupted views of the sea from the promenade and the road</td>
</tr>
<tr>
<td>• Reduce the amenity value of the promenade and road</td>
</tr>
<tr>
<td>• Expensive</td>
</tr>
</tbody>
</table>

Option 2 – Construct New Concrete Seat/splash wall eastwards of existing

The concrete seat which currently exists along 60% of the length of seawall would be continued eastwards.

**For**

• Increased protection provided to the road and nearby recreational, historical and residential assets
• Closure of the road would occur less frequently

**Against**

• Obscure the existing uninterrupted views of the sea from the road
• Reduced access to the beach
• Not as efficient as a wave return wall

Recommendations

Option 2 is considered as the preferred option for this section of the frontage because of the lower initial construction costs and the maintenance of clear views from the promenade.

Sub-cell 2e

Typical Proposals: Sub-cell 2e, Defence lengths 571/3225 & 3226

General Notes

It is considered that a failure of the defences in this location could result in a breach of the spit protecting the entrance to Langstone Harbour and potentially result in a widening of the channel entrance. Should a widening occur then there would be the potential for large waves to propagate into Langstone Harbour potentially changing the coastal conditions at the face of the defences along the Langstone Harbour Shoreline.

Option 1 – Build Wave Return Wall

A wave return wall could be constructed on top of the existing seawall or occupying the same footprint.

**For**

• Increased protection provided to the MoD assets and flooding of assets located further inland
• Expensive

**Against**

• Expensive
• The additional weight may create stability problems for the existing structure
• A greater footprint may be required
• The reduction in overtopping may lead to scour at the toe of the seawall

Option 2 – Construct Set Back Wave Wall
A wave return wall could be set back between the existing seawall and the buildings.

**For**
- Increased protection provided to the MoD assets and flooding of assets located further inland
- No increased loading on existing wall

**Against**
- Expensive
- The existing seawall unprotected and would be subjected to overtopping of a level that could cause structural damage in storm conditions
- The reduction in overtopping may lead to scour at the toe of the seawall

Option 3 - Revetment

A rock revetment could be built in front of the existing sea wall to dissipate wave energy and reduce overtopping. Although it is known to reduce overtopping it is unclear at this stage what heights of defences would be required to achieve acceptable overtopping rates, therefore further modelling would be required before this option could be considered further.

**For**
- Increased protection provided to the MoD assets and flooding of assets located further inland
- No increased loading on existing wall
- Reduced scour at toe of wall
- Protects existing defences

**Against**
- Expensive
- Increased footprint of defences on beach

Recommendations

Option 2 'construct set back wave wall' is the preferred option as option 1 would create stability problems with the existing wall due to the very high crest levels required.

It is suggested that further investigations are carried out at PAR stage to determine the relationship between the defences in this location and other defences located within the Langstone Harbour Shoreline to ensure that should a breach form in these defences, the potential widening of the Langstone Harbour entrance channel will not have an adverse impact on the exposure on adjacent defences within Langstone Harbour. It should be noted that the existing defences provide an adequate standard of protection against overtopping and consequently any improvement works will not require the existing defences to be raised.