REPORT

BASELINE DOCUMENT FOR MAINTENANCE DREDGING IN PORTSMOUTH HARBOUR

October 2017

Client: Defence Infrastructure Organisation

02/Final

Defence Infrastructure Organisation
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SUMMARY

The purpose of the Baseline Document is to present information relating to maintenance dredging activity and the condition of the designated marine protected areas within Portsmouth Harbour.

This document presents information to inform an assessment of the potential effects of maintenance dredging activity in relation to the nationally and internationally designated sites within, and in proximity to, Portsmouth Harbour.

The information presented includes the history of dredging in the area, the potential effects of dredging activity and how dredging requirements have changed over time. It then examines dredging activity in relation to the condition of the designated sites to enable the use of the document in making an assessment of the impacts of maintenance dredging on their conservation objectives.

This Baseline Document concludes that the present maintenance dredging practices are sustainable and not likely to have a significant effect on the features of Portsmouth Harbour designated sites.

A five year update is recommended to ensure that the information presented in the Baseline Document remains relevant and up to date. Further legislative and regulatory changes are not anticipated in the next five year period, however, should there be any changes that affect the content of the Baseline Document it should be updated accordingly.
1 INTRODUCTION

Portsmouth Harbour is a large natural Harbour which has been extensively industrialised but still includes one of the largest expanses of mudflats and tidal creeks on the south coast. It is almost completely landlocked except for the narrow entrance channel which connects it to the Solent. The Harbour is the main home of the Royal Navy and is also one of the busiest in the country with over 80,000 significant vessel movements each year. The Harbour has an extensive history of industrial and naval use and in more recent times this has expanded into recreational uses with the development of a number of marinas within the Harbour; there are approximately 3,500 recreational vessels licensed to moor in the Harbour. The city of Portsmouth is situated on Portsea Island to the east of the Harbour with Gosport situated on the western side.

The Queen's Harbour Master (QHM), Portsmouth, is the regulatory authority of the Dockyard Port of Portsmouth. This is a 55 square mile (142 square km) area that encompasses Portsmouth Harbour and the Eastern Solent. QHM has statutory control of the Dockyard Port of Portsmouth. The limits of the Dockyard Port cover not only Portsmouth Harbour itself, but also all the waters from Cowes in the west to Hayling Island and down to Sandown Bay in the east, with the single exception of Bembridge Harbour. The Naval Base itself comprises only a small part of the geographical area of the Dockyard Port. Vessels associated with Portsmouth include aircraft carriers, large warships, ferries, hovercrafts and fishery protection squadrons.

Maintenance dredging is regularly undertaken by the Defence Infrastructure Organisation (DIO) on behalf of the Dockyard Port to maintain the depth of the navigable channels and berths. In the naval dockyard regular dredging is essential for the Ministry of Defence (MoD) to maintain the UK’s tactical and strategic defence commitments.

Portsmouth City Council own and operate Portsmouth International Port which offers ferry routes to more destinations than any other UK port.

Maintenance dredging is licensed and regulated through the Marine Management Organisation (MMO). An application must be submitted to the MMO for a licence to undertake any maintenance dredging or maintenance dredging and disposal activity. The DIO (or previously its dredging contractor) is the licence holder for all maintenance dredging activity of its approach channels and berths. The private marina operators are the licence holders for any maintenance dredging of their berths.

DIO has commissioned Royal HaskoningDHV (RHDHV) to compile an updated Maintenance Dredging Protocol (MDP) Baseline Document as a tool to assess the impacts of maintenance dredging on the marine protected areas in the vicinity of the Dockyard Port of Portsmouth.

This new Baseline Document builds on the 2012 draft assessment to take account of any changes in the dredging regime or condition of the designated sites. The main updates in this document include new legislation that has led to changes in the regulatory process for the licensing of maintenance dredging and the designation of a number of new marine protected areas (MPAs).
1.1  Background

Baseline Documents were initially drawn up under the 2007 Defra guidance ‘Maintenance Dredging & The Habitats Regulations 1994 - A Conservation Assessment Protocol for England’.

Marine licensing for dredging operations was introduced when the MMO was vested in 2011 however a decision on whether maintenance dredging should be a licensable activity was deferred until April 2014. Up until April 2014 it was only the disposal of maintenance dredging material that required a licence, maintenance dredging itself was not regulated through licensing. However, where maintenance dredging had the potential to affect a European designated site, for example, a Special Area of Conservation (SAC) or Special Protection Area (SPA), both protected under the EC Habitats Directive 92/43/EEC, the UK Government considered it to be a ‘plan or project’ for the purposes of the Habitats Directive. Because of this, maintenance dredging operations that had the potential to impact on a European designated site would need to be assessed in accordance with Article 6(3) of the Directive and with Reg. 48 of the 1994 Regulations / Reg. 61 of the 2010 Regulations.

To avoid the administrative burden of undertaking assessment under the Habitats Regulations for each dredging activity, the ‘Conservation Assessment Protocol’ was produced (Defra, 2007). The protocol set out an approach for operators and regulators to provide a ‘Baseline Document’ to present existing and readily available information to describe the current and historical patterns of dredging in relation to the conservation objectives of a European designated site.

The first Maintenance Dredging Baseline Document for HMNB Portsmouth was drafted for DIO in 2005. This document was updated as draft in 2012 but was not finalised. The document was produced using the protocol guidance and provided a tool for the DIO on behalf of the Dockyard Port to demonstrate that their maintenance dredging activity was not having an impact on the European designated sites in the vicinity of the Portsmouth Harbour.

1.1.1  Legislative changes

Since April 2014, both maintenance dredging activity and disposal of the dredged material to sea have been regulated by the MMO through marine licensing under the Marine and Coastal Access Act (2009) (MCAA). Despite the change in regulation, the Baseline Document provides a useful tool for assessing dredging impacts on marine protected areas. It can be used to support maintenance dredging licence applications and prevent the need for re-assessment for each licence application.

Current advice from Natural England is that a Baseline Document is still a useful tool to provide an assessment of the impacts of maintenance dredging activity on the designated features of a European site (Baseline Documents have been used by ports to support their Marine Licence applications since the regulation change). An updated document can be used to support Marine Licence applications for maintenance dredging rather than having to complete an assessment under the Habitats Regulations (HRA) each time.

As well as the introduction of marine licensing, there is also now a suite of new Marine Conservation Zones (MCZs) which have been designated under the MCAA 2009. Natural England has recommended that, where applicable, MCZs are included as part of the Baseline Document. The Baseline Document would then provide an assessment under both the Habitats Regulations and the MCAA for impacts of maintenance dredging on European or nationally designated sites. This would

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7 The Conservation (Natural Habitats &c.) Regulations 1994 have since been superseded by the Conservation of Habitats and Species Regulations 2010
avoid the need to undertake and submit a separate HRA and MCZ assessment for each licence application for maintenance dredging and act as a time and cost saving tool for the licence applicant.

This current document therefore represents the Baseline Document as a tool for the assessment of maintenance dredging undertaken by HMNB Portsmouth in the Dockyard Port of Portsmouth.

In 2016-17 Defra has undertaken a formal consultation on proposals for a new Solent and Dorset Coast potential Special Protection Area (pSPA), proposed to protect important foraging areas of common tern, Sandwich tern and little tern. The site is approximately 255.2nm² and extends from the Isle of Purbeck in the west to Bognor Regis in the east, following the coastline on either side to the Isle of Wight and into Southampton Water and Portsmouth Harbour. The boundary was established as a composite of the usage of the area within adjacent SPAs. This site has been incorporated into this Baseline Document.

Fareham Creek was put forward for consideration as a recommended MCZ (rMCZ) for native oyster beds. This site has been incorporated into this Baseline Document to future proof the document should the site be formally designated in the future., although Natural England advised at the May 2017 Solent Forum Meeting that Fareham Creek is not being taken forward for formal consultation “due to a lack of evidence for the proposed features (apart from the native oyster, which has adequate representation within the Isle of Wight sites)”. 

1.2 Context and Scope of the Baseline Document

Maintenance dredging is regularly carried out by HMNB Portsmouth and the private marinas in Portsmouth Harbour with dredging practices taking place either within or in close proximity to a number of designated sites. Material that is disposed at sea is predominantly taken to the Nab Tower disposal ground (See Figure 1.1).

Nationally and internationally designated sites in Portsmouth Harbour are:

- Portsmouth Harbour SPA and Ramsar site;
- Solent and Dorset Coast pSPA;
- Portsmouth Harbour Site of Special Scientific Interest (SSSI);
- Fareham Creek rMCZ; and
- Gilkicker Lagoon SSSI.

Outside of the Harbour but still within the Dockyard Port of Portsmouth’s statutory limits are:

- Solent Maritime SAC;
- South Wight Maritime SAC;
- Norris to Ryde rMCZ;
- Ryde Sands and Wooten Creek SSSI;

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- Bembridge rMCZ;
- Brading Marshes to St Helen’s Ledges SSSI; and
- Whitecliff Bay and Bembridge Ledges SSSI.

Figure 1.1 shows the location of these designated and proposed conservation areas.

For the purpose of this document the study area has been defined as being the area in which maintenance dredging is undertaken, that is, the inner Harbour and its approaches. Following the approach of the 2005 and 2012 draft Baseline Documents, a 6km buffer has been used as the boundary for the study area around the mouth of the estuary (Figure 1.1). The maintenance dredge area within Figure 1.1 represents the area maintained prior to the capital dredging project that was undertaken in 2016/2017. An updated maintenance dredge area figure is provided within Figure 2.2 showing the widening and lengthening of the approaches to Portsmouth. Future maintenance dredging will occur within the area shown in Figure 2.2.

Potential ecological impacts of the disposal of dredged material at the Nab Tower disposal ground on designated sites are not considered to be within the scope of this Baseline Document. This is primarily because the Nab Tower site is used by a number of different port authorities, each with their own Baseline Document which could result in duplicated or conflicting assessments. The MOD agrees that the MMO is best placed to assess, monitor and manage the cumulative impacts of disposal through its oversight of the Marine Licensing process and will provide input to future disposal site management plans accordingly.

1.3 Objectives

The objectives of this updated Baseline Document are to:

- Combine relevant existing information about the environmental status of the study area and, in particular, what is known about the potential extent of impacts of previous capital and maintenance dredging undertaken by the MoD, their agents or other operators within Portsmouth Harbour;
- Provide the data necessary to allow any maintenance dredging to be assessed in accordance with Article 6(3) of the Habitats Directive and in line with the Conservation Assessment Protocol on Maintenance Dredging and the Habitats Regulations; and
- Provide the data necessary to allow any maintenance dredging proposals in the vicinity of MCZs (presently rMCZ) to be assessed in accordance with the MCAA (2009).

It should be noted that this document will require regular updating as further information becomes available, if circumstances and requirements change, and potentially as a result of any wider consultation.

1.3.1 Content of the document

According to the Maintenance Dredging Protocol, Baseline Documents are to be based on existing and readily available information (e.g. from previous applications and/or Environmental Impact Assessment (EIA), dredge disposal returns and condition monitoring). Where possible, they are intended to identify the:

- existing need for maintenance dredging in individual areas;
existing volumes, frequencies and duration of dredging operations – where this should be based on actual dredge returns rather than volumes applied for in consents;

precise locations of dredging and disposal;

methods of dredging, transport (and disposal where in-scope), including any restrictions imposed as licence conditions or by physical constraints (e.g. depth, tidal flow, wave or weather conditions);

material type and chemical status (existing and historical);

history of dredging (and disposal where in-scope) at particular locations, as well as the variability in material type and volumes due to natural changes;

any monitoring requirements previously imposed through licences, and the outcomes of such monitoring;

any beneficial use and sediment cell maintenance schemes, or mitigation and compensation schemes entered into, and;

any other relevant information from past studies or previous applications that have possible direct or indirect links to the maintenance dredging.

The Baseline Document should also include information supplied by Natural England and others (e.g. the MMO, the Centre for the Environment, Fisheries and Aquaculture Science (Cefas), and the Environment Agency) on the condition characteristics of the designated sites, and in particular the interest features of the site and their conservation objectives, which could be affected by maintenance dredging.

1.4 Methodology

The Baseline Document is based on a desk study of existing and readily available data only. The data gathering exercise has deliberately focused on those environmental parameters that could potentially be affected by maintenance dredging and are of relevance to the integrity of the designated sites in the vicinity of Portsmouth Harbour (as defined by the Study Area in Figure 1.1 and incorporating the amended maintenance dredge area as set out in Figure 2.2). These include the following:

- Coastal processes and geomorphology;
- Estuarine and marine habitats and ecology;
- Ornithology;
- Noise (in respect of disturbance to birds or migratory fish);
- Sediment quality; and,
- Water quality.

Natural England and the key Relevant Authorities were consulted on a draft of this Baseline Document during Summer 2017 and their comments have been taken into account in the finalised version.
1.5 Report Structure

Error! Reference source not found. summarises the contents of this Baseline Document.

Table 1.1 Report structure

<table>
<thead>
<tr>
<th>Section</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Introduction</td>
<td>Provides the background, context and scope of the Baseline Document and outlines the objectives of the document.</td>
</tr>
<tr>
<td>2. Existing dredging regime</td>
<td>Details the history and operations of dredging within the Portsmouth Harbour study area.</td>
</tr>
<tr>
<td>3. Designated Sites</td>
<td>Presents the Portsmouth Harbour SPA &amp; Ramsar Site, Solent and Dorset Coast pSPA, Fareham Creek rMCZ and Portsmouth Harbour SSSI.</td>
</tr>
<tr>
<td>4. Description of baseline conditions</td>
<td>Presents the baseline conditions including; coastal processes and geomorphology, estuarine habitats and ecology, ornithology, sediment and water quality.</td>
</tr>
<tr>
<td>5. Summary of information for the assessment of maintenance dredging</td>
<td>Presents a summary of the baseline information in relation to the potential to impact on the condition of the designated sites.</td>
</tr>
<tr>
<td>6. Conclusions and recommendations</td>
<td>Presents the conclusions in relation to an assessment of impacts on the designated sites and recommendations for future updates of the document.</td>
</tr>
</tbody>
</table>
2 EXISTING DREDGING REGIME

2.1 Maintenance Dredging Activity

2.1.1 Overview

The Portsmouth Harbour area supports a range of waterfront activities that give rise to the need for regular maintenance dredging.

Maintenance dredging can be defined as regular dredging activity which is undertaken to remove accumulated sediments from within berths to maintain the appropriate agreed depth.

Dredging within Portsmouth Harbour is carried out by various organisations however depths within the main navigation channels and berths are maintained by DIO on behalf of QHM. In addition to QHM’s activities, a number of other port, ferry and marina operators carry out dredging outside of these areas – these are detailed in Section 2.1.4.

Most dredging is undertaken by trailing suction hopper dredgers (TSHD) which remove the material for disposal at sea but there is understood to be widespread use of plough (bed leveller) dredging to remove high spots at marinas and individual berths. Back hoe and water injection dredging techniques are used at some sites but this is not widespread and is used infrequently.

Data on dredging operations within the study area were obtained through consultation with the QHM Portsmouth, Boskalis Westminster Ltd. (BWL) and by direct contact with the civilian harbour authorities and marina operators. BWL has been the sole maintenance dredging contractor to DIO on behalf of QHM, as a subcontractor to Debut Services from 2004 to 2016. Records before 2004 are sparse and incomplete.

2.1.2 Dredging methodology

A typical maintenance dredging campaign consists of a pre-dredge survey to ascertain the amount of sediment to be dredged (accumulated silt between minimum maintained depth (MMD) and approved dredge depth (ADD)), the dredging operation to remove / move the identified sediment and a post-dredge survey to confirm the operation.

There are two main methods of dredging currently used for maintenance dredging:

- **Using a TSHD to remove sediment from the berths and dispose at the licensed Nab Tower disposal ground**
  This dredging method involves a self-propelled vessel trailing a suction pipe with a draghead attached to the end, along the sea bed. The draghead is pulled slowly along the bed by forward motion of the vessel. The suction pipe is connected to pumps on board the vessel that provide suction to the draghead which in turn ‘sucks up’ a mixture of water and silt. The draghead can be equipped with cutting teeth for the agitation of firmer sediment or water jets to lift softer material into suspension. The silt and water travels up the suction pipe and is deposited in a hopper located in the vessel. The vessel continues to dredge until the capacity of the hopper is reached. A range of TSHDs are licensed for use during the maintenance operations. The hopper capacities of the vessels used at Portsmouth Harbour are approximately 4,500m$^3$. Once the hopper capacity is reached, the vessel then stows the suction pipe and draghead on board and transits to the disposal site.
At the disposal site the material in the vessel’s hopper is discharged by ‘bottom dumping’. This discharge method entails the opening of the doors located in the bottom of the vessel’s hopper and allowing the material to fall to the seabed under gravity. The material dredged for the maintenance works at Portsmouth Harbour is primarily silt and fine sands. Excluding time for positioning and dependant on hopper capacity, a hopper can be filled in 30 to 60 minutes providing no hard material is encountered. The bottom dumping of the dredged material can take as little as five minutes but time at the disposal site can be up to an hour to allow for positioning, bad weather etc.

- Dispersive plough dredging and submersible pump methods

Ad hoc plough dredging is undertaken in conjunction with the TSHD or as a standalone bed levelling practice. The plough vessel is an integral part of the TSHD operation as it improves both efficiency and effectiveness. The draghead of the TSHD creates 'tracks' (troughs & peaks) during the dredging work. The high and low spots reduce the contact area of the draghead and consequently reduce the dredging efficiency. The plough assists the process by levelling the bed, pulling material out of confined spaces that are not accessible to the TSHD and reducing the height of peaks above the design depth.

The plough dredging method involves a self-propelled vessel which operates by lowering a beam, blade or box plough (depending on material) to the required depth, usually ADD, or the seabed (if significantly higher) and traverses the area with the plough. The plough sails through the dredging area, turning and lifting the blade from the seabed as necessary, until the required level has been achieved (by pushing the high areas in to the void spaces). The volume of material in the dredge area will not significantly change as the material is being redistributed within it and no material is being taken out of the area. The quantification of the volume moved by ploughing will depend on the vertical reference used. Ploughing is generally targeted to achieve ADD. Ploughing does not give rise to a significant re-suspension of sediment but if the sediment ploughed is soft it may be sufficiently disturbed to rise in suspension.

The non-disposal ploughing and submersible pump methods are used in conjunction with TSHD to carry out the dredging where access is difficult for larger TSHD vessels and to complete bed levelling in the dredged berths.

There are also two further methods that have been or are used for maintenance dredging. These are back hoe dredger and water injection dredging. Back hoe dredging is used as normal practice but on a small scale and water injection dredging has been used in the past. There are no current maintenance licences where water injection dredging is currently undertaken in Portsmouth Harbour.

2.1.3 Portsmouth Harbour maintenance dredging on behalf of QHM

The MoD (through the QHM) has a statutory duty to maintain navigation within Portsmouth Harbour. As part of this responsibility, QHM must maintain the advertised dredge depths within designated areas of the Harbour (hereafter referred to as the maintained areas). In order to achieve this, QHM carries out periodic maintenance dredging. Due to the Dockyard’s location and lack of fluvial input, it is subject to the accretion of sediment transported through the Solent and into the Harbour by tidal flow. This sediment accretion is the target of the maintenance dredging operations.

Maintenance dredging is required to maintain the operational depths in the approaches and berth pockets of the Dockyard and allow the MoD to maintain its tactical and strategic defence commitments.
Until changes to marine licensing occurred with the formation of the MMO, only the disposal of maintenance dredge material required a licence. Between 1985 and 2011 disposal of maintenance dredge material was authorised through a Food Environment Protection Act (1985) (FEPA) licence issued previously by the Marine Fisheries Agency (MFA) and Marine Consents and Environment Unit (MCEU). FEPA licences were replaced with Marine Licences when the MMO formed to replace the MFA (and other bodies) in 2011. A decision on the licensing of maintenance dredging was deferred following vesting of the MMO in 2011 however since 2014 maintenance dredging activity in addition to the disposal of maintenance dredge material has required a Marine Licence from the MMO.

Maintenance dredging is currently undertaken under Marine Licence L/2014/00049. For licensing purposes disposal tonnages are calculated as wet metric tonnes (wmt) from in situ volumes at a conversion rate (bulk density) of 1.45 wmt per m$^3$.

**Current and historic maintenance dredging operations**

The majority of the dredging operations use TSHD with the works continuing on a 24 hour basis during a dredging campaign until the design depth has been achieved.

The area is managed by QHM by dividing the maintained area into a series of arbitrary boxes. A dredging register is kept, which records the “minimum maintained depth (MMD)” and the “actual dredge depth (ADD)” within each box. In general, the MMD is one metre higher than ADD. The required depths for navigational purposes within each box were re-evaluated by QHM in recent years. The majority of the approach channel has been maintained at 9.5m below CD, with the approach to Fountain Lake Jetty maintained at 8m below CD and the approach to Bedenham Pier maintained at 5m below CD.

Prior to 2004, maintenance dredging by QHM was undertaken on an ‘as-needed’ basis, with dredging carried out as and when to address specific problems. In 2004, a more strategic approach was adopted, and continues to this day. Dredging only occurs to maintain operations i.e. dredging is targeted to areas where dredging is a necessity to maintain navigable safety and where reasonable dredging productivity can be achieved rather than constantly trying to achieve certain levels across the site.

**Future maintenance dredging**

Depths in several of the existing maintenance dredge boxes will change once the capital dredge for the Queen Elizabeth Class (QEC) aircraft carrier has been completed in 2017. Details of the new dredge depths can be found in Table 2.1 – areas that will change in depth as a result of the capital works show both the old depth and the new depth.

Despite the deepening and widening of the approach channel, turning circle and berths to accommodate the new aircraft carrier the modelling undertaken for the environmental impact assessment for the project (ABPmer, 2008) and the subsequent Environmental Statement (Royal HaskoningDHV, 2012) anticipates no increase in maintenance dredging requirements as a result of the capital dredge. This is because the areas of sedimentation within the Harbour are not significantly changed by the capital dredge and the sediment flux in and out of the Harbour was found to be reduced by only 800tonnes per year following the capital dredge (ABPmer, 2008). This is due to the design of the new channel and berth pockets which work with the existing tidal regime allowing the ebb dominant tide to self-clear the berths and channel thereby minimising sedimentation. These small scale changes in predicted sedimentation would not significantly alter the maintenance dredging regime within Portsmouth Harbour.
Locations of maintenance dredging

The area that DIO maintains on behalf of QHM is listed in Table 2.1 and illustrated in Figure 2.1. This covers the majority of the navigation channels within the Harbour. Changes to the shape of the approach channel and berths as a result of the capital dredge are shown in Figure 2.2 which therefore also shows the extent of the future maintenance dredging area.

Table 2.1 Description of areas maintained under the current licence at HMNB Portsmouth (where applicable changes as a result of the capital dredge are noted for future dredging)

<table>
<thead>
<tr>
<th>Ref</th>
<th>Area</th>
<th>Levels(mCD)</th>
<th>Area (m²)</th>
<th>Last maintenance dredge</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>MMD</td>
<td>ADD</td>
<td></td>
</tr>
<tr>
<td>AA1 (formerly AA/AB/AC)</td>
<td>Southern railway Jetty, Victory Jetty and Sheer Jetty</td>
<td>10.0</td>
<td>11.0</td>
<td>40,226</td>
</tr>
<tr>
<td></td>
<td>Part of this area will now operate at new MMD and ADD</td>
<td>12.8</td>
<td>13.8</td>
<td></td>
</tr>
<tr>
<td>AG</td>
<td>Formerly Middle Slip Jetty – now renamed Princess Royal Jetty</td>
<td>12.0</td>
<td>13.0</td>
<td>21,767</td>
</tr>
<tr>
<td></td>
<td>This area will now operate at new MMD and ADD</td>
<td>12.8</td>
<td>13.8</td>
<td></td>
</tr>
<tr>
<td>AH1</td>
<td>North Corner Jetty and North West Wall</td>
<td>10.0</td>
<td>11.0</td>
<td>37,924</td>
</tr>
<tr>
<td>AJ</td>
<td>Tidal Basin</td>
<td>8.0</td>
<td>9.0</td>
<td>71,400</td>
</tr>
<tr>
<td>ALA</td>
<td>C&amp;D Lock Entrances</td>
<td>9.0</td>
<td>10.0</td>
<td>10,693</td>
</tr>
<tr>
<td>AP</td>
<td>Fountain Lake – berths 1-3 and approach</td>
<td>8.0</td>
<td>9.0</td>
<td>152,879</td>
</tr>
<tr>
<td>AP1 or APA</td>
<td>Fountain Lake Berth 3/4</td>
<td>6.0</td>
<td>6.0</td>
<td>3,177</td>
</tr>
<tr>
<td>AQ</td>
<td>RMAS Hoist, Near Round Tower</td>
<td>3.0</td>
<td>4.0</td>
<td>2,673</td>
</tr>
<tr>
<td>AS</td>
<td>South Camber</td>
<td>2.0</td>
<td>3.0</td>
<td>3,308</td>
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<td>AT</td>
<td>Kings Stairs</td>
<td>3.0</td>
<td>4.0</td>
<td>1,850</td>
</tr>
<tr>
<td>ATA</td>
<td>North Camber</td>
<td>0.5</td>
<td>1.0</td>
<td>3,719</td>
</tr>
<tr>
<td>AU</td>
<td>Training Ship Mooring (no longer used)</td>
<td>6.5</td>
<td>7.5</td>
<td>18,803</td>
</tr>
<tr>
<td>AU</td>
<td>Training Ship Mooring</td>
<td>6.5</td>
<td>7.5</td>
<td>12,216</td>
</tr>
<tr>
<td>AV</td>
<td>UHAF Dolphins (old location no longer used)</td>
<td>10.0</td>
<td>11.0</td>
<td>11,965</td>
</tr>
<tr>
<td>AV</td>
<td>UHAF Warship Side</td>
<td>9.5</td>
<td>10.0</td>
<td>10,926</td>
</tr>
<tr>
<td>AVA</td>
<td>Restricted Section of AV Due Cable Trench (old location no longer used)</td>
<td>8.0</td>
<td>8.0</td>
<td>2,098</td>
</tr>
<tr>
<td>AW</td>
<td>Fountain Lake Approach West (3 buoy turning circle)</td>
<td>8.5</td>
<td>9.5</td>
<td>302,751</td>
</tr>
<tr>
<td></td>
<td>Part of this area will now operate at new MMD and ADD</td>
<td>10.5</td>
<td>11.0</td>
<td></td>
</tr>
<tr>
<td>AY</td>
<td>Approach Channel to UHAF</td>
<td>8.5</td>
<td>9.5</td>
<td>110,385</td>
</tr>
<tr>
<td>AZ</td>
<td>No. 2 Buoy Circle</td>
<td>7.5</td>
<td>8.5</td>
<td>40,365</td>
</tr>
<tr>
<td>BA</td>
<td>No. 1 Basin</td>
<td>3.5</td>
<td>3.5</td>
<td>7,839</td>
</tr>
<tr>
<td>BAA</td>
<td>Entrance to No. 1 Basin</td>
<td>3.5</td>
<td>3.5</td>
<td>944</td>
</tr>
<tr>
<td>BB</td>
<td>No. 2 Basin</td>
<td>4.5</td>
<td>4.5</td>
<td>26,286</td>
</tr>
<tr>
<td>BE</td>
<td>Dolphins East Munitions Moorings (old location no longer used)</td>
<td>4.5</td>
<td>5.5</td>
<td>6,971</td>
</tr>
<tr>
<td>BE</td>
<td>UHAF Barge Slide</td>
<td>5.0</td>
<td>5.5</td>
<td>12,500</td>
</tr>
<tr>
<td>DA</td>
<td>No. 1 Jetty Approach (ballast bank)</td>
<td>9.0</td>
<td>10.0</td>
<td>27,229</td>
</tr>
<tr>
<td>DAA</td>
<td>No.1 Jetty Berthing</td>
<td>6.0</td>
<td>7.0</td>
<td>33,179</td>
</tr>
<tr>
<td>DAB</td>
<td>Joint Services SC Outer (used to be DL)</td>
<td>3.0</td>
<td>4.0</td>
<td>11,891</td>
</tr>
<tr>
<td>DC</td>
<td>No.1 Jetty – Boat Pool</td>
<td>1.5</td>
<td>1.8</td>
<td>1,824</td>
</tr>
<tr>
<td>DE</td>
<td>No.2 Jetty and Approach</td>
<td>5.0</td>
<td>6.0</td>
<td>8,951</td>
</tr>
<tr>
<td>DG</td>
<td>Gosport Oil Jetty – Inside</td>
<td>4.0</td>
<td>5.0</td>
<td>13,099</td>
</tr>
<tr>
<td>DH</td>
<td>Gosport Oil Jetty – North Side</td>
<td>9.0</td>
<td>10.0</td>
<td>24,849</td>
</tr>
</tbody>
</table>
Ref | Area | Levels (mCD) | Area (m²) | Last maintenance dredge |
--- | --- | --- | --- | --- |
DK | Gosport Oil Jetty – Main Berth | 12.0 | 13.0 | 15,397 | 2015 |
EB | Bedenham Pier | 5.0 | 6.0 | 10,288 | 2015 |
EF | Fareham Creek – Deep Channel | 5.0 | 6.0 | 86,864 | 2015 |
ED | Bedenham Creek at QHMs discretion | Naturally deep channel | | |
FA | Royal Clearance Yard – Main Yard | 1.0 | 1.5 | 2,522 | 2015 |
FD | Royal Clarence yard – Main Jetty | 4.0 | 4.5 | 5,842 | 2015 |
GC | Outer Spit Buoy to Harbour Entrance | 9.5 | 10.5 | Approx 1,819,834 | 2015 |
| This area will now operate at new MMD and ADD | 10.5 | 10.8 | |
GD | Harbour Entrance to North Corner | 9.5 | 10.5 | 459,774 | 2015 |
| This area will now operate at new MMD and ADD | 10.5 | 11.0 | |

Note – mCD = metres Chart Datum, MMD = Minimum Maintained Depth, ADD = Approved Dredged Depth
2.1.4 Port, Ferry and Marina operators’ maintenance dredging

There are a number of port and marina operators within Portsmouth Harbour who regularly undertake maintenance dredging (Figure 2.1).

**Portsmouth International Port**

Portsmouth City Council owns the commercially operated Portsmouth International Port (formerly known as Portsmouth Commercial Port). The Port consists of nine commercial berths with the majority serving ferries operating to France, Spain and the Channel Islands as well as locally to the Isle of Wight. There are two berths serving deep sea container vessels. The Port is also responsible for the Camber Dock which is used for recreational boating and fishing vessels.

Dredging is undertaken on an as needed basis, however this is typically required every couple of years. A TSHD is used and material is disposed of at Nab Tower. The last dredge was undertaken in early 2015 with the next campaign planned for early 2017.

**Gosport Ferry**

Gosport Ferry manages the berths for the passenger ferry which operates between Gosport and Portsmouth with a regular timetable throughout the day.

Typically dredging is undertaken on a six year cycle with previous dredging taking place in 2007 and 2011. Based on personal communications with Gosport Ferry in 2016, the next dredge is planned for 2017. Recently a larger ferry has been purchased which may affect future dredging programmes. Material is disposed of at Nab Tower.

The dredging returns data for Portsmouth International Port and Gosport Ferry are shown alongside other operators in Table 2.3 below.

**Marina Operators**

There are a number of marina operators within Portsmouth Harbour and these are listed below.

- **Wicor Marine Yacht Haven**
  
  Information obtained through the MMO Marine Licence public register shows that there is no regular licensed dredging taking place at Wicor.

- **Fountain Lake Angling Club**
  
  Dredging is apparently undertaken every five years, and it is understood that the works are managed by Portsmouth City Council on behalf of the angling club. Material is disposed of at Nab Tower No information regarding disposal amounts is available.

- **Gunwharf Quays**
  
  No dredging has been undertaken in the last three years. Hydrographic surveys are undertaken periodically to monitor depths above CD, a survey is planned for 2017. Any material disposed of is taken to Nab Tower. No information regarding disposal amounts is available.

- **Port Solent Marina**
  
  This is a locked marina but maintenance dredging is undertaken in the approach channel on an annual basis. Dredging is undertaken using a backhoe dredger and material is disposed at Nab Tower. An average of 6,000m$^3$ is removed from the approaches each year. A 10 year licence is currently in place and runs from March 2015 to March 2025.
Royal Clarence Marina
The marina undertakes plough dredging on an as needed basis. No dredging has been undertaken since early 2013. A licence exemption application was submitted and accepted by the MMO for a 500m$^3$ plough dredge in November 2016.

Gosport Marina
Maintenance dredging of the berths is undertaken on an as needed basis using back-hoe dredgers and disposing of material at Nab Tower. The current Marine Licence for ongoing maintenance dredging expires in 2024 with volumes licensed for removal of up to 91,000m$^3$ in total over the lifetime of the licence.

Haslar Marina
Maintenance dredging is undertaken on an as needed basis using backhoe dredgers with disposal at Nab Tower (or Hurst Fort during bad weather). The current Marine Licence for the removal of 111,000m$^3$ of material over a five year period runs from September 2016 to September 2021.

2.2 Maintenance Dredging Disposal Returns

Data on maintenance dredging disposal returns for material dredged within the study area was obtained through consultation with the MMO, Cefas, the DIO and by direct contact with the port and marina operators.

Records held by Cefas on behalf of the MMO (formerly Marine Fisheries Agency (MFA) and Marine Consents and Environment Unit (MCEU)) have been made available for the period 2006 to 2015 (2016 data was not available at the time of writing) to update this document. These records are not infallible, in that sometimes licence applications and renewals or variations can be double counted within the records provided. The annual returns for the disposal of the dredged material are summarised in Table 2.2 and 2.3. This data therefore represents the tonnage disposed of to sea as a result of maintenance dredging. The full data is reproduced in Appendix A.

Table 2.2 Total maintenance dredging disposal returns for HMNB Portsmouth (wet metric tonnes, wmt) for the Nab Tower disposal ground 2006 - 2015 (source Cefas)

<table>
<thead>
<tr>
<th>Year (campaign end date)</th>
<th>HMNB Portsmouth Licensed Disposal</th>
<th>Returns Data (wmt)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2006</td>
<td>No Maintenance Dredging Disposal</td>
<td>-</td>
</tr>
<tr>
<td>2007</td>
<td>Royal Boskalis Westminster Dredging Co Ltd</td>
<td>16,047</td>
</tr>
<tr>
<td>2008</td>
<td>Royal Boskalis Westminster Dredging Co Ltd</td>
<td>24,920</td>
</tr>
<tr>
<td>2009</td>
<td>Royal Boskalis Westminster Dredging Co Ltd</td>
<td>68,242</td>
</tr>
<tr>
<td>2010</td>
<td>No Maintenance Dredging Disposal</td>
<td>-</td>
</tr>
<tr>
<td>2011</td>
<td>No Maintenance Dredging Disposal</td>
<td>-</td>
</tr>
<tr>
<td>2012</td>
<td>Westminster Dredging Disposal</td>
<td>68,436</td>
</tr>
<tr>
<td>2013</td>
<td>Westminster Dredging Disposal</td>
<td>141,368</td>
</tr>
<tr>
<td>2014</td>
<td>Royal Boskalis Westminster Dredging Co Ltd</td>
<td>85,866</td>
</tr>
<tr>
<td>2015</td>
<td>Royal Boskalis Westminster Dredging Co Ltd</td>
<td>51,200</td>
</tr>
<tr>
<td>Total (10 years)</td>
<td></td>
<td><strong>456,079</strong></td>
</tr>
</tbody>
</table>
All dredge return material detailed above was taken to the Nab Tower disposal ground (disposal ground reference WI060).

The returns data over the past 10 years shows that dredging on behalf of QHM occurs on an as needed basis rather than through regular annual campaigns. The quantities removed varied considerably from zero in some years to over 141,000wmt in 2013 with no obvious trend in quantities removed.

Table 2.3 Maintenance dredging disposal returns for other operators within Portsmouth Harbour (wmt) for the Nab Tower disposal ground 2006 - 2015 (source Cefas)

<table>
<thead>
<tr>
<th>Year (campaign end date)</th>
<th>Other Operators Licensed Disposal</th>
<th>Returns Data (wmt)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2006</td>
<td>ML (UK) Ltd</td>
<td>6,240</td>
</tr>
<tr>
<td></td>
<td>Premier Marinas Ltd*</td>
<td>7,620</td>
</tr>
<tr>
<td></td>
<td><strong>Total (2006)</strong></td>
<td><strong>13,860</strong></td>
</tr>
<tr>
<td>2007</td>
<td>Premier Marinas Ltd*</td>
<td>7,809</td>
</tr>
<tr>
<td></td>
<td><strong>Total 2007</strong></td>
<td><strong>7,809</strong></td>
</tr>
<tr>
<td>2008</td>
<td><strong>No disposal returns</strong></td>
<td>-</td>
</tr>
<tr>
<td>2009</td>
<td>Premier Marinas Ltd*</td>
<td>7,051</td>
</tr>
<tr>
<td></td>
<td>Portsmouth Commercial Port</td>
<td>39,296</td>
</tr>
<tr>
<td></td>
<td><strong>Total 2009</strong></td>
<td><strong>46,347</strong></td>
</tr>
<tr>
<td>2010</td>
<td>Premier Marinas Limited*</td>
<td>6,097</td>
</tr>
<tr>
<td></td>
<td><strong>Total 2010</strong></td>
<td><strong>6,097</strong></td>
</tr>
<tr>
<td>2011</td>
<td>Gosport Ferry Limited</td>
<td>2,827</td>
</tr>
<tr>
<td></td>
<td>Premier Marinas Ltd*</td>
<td>5,850</td>
</tr>
<tr>
<td></td>
<td><strong>Total 2011</strong></td>
<td><strong>8,677</strong></td>
</tr>
<tr>
<td>2012</td>
<td>Premier Marinas Ltd*</td>
<td>6,996</td>
</tr>
<tr>
<td></td>
<td>Premier Marinas (Gosport) Limited</td>
<td>33,255</td>
</tr>
<tr>
<td></td>
<td><strong>Total 2012</strong></td>
<td><strong>40,251</strong></td>
</tr>
<tr>
<td>2013</td>
<td>RNSA (Portsmouth Branch Moorings)</td>
<td>5,132</td>
</tr>
<tr>
<td></td>
<td>Premier Marinas (Gosport) Limited</td>
<td>650</td>
</tr>
<tr>
<td></td>
<td>Premier Marinas Ltd*</td>
<td>5,655</td>
</tr>
<tr>
<td></td>
<td><strong>Total 2013</strong></td>
<td><strong>11,437</strong></td>
</tr>
<tr>
<td>Year (campaign end date)</td>
<td>Other Operators Licensed Disposal</td>
<td>Returns Data (wmt)</td>
</tr>
<tr>
<td>--------------------------</td>
<td>-----------------------------------</td>
<td>-------------------</td>
</tr>
<tr>
<td>2014</td>
<td>Premier Marinas Ltd*</td>
<td>6,806</td>
</tr>
<tr>
<td></td>
<td>Premier Marinas (Gosport) Limited</td>
<td>1,950</td>
</tr>
<tr>
<td></td>
<td><strong>Total 2014</strong></td>
<td><strong>8,756</strong></td>
</tr>
<tr>
<td>2015</td>
<td>Premier Marinas Ltd*</td>
<td>16,000</td>
</tr>
<tr>
<td></td>
<td><strong>Total 2015</strong></td>
<td><strong>16,000</strong></td>
</tr>
<tr>
<td>Total (10 years)</td>
<td></td>
<td><strong>159,234</strong></td>
</tr>
<tr>
<td>Annual Max</td>
<td></td>
<td><strong>46,347</strong></td>
</tr>
<tr>
<td>Annual Min</td>
<td></td>
<td>0</td>
</tr>
<tr>
<td>Average per year (total divided by 10 years)</td>
<td></td>
<td><strong>15,923</strong></td>
</tr>
</tbody>
</table>

*Returns provided by Premier Marinas Ltd may relate to either Port Solent Marina or Gosport Marina. Cefas data returns are not clear in this respect.

Maintenance dredging volumes for the other port, ferry and marina operators are comparatively small compared with the Naval Base. Material is removed as required rather than through regular annual campaigns. Given this, there is no particular trend in volumes removed over the past 10 years.

**Figure 2.3** shows the annual maintenance dredge returns, and five year rolling averages from 2006 to 2015 for all dredge returns (HMNB Portsmouth and other operators in Portsmouth Harbour). The highest combined annual return since 2006 was 152,805wmt in 2013. Since 2006 annual returns have varied between 6,000 and 152,805wmt per annum and the five year rolling average has varied between approximately 35,628 and 91,500 wmt.
2.3 Capital Dredging Returns

Capital dredging is usually undertaken to create a new Harbour, berth or waterway or deepen or widen an existing channel. Capital dredging is defined by the MMO as any dredging activity which is either in an area that has not been previously dredged or an area that has not been dredged within the past 10 years.

Given the historic and current maritime and military importance of Portsmouth Harbour, there is a long history of capital dredging within the area. Capital dredge returns between 2006 and 2015 are presented in Table 2.4.

Material removed during capital dredging projects has to date been disposed at the Nab Tower disposal ground. Dredge return data is only available for material that has been disposed to sea.

Table 2.4 Capital Dredging Returns (wmt) for Nab Tower disposal ground 2006 – 2015 (Cefas)

<table>
<thead>
<tr>
<th>Year</th>
<th>Quantity – HMNB Portsmouth (wmt)</th>
<th>Description</th>
<th>Quantity Others (wmt)</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>2006</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>2007</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>2008</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>2009</td>
<td>-</td>
<td></td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>2010</td>
<td>5,152</td>
<td>Portsmouth Naval Base Property Trust</td>
<td>20,039</td>
<td>Trafalgar Wharf</td>
</tr>
</tbody>
</table>
2.3.1 Recent capital dredging operations

HMNB Portsmouth Approach Channel Dredge

As already discussed in Section 2.1.3 in 2016/2017 HMNB Portsmouth undertook capital dredging works to deepen, widen and lengthen the approach channel into Portsmouth Harbour to accommodate the new QEC aircraft carrier. The location of the capital dredge is shown in Figure 2.2.

This capital dredge includes the removal of material from the approach channel, turning circle and Middle Slip Jetty (now renamed Princess Royal Jetty) where the vessel will be berthed. The total amount of material removed is estimated to be 6,203,150wmt of material over a 12 month period between August 2016 and July 2017. All of the material was licensed for disposal at sea to the Nab Tower disposal site. A proportion of the material (sand and gravel) is suitable for re-use and where possible was brought to land or placed at a temporary storage site for future dredging as aggregate. However, most of the material was disposed of at the Nab Tower disposal site. The specific returns data for this capital dredge is not included in the Table 2.4 as the information is not yet available.

2.4 Disposal Sites

There are three licensed marine dredging disposal sites in the Solent area:

- Nab Tower (Site Code W1060)
- Hurst Fort (Site Code W1080)
- Needles (Site code W1090)

Hurst Fort is at the western end of the Solent and restricted to maintenance dredging from Lymington and Yarmouth Harbours.
The Needles site is on the south side of the Isle of Wight. It is considered to be closed but is occasionally made available for small quantities of capital dredging from Lymington and Yarmouth.

Dredged arisings from the Solent harbours, including Portsmouth Harbour (from both maintenance and capital operations), are disposed of at the Nab Tower disposal ground. The Nab Tower is situated approximately 15km to the south-east of the eastern shoreline of the Isle of Wight (Figure 1.1). The water depth at the site, where the spring tidal range is approximately 4m, varies between 40m and 44m. It is a dispersive site and the main disposal area in the Solent. Since 1990, the Nab Tower has received all the capital dredge material for sea disposal arising from within the Solent (Cefas, 2001).

As discussed above, the Nab Tower site is used by a number of different port authorities, each with their own Baseline Document which could result in duplicated or conflicting assessments. The MOD agrees that the MMO is best placed to assess, monitor and manage the cumulative impacts of disposal through its oversight of the Marine Licensing process. The ecological impacts of disposal on designated sites are therefore not considered further within this Baseline Document.
3 DESIGNATED SITES

3.1 Overview

The purpose of this Baseline Document is to provide a tool for the assessment of impacts of maintenance dredging on the European and nationally designated sites (SPAs and SACs under the Habitats Directive and Regulations, Ramsar sites under the UN Convention on Internationally Important Wetlands, SSSIs under the Wildlife and Countryside Act 1981 and MCZs under the Marine and Coastal Access Act (MCAA) 2009) to provide a comprehensive tool for the assessment of maintenance dredging impacts as part of the marine licensing process.

The following sites, designated under national and international legislation, are potentially affected by maintenance dredging in Portsmouth Harbour:

- Portsmouth Harbour SPA and Ramsar site.
- Portsmouth Harbour SSSI.
- Fareham Creek rMCZ.

There is also a potential new SPA which underwent consultation by Defra between January and March 2016. As this site has gone forward for formal consultation it should now, as a matter of policy, be given consideration as though it were a fully designated site:

- Solent and Dorset Coast pSPA.

The Portsmouth Harbour coastal SPA and Ramsar site is underpinned by the Portsmouth Harbour SSSI which provides protection for the supporting habitat. If the SPA and Ramsar site is impacted then the SSSI could also be impacted and vice versa. The condition of the underpinning SSSI may be used to inform the condition of the SPA and Ramsar site.

3.2 Portsmouth Harbour SPA and Ramsar Site

In 1995, the Portsmouth Harbour SPA and Ramsar site was designated for extensive intertidal mudflats and sandflats with seagrass beds, areas of saltmarsh, shallow coastal waters, coastal lagoons and coastal grazing marsh. The site is one component of the Solent European Marine Site (EMS), a network of seven sites composed of SACs, SPAs and Ramsar sites in the Solent area. The Portsmouth Harbour SPA and Ramsar site share a common boundary and the features are almost identical, so for the purposes of this Baseline Document, the SPA and Ramsar site are considered to have the same functional baseline conditions, sensitivities to operations and impact assessments, and references to the SPA in Sections 3, 4 and 5 should be considered to also apply functionally to the Ramsar site.

Portsmouth Harbour is a natural harbour on the south coast of England. It is adjacent to Chichester and Langstone Harbours and together these form one of the most important sheltered intertidal sites in the south of England (Figure 1.1). The Portsmouth Harbour SPA covers 1,248.77 hectares (ha) and is characterised by extensive intertidal mudflats and sandflats with seagrass beds, areas of saltmarsh, shallow coastal waters, coastal lagoons and coastal grazing marsh.

One of the characteristic features of the site is the narrow tidal exit at the Solent; as a result of this, the site has a non-typical estuarine hydrological regime. Additionally, there is a relatively low freshwater input
to Portsmouth Harbour, the largest input being the River Wallington which flows into the north-west of the Harbour at Fareham Creek. The estuarine sediments support diverse populations of intertidal invertebrates, which provide an important food source for wintering birds (Natural England, 2015a).

There are approximately 67ha of seagrass beds in Portsmouth Harbour, which are predominantly located in the north-west of the site. These beds include both Zostera marina and Zostera noltii. The seagrass beds are amongst the most extensive in Britain and are an important food source for dark-bellied Brent goose. The Hampshire and Isle of Wight Wildlife Trust undertook surveys of the seagrass beds of Portsmouth Harbour in 2013. Their data shows the spatial distribution and status of the beds and are detailed in Appendix B. The Trust has published a more recent report (May 2014) which is an inventory of eelgrass beds in Hampshire and the Isle of Wight (Marsden AL, Chesworth JC, 2014). Portsmouth Harbour is referenced on a number of occasions in the document, however it does not mention the 2013 survey, or provide updated maps.

The saltmarsh areas are mainly comprised of cordgrass (Spartina) swards and provide feeding and roosting areas for overwintering birds. Areas outside the SPA contain important supporting habitats for the birds that use the site, including coastal grazing marsh and agricultural land.

The SPA was designated in 1995 to protect the following bird species:

- Black-tailed godwit, Limosa limosa.
- Dunlin, Calidris alpine.
- Red-breasted merganser, Mergus serrator.
- Dark-bellied Brent goose, Branta bernicla bernicla.

The site's conservation objectives apply to the SPA and the individual species and/or assemblage of species for which the site has been classified. A conservation objective is a statement describing the desired ecological/geological state (the quality) of a feature for which the site is designated. The conservation objective establishes whether the feature meets the desired state and should be maintained, or falls below it and should be recovered to favourable condition. Therefore ‘favourable condition’ is the overall aim and whether the feature requires ‘recovery to’ or to be ‘maintained in’, is the action needed to achieve the objective.

Protected sites in the UK use the term favourable condition to represent the desired state of their features. A ‘feature’ is one of the habitats, species or geodiversity interests that sites are intended to conserve.

The objectives are designed to ensure that, subject to natural change, the integrity of the site is maintained or restored as appropriate, and that the site contributes to achieving the aims of the Birds Directive. The Birds Directive (formally known as Council Directive 2009/147/EC on the conservation of wild birds) is a European Union directive adopted in 2009. The Directive aims to protect all European wild birds and the habitats of listed species, in particular through the designation of SPAs, by maintaining or restoring:

- The extent and distribution of the habitats of the qualifying features.
- The structure and function of the habitats of the qualifying features.
- The supporting processes on which the habitats of the qualifying features rely.
The conservation objectives apply under the Habitats Regulations, Habitats Directive and Birds Directive, and must be considered during a Habitats Regulations Assessment. The Habitats Regulations state that any plan or project not directly connected with or necessary to the management of the site but likely to have a significant effect thereon, either individually or in combination with other plans or projects, shall be to an assessment of its implications for the site in view of the site’s conservation objectives. In the event that dredging activities are not classified as a plan or project connected with the management of the site, this Baseline Document would act as a source of ecological information to inform the Habitats Regulations Assessment process.

The conservation objectives and accompanying supplementary advice provides a framework to inform the management and measures needed to conserve or restore the European site, and the prevention of deterioration and significant disturbance of the features of interest. An intrinsic part of this management process is defined in the Habitats Regulations where an assessment must be carried out by a competent authority for any plans or projects which are likely to have a significant effect on the conservation objectives of a European designated site.

Assessing site condition

Natural England has a statutory duty to report on the condition of designated SPAs, SACs, SSSIs and MCZs. Natural England undertakes condition monitoring of these designated sites on a six yearly cycle. This assessment cycle is undertaken as part of the six yearly programme of rolling assessments which will inform Natural England’s advice on marine licensing and contribute to Natural England’s statutory national level reporting against the site’s conservation objectives. The Portsmouth Harbour SPA has not been subject to a condition assessment by Natural England. However the SPA is underpinned by the Portsmouth Harbour SSSI units. Although the condition assessments of the SSSIs are not strictly for the European designated sites, they are considered to be relevant as the SSSIs underpin the Portsmouth Harbour SPA. Therefore, condition assessments of these units can assist in providing an assessment of the condition of the SPA.

SSSIs are divided up into management units so their requirements to reach a favourable status can be unit specific. For each of these units Natural England has assessed their condition according to a number of criteria and assigned them a term which best represents the unit in question. The terms are defined in Table 3.1. The SSSIs and their condition status are shown visually in Figure 3.1.
Environmental Designation data from Natural England 2016

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A full list of the SSSIs including details of their features of interest is included in Appendix C.

Table 3.1 Definition of SSSI condition assessment terms (Natural England, 2009)

<table>
<thead>
<tr>
<th>Term</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Favourable</td>
<td>Favourable condition means that the SSSI land is being adequately conserved and is meeting its ‘Conservation Objectives’; however, there is scope for the enhancement of these sites.</td>
</tr>
<tr>
<td>Unfavourable recovering</td>
<td>Unfavourable recovering condition is often known simply as ‘recovering’. SSSI units are not yet fully conserved but all the necessary management measures are in place. Provided that the recovery work is sustained, the SSSI will reach favourable condition in time.</td>
</tr>
<tr>
<td>Unfavourable no change</td>
<td>This means the special interest of the SSSI unit is not being conserved and will not reach favourable condition unless there are changes to the site management or external pressures. The longer the SSSI unit remains in this poor condition, the more difficult it will be, in general, to achieve recovery.</td>
</tr>
<tr>
<td>Unfavourable declining</td>
<td>This means that the special interest of the SSSI unit is not being conserved and will not reach favourable condition unless there are changes to site management or external pressures. The site condition is becoming progressively worse.</td>
</tr>
<tr>
<td>Part destroyed</td>
<td>Part destroyed means that lasting damage has occurred to part of the special conservation interest of a SSSI unit such that it has been irretrievably lost and will never recover. Conservation work may be needed on the residual interest of the land.</td>
</tr>
<tr>
<td>Destroyed</td>
<td>Destroyed means that lasting damage has occurred to all the special conservation interest of the SSSI unit such that it has been irretrievably lost. This land will never recover.</td>
</tr>
</tbody>
</table>

3.3 Solent and Dorset Coast pSPA

The Solent and Dorset Coast pSPA is a new potential SPA which has recently been put forward for formal consultation by Natural England to be designated as a new European site. The consultation was held between January and April 2016 and the results of the consultation are currently being analysed by Defra.

The site is proposed to protect important foraging areas for three species of tern which breed in coastal areas throughout the Solent and Dorset Coast. These species are abundant at a number of breeding colonies which are already designated as part of the existing network of coastal SPAs in the area (Table 3.2).

The Solent and Dorset Coast pSPA is being put forward to cover the marine area where these birds forage during the breeding season. The boundary was established as a composite of the usage of the area from evidence gathered on bird foraging ranges and supporting habitat. The site is approximately 255.2 km² (approximately 87,531 ha) and extends from the Isle of Purbeck in the west to Bognor Regis in the east, following the coastline on either side to the Isle of Wight and into Southampton Water (Natural England, 2016a).
Table 3.2 Summary of qualifying ornithological interest in Solent and Dorset Coast pSPA

<table>
<thead>
<tr>
<th>Species</th>
<th>Count (period)</th>
<th>% of GB breeding population</th>
<th>Stage of Selection Guidelines</th>
<th>Interest type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sandwich tern</td>
<td>441 pairs (882 breeding adults)</td>
<td>4.01%</td>
<td>1.1</td>
<td>Annex 1</td>
</tr>
<tr>
<td>Sterna sandvicensis</td>
<td>(2008 - 2014)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Common tern</td>
<td>492 pairs (984 breeding adults)</td>
<td>4.77%</td>
<td>1.1</td>
<td>Annex 1</td>
</tr>
<tr>
<td>Sterna hirundo</td>
<td>(2009 - 2014)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Little tern</td>
<td>63 pairs (126 breeding adults)</td>
<td>3.31%</td>
<td>1.1</td>
<td>Annex 1</td>
</tr>
<tr>
<td>Sternula albifrons</td>
<td>(2009 - 2014)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The seaward and alongshore extent of the Solent and Dorset Coast pSPA (Figure 1.1) is determined wholly by the modelled foraging distributions of Sandwich terns; from west to east by the distributions of birds originating from: Poole Harbour SPA, Solent and Southampton Water SPA (colony at Pitts-Deep-Hurst) and Chichester and Langstone Harbours SPA (Natural England, 2016a). The overlapping nature of these foraging ranges is also evident, meaning that some sea areas will be supporting birds of the same species from different SPAs. The boundaries to the areas predicted to support most of the foraging activity by little terns originating from colonies within the Solent and Southampton Water SPA, and Chichester & Langstone Harbours SPA (and Pagham Harbour SPA) are contained entirely within the composite boundary of the pSPA, as are the areas predicted to support most of the foraging activity by common terns originating from colonies within the Chichester & Langstone Harbours SPA, the Solent and Southampton Water SPA and Poole Harbour SPA (Natural England, 2016a).

3.4 Portsmouth Harbour SSSI

The Portsmouth Harbour SSSI was designated in 1992 under the Wildlife and Countryside Act 1981. The site was extended in 1992 to include intertidal areas omitted at the earlier notifications. These include Brick Kiln, Forton, Haslar and Tipner Lakes.

The SSSI includes two brackish lagoons adjoining Haslar Lake in the south-west of the Harbour. Brackish lagoons in which there is little rise or fall in water levels support a narrow range of species which are, however, highly specialist to lagoonal conditions. The fauna and flora of Little Anglesey Lake (= lagoon) is the most diverse known in lagoons in south-east England. Cockle Pond has a less diverse fauna but includes, in common with Little Anglesey Lake, populations of both the starlet sea anemone Nematostella vectensis and the lagoon sand shrimp Gammarus insensibilis, which are specially protected by Section 9(5) and Schedule 5 of the Wildlife and Countryside Act 1981 (Natural England, 1993).

The SSSI also includes a small area of terrestrial habitat extending along the southern side of Horsea Island, where chalk spoil dumped early in the 20th Century supports a rich chalk grassland flora invaded by hawthorn. Detail on this area has not been included within the baseline document as this part of the SSSI would not be potentially impacted by the maintenance dredging works.

Portsmouth Harbour SSSI units and their current condition (as at June 2017) are set out in Table 3.3 below. Please note that terrestrial and intertidal units within the SSSI that will not be affected by maintenance dredging have been removed from the table. The full condition assessment for the site is presented in Appendix D and represented visually in Figure 3.1.
Table 3.3 Portsmouth Harbour SSSI – Condition status

<table>
<thead>
<tr>
<th>Unit Number</th>
<th>Unit Name</th>
<th>Condition</th>
<th>Condition Threat Risk</th>
<th>Habitat</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Workhouse Lake</td>
<td>Unfavourable - No change</td>
<td>Medium</td>
<td>Littoral Sediment</td>
</tr>
<tr>
<td>4</td>
<td>Haslar Lake</td>
<td>Unfavourable – Recovering</td>
<td>High</td>
<td>Littoral Sediment</td>
</tr>
<tr>
<td>5</td>
<td>Forton Lake</td>
<td>Unfavourable – Recovering</td>
<td>High</td>
<td>Littoral Sediment</td>
</tr>
<tr>
<td>6</td>
<td>Priddys Hard</td>
<td>Unfavourable - No change</td>
<td>Medium</td>
<td>Littoral Sediment</td>
</tr>
<tr>
<td>7</td>
<td>Bedenham</td>
<td>Unfavourable – Recovering</td>
<td>Medium</td>
<td>Littoral Sediment</td>
</tr>
<tr>
<td>8</td>
<td>Frater</td>
<td>Unfavourable - No change</td>
<td>Medium</td>
<td>Littoral Sediment</td>
</tr>
<tr>
<td>9</td>
<td>Fleetlands</td>
<td>Unfavourable – Recovering</td>
<td>Medium</td>
<td>Littoral Sediment</td>
</tr>
<tr>
<td>10</td>
<td>Fareham Creek</td>
<td>Unfavourable – Recovering</td>
<td>Medium</td>
<td>Littoral Sediment</td>
</tr>
<tr>
<td>11</td>
<td>Cams Bay</td>
<td>Unfavourable – Recovering</td>
<td>High</td>
<td>Littoral Sediment</td>
</tr>
<tr>
<td>13</td>
<td>Vosper Thornycroft</td>
<td>Unfavourable - No change</td>
<td>High</td>
<td>Littoral Sediment</td>
</tr>
<tr>
<td>14</td>
<td>Port Solent To Horsea</td>
<td>Unfavourable – Recovering</td>
<td>Medium</td>
<td>Littoral Sediment</td>
</tr>
<tr>
<td>16</td>
<td>Tipner Lake</td>
<td>Unfavourable – Recovering</td>
<td>Medium</td>
<td>Littoral Sediment</td>
</tr>
<tr>
<td>18</td>
<td>Whale Island</td>
<td>Unfavourable – Recovering</td>
<td>Medium</td>
<td>Littoral Sediment</td>
</tr>
<tr>
<td>19</td>
<td>Haslar Marina</td>
<td>Destroyed</td>
<td>No assessment of Condition Threat undertaken</td>
<td>Littoral Sediment</td>
</tr>
<tr>
<td>20</td>
<td>Pewit Island</td>
<td>Unfavourable – Recovering</td>
<td>Medium</td>
<td>Supralittoral Sediment</td>
</tr>
<tr>
<td>21</td>
<td>Fareham Creek</td>
<td>Unfavourable – Recovering</td>
<td>Medium</td>
<td>Littoral Sediment</td>
</tr>
<tr>
<td>22</td>
<td>Horsea Lagoon</td>
<td>Unfavourable - No change</td>
<td>Medium</td>
<td>Inshore Sublittoral Sediment – CL</td>
</tr>
<tr>
<td>23</td>
<td>Portchester</td>
<td>Unfavourable – Recovering</td>
<td>Medium</td>
<td>Littoral Sediment</td>
</tr>
<tr>
<td>24</td>
<td>Bombketch Lake</td>
<td>Unfavourable – Recovering</td>
<td>Medium</td>
<td>Littoral Sediment</td>
</tr>
</tbody>
</table>
As can be seen in the table the intertidal units have been assessed as being in an ‘unfavourable recovering’ or ‘unfavourable no change’ condition, based on a number of key findings including:

- Poor water quality in particular dissolved oxygen and dissolved inorganic nitrogen (in particular resulting in the condition assessment of units 2, 6, 8 and 13 being downgraded in May 2017).
- Presence of pollution by way of assorted plastic and metal debris.
- Excessive macroalgal cover of the intertidal area and a resulting anoxic layer of sediments directly underneath.
- Evidence of bait digging on the foreshore.
- Recreational pressure.
- Historic levels of industrial contamination (including landfill).
- Changes in water level associated with sea level rise.

In response to these units being classified as ‘unfavourable’, Natural England has implemented or agreed a number of mechanisms to recover the condition of the units, hence the classification ‘unfavourable recovering’. The measures are as follows:

- The Solent Diffuse Water Pollution Plan (DWPP) has been implemented to address the dense algal mats across the Harbour by reducing diffuse pollution inputs (Natural England, 2010). Natural England is currently working to update the plan. Natural England has also been undertaking a project which follows the plan, called ‘Source to Sea’, to identify the sources of diffuse pollution into the Solent. This report is expected to be published the near future.
- A bait digging working group is being set up by the Southern Inshore Fisheries and Conservation Authority (IFCA) to look at mapping bait digging activity levels across the Harbour and determine and introduce appropriate management measures as required.
- Coastal squeeze has been assessed under the Shoreline Management Plan 2 and is offset for the first epoch (until 2030) by the habitat compensation created at the Medmerry managed realignment site.
- Recreational disturbance pressures to bird features are being addressed through the Solent Recreation Mitigation Strategy.
- High levels of historic contamination and potential impacts on water quality from previous uses including a bone works, refuse sites, sewage works, quarries and possibly a burial site are being investigated. Further investigation is required to determine the potential impact of any contamination on water quality in the Harbour and this is being examined in the Hamble to Portchester Coastal Strategy.
- Potentially high levels of contamination exist from the historic landfill at Paulsgrove. Further investigation is required to determine the potential impact of any contamination on water quality in the Harbour and this is being examined in the Portchester to Emsworth Coastal Strategy.

There is also a Site Improvement Plan (SIP) for the Solent and its associated European designated sites (Natural England, 2014). The plan provides a high level overview of the issues (both current and predicted) affecting the condition of the Natura 2000 features on the site(s) and outlines the priority
measures required to improve the condition of the features. It does not cover issues where remedial actions are already in place or ongoing management activities which are required for maintenance.

Natural England has identified a list of Operations Likely to Disturb (OLD) the interest features of the site (Natural England, 2016b). Those relevant to the scope of this document are as follows:

- Dumping, spreading or discharge of any materials (OLD Ref. No. 7);
- Modifications of the structure of watercourses, including their banks and beds, as by realignment, regrading or dredging (OLD Ref. No. 13b);
- The changing of water levels and tables and water utilisation (OLD Ref No. 14);
- Infilling of marshes (OLD Ref. No. 15);
- Reclaiming of land from estuary or marsh (OLD Ref. No. 17);
- Extraction of minerals, including sand and gravel (OLD Ref No. 20);
- Erection of permanent or temporary structures, or the undertaking of engineering works including drilling (OLD Ref. No. 23); and
- Modification of natural or man-made features (including cave entrances) and clearance of boulders, large stones, loose rocks or scree (OLD Ref. No. 24).

In order to protect the interest features of the site, activities listed under the OLD list will be assessed by Natural England prior to SSSI Consent (under s28E) or Assent (under s28H) being given.

3.5 Marine Conservation Zones

Marine Conservation Zones (MCZs) are in the process of being designated in English waters under the MCAA 2009. Their designation is intended to conserve marine animals, plants and their habitats, in addition to areas of geological importance. Designation of these sites has taken place in ‘tranches’ with the first sites designated in 2014 and a second round in 2016. It is expected that there will be a third round of consultation and site designation for the remaining sites in 2017/18.

Natural England has recommended that, where applicable, MCZs are included as part of the Baseline Document. The Baseline Document would then provide an assessment under both the Habitats Directive and the MCAA for impacts of maintenance dredging on European or nationally designated sites. This would avoid the need to undertake and submit a separate HRA and MCZ assessment for each licence application for maintenance dredging and act as a time and cost saving tool for the licence applicant.

3.5.1 Fareham Creek rMCZ

Fareham Creek has been recommended for consideration as an MCZ but as at June 2017 it is not likely to be put forward for consultation to designate. The site was recommended to provide protection to native oyster (*Ostrea edulis*) which has been recorded in the area, as well as the broad scale habitat, sheltered muddy gravels, which is known to support this species (Table 3.4).

The site covers Fareham Creek which is situated in the north-western tributary into Portsmouth Harbour (Figure 3.2). The banks of the estuary at Fareham are relatively undeveloped and have retained their natural communities of wooded banks and grassland. The rMCZ boundary overlaps with the Portsmouth
Harbour SSSI, SPA and Ramsar site but the recommended features are not included within any of the other designations.

The habitats of conservation importance that have been proposed as features within this site are the native oyster and the sheltered muddy gravels broad scale habitat. At the May 2017 Solent Forum Natural England advised that “Fareham Creek is not being considered in Tranche 3 however, due to a lack of evidence for the proposed features (apart from the native oyster, which has adequate representation within the Isle of Wight sites)”.

Table 3.4 Recommended features of the Fareham Creek rMCZ

<table>
<thead>
<tr>
<th>Feature</th>
<th>Conservation Objective</th>
</tr>
</thead>
<tbody>
<tr>
<td>Native Oyster (Ostrea edulis) beds</td>
<td>Maintain in favourable condition</td>
</tr>
<tr>
<td>Native Oyster (Ostrea edulis)</td>
<td>Maintain in favourable condition</td>
</tr>
<tr>
<td>Sheltered muddy gravels</td>
<td>Maintain in favourable condition</td>
</tr>
</tbody>
</table>
3.6 Sensitivity to Maintenance Dredging Activity

This section details activities specific to maintenance dredging that may have an impact on the designated features of sites in Portsmouth Harbour. It is important to reiterate that this Baseline Document provides a tool to assess the maintenance dredging operations in Portsmouth Harbour and not an assessment of the disposal of the maintenance dredging material.

The Regulation 35 advice provided by Natural England for the Portsmouth Harbour SPA sets out targets, broken down by feature, for achieving favourable status (Natural England, 2015a). These targets are detailed in the ‘Supplementary Advice’ section of the conservation advice package and the full list of targets is provided in Appendix E of this document. The Advice on Operations section of this advice identifies pressures associated with the most commonly occurring marine activities in the site, and provides a broad scale assessment of the sensitivity of the designated features of the site to these pressures (Natural England, 2015b).

Maintenance dredging is listed as an activity under the ‘Ports and Harbours (maintenance)’ operation as having the potential to impact on the designated features of the SPA through direct impacts such as abrasion and removal of habitat to indirect impacts including potential changes in hydrodynamics, suspended sediment concentrations and coastal processes. Full details of the features and their sensitivity can be found in Natural England’s Advice on Operations document on the Gov.uk website (Natural England, 2015b).

The intertidal sediment and intertidal and subtidal mud habitats of the Portsmouth Harbour area (including those designated as SSSI habitats) are identified as being sensitive to impacts associated with maintenance dredging. Specifically increases in suspended sediment and habitat structure changes through removal of substratum are highlighted as activities that may have significant effects on protected sites.

The sheltered muddy gravels within the Fareham Creek rMCZ are also considered sensitive habitats to these operations. The native oyster population in the Fareham Creek rMCZ is sensitive to suspended sediment loads, particularly to the risk of smothering and higher levels of suspended sediment affecting its ability to filter seawater.

The saltmarsh habitat, protected by both the SPA and SSSI designations, is identified as being sensitive to abrasion caused by higher concentrations of suspended sediment, non-native species invasion through disposal of dredged material and physical change to seabed types affecting sediment concentrations and distributions.

The next section of this document details the current baseline conditions of the site which will assist in quantifying and impacts that may be related to dredging or disposal of dredged material. Section 5 - Information For Assessment of Maintenance Dredging Impacts, includes information on the potential impacts of maintenance dredging at Portsmouth on the designated site features.
4 DESCRIPTION OF BASELINE CONDITIONS

This section details the existing environmental conditions within Portsmouth Harbour and the study area. It sets out the current conditions within the site along with any notable historical changes that have affected these conditions and, in particular, considers the potential extent of impacts of previous capital and maintenance dredging undertaken by the MoD, their agents or other operators.

4.1 Coastal Processes and Geomorphology

This section of the report summarises the baseline morphological conditions; coastal evolution and historical change; sediment budget (source, transport and storage of sediment) and likely future change. Whilst the main focus of this section is on the inner Harbour, a description of coastal processes on the open coast is also provided in order to present context and because maintenance dredging is carried out in the approaches to the Harbour.

The information in this section is drawn from the following documents and studies:

- North Solent Shoreline Management Plan (New Forest District Council, 2010)
- East Solent Shoreline Management Plan (HR Wallingford, 1997)
- The Solent Coastal Habitat Management Plan (Royal Haskoning, 2003); and
- SCOPAC Sediment Transport Study (2004).
- HMNB Portsmouth Approach Channel Dredge and Associated Works Environmental Statement (Royal HaskoningDHV, 2012).

4.1.1 Geomorphological context

Portsmouth Harbour is a tidal inlet lying adjacent to and west of Langstone and Chichester Harbours. It is characterised by a relatively narrow mouth constrained by Harbour defences and groynes. In addition to the Naval Base within the Harbour, there is a ferry terminal and commercial docks, all of which have been constructed on reclaimed land. The Harbour contains extensive saltmarshes and mudflats, and is connected to Langstone Harbour at high water by a small channel at its north-east corner.

The present Harbour area occupies the floodplain section of a previous northern tributary of the ancestral River Solent, represented today by the Wallington River. The Solent river valley and its tributaries were progressively submerged, in a sequence of marine transgressions between approximately 15-14,000 BP and 3,500-3,000 BP. Large quantities of sand and shingle, originally deposited as fluvial terraces, were reworked by wave action and tidal current transport. Some of this material was concentrated into one, or more, massive coarse clastic barrier beaches initially located several kilometres seaward of the modern coastline. This material has moved into the eastern Solent with subsequent, ongoing sea-level rise, confining extensive brackish and, later, freshwater wetlands.

Commencing in approximately 6,000 to 6,500 BP, a barrier breach (or possible tidal inlet) allowed initial tidal inundation of the original incised channel, introducing mostly fine sediments (probably transported from the East Solent) as initial infill. It is not known if this barrier breach was periodically resealed by shingle (gravel) transport, but it would have continued to migrate landwards, a process known as rollover.
During this stage the formation which the present Harbour has evolved from, either a shallow estuary or a confined lagoon (depending on barrier integrity), was created.

The rate of sea level rise reduced after approximately 5,500 to 5,000 BP. At around 3,000 BP sea-level remained static at ~-4.5m OD. During this stage, it is likely that Portsmouth Harbour was subject to simultaneous submergence and the accumulation of sediment. From 3,000 BP through to the present, the natural (i.e. pre-land claim and waterfront development) outline of the Harbour was attained with rising sea levels. The confined entrance to the Harbour is the result of spit growth sustained by convergent pathways of littoral sand and gravel transport along the adjacent open coastlines facing the Solent. An asymmetric, ebb-dominated hydraulic regime became established, with progressively greater dominance of tidal over wave processes.

4.1.2 Recent historic change

Historical changes to the Harbour shoreline have been dominated by two factors:

- anthropogenic change, such as land claim (reclamation) for farming, port development and construction of transport routes; and
- natural growth and dieback of the saltmarshes.

Land claim

Much of the shoreline of Portsmouth Harbour has been reclaimed over the past 130 years for port development, naval facilities and land fill sites (the Naval Base, ferry terminal and commercial docks are all on reclaimed land). Prior to that, most of the low lying land around the Harbour was drained and protected by flood banks for agriculture. Over the past 40 years this former agricultural land has been converted to residential, industrial or recreational use. In total, approximately 35% of the land area of Portsmouth Harbour (approximately 1,850ha since the early 16\textsuperscript{th} Century) has been reclaimed with the process continuing up to the present in response to various development pressures including the confinement of Portsea Island on urban growth (SCOPAC, 2004).

Reclamation for the Royal Navy predominantly occurred in the late 19\textsuperscript{th} Century with the development of the Dockyard, Whale Island and the torpedo test facility at Horsea Island. Smaller sites included part of Haslar Lake, the shipyard at Portchester and the upper reaches of several tidal creeks.

Between 1970 and 1973, almost 27% of the extant intertidal area was polderised and converted to a mix of manufacturing and infrastructure related land uses. Since the early 1980s most land claims have been connected with marina developments (e.g. Eastney and Haslar). Port Creek, connecting Langstone and Portsmouth Harbour has also been straightened and confined by marginal land claim (the north bank is now the M27/A27 embankment). Other works have included the M275 route into Portsmouth, several small sites up the Harbour arm to Fareham and, most recently, the major reclamation and land fill site at Port Solent north of Horsea Island. The extent of land reclamation in the Harbour is shown in Figure 4.1.

Some sites have been created, and others extended, through the use of landfill. Figure 4.1 shows areas of land reclamation within the Harbour. In the mid and late nineteenth centuries, dock excavation in Portsmouth Dockyard provided spoil used in the construction of artificial islands, e.g. Burrow and Horsea (SCOPAC, 2004).
Intensive military and commercial development of the margins of the southern Harbour has resulted in the construction of substantial coastal defence structures. The entrance to the Harbour is defined by the Haslar seawall on one side and by the various walls protecting Old Portsmouth on the other, some of which have been in place since the 15th Century. Low lying areas, originally reclaimed for farming, were developed for the post-war housing expansion, particularly in Hilsea, Tipner and Portchester. Original earth embankments were strengthened using a variety of materials, many of which have now come to the end of their useful life (HR Wallingford, 1997). Replacement schemes have been undertaken around Portchester and along sections of Haslar and Forton Lakes. Much of the higher ground on the Gosport frontage has been protected against erosion by low masonry, stone and timber walls. Residential, commercial, recreational and infrastructure development has extended to the edge of these walls resulting in an ongoing maintenance requirement.

Where development has been limited, the hard defence line is discontinuous. However, only two extensive areas of natural, transitional, coastline remain in Portsmouth Harbour. These are the MoD area of Fleetlands north of Gosport and the east shore of the upper reaches of Fareham Lake. Fleetlands rises gradually from saltmarshes, through coastal scrub to higher ground, while the shoreline of Fareham Lake rises steeply to the higher ground of Cams Hall.
4.1.3 Hydrodynamics

Portsmouth Harbour is a tidal inlet lying adjacent to and west of Langstone and Chichester Harbours. It is characterised by a relatively narrow mouth constrained by Harbour defences and groynes. In addition to the Naval Base within the Harbour, there is a ferry terminal and commercial docks, all of which have been constructed on reclaimed land. The Harbour contains extensive saltmarshes and mudflats, and is connected to Langstone Harbour at high water by a small channel at its north-east corner.

Tidal Processes

Portsmouth Harbour is considered to be an ebb dominant system at its mouth but is a weak sink for both fine and coarse sediment within the Harbour. The wider geomorphological unit that incorporates the Harbour is the Solent. The wave climate and tidal regime that characterises the Solent is complex by comparison to other areas of the UK, due to the influence of the Isle of Wight and the constricted Harbour entrances. The tides are particularly complex, with a rapidly changing tidal range, extended high waters and complex patterns of tidal flow, including strong ebb and flood currents through the Harbour entrance channels and around the major headlands (Royal HaskoningDHV, 2012).
The tidal currents in the East Solent were modelled by ABPmer as part of the EIA for the QEC capital dredge project. They showed that on typical spring flood and ebb tides, the highest depth averaged current velocities are located in the entrances to Portsmouth and Langstone Harbours, with maximum current velocities of up to 2.25m/s through Langstone Harbour entrance and over 1.25m/s through Portsmouth Harbour entrance. However, most of the East Solent is characterised by tidal current velocities less than 0.5m/s. Maximum near-bed currents through Portsmouth Harbour entrance were estimated around 1.2m/s. (ABPmer, 2008).

At the mouth of Portsmouth Harbour, the mean ebb current is of a shorter duration but greater velocity than the flood current. The longer duration of the flood tide results in potential for the transport of fine-grained suspended sediments into the Harbour. The deposition is assisted by the tidal stand at high water and the presence of intertidal flora which serves to attenuate wave action and assist accretion. The tidal regime produces a double high water within the Solent, resulting in a corresponding long stand of high water within Portsmouth Harbour (ABPmer, 2008).

An earlier study for the East Solent Shoreline Management Plan undertook modelling for the Pagham to River Hamble Strategy (HR Wallingford, 1995a, b) which used the TELEMAC 2D depth averaged tidal flow model to analyse tidal currents and water levels. The model simulated spring and neap tide flows, plus storm surge conditions, for the existing sea levels and for a projected 260mm sea level rise over 20 years.

The model showed that:

- ebb currents (westward) are generally stronger than flood (eastward);
- the strongest currents are found off East Beach, Selsey Bill, Gilkicker Point and within the Harbour entrance channels along this section of coast; and
- residual currents can be an important component of the transport regime in the Harbour entrances, where they give rise to ebb tide deltas.

The coastal areas in Portsmouth Harbour show a flood risk level between very low to high (that is that within a year there is between 0.01% - 3.3% chance of coastal flooding) (Environment Agency, 2016). The risk of flooding from rivers and sea is lower on the eastern side of the Harbour with only a low risk of flooding shown within the dockyard port. The annual extreme water levels for Portsmouth, as published by the Environment Agency (2011) are 2.56m OD (1 in 1 year) with the 1 in 100 year flood event being 3.05m OD (base data for year 2008 but still the most up to date data available).

Wave Processes

Complex bathymetry due to the Langstone Harbour tidal delta results in wave refraction, wave/tidal current interaction and wave shoaling that set up complexities in open coast littoral sediment transport across the eastern sector of Portsea Island (HR Wallingford, 1997). Wave attenuation is also set up by Hamilton and Dean Sands, and other smaller sediment banks. These banks may be either:

- Elements of a formerly more extensive ebb tidal delta beyond the Portsmouth Harbour entrance; or
- Palaeo shoals and/or relict barrier structures (i.e. formed under geologically earlier marine conditions).
Mudflats and low to mid-level saltmarsh help dissipate the remaining wave energy within Portsmouth Harbour; although marsh erosion and retreat has reduced their effectiveness over the past few decades. The Haslar and Camber spits, previously constructed by longshore drift, provide substantial protection from waves to the estuarine environment of the Harbour.

4.1.4 Sediment supply

Littoral supply

The wider coastline in the vicinity of Portsmouth Harbour varies in character from eroding cliffs, shingle banks and heavily defended headlands on the open coast to saltmarshes, flood embankments and deep water jetties within other natural harbours along the Solent area (HR Wallingford, 1997).

With the widespread introduction of coastal protection over the past 100 years, erosion no longer supplies much additional sediment to the coast and groynes interrupt many transport pathways. Furthermore, dredging for navigation (including the entrance to Portsmouth Harbour) and aggregates (especially Horse and Dean Sands for Portsmouth Harbour reclamations) has removed large quantities of sediment from the system. Littoral sediment sources within this system are therefore depleted and most of the coarser sediment is being re-worked (SCOPAC, 2004). Further sources are limited, although there are still some sources along the coast local to Portsmouth, described below.

Erosion of the soft cliffs and nearshore seabed of the open coast around the drift divide at Solent Breezes provides shingle and sand to the sediment budget. Cliff erosion rates reduce to the south-east and shingle accretion occurs updrift of Hill Head Harbour (at the mouth of the River Meon, north-west of Lee on Solent). Erosion begins again at Hill Head, but shoreline protection in the form of groynes and seawalls maintain the high water line as far as the south end of Lee-on-the-Solent. Onshore migrating shingle bars are believed to feed the beach south of Hill Head. Drift continues southwards, feeding the shingle forelands at Browndown and along Stokes Bay. Shingle tends to accumulate around the River Alver outfall, causing maintenance problems. Some bed load drift passes Gilkicker Point and encounters the (dominantly) ebb tidal processes of the Portsmouth Harbour entrance channel; the volume is not fully quantified, although it is considered to be low. Similarly, the input of suspended sediment through the Harbour entrance is an important contribution to the Harbour sediment budget, but has not been adequately quantified (SCOPAC, 2004).

Fluvial input

Since sea level rise slowed approximately 5,000 years BP, Portsmouth Harbour has received little fresh water inflow and the input of fluvial sediment has been insignificant. The only significant fluvial input into Portsmouth Harbour is the Wallington River with a mean flow of 0.63m³/s (based on National River Flow Archive (NRFA) data between 1951 and 2015) and peak flows ranging from 3.84m³/s to 49.92m³/s (based on NRFA data between 1976 and 2014) (NRFA, 2001) (NRFA, 2016) Sediment input from this source is considered to be negligible, but has not been tested by field measurements (SCOPAC, 2004).

Local sources of sediment due to coastal erosion

As the geology of the Harbour area is predominantly “easily erodible”, then any change to hydrodynamic conditions has the potential to affect the shoreline, causing either erosion or the development of beaches, spits, intertidal flats or saltmarshes (SCOPAC, 2004).

The position of the Mean High Water Mark was plotted between 1870 and 1965 using successive Ordnance Survey maps and concluded that the Harbour shape had changed very little since the 16th
Century, except in areas of land claim and oyster bed construction (Hooke and Riley, 1987). Furthermore, only 10% of the total Harbour shoreline was classified as eroding in the East Solent SMP (HR Wallingford, 1997). This is probably due to a lack of penetration by waves operating on the adjacent open coasts, together with limited fetch lengths for internal wave generation due to the historical extent of Spartina sp. marshes; which have limited the potential for erosion of both the seabed and cliff sediments. However, fetch lengths are now increasing as marshes retreat with the rapid dieback of Spartina sp. marshes. The reasons for Spartina dieback is still not fully understood however widespread land reclamation and the construction of hard defences leading to coastal squeeze are thought to be contributing factors (Royal HaskoningDHV, 2003). In line with this, shoreline wave energy is also likely to be increasing, creating a feedback link between erosion, the re-suspension of sediments and, in some areas, the expansion of the lower intertidal/subtidal within the Harbour.

A small outcrop of London Clay is subject to erosion at Hardway, Gosport providing a small input of fine sediments. Superficial (drift) sediments overlying Eocene and Chalk substrates may also be temporarily exposed within creek channels, thus contributing a small additional input of predominantly coarse sediment.

4.1.5 Sediment transport

The dominant processes below low water and out to the deep channels of the Solent are tidal currents. Net transport rates in the deep channels are low and generally run south-eastwards out of the Solent (SCOPAC, 2004).

The SCOPAC sediment transport study showed that nearshore sediment transport from the River Hamble to Portsmouth is dominated by south-westerly waves, causing south-easterly drift, except for the frontage north of Solent Breezes where north-westerly drift has given rise to Hook Spit. From the Portsmouth Harbour entrance channel to Selsey Bill there is believed to be a net movement of sediment south-eastwards in the broad nearshore zone, driven by the dominant ebb tidal flows; this general pattern is complicated by the channels and ebb tide deltas of the south coast harbours, and by onshore transport driven by wave action. To the west of Portsmouth Harbour (south and east of Selsey Bill) the net transport direction is south-westwards for suspended load.

Sediment is transported into Portsmouth Harbour from the Eastern Solent. The narrow Harbour entrance restricts the penetration of waves, but increases the velocity of tidal currents, which become the most important transport mechanism. The mean ebb current is of shorter duration but of significantly greater velocity than the flood current. Maximum spring tide flood velocities are 0.95m/s and ebb velocities 2.04m/s. For coarse sands and gravels, the net bedload transport is dominantly seaward at the Harbour entrance, forming extensive part-submerged coarse sand and gravel delta deposits immediately offshore. Sand and shingle carried towards the entrance to Portsmouth from east of Gilkicker Point is, therefore, flushed back by the strong ebb flows feeding the sediment sinks at Spit Sands and Horse and Dean Sands.

The strong tidal flow at Portsmouth Harbour entrance is not by-passed by bedload transport. Hence, the open coast of central-western Portsea Island is a discrete sediment budget sub-cell. The input of coarse sediment into the Harbour is only possible when spring flood tides coincide with southerly storms, however, a combination of tidal and wave driven currents transport this size range of material too far into the harbours for their re-entrainment by the ebb tidal stream (HR Wallingford, 1984). Although this process has not been studied in detail, it may explain the flood banks of relatively coarse material which exist immediately up-estuary from the entrance channels of all three harbours (Portsmouth, Langstone...
...and Chichester). They may represent a periodic "pulsed" input, with some limited potential for progressive accretion.

The longer duration of the flood tidal stream results in the potential for the net transport of suspended sediments into the harbours. Suspended sediments can reach the innermost parts of the estuary. Deposition is assisted by a tidal stand at high water and the presence of intertidal flora (suppressing wave action and assisting accretion).

As the navigation channels have been progressively deepened, both ebb and flood tidal current velocities have increased by small amounts. (Universities of Newcastle and Portsmouth, 2000).

4.1.6 Sediment storage

Portsmouth Harbour

Sediment types in Portsmouth Harbour range from sand and gravel in the navigation channels, to silt and clay further landward. This sediment distribution pattern is explained by varying peak tidal velocities with coarser sediments found at the Harbour entrance as a consequence of increased tidal current velocity. The principal sediment inputs to Portsmouth Harbour are derived from marine and fluvial sources and by coastal erosion. Generally sediment from the mouth of Portsmouth Harbour is flushed out by the dominant ebb tide and the area outside of the Harbour entrance is made up of sand and gravel. Despite net bedload transport of coarse sands and gravels being predominantly seawards, as a result of this ebb dominance, the input of coarse sediment can occur when spring flood tides coincide with southerly storms allowing the sediment to be transported into the Harbour system by tidal and wave processes (Royal HaskoningDHV, 2012).

In general terms, Portsmouth Harbour may be regarded as a virtual sediment sink, where the rate of sedimentation has kept pace with post mid to late Holocene sea-level rise (HR Wallingford, 1997). Within Portsmouth Harbour the principal inputs of sediment to the system are; marine sources from littoral flow, both west and east directions, which converge at the Harbour entrance, and, fluvial sources, currently unquantified, with the Wallington River thought to provide significant input. Coastal erosion also provides some sediment input but given that over 70% of the shoreline around the Harbour comprises reclaimed land this is a less significant amount than marine and fluvial inputs.

The principle outputs of sediment are; tidal currents where sands and coarse materials are transported offshore by the dominant ebb flow, land claim, where loss of land as a result of reclamation leads to a reduction in mobile sediments within the system, and the history of dredging activity within the Harbour (ABPmer, 2008).

Sediment stores within the Harbour include; beaches of gravel and sand around parts of the Harbour seawards of Portchester Castle, sand banks and mudflats. Mudflats are located in areas of low flow that allow fine sediment to settle and are found in Stamshaw and Tipner Lakes (ABPmer, 2008). Although the net trend is for retention of fine sediments, there is a net loss of coarse sands and gravels at the Harbour entrance (HR Wallingford, 1997).

Substantial parts of the East Solent harbours became colonised by the saltmarsh plant *Spartina anglica*, particularly in the first decade of the 20th Century (having been first planted in Southampton Water around 1860) (Allen and Gardiner, 2000). The swards of grass interrupt water flow and act to suppress wave energy, and hence increase sedimentation. Large areas of high level *Spartina sp.* marsh have accreted up to 1.5m above the level of the adjacent mudflats. However, since the early 1950s dieback of *S. anglica*...
has occurred. This has changed from a slow process initially, accelerating after the mid-1960s. With the death of the binding flora, the high level marsh is susceptible to erosion at its edges, forming receding marsh cliffs up to 2m high in some areas (Allen and Gardiner, 2000). The saltmarsh is also subject to fragmentation through this dieback process, leading to a reduction in sward width.

Land claim (shown in Figure 4.1) effectively impounds large volumes of previously potentially mobile harbour sediment. Although the SCOPAC research records major areas and dates of land claim, few precise details of the volume and character of sediments are known. Land claim alters harbour sediment budgets as the tidal prism is reduced, tidal currents diminish and sedimentation is stimulated. This effect was theoretically calculated for Portsmouth Harbour by Hydraulics Research (1959) using a physical model. The potential impact of two proposed major reclamations were investigated at several points in the major tidal channel, and it was concluded that ebb and flood currents could be reduced by up to 25% (as a result of those proposals).

**Sediment sinks outside of the Harbour**

The open coastline of Portsea Island is largely formed by a substantial shingle bank, the eastern part of which has a history of stability or accretion. The major area of recent accretion is to the east, between Fort Cumberland and the outfall at Eastney Point. To the west there is some long term foreshore steepening around Southsea Castle, where a variety of defences have been built to stabilise the High Water line. Beyond these walls and groynes is a further area of shingle beach leading up to Clarence Pier which acts as a large groyne. From Clarence Pier to Old Portsmouth the High Water line is defined by sea walls and fortifications, some dating back to the 15th Century. Little change of the foreshore is recorded for this frontage (HR Wallingford, 1995).

Offshore of Portsea Island is the Horse and Dean Sands, which has been heavily dredged in the past to provide fill and aggregate for reclamation and construction works in Portsmouth Harbour. This area is a sink for sediment transport along the shoreline, and dredging has had little apparent impact on the shoreline.

The flushing of sand and gravel sediments seawards from the Harbour entrance has also created sediment sinks at Hamilton Bank and Spit Sands (Lonsdale, 1969; Harlow, 1980; HR Wallingford, 1995).

**4.1.7 Summary of morphological characteristics**

Owing to its constricted entrance, Portsmouth Harbour is virtually a landlocked tidal basin. It is characterised by a near symmetrical distribution of major creeks (and tributaries), although a linear channel connects the north-eastern extremity of the Harbour with Langstone Harbour.

Numerical modelling predictions together with Expert Geomorphological Assessment (EGA) were used to assess morphological change within the Harbour as a result of the Portsmouth approach channel capital dredge project in 2012. This method involves interrogating a range of data and applying expert judgement to evaluate how the hydrodynamic and sedimentary regimes function and determine how any changes to these regimes may affect geomorphology and sediment distribution.

A dominant ebb tidal flow has created a tidal delta, seawards of the entrance, but much of this has been removed over the past two centuries by dredging for navigation and ballast. As a result of lesser flows on the flood tide, the flood delta is close to the Harbour mouth, but is routinely dredged. Most coarse sediment introduced into the Harbour by the flood tide has a short residence time, but fine (suspended) material is transported further into the Harbour. Some of this adds to mudflat and marsh sediments, whilst a proportion is removed by ebb tide currents. On balance, there is a net gain of fine material and the
Harbour functions as a sink for clay, silt and fine sand, with the main input of coarser material being flushed seaward as bedload to accumulate in the ebb tidal delta.

As a result of this tidal asymmetry, there is a net seaward transport (output) of coarse materials (as bedload) and a net shoreward transport (input) of fine materials (suspended load) within the Harbour. Overall, a relatively small quantity of material is transported through the entrance channels, thus the Harbour is relatively stable, with a small but cumulative gain of suspended sediment. However, there is considerable internal re-circulation of sediment, accentuated by the remobilisation of fine-grained materials due to Spartina sp. dieback and the ephemeral and dynamic nature of such environments over the longer term (SCOPAC, 2004).

4.1.8 Portsmouth Harbour sediment budget, maintenance dredging and the recent capital dredging scheme

The effect of dredging on the overall Harbour sediment budget was discussed in detail as part of the Portsmouth Approaches and Harbour Deepening: Scheme Assessment Report (ABPmer, 2008). The assessment report suggested that there appears to be a balance between the net supply of sediment into Portsmouth Harbour, the removal of maintenance dredge material from berths throughout the Harbour and the supply of sediment to intertidal areas.

Whilst accepting that the complex nature of the sediment budget of Portsmouth Harbour and the lack of available data did not allow for quantitative measurement of the baseline sediment budget the ABPmer report set out the qualitative understanding of the budget and also provided an argument for the apparent balance in net supply and removal.

Modelling outputs within the ABPmer report showed sediment fluxes during the spring-neap cycle that indicated a net influx of sediment into the Harbour, confirming that prior to the capital dredge undertaken in 2016/2017 the system had the capacity to import sediment. For individual tides the report also showed that the peak sediment loads into the Harbour occur at HW and the peak sediment loads out of the port occur at LW. The impact of the capital dredge scheme was also presented and the modelling output predicted a stabilised import in sediment load during the latter part of the simulation.

Based on the baseline trend in sediment these rates were then extrapolated to provide an estimate of the annual sediment rate which suggests a net import in excess of 47,000 dry tonnes. This value is similar to the long-term mean total maintenance dredging (30,500 dry tonnes), (Royal Haskoning, 2006) which provide an indication of the amount of sediment removed from the Harbour. Since the amount of sediment imported is similar to the amount of sediment removed, this suggests that there is surplus sediment available to supply intertidal areas to help the system keep pace with sea level rise. After introducing the scheme, it is predicted that the flux of sediment into the Harbour will be reduced by 800 tonnes per year, representing 1.7% of the net annual supply. This reduction in supply results mainly from the predicted net increase in siltation within depositional areas seaward of the entrance.

There would appear to be a balance between the net supply of sediment into Portsmouth Harbour, the removal of maintenance dredge material from berths throughout the Harbour and the supply of sediment to intertidal areas, as required to keep pace with sea level rise. Due to the negligible reduction in suspended sediment concentrations within the Harbour, there is unlikely to be any significant impact on sediment supply to fine sediment intertidal areas as a result of the capital dredge that occurred in 2016/2017.
4.1.9 Future change

Future patterns of sediment transport cannot be predicted with any certainty as they will depend on a number of factors, including management operations and changes in the wave climate, tidal regime and water levels. However, we can provide some commentary on possible changes, assuming that current operations remain constant.

Best estimates can be made based on recent trends in wave climates which, in general, are becoming more energetic and shifting clockwise in direction (HR Wallingford, 1995). These wave climate changes suggest that the high north-easterly drift to the east of Selsey will increase, while the much lower north-westerly drift west of Selsey will decrease still further and may even reverse in direction. The low net drift westward from Eastoke may also decrease, causing further complexity in this area of annual variations.

It is generally accepted that present rates of sea level rise (SLR) are likely to increase. Between 1901 and 2010, global mean sea level (GMSL) rose by 0.19m and has risen at an average rate of 3.3mm/year from 1993 to present, with 2015 having the highest average GMSL on record at 70mm greater than the 1993 average (Merrifield et al., 2015). GMSL is projected to rise by between 0.26 and 0.82m by 2100 (IPCC, 2013) with predicted future rates of GMSL rise of 8mm to 16mm/year between 2081 and 2100 (IPCC, 2014). The rate of SLR around the UK between 1961 and 2003 was approximately 1.8mm per year with predictions for the period between 1990 and 2095 ranging between 0.12m and 0.76m (Murphy et al, 2009). Table 4.1 presents both the global and UK predicted SLR predictions.

<table>
<thead>
<tr>
<th>Time period</th>
<th>Global</th>
<th>Time period</th>
<th>UK</th>
</tr>
</thead>
<tbody>
<tr>
<td>SLR between 1901-2010</td>
<td>+0.19m</td>
<td>SLR between 1901-2010</td>
<td>Not given</td>
</tr>
<tr>
<td>Rate of SLR 1993-2015</td>
<td>+3.3mm/year</td>
<td>Rate of SLR 1961-2003</td>
<td>+1.8mm/year</td>
</tr>
<tr>
<td>SLR between 2013-2100</td>
<td>+0.26-0.82m</td>
<td>SLR between 1990-2095</td>
<td>+0.12-0.76m (-/+0.1m for vertical land movement)</td>
</tr>
<tr>
<td>Rate of SLR 2081-2100</td>
<td>+8-16mm/year</td>
<td>Rate of SLR 2081-2100</td>
<td>Not given</td>
</tr>
</tbody>
</table>

Although long term predictions are not consistent, it is likely that storm frequency and offshore wave heights will increase. Changes in wave directions, even by small amounts will lead to changes in the sediment budget. Decreasing potential drift due to more shore normal waves will lead to reduced erosion; conversely, increasing potential drift will lead to increased erosion. As many areas of the frontage of the open coast have very low net drift rates due to their orientation with the dominant wave direction, then a shift in offshore wave direction may cause a reversal in drift.

The high current velocities exiting Portsmouth Harbour on the ebb tide will still, probably, tend to move sediment seaward, irrespective of the direction of coastal drift to the mouth and such changes in wave energy. The most significant consequence for the Harbour is likely to relate to wave penetration into the Harbour mouth, with respect to both duration and height, and this may lead to morphological change in this location.

As stated above, land claim has also had a significant negative impact on habitat integrity in the past, but current planning policies place severe constraints on any further significant losses (SCOPAC, 2004). This is likely therefore to be a less significant agent for change into the future.
Existing hard defences around the shoreline of Portsmouth Harbour reduce its capacity for morphological response to change. Under rising sea levels, erosion of mudflats and saltmarsh (due to coastal squeeze) will continue to occur at existing levels and potentially accelerate in line with sea level rise. This could be exacerbated by climatic changes, potentially increasing hydroperiods (the period of inundation) and both wave and tidal energy. Wave erosion has been a major factor in the acceleration of marsh edge retreat in all lower marsh areas dominated by moribund *S. anglica* in Portsmouth Harbour. Erosion is promoted by the reduced stability of the muddy substrate as roots and stems lose their ability to accrete new sediment and wave disturbance is increased. If areas of elevated *Spartina* sp. marsh are reduced, so fetch lengths within the Harbour will continue to enlarge, allowing larger waves to be generated by local winds.

In these circumstances, tidal currents would contribute to the transport of increased suspended sediment loads; increasing turbidity and potentially affecting Harbour ecology (for example, by reducing timespans for photosynthesis for intertidal vegetation).

Loss of *S. anglica* reduces its role as a wave energy “baffle” providing some protection to rearward defences. It could result in increased wave reflection from defences back to the adjoining marsh, helping to suppress sedimentation and further promote coastal squeeze.

Long-term predictions for habitat change within Portsmouth Harbour have been made in the Solent Coastal Habitat Management Plan (Royal Haskoning, 2003). The predicted changes to the extent of intertidal habitats in Portsmouth Harbour are presented in Table 4.2.

<table>
<thead>
<tr>
<th>Habitat</th>
<th>Area (ha); best estimate of existing area in 2001</th>
<th>Estimated loss or gain in habitat (ha) by 2101</th>
</tr>
</thead>
<tbody>
<tr>
<td>Saltmarsh</td>
<td>53</td>
<td>-50</td>
</tr>
<tr>
<td>Intertidal mud/sand flats</td>
<td>926</td>
<td>-48</td>
</tr>
<tr>
<td>Lagoon</td>
<td>6</td>
<td>No change</td>
</tr>
<tr>
<td>Vegetated shingle</td>
<td>8</td>
<td>+1</td>
</tr>
<tr>
<td>Intertidal (total saltmarsh and intertidal flats)</td>
<td>979</td>
<td>-98</td>
</tr>
</tbody>
</table>

It is estimated that by 2102 approximately 10% of the existing intertidal habitat of the Harbour will be lost, with most of the saltmarsh changing to intertidal mud/sandflats. However, it also predicted that intertidal areas will be impacted, converting to subtidal and, hence, a process of parallel retreat could occur. Table 4.1 presents the sea level rise prediction data across the UK until 2095.

### 4.2 Sediment Quality

#### 4.2.1 Overview

This section describes the chemical and physical characteristics of sediments within Portsmouth Harbour. Any Marine Licence application received by the MMO that includes a requirement to dredge and dispose of sediments offshore requires recent sediment sample analysis representative of the area to be dredged. The sediments are therefore analysed to assess the physical nature and degree of any chemical contamination present. Historically the sediment analysis has been undertaken by the MMO’s scientific advisor Cefas (The Centre for Environment, Fisheries and Aquaculture Science). To inform this Baseline
Document, data on sediment quality within the Portsmouth Harbour have been obtained from Cefas. Sediment analysis is undertaken for the following chemical and physical parameters:

- Heavy metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel and zinc).
- Organotins (tributyl tin (TBT) and dibutyl tin (DBT)).
- Total petroleum hydrocarbons (TPH).
- Polycyclic aromatic hydrocarbons (PAHs).
- Polychlorinated biphenyls (PCBs) including 25 congeners.
- Particle size.

### 4.2.2 Guidelines

To inform decisions regarding suitability of material for disposal at sea, results are compared with the Cefas Action Levels (AL) developed under the FEPA 1985 licensing process for disposal of dredged material (Table 4.3). ALs are not statutory contamination concentrations, but are used as part of a ‘weight of evidence’ approach in decision making. These values are therefore used in conjunction with a range of other assessment methodologies (e.g. comparison with historic data, knowledge of site environmental conditions, physical characteristics of disposal material, bioassays etc.). ALs are therefore not single pass or fail criteria.

In general, contamination levels in dredged material that are below AL1 are unlikely to exclude the material for disposal to sea. In contrast, contamination levels above AL2 are considered unsuitable for disposal at sea, and as a result alternative options for disposal will need to be considered. Contamination levels between AL1 and AL2, depending on the magnitude of exceedance, could require further consideration and testing before a decision can be made.

For an explanation of how the AL values were established, refer to: High Level Review of Current UK Action Level Guidance MMO Project No: 1053, December 2015.

**Table 4.3 Cefas guideline Action Levels (ALs) for dredged material (Cefas, 2005)**

<table>
<thead>
<tr>
<th>Contaminant/compound</th>
<th>AL1 mg/kg dry weight (ppm)</th>
<th>AL2 mg/kg dry weight (ppm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arsenic</td>
<td>20</td>
<td>100</td>
</tr>
<tr>
<td>Mercury</td>
<td>0.3</td>
<td>3</td>
</tr>
<tr>
<td>Cadmium</td>
<td>0.4</td>
<td>5</td>
</tr>
<tr>
<td>Chromium</td>
<td>40</td>
<td>400</td>
</tr>
<tr>
<td>Copper</td>
<td>40</td>
<td>400</td>
</tr>
<tr>
<td>Nickel</td>
<td>20</td>
<td>200</td>
</tr>
<tr>
<td>Lead</td>
<td>50</td>
<td>500</td>
</tr>
<tr>
<td>Zinc</td>
<td>130</td>
<td>800</td>
</tr>
<tr>
<td>Organotins; TBT, DBT, MBT</td>
<td>0.1</td>
<td>1</td>
</tr>
<tr>
<td>PCB's, sum of ICES 7</td>
<td>0.01</td>
<td>None</td>
</tr>
<tr>
<td>PCB's, sum of 25 congeners</td>
<td>0.02</td>
<td>0.2</td>
</tr>
<tr>
<td>PAHs*</td>
<td>0.1</td>
<td>None</td>
</tr>
</tbody>
</table>

* An exception to this is Dibenz[ah]anthracene with an AL1 of 0.01
4.2.3 Baseline conditions

The contaminant levels in the sediments of Portsmouth Harbour used to inform this section, have been gathered from two data sets (2005-2010 and 2012-2016), both obtained from Cefas (see Appendix F). A summary of the data in relation to Cefas ALs is provided below.

Heavy metals

The 2005-2010 data indicates that the average concentrations of heavy metals at all of the dredged locations in Portsmouth Harbour are below AL2. In the 2012 to 2016 data, the results indicate that all of the average concentrations are below AL2 with isolated individual results in excess of AL2.

Organotins (TBT/DBT)

The average recorded concentrations of organotins were below AL1 in all areas surveyed between 2005 and 2010 and also between 2012 and 2016, with isolated samples showing levels in excess of AL1 and no records showed an increase above AL2. Previously TBT levels in the Tidal Basin area had been subject to an exclusion zone as part of a supplementary condition on the FEPA licence from 2004 to 2007 (Licence No. 32426/04/0) and material dredged from this area was not permitted for disposal at sea. Since 2007 TBT levels at the Tidal Basin have dropped below AL2 and sea disposal of dredged material from this area is now permitted.

The reason why elevated organotin levels were recorded in the vicinity of the Naval Base is that, historically activities such as the application and removal of coating materials containing tributyltin or triphenyltin compounds were subject to little control. Due to these activities, there was potential for contamination to be present in substances such as anti-corrosion or anti-fouling coatings, blasting grit, wash down water, solvents etc. Reductions in recorded levels in recent data sets are attributed to organotins no longer being used in vessel paint protective coatings.

Polycyclic aromatic hydrocarbons (PAHs)

In the 2005 to 2010 data set, not all of the dredged sites had PAH data, but of those that did, many values for individual PAHs exceeded AL1. PAH concentrations were particularly high at the Continental Ferry Port and also at Heavy Reach Cams Bay. In the 2012 to 2016 data, levels in all areas where PAH's were sampled were in excess of AL1.

Polychlorinated biphenols (PCBs)

Between 2005 and 2010 only one of the dredged areas were sampled and PCB levels were found to be below AL1. A study undertaken by Cefas in 2004 found that the Sheer Jetty area for the total combined concentration of all 25 PCB congeners was elevated. Historically, elevated PCB levels have also been found in the Port Solent sampling stations. In the 2012-2016 data, not all dredge areas were sampled for PCB's. Of those that were, half indicated PCB levels in excess of AL1.

Summary

The sediment contaminant levels vary throughout the Harbour. There are some exceedances of AL2 but these are isolated.
4.3 Water Framework Directive

4.3.1 Introduction

The Water Framework Directive (WFD) provides the main mechanism to control and improve water quality in all types of watercourses, alongside ensuring that water bodies meet certain requirements for marine ecology and hydromorphology. European designated sites are also recognised in their own right under the WFD as Protected Areas and therefore the monitoring and management systems in place to ensure compliance with this directive are relevant to this baseline document.

The WFD was transposed into national law by means of the Water Environment (Water Framework Directive) (England and Wales) Regulations 2003. These regulations have recently been replaced by the Water Environment (Water Framework Directive) (England and Wales) Regulations 2017. The WFD Regulations provide for the implementation of the WFD, from designation of all surface waters (rivers, lakes, transitional (estuarine) waters, coastal waters and ground waters) as water bodies, to the requirement to achieve Good Ecological Status (GES) or Good Ecological Potential (GEP).

4.3.2 Water body status and objectives

The Directive seeks to protect and enhance the quality of all ground waters and surface waters out to one nautical mile and considers the quality of water bodies based on their ecological, physio-chemical and chemical composition (chemical status applies out to 12nm). Using these compliance parameters, it then provides an overall assessment of a water body’s status.

In order to inform this baseline document, WFD water bodies in the study area have been identified using the Environment Agency’s water body shapefiles and online WFD mapping system; Data Catchment Explorer tool (Environment Agency, 2017). The WFD water bodies identified are shown in Figure 4.2 and are listed below:

- Portsmouth Harbour (Transitional) (GB580705140000).
- Solent (Coastal) (GB650705150000).
- Upper Wallington (River) (GB107042016350).
- Wallington below Southwick (River) (GB107042016360).
- Isle of Wight East (Coastal) (GB650705530000).

Summaries of the baseline information available regarding the status and objectives of the above water bodies are provided in Table 4.4 and Table 4.5.
Maintenance dredge area prior to capital dredge undertaken 2016/2017
WFD coastal waterbody
WFD transitional waterbody
WFD river waterbody

Legend:

Client: DIO
Project: Portsmouth Harbour Baseline Document
Title: WFD Waterbodies

Figure: 4.2 Drawing No: PB4532-100-008
Revision: Date: Drawn: Checked: Size: Scale:
02 12/07/2017 JE MK A3 1:200,000
01 30/08/16 BN MK A3 1:200,000

Co-ordinate system: British National Grid

Contains Ordnance Survey data © Crown copyright and database right 2016.
Table 4.4 Water bodies within the study area (information taken from the Environment Agency’s catchment data explorer. Last updated last 10/5/17 http://environment.data.gov.uk/catchment-planning)

<table>
<thead>
<tr>
<th>Water body name and reference</th>
<th>Water body size (area – km²)</th>
<th>Overall Current Status (2016)</th>
<th>If not at “good status”, record objective</th>
<th>If not at “good status”, record all WFD parameters at moderate status or below</th>
<th>Is the water body designated as heavily modified or artificial? If so record the reason for designation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solent (GB650705150000)</td>
<td>259.581</td>
<td>Moderate</td>
<td>Good by 2027</td>
<td>Angiosperms, Mitigation measures assessment, Dissolved Inorganic Nitrogen (DIN),</td>
<td>Heavily modified - Coastal protection, flood protection</td>
</tr>
<tr>
<td>Upper Wallington (GB107042016350)</td>
<td>51.909</td>
<td>Moderate</td>
<td>Good by 2027</td>
<td>Macrophytes and Phytobenthos combined</td>
<td>Not designated artificial or heavily modified</td>
</tr>
<tr>
<td>Wallington below Southwick (GB107042016360)</td>
<td>22.724</td>
<td>Moderate</td>
<td>Good by 2027</td>
<td>Phosphate</td>
<td>Not designated artificial or heavily modified</td>
</tr>
<tr>
<td>Isle of Wight East (GB650705530000)</td>
<td>263.697</td>
<td>Good</td>
<td>Good by 2015</td>
<td>N/A</td>
<td>Heavily modified - Coastal protection, flood protection</td>
</tr>
</tbody>
</table>
## Table 4.5 Protected Areas and mitigation measures (heavily modified water bodies only) (Environment Agency’s catchment data explorer, Last updated 10/5/17 http://environment.data.gov.uk/catchment-planning)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Upper Wallington GB107042016350</td>
<td>Nitrates Directive</td>
<td>N/A</td>
</tr>
<tr>
<td>Wallington below Southwick GB107042016360</td>
<td>Nitrates Directive</td>
<td>N/A</td>
</tr>
</tbody>
</table>
In summary, the only water body in the area currently at good status is the Isle of Wight East coastal water body. All other water bodies record specific issues with either biological and/or chemical parameters or mitigation measures for heavily modified water bodies not being in place. Nutrient issues are recorded in three of the five water bodies; dissolved inorganic nitrogen (DIN) for the transitional and coastal water bodies and phosphate for one of the river water bodies. TBT was recorded as failing chemical status in the Solent coastal waterbody in the 2009 classification but not in the recent 2016 classification, and sediment quality does not indicate that sediment released during maintenance dredging is a source of TBT to the water column (see Section 4.2 Sediment Quality).

The main reason for elevated DIN concentrations given in the RBMP relates to concentrations of nitrates in groundwater leaching into surface waters, resulting in elevated DIN concentrations in Portsmouth Harbour. There is also reference to diffuse pollution from agricultural activities and point source pollution from water industry sewage works, both of which can contribute to elevated nitrogen levels within the estuary and phosphate levels in rivers. There is no information regarding the reasons for failure for biological elements other than good status is being prevented by the reasons for the heavily modified designation i.e. coastal and flood protection structures are limiting the water body’s capability to support good ecological potential.

Overall, there is therefore no evidence within the RBMPs that the ongoing maintenance dredging is contributing to the water bodies not achieving overall good status.

4.3.3 WFD Protected Areas

There are a number of Protected Areas listed within each of the WFD water bodies. These are summarised in Table 4.8 below. Note that Bathing Waters are protected under the Revised Bathing Waters Directive and require the consideration of specific parameters which relate to the protection of human health. As a result, baseline information in relation to these specific Protected Areas is not deemed relevant to this Baseline Document and therefore Bathing Waters are not considered further.

The remaining Protected Areas include those designated under the Nitrates Directive which relate to actions associated with farming and land use and as such, are protected by the defining of Nitrate Vulnerable Zones (NVZ). The objective of the Nitrates Directive is to reduce water pollution caused by nitrates from agricultural sources and to prevent further such pollution occurring. NVZs are therefore designated where nitrate concentrations in water bodies are high or increasing, or water bodies are, or may become, eutrophic due to agricultural nitrate pollution. Farmers within NVZs must comply with mandatory action programme measures to reduce agricultural nitrate losses. In addition, a code of good agricultural practice has been established for voluntary implementation by all farmers.

Regarding any Protected Areas designated under the Urban Waste Water Treatment Directive, these are defined in order to protect the environment from the adverse effects of waste water discharges. Sensitive areas are designated for water bodies affected by eutrophication or where surface water abstraction is affected by elevated nitrate concentrations. Reductions or emission standards for nutrients in sewage effluent must be met within areas sensitive to nutrient pollution. Sensitive areas may also be designated due to the presence of bathing waters for example which drives the requirement for improved treatment levels, such as the addition of Ultra Violet (UV) disinfection for waste water discharges to the area.

In terms of the Natura 2000 European Designated sites, the potential effects of the maintenance dredging operations are considered within Section 5.1 and 5.2.
Table 4.6 illustrates that pressures on these protected areas are unlikely to be associated with temporary periods of maintenance dredging since other sources of pollution are identified as either impacting or have the potential to impact on compliance/ability of the Protected Area to meet requirements.
## Table 4.6 Summary of Protected Areas and information available

<table>
<thead>
<tr>
<th>WFD water body</th>
<th>Protected Area</th>
<th>Name or reference number</th>
<th>Pressures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Portsmouth Harbour (GB68070514000)</td>
<td>Nitrates Directive</td>
<td>184</td>
<td>Nitrate Vulnerable Zones (NVZs) are areas designated as being at risk from agricultural nitrate pollution.</td>
</tr>
<tr>
<td></td>
<td>Urban Waste Water Treatment Directive</td>
<td>Portsmouth Harbour</td>
<td>No further information available – likely to be associated with presence of shellfish and bathing waters in addition to issues regarding eutrophication. Sources of pollution are listed to be associated with waste water discharges and diffuse pollution. Waste Water discharges and land runoff during periods of heavy rain.</td>
</tr>
<tr>
<td></td>
<td>Shellfish Waters Directive</td>
<td>Portsmouth Harbour</td>
<td>No further information available – likely to be associated with presence of shellfish and bathing waters plus issues regarding risk of eutrophication.</td>
</tr>
<tr>
<td></td>
<td>Shellfish Waters Directive</td>
<td>Spithead and Stokes Bay</td>
<td></td>
</tr>
<tr>
<td>Solent (GB650705150000)</td>
<td>Shellfish Waters Directive</td>
<td>Approaches to Southampton Water, Central Solent, Cowes and Medina_M, Langstone Harbour, Lepe Middle Bank, Lymington and Sowley_M, Newtown_M, Pennington, Ryde, Spithead and Stokes Bay, Stanswood Bay, Yarmouth</td>
<td>Sources of pollution related to runoff during heavy rain and waste water discharges. Influx of tourists during summer months places added pressure on waste water treatment systems.</td>
</tr>
<tr>
<td></td>
<td>Nitrates Directive</td>
<td>184, 189, 524, 525</td>
<td>Nitrate Vulnerable Zones (NVZs) are areas designated as being at risk from agricultural nitrate pollution.</td>
</tr>
<tr>
<td></td>
<td>Urban Waste Water Directive</td>
<td>Chichester Harbour, Medina Estuary, Newtown Harbour</td>
<td>No further information available – likely to be associated with presence of shellfish and bathing waters plus issues regarding risk of eutrophication.</td>
</tr>
<tr>
<td>Habitats and Species Directive</td>
<td>Solent &amp; Isle of Wight Lagoons, South Wight Maritime</td>
<td></td>
<td>This site is outside of the search area for the Portsmouth Baseline document.</td>
</tr>
<tr>
<td>WFD water body</td>
<td>Protected Area</td>
<td>Name or reference number</td>
<td>Pressures</td>
</tr>
<tr>
<td>--------------------------------------</td>
<td>-----------------------------------------</td>
<td>--------------------------</td>
<td>---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Upper Wallington</td>
<td>Nitrates Directive</td>
<td>184, 527</td>
<td>Nitrate Vulnerable Zones (NVZs) are areas designated as being at risk from agricultural nitrate pollution.</td>
</tr>
<tr>
<td>Wallington below Southwick</td>
<td>Nitrates Directive</td>
<td>184</td>
<td>These sites are outside of the search area for the Portsmouth Baseline document.</td>
</tr>
<tr>
<td></td>
<td>Conservation of Wild Birds Directive</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Isle of Wight East</td>
<td>Habitats and Species Directive</td>
<td>South Wight Maritime, Solent Maritime</td>
<td>No further information available – likely to be associated with presence of shellfish and bathing waters plus issues regarding eutrophication.</td>
</tr>
<tr>
<td></td>
<td>Urban Waste Water Treatment Directive</td>
<td>Chichester Harbour</td>
<td>Nitrate Vulnerable Zones (NVZs) are areas designated as being at risk from agricultural nitrate pollution.</td>
</tr>
<tr>
<td></td>
<td>Nitrates Directive</td>
<td>666</td>
<td>Pressures relating to waste water discharges and diffuse pollution.</td>
</tr>
<tr>
<td></td>
<td>Shellfish Water Directive</td>
<td>Chichester Harbour (Emsworth Channel)</td>
<td></td>
</tr>
</tbody>
</table>
4.3.4 Pollution incidents

The pollution incidents that have occurred in Portsmouth Harbour, the Solent and the Isle of Wight waterbodies since 2001 have been summarised in Error! Reference source not found. However, it should be noted that these were short term and localised. As a result, it is likely that the dilution afforded by the overlying water would remove any significant risk of contaminating the underlying sediments. No incidents are recorded post 2013.

Table 4.7 Summary of Pollution incidents since 2001 (taken from Environment Agency website ‘What’s in Your Backyard’, 2016)

<table>
<thead>
<tr>
<th>Water body</th>
<th>Year</th>
<th>Impact on water</th>
<th>EA Incident Number</th>
<th>Pollutant</th>
</tr>
</thead>
<tbody>
<tr>
<td>Portsmouth Harbour</td>
<td>2001</td>
<td>Significant</td>
<td>23019**</td>
<td>Sewage materials</td>
</tr>
<tr>
<td></td>
<td>2001</td>
<td>Significant</td>
<td>10872**</td>
<td>Oils and fuel</td>
</tr>
<tr>
<td></td>
<td>2003</td>
<td>Significant</td>
<td>180607</td>
<td>Pollutant not identified</td>
</tr>
<tr>
<td></td>
<td>2004</td>
<td>Significant</td>
<td>259352</td>
<td>Sewage materials</td>
</tr>
<tr>
<td></td>
<td>2009</td>
<td>Significant</td>
<td>710648**</td>
<td>Pollutant not identified</td>
</tr>
<tr>
<td></td>
<td>2010</td>
<td>Significant</td>
<td>768569</td>
<td>Oils and fuel</td>
</tr>
<tr>
<td>Solent</td>
<td>2001</td>
<td>Significant</td>
<td>8730*</td>
<td>Contaminated water</td>
</tr>
<tr>
<td></td>
<td>2002</td>
<td>Significant</td>
<td>96629</td>
<td>Sewage materials</td>
</tr>
<tr>
<td></td>
<td>2002</td>
<td>Significant</td>
<td>90999</td>
<td>Agricultural materials and wastes</td>
</tr>
<tr>
<td></td>
<td>2002</td>
<td>Significant</td>
<td>79677*</td>
<td>Sewage materials</td>
</tr>
<tr>
<td></td>
<td>2003</td>
<td>Significant</td>
<td>195567</td>
<td>Oils and fuel</td>
</tr>
<tr>
<td></td>
<td>2003</td>
<td>Significant</td>
<td>172964</td>
<td>Sewage materials</td>
</tr>
<tr>
<td></td>
<td>2003</td>
<td>Significant</td>
<td>204417**</td>
<td>Sewage materials</td>
</tr>
<tr>
<td></td>
<td>2004</td>
<td>Significant</td>
<td>219786*</td>
<td>Oils and fuel</td>
</tr>
<tr>
<td></td>
<td>2005</td>
<td>Significant</td>
<td>328464*</td>
<td>Other pollutant</td>
</tr>
<tr>
<td></td>
<td>2006</td>
<td>Significant</td>
<td>435488</td>
<td>Sewage materials</td>
</tr>
<tr>
<td></td>
<td>2007</td>
<td>Significant</td>
<td>502459</td>
<td>Pollutant not identified</td>
</tr>
<tr>
<td></td>
<td>2008</td>
<td>Significant</td>
<td>560487*</td>
<td>Agricultural materials and wastes</td>
</tr>
<tr>
<td></td>
<td>2008</td>
<td>Significant</td>
<td>587813*</td>
<td>Pollutant not identified</td>
</tr>
<tr>
<td></td>
<td>2010</td>
<td>Significant</td>
<td>816433</td>
<td>Pollutant not identified</td>
</tr>
<tr>
<td></td>
<td>2013</td>
<td>Significant</td>
<td>1151559</td>
<td>Sewage materials</td>
</tr>
<tr>
<td>Isle of Wight</td>
<td>2001</td>
<td>Significant</td>
<td>37322**</td>
<td>Organic chemicals/products</td>
</tr>
<tr>
<td></td>
<td>2001</td>
<td>Major</td>
<td>40220*</td>
<td>Contaminated water</td>
</tr>
<tr>
<td></td>
<td>2009</td>
<td>Significant</td>
<td>655806 * and **</td>
<td>Inert material and wastes</td>
</tr>
</tbody>
</table>

* Incidents classified as terrestrial but with Significant or Major impacts to water.
** Incidents occurring adjacent to the water body boundary but with impacts to water body
Note: Terminology used in Error! Reference source not found.7 is taken from the Environment Agency website. ‘Significant’ is classified as category 2 incidents and predicted to have a significant impact on the receiving environment. ‘Major’ is classified as a category 1 incident and predicted to have a major impact on the receiving environment.”
4.4 Marine Ecology

4.4.1 Overview

This section describes the intertidal and subtidal habitats and species of Portsmouth Harbour. Estuarine communities include both benthic and epibenthic marine flora and fauna and fish. The intertidal and subtidal ecology is considered separately.

4.4.2 Sources

In addition to literature in peer reviewed journals, the information used to complete this section is drawn from the following data sources:

- SPA, Ramsar site and SSSI citations;
- Solent European Marine Sites website, available from: http://www.solentems.org.uk/;

4.4.3 Intertidal baseline conditions

Habitats

Portsmouth Harbour forms a non-typical intertidal estuarine ecosystem as it receives relatively little freshwater, the predominant source being the River Wallington that flows into Fareham Creek and a number of smaller streams. Additionally, the entrance to the Solent is restricted to a narrow channel which reduces the inward and outward flow of saline water into the Harbour. These factors do affect flow rates in and out of the Harbour, however its salinity is consistent with seawater.

The enclosed area contains extensive areas of intertidal mudflats which are dissected by deep water channels (Fountain Lake, Portchester Lake and Fareham Lake). Defra’s ‘Magic’ mapping website shows the intertidal habitats of Portsmouth Harbour are dominated by mud, sand and gravel habitats (Defra, 2016). The majority of the mudflats are located within the centre and northern half of the Harbour and numerous creeks border the main Harbour perimeter creating extensive sheltered intertidal areas. Work carried out as part of the Solent Coastal Habitat Management Plan (Royal HaskoningDHV, 2003) in 2003 identified approximately 979ha of intertidal habitat within Portsmouth Harbour. This is one of the four largest expanses of mudflats and tidal creeks on the south coast of Britain (JNCC, 2006).

The mudflats support significant areas of cord grass marshes, which are dominated by S.anglica. These form large monospecific stands of S.anglica on elevated platforms of accreted mud. S.anglica was extensively planted in the Solent in the past as an aid to stabilising intertidal mudflats and to act as
a sedimentary stimulus prior to enclosure and land claim. Monoculture swards of either *S.anglica* or *S.x townsendii* are of relatively low intrinsic value to wildlife compared to more mixed saltmarshes or intertidal flats.

*Spartina sp.* is a tolerant species and can inhabit a broad range of levels in relation to the tidal range and hence colonise from higher saltmarsh levels to being the lowest intertidal saltmarsh coloniser. In many areas, *S.anglica* is generally considered a threat to the intertidal mudflats used as feeding-grounds by large populations of waders and wildfowl (JNCC, 2016). According to SCOPAC (2004), a general decline in *S.anglica* within Portsmouth Harbour has been observed since the 1950’s, with some areas surviving in the north-west of the Harbour and virtual elimination from central areas, Stamshaw and Tipner Lakes and the Portchester channel. Low (0.5m to 1m) eroding bluffs now separate mudflats from the residual areas of *Spartina sp.* at Fareham Creek and Portchester. The latter occupy some 140ha in several isolated areas in the north-west of the Harbour, with contemporary loss mostly due to marsh edge recession (SCOPAC, 2004).

At the uppermost levels of the *Spartina sp.* marshes, the cord grass is replaced locally by saltmarsh dominated by sea purslane *Halimione portucaloides*. At their highest levels these marshes grade into grassland dominated by sea couch *Elymus pycnathus* and, on Pewit Island, this grassland has been colonised by oak *Quercus sp.* and blackthorn *Prunus spinosa* scrub. In 1993 the nationally scarce golden sampahire *Inula crithmoides* was noted to occur at the upper limits of sea purslane marsh and at the toe of some sea walls (Natural England, 1993).

The mudflats also support extensive beds of eelgrasses; *Zostera noltii* and *Z.angustifolia*. The eelgrass beds are amongst the most extensive in Europe and Portsmouth Harbour is one of only four intertidal areas on the south coast to support extensive eelgrass beds. Widespread populations of ephemeral green algae species, such as *Ulva intestinalis* and *Ulva lactuca*, are also found in summer. *Ulva sp.* has spread widely since the early 1980s across vacant areas of mudflat (Baily et al., 2002) but might also impact upon the eelgrass beds. Eelgrasses and green algae form an important food source for overwintering dark-bellied Brent goose. The mudflats comprise fine silts and organic matter, though over extensive areas angular flint gravel occurs commonly at the surface and similar material forms a beach at high water and a floor to the channels.

**Species**

Little survey data are available on the faunal species of the mudflats. However, they are reported to support an abundant fauna of benthic marine animals, comprised of approximately 60 species (Natural England, 1993). The distribution and abundance of organisms is subject to seasonal variation due to the presence of dense algal coverage at certain times of the year. The algal layer provides a habitat for many species, in particular oligochaete and polychaete worms. It is also used for shelter by small fish and crustaceans and provides a food source for birds, larger fish and invertebrate species. The Upper Harbour Ammunition Facility (UHAF) ES reports that very high number of the gastropods *Hydrobia ulvae* and *Littorina littorea* and of the bivalve *Abra tenuis* are present at most sites throughout the intertidal areas within the Harbour (Hyder, 2009).

The Portsmouth Harbour SSSI also includes several saline lagoons, including Cockle Pond and Little Anglesey Lake which adjoin Haslar Lake in the south-west of the Harbour. The flora and fauna of Little Anglesey Lake is the most diverse known in any lagoon in south-east England and includes populations of the starlet sea anemone *Nematostella vectensis* and the lagoon sand shrimp *Gammarus insensibilis*, both of which are protected by Section 9(5) and Schedule 5 of the Wildlife and Countryside Act 1981.
An ecological study of an intertidal area within Portsmouth Harbour was carried out by Royal Haskoning in 1993 as part of the environmental assessment for Portsmouth City Council’s Phase VII extension to the Continental Ferry Port (Posford Duvivier Environment, 1993). This study found that the intertidal area on Whale Island, opposite the proposed ferry berth, contained a variety of habitats ranging from soft mud sediments to mixed sediments with a relatively high percentage of coarse material. This diversity of sediments can support abundant macrofaunal communities, comparable to those found in other areas within the Solent harbours, including Stramshaw Lake to the north of the site.

Of the invertebrates sampled during the 1993 survey, species recorded included the ragworm *Nereis sp.*, the laver spire shell *Hydrobia ulvae* and the cockle *Cerastoderma edule*. The survey identified *C. edule* in low numbers, while the other two species were recorded as relatively abundant (although *Nereis sp.* had a patchy distribution). *H. ulvae* often occurs in high densities in estuaries, attracting smaller wader species and shelduck *Tadorna tadorna*, and *Nereis sp.* are important for larger birds such as curlew *Numenius arquata* and pintail *Anas acuta* (Prater, 1981). Both *H. ulvae* and *Nereis sp.* are important in the diet of most estuarine birds, whilst other prey species are utilised by a smaller number of birds within specific feeding niches.

4.4.4 Subtidal baseline conditions

Habitats and species

Data on the ecology of the subtidal channels of the Harbour exists from surveys carried out by the JNCC as part of the Marine Nature Conservation Review and from a survey carried out by Entec UK as part of the UHAF ES (Hyder, 2009).

The JNCC collected grab samples in seven locations within the Harbour. The results identified a sublittoral *Melinna sp.* bed located to the west of the North West Wall of Portsmouth Docks. The biotope “*Aphelochaeta marioni sp.* and *Tubificoides sp.* in variable salinity infralittoral mud” was recorded at most of the survey points.

The UHAF survey results showed benthic communities which were typical of semi-estuarine conditions in southern England and were representative of the muddy/sandy sediment conditions encountered. The high abundance of individuals in each sample was noted; however no rare species were found (Entec 2000).

In 2006 a survey was carried out by Emu Ltd. on behalf of Defence Estates for the Portsmouth Approach Channel Dredging project (EMU Ltd. 2006). This survey provides an overview of the macrobenthic fauna present in the subtidal for the approach channel. The subtidal area was surveyed for benthic and epibenthic communities using grab sampling and beam trawling.

In the grab sample survey, the species most frequently recorded was the acorn barnacle *Balanus crenatus*. In addition to *B. crenatus*, samples were dominated by burrowing deposit-feeding polychaetes including *M. palmata, Chaetozone gibber* and *A. marioni*.

These results support the theory that subtidal communities are relatively stable within this area of Portsmouth Harbour.

Epibenthic samples collected during the 2006 survey recorded over 60 taxa from five beam trawls. The most abundant species was *B. crenatus*, as was found in the grab samples. High numbers of the
slipper limpet *Crepidula fornicata* were also recorded. Where variable sediment conditions and coarser material were encountered there was a regular occurrence of the long-clawed porcelain crab *Pisidia longicornis*. Sessile colonial, crust or turf forming species were found to be commonly occurring throughout the survey area with 30 species of bryozoans, hydroids and sponges being recorded. The following species were recorded from three or more of the five trawl surveys: the hydroids *Hydallmania falcata* and *Obelia dichotoma* and the bryozoans *Electra pilosa*, *Bicellariella ciliata*, *Alocyoniidium gelatinosum*, *Celleporella hyalina*, *Escharella immerse*, *Scrupocellaria scopulosa* and *Bowerbankia imbricate*.

Two species of seahorse are found in British waters, namely *Hippocampus guttulatus* (the spiny seahorse) and *Hippocampus hippocampus* (the short-snouted seahorse). Records from SeaSearch Marine Surveys show presence of *Hippocampus hippocampus* in the Solent, outside Portsmouth Harbour (NBN Gateway, 2011). Both seahorse species are protected under the Wildlife and Countryside Act (1981) and is an offence to intentionally or recklessly harm or disturb any seahorse. Additionally, they are protected against killing, injuring or taking; possession or control. It is also prohibited to damage or destroy their places of shelter, or disturb an animal whilst it is occupying a place of shelter.

**Fisheries**

Sea trout are known to migrate through Portsmouth Harbour into the Wallington River between March and October each year. Fish enter the Harbour via the main channel and head in a northerly direction. Dace, roach, perch and carp are also found within the Wallington River. Migratory eels are present in Portsmouth Harbour in the Fareham Creek area.

The native oyster *Ostrea edulis* is found in Portsmouth Harbour where there is a commercial shellfishery for this species. The commercial oyster fishery site within the Solent stretches from Hurst Castle in the west to Horse Sand in the east. The approach channel lies within the limits of the regulated fishery. There has also been a significant oyster fishery within Portsmouth Harbour for many years and the Portsmouth Harbour stock has previously represented the largest self-sustaining stock in Europe. However the oyster fishery of the Solent is on the verge of collapse with stock reaching an all-time low. In addition oysters have been hit by a virus affected much of the oyster industry in Britain in 2010 and have also been impacted by the American sea snail known as a ‘tingle’ which bores into oyster shells and eats them. During the 2006 survey three individuals were recorded from within the approach channel of the Harbour (Royal Haskoning, 2010). Fishing for oysters in Portsmouth Harbour and the wider Solent has been prohibited under a bylaw enforced by the Southern Inshore Fisheries and Conservation Authority (IFCA) (Southern IFCA, 2015). The native oyster is a recommended feature of the Fareham Creek rMCZ.

The common whelk *Buccinum undatum* is landed commercially in Portsmouth. Significant populations of common whelk are found with the Solent and this species is found from Mean Low Water Springs (MLWS) out into sub-littoral waters in both hard and soft sediments.

The Solent is a known spawning ground for bass *Dicentrarchus labrax* which is predominantly a marine species but is found in estuarine waters during the summer months. Tidal waters south of a line between Gilkicker Point and Southsea Castle are designated as a Bass Nursery Area meaning that fishing for bass is prohibited in this area.

Cefas surveys have shown that sole *Solea solea* are important in the Solent (Cefas, 2001). Spawning typically occurs around the mouths of estuaries.
**Marine mammals**


The English Channel and Solent regions are thought not to be of particular importance for cetaceans with only four out of the 26 reported species of cetacean common to British waters regularly recorded in the region in the 1980s and 1990s (Barne *et al.*, 1996). The recent SCANS III estimates of cetacean abundance in European Atlantic waters shows the most common species is the bottlenose dolphin (*Tursiops truncates*) whilst the Harbour porpoise (*Phocoena phocoena*) recorded as an occasional visitor (SMRU 2016). The common dolphin (*Delphinus delphis*) and the white beaked dolphin (*Lagenorhynchus albirostris*) have also been recorded in the region (Orca, 2015).

A Solent seal tagging programme was undertaken by the Wildlife Trust in 2010. Results from this project showed that both grey *Halichoerus grypus* and Harbour seals *Phoca vitulina* are found throughout the harbours and rivers across the Solent and the south side of the Isle of Wight. Portsmouth Harbour had relatively few recordings with much higher numbers in the Eastern harbours of Langstone, Chichester and Pagham (Chesworth *et al* 2010).

### 4.5 Ornithology

Portsmouth Harbour supports a number of different protected bird species seasonally throughout the year. The Portsmouth Harbour SPA and Ramsar site was designated in 1995 to support populations of wintering wader and diving duck, including black tailed godwit *Limosa limosa*, dunlin *Calidris alpine*, red breasted merganser *Mergus serrator* and Brent goose *Branta bernicla* (Natural England, 2015b). Solent and Southampton Water to the west and the harbours to the east of Portsmouth are known to support breeding populations of gull and tern species which use the harbours and Solent to forage for prey (Natural England, 2016a).

The intertidal mudflats of Portsmouth Harbour and the surrounding areas; Southampton Water, Langstone Harbour and Chichester Harbour have diverse infaunal communities rich in bivalves and other invertebrates which provide feeding grounds for waterbirds in numbers of international importance.

#### 4.5.1 Overwintering birds

*Table 4.8* presents the British Trust for Ornithology data (BTO) on the bird species designated within Portsmouth Harbour SPA (British Trust for Ornithology, 2015). This table shows the most recent five year peak mean in relation to the qualifying thresholds for a population to being considered nationally or internationally important.
Black tailed godwit

The five year mean peak for this species has remained similar over the past decade however data on the BTO website shows that the species has been under recorded with incomplete WeBS counts on a number of years (British Trust for Ornithology, 2015). When the site was classified in 1995 it supported over 1% of the UK population which then stood at 70 birds. Numbers of the species at Portsmouth Harbour have steadily increased since the time of classification and the site now supports a far greater number of birds. At high tide, black-tailed godwits roost on upper saltmarsh areas in Portsmouth Harbour and on coastal grazing marsh outside the SPA boundary with important roost sites located at RNAD Gosport in Bedenham, Pewit Island and at Farlington Marshes in Langstone Harbour (Natural England, 2015a). In wet weather, black-tailed godwits also move between Portsmouth Harbour and Titchfield Haven in the Meon Valley (Natural England, 2015b).

At low tide, high densities of black-tailed godwit feed on the intertidal in the north-western section of Portsmouth Harbour at Cams Bay and Wicor Lake (Austin et al, 2014).

Dunlin

Dunlin is a nationally important species in Portsmouth Harbour. When classified in 1995 it supported over 1% of the UK population which then stood at 8,010 birds (Natural England, 2015a). Population numbers of dunlin at Portsmouth Harbour have remained stable in the years following designation although the peak mean from 2011-2015 shows a fall from that of the preceding five year period (British Trust for Ornithology, 2015).

At high tide, dunlin roost on pontoons near Wicor Shore, on saltmarsh at RNAD Gosport, Bedenham or on an island adjacent to Priddy’s Hard. Dunlin also fly over to Langstone Harbour to roost at high tide (Natural England, 2015a). At low tide, dunlin feed in high densities on the intertidal in the north-western corner of the Harbour around Cams Bay and Wicor Lake. High densities also feed at Forton Lake and along the western side of the Harbour (Austin et al, 2014).

Red breasted merganser

Red-breasted merganser is a nationally important species in Portsmouth Harbour. When classified in 1995 the site was designated for 100 individuals representing 1% of the British population. The
population of red-breasted merganser has remained relatively stable since the time of classification although there are on average fewer individuals using the site (Austin et al, 2014).

Red-breasted merganser roost at night with other species of diving ducks, either in the mid-channel in Portsmouth Harbour or other shallow coastal waters in the Solent. Red-breasted merganser is also known to raft in Portsmouth Harbour for shelter during times of stormy weather (Natural England, 2015a). This species forages predominantly on small fish and aquatic invertebrates in the shallow coastal waters of Portsmouth Harbour (Natural England, 2015a).

**Dark-bellied Brent goose**

When classified in 1995, Portsmouth Harbour supported internationally important numbers of dark-bellied Brent goose with 2,290 individuals present, representing 1.3% of the north-west European population and 2.5% of the British wintering population (Natural England, 2015a). The population of dark-bellied Brent goose at Portsmouth Harbour has remained relatively stable since the site was classified (Austin et al, 2014).

### 4.5.2 Breeding birds

There are a number of sites in and around Portsmouth Harbour which are used by breeding seabirds. The information presented below shows numbers for the tern species which have been put forward for inclusion within the proposed Solent and Dorset Coast pSPA only and does not include information on gull species which also breed in the area.

Table 4.9 shows the numbers for foraging tern within the Solent and Dorset Coast pSPA. These figures have been taken from the Departmental Brief which was prepared by Natural England for the formal consultation on the site (Natural England, 2016). The numbers set out in the Departmental Brief are taken from the most recent data from the JNCC Seabird Monitoring Programme together with direct count data from rangers/managers reporting on breeding colony numbers.

Table 4.9 shows five year mean data for the breeding populations of tern foraging within the Solent and Dorset Coast pSPA

<table>
<thead>
<tr>
<th>Species</th>
<th>Count</th>
<th>% of GB Population</th>
</tr>
</thead>
<tbody>
<tr>
<td>Little tern (<em>Sternula albifrons</em>)</td>
<td>63 pairs (126 breeding adults) (2009 - 2014)</td>
<td>3.31%</td>
</tr>
<tr>
<td>Common tern (<em>Sterna hirundo</em>)</td>
<td>492 pairs (984 breeding adults) (2009 - 2014)</td>
<td>4.77%</td>
</tr>
<tr>
<td>Sandwich tern (<em>Thalasseus sandvicensis</em>)</td>
<td>441 pairs (882 breeding adults) (2008 - 2014)</td>
<td>3.31%</td>
</tr>
</tbody>
</table>

**Little tern**

Of the five species of tern which regularly breed in Great Britain, the little tern is the smallest and has the most limited foraging range, at an average distance of 2.1km (and recorded maximum of 6.3km) from its breeding grounds. Little tern breeding colonies in proximity to Portsmouth Harbour are at Chichester and Langstone Harbours and Pagham Harbour. The maximum foraging range for little tern suggests that those breeding at Langstone Harbour could use Portsmouth Harbour for foraging during...
the breeding season. Tern prey species include sandeel, herring and sardine (Natural England, 2016a).

**Common tern**

Common terns do not breed within Portsmouth Harbour but have breeding grounds in the Solent and Southampton Water SPA and Chichester and Langstone SPA which are adjacent to Portsmouth Harbour (Natural England, 2016a). The maximum foraging range for common tern has been recorded at 20.4km however most have been recorded as foraging within 5-10km from their breeding grounds (del Hoyo et al, 1996). Given this range it is expected that common tern would forage within the Portsmouth Harbour area.

**Sandwich tern**

Sandwich terns have the largest maximum foraging range of the three tern species which breed in the area at 32km from the breeding colony (Natural England, 2016a). They have a mean foraging range of 10-15km (Thaxter et al, 2012). Sandwich terns nest colonially in high densities on the ground, on dunes, shingle spits and ridges, and low offshore islands, often in association with black-headed gull colonies and where disturbance is limited. Sandwich terns have breeding colonies in Poole Harbour, Solent and Southampton Water, Chichester and Langstone and Pagham Harbour SPAs (Natural England, 2016a). Given their extensive foraging ranges it is possible that birds from all of these colonies could use Portsmouth Harbour as a foraging ground during the breeding season.

**4.5.3 Noise disturbance to birds**

An EIA for the UHAF found that noise levels within Portsmouth Harbour were principally related to the passage of boat traffic (Hyder, 2009). This is likely to be particularly true in the more remote feeding areas of the SPA.

Dredging activities in Portsmouth Harbour have been ongoing since the late 19th Century and therefore it is reasonable to expect that birds are accustomed to a certain level of noise disturbance.
5 INFORMATION FOR ASSESSMENT OF MAINTENANCE DREDGING IMPACTS

This Baseline Document sets out relevant information to enable an assessment of maintenance dredging activity to be undertaken in relation to the designated sites. The document has presented details on the maintenance dredging regime in Portsmouth Harbour, the designated sites, features of interest and their sensitivity and details on the baseline conditions within Portsmouth Harbour and the surrounding area. This section summarises this information to provide an assessment of the potential impacts of maintenance dredging on the condition of the designated sites in Portsmouth Harbour.

5.1 Maintenance Dredge Activity and the Habitats Directive

As discussed in Section 4.1, there is a net gain of fine material into Portsmouth Harbour which leads to the requirement for maintenance dredging to maintain the navigation channels and berths. The Harbour functions as a sink for clay particles, silt and fine sand, with coarser material being flushed seaward. Overall the Harbour is a relatively stable system with a small but cumulative gain of sediment which is re-circulated within the Harbour.

Maintenance dredging in both the dockyard and the areas managed by other operators is carried out on an as needed basis. The volumes are moved by plough dredging or removed through a combination of plough dredging and TSHD/Backhoe dredging with disposal to the Nab Tower site. Volumes removed vary over the years and there is not a pattern of regular maintenance dredging undertaken. Over the past decade dredging disposal campaigns have taken place during consecutive years but then been followed by periods when no dredging disposal has occurred.

Marine Licences for maintenance dredging within Portsmouth Harbour include a number of standard conditions to mitigate potential environmental impacts. These conditions are listed in Table 5.1.

Table 5.1 Marine Licence Conditions

<table>
<thead>
<tr>
<th>Measure</th>
<th>Licence Condition</th>
<th>Reason</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contaminant control and</td>
<td>Tailored conditions, depending on the licence, for sediment sampling plans for specific dredge areas where contamination is a risk.</td>
<td>To ensure suitability of material for disposal to sea.</td>
</tr>
<tr>
<td>sediment suspension</td>
<td>RMAS Hoist near Round Tower (AQ) and North Camber (ATA) must not be dredged or the material disposed of to sea. If dredging is required, an Alternate Means of Disposal method statement must be submitted to the MMO for written approval 6 weeks prior to works starting.</td>
<td></td>
</tr>
<tr>
<td>Litter prevention measures</td>
<td>Any man-made material must be separated from the dredged material and disposed of to land.</td>
<td>To minimise the amount of man-made material disposed of at sea.</td>
</tr>
<tr>
<td>Pollution prevention measures</td>
<td>Bunding and/or storage facilities must be installed to contain and prevent the release of fuel, oils, and chemicals associated with plant, refuelling and construction equipment, into the marine environment. Secondary containment must be used with a capacity of no less than 110% of the container's storage capacity.</td>
<td>To minimise the risk of marine pollution incidents.</td>
</tr>
</tbody>
</table>
The European designated sites that have the potential to be impacted by maintenance dredging activity are the Portsmouth Harbour SPA and Ramsar site and the Solent and Dorset Coast pSPA.

Updated conservation advice for the Portsmouth Harbour SPA was published by Natural England in 2015 (Natural England, 2015b). This includes detailed advice on operations that have the potential to affect the features of interest of the site and specifically sets out the site sensitivities in relation to maintenance dredging activity. The risk of impact is then scored from high to low.

The potential risks and pressures that have a medium score or above are set out in Table 5.2, together with an assessment of the significance of the potential effects of ongoing maintenance dredging operations within Portsmouth Harbour. Those potential risks and pressures that have a low score or below have not been included as these are very unlikely to have a significant effect on the SPA and Ramsar site features.
Table 5.2 Assessment for Maintenance Dredging – Portsmouth Harbour SPA and Ramsar site

<table>
<thead>
<tr>
<th>Sensitive feature/s</th>
<th>Pressure (potential risk identified)</th>
<th>Activity-pressure justification (Natural England Conservation advice)</th>
<th>Assessment</th>
<th>Likely Significant Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supporting habitat</td>
<td>Abrasion/disturbance of the substrate on the surface of the seabed</td>
<td>This pressure is exerted through the direct action of dredger vessels operating to remove sediment from berths and navigation channels.</td>
<td>Maintenance dredging only occurs in the navigation channels and berths of Portsmouth Harbour. The dredging activity does not overlap with the intertidal interest features of Portsmouth Harbour SPA and Ramsar site and would not have an impact on these site supporting habitats through abrasion or disturbance of the seabed.</td>
<td>No</td>
</tr>
<tr>
<td>Coastal lagoons,</td>
<td></td>
<td></td>
<td>Maintenance dredging has been an ongoing activity within the Harbour throughout its extensive history of industrial and naval use and prior to the designation of the Portsmouth Harbour SPA and Ramsar site in 1995. Subtidal sediments are disturbed through dredging activity with accumulated fine sediments removed from the berths and channels and disposed of to sea. The ongoing maintenance dredging operations occur in areas that have been dredged on a regular basis historically and, as discussed in Section 4.1.8, the volumes of sediment removed from the Harbour (long term mean annual average of 30,500 dry tonnes annually) balance with the annual net import of sediment into the Harbour (excess of 47,000 dry tonnes annually). This balance of sediment allows the extent of supporting intertidal and subtidal habitats to be maintained in line with the conservation objectives for the site. The evidence for this balance of sediment is supported by the condition assessment for</td>
<td></td>
</tr>
</tbody>
</table>
### Sensitive feature/s

<table>
<thead>
<tr>
<th>Sensitivity feature/s</th>
<th>Pressure (potential risk identified)</th>
<th>Activity-pressure justification (Natural England Conservation advice)</th>
<th>Assessment</th>
<th>Likely Significant Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Black tailed godwit, Dark bellied Brent goose, Dunlin, Red breasted merganser</td>
<td>Barrier to species movement</td>
<td>The pressure refers to obstructions to species movement caused by physical barriers or prolonged exposure to noise, light, visual disturbance or changes in water quality. The scale of the impact will depend on the scale of activity and the location and will need to be considered on a case-by-case basis to determine relevance to a given feature/site. The noise and turbidity arising from dredging operations may pose a barrier to species migration when occurring on or in proximity to specific migratory routes.</td>
<td>Portsmouth Harbour is an important site for overwintering waders and wildfowl. Noise disturbance can affect the condition of birds if it is at levels where their feeding is interrupted or there is a displacement from feeding habitats. The busy dockyard and commercial port within Portsmouth Harbour mean that there are continuous movements of large vessels in and out of the Harbour. Noise from dredging is likely to be lower than noise resulting from the operation of other regular shipping operations, such as ferry routes, recreational boating and naval operations. The dredging operations are intermittent but it is likely that birds have become habituated to the regular movements of vessels within the Harbour and will be tolerant to the presence of dredgers.</td>
<td>No</td>
</tr>
</tbody>
</table>

### Species

- **Red breasted merganser**

#### Supporting Habitat

- Coastal lagoons,
- Intertidal mixed sediments,
- Intertidal seagrass

Changes in suspended solids (water clarity)

Red breasted merganser primarily feed on small fish in coastal waters <10m depth. They are visual hunters and so may be affected by suspended solids. Dredging causes local increases in suspended sediment, particularly in the direct vicinity of a dredge site. This sediment includes material disturbed at the drag head of the dredger and also some overflow. The relative changes in suspended solids can lead to a localised increase in suspended sediment concentrations in the vicinity of the dredger. These areas of increase are known as the sediment plume. Plume modelling for the QEC capital dredge (ABPMer 2012[R.1988]) concluded that when dredging takes place in Portsmouth Harbour, SSCs will largely be constrained to the sub-tidal channels, with very limited effect on waders and wildfowl. | Both TSHD and plough dredging activity can lead to a localised increase in suspended sediment concentrations in the vicinity of the dredger. These areas of increase are known as the sediment plume. | No |
<table>
<thead>
<tr>
<th>Sensitive feature/s</th>
<th>Pressure (potential risk identified)</th>
<th>Activity-pressure justification (Natural England Conservation advice)</th>
<th>Assessment</th>
<th>Likely Significant Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>beds,</td>
<td></td>
<td>elevation of suspended sediment above background levels will depend on dredge location, natural background level, type intensity, and duration of dredging, sediment characteristics. The magnitude and spatial extent of the suspended sediment plume around dredging operations is a function of the type of dredger used, the physical and biological characteristics of the material being dredged (e.g., density, grain size, organic content) and site-specific hydrological conditions (e.g., currents, water body size/configuration). A generalized &quot;worst case&quot; field can be defined as having suspended sediment levels less than or equal to 500 mg/L at distances less than or equal to 500 m from the dredge, with maximum concentrations generally restricted to the lower water column within 50-100 m, decreasing rapidly with distance.</td>
<td>interaction with the intertidal areas. Modelled peak SSC levels within the main channel and berth pockets of more than 1,000mg/l were short lived, occurring for a 2 hour period on the flooding spring tide. SSC increases in the order of 100mg/l are expected during spring tides within the channels north of the turning circle. Over neap tides, little to no change in SSCs is predicted within the Harbour indicating little or no movement of the disturbed sediment on neap flows. For maintenance dredging activity, quantities of material being removed are relatively small and dredging tends to be intermittent, removing small volumes of material from each berth. This leads to localised areas of increased turbidity whilst the dredger operates which settle out close to the working area. These changes are small in scale and temporary and could temporarily affect the distribution of birds foraging within the Harbour.</td>
<td>interaction with the intertidal areas. Modelled peak SSC levels within the main channel and berth pockets of more than 1,000mg/l were short lived, occurring for a 2 hour period on the flooding spring tide. SSC increases in the order of 100mg/l are expected during spring tides within the channels north of the turning circle. Over neap tides, little to no change in SSCs is predicted within the Harbour indicating little or no movement of the disturbed sediment on neap flows. For maintenance dredging activity, quantities of material being removed are relatively small and dredging tends to be intermittent, removing small volumes of material from each berth. This leads to localised areas of increased turbidity whilst the dredger operates which settle out close to the working area. These changes are small in scale and temporary and could temporarily affect the distribution of birds foraging within the Harbour.</td>
</tr>
</tbody>
</table>

Supporting Habitat
- Coastal lagoons,
- Intertidal coarse sediments,
- Intertidal mixed sediments,
- Intertidal mud,
- Intertidal seagrass beds,

Habitat structure changes - removal of substratum (extraction) Navigation dredging results in the physical removal of substrate and thus associated habitats and species within the area to increase or maintain depths within navigation channels. The depth of material removed during maintenance dredging varies greatly depending on the location and target level required, generally between 0.5m and 2m of sediment is removed. Maintenance dredging only occurs in the navigation channels and berths of Portsmouth Harbour. There is no overlap with the intertidal supporting habitats of Portsmouth Harbour SPA and Ramsar site and therefore no direct impact to these supporting habitats. Maintenance dredging has been an ongoing activity within the Harbour throughout its extensive history of industrial and naval use and prior to the designation of the Portsmouth Harbour SPA and Ramsar site in No |
### Sensitive feature/s
- Subtidal mixed sediments, Subtidal mud,
- Water column,
- Atlantic salt meadows,
- Salicornia, Spartina

<table>
<thead>
<tr>
<th>Pressure (potential risk identified)</th>
<th>Activity-pressure justification (Natural England Conservation advice)</th>
<th>Assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1995. Subtidal sediments are disturbed through dredging activity with accumulated fine sediments removed from the berths and channels and disposed of to sea. The ongoing maintenance dredging operations occur in areas that have been dredged on a regular basis historically and, as discussed in Section 4.1.8, the volumes of sediment removed from the Harbour (long term mean annual average of 30,500 dry tonnes annually) balance with the annual net import of sediment into the Harbour (excess of 47,000 dry tonnes annually). This balance of sediment allows the extent of supporting intertidal and subtidal habitats to be maintained in line with the conservation objectives for the site. The evidence for this balance of sediment is supported by the condition assessment for the SSSI units which underpin the SPA and show no loss in the extent of intertidal habitat available to support the designated bird interest of the site. The dredging activity does not overlap with the intertidal interest features of Portsmouth Harbour SPA so there is no direct impact on these features.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Supporting Habitat</th>
<th>Penetration and/or disturbance of the substrate below the surface of the seabed</th>
<th>Navigation dredging and excavation activities result in the penetration of the seabed due to the physical removal of substrate.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coastal lagoons,</td>
<td>Maintenance dredging only occurs in the navigation channels and berths of Portsmouth Harbour and there is no overlap with the intertidal supporting features of Portsmouth Harbour SPA. There is no direct impact on these supporting habitats for the SPA and Ramsar site.</td>
<td>Maintenance dredging only occurs in the navigation channels and berths of Portsmouth Harbour and there is no overlap with the intertidal supporting features of Portsmouth Harbour SPA. There is no direct impact on these supporting habitats for the SPA and Ramsar site.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Likely Significant Effect</th>
<th>No</th>
</tr>
</thead>
</table>
Defence Infrastructure Organisation

## Sensitive feature/s
- beds,
  - Subtidal mixed sediments,
  - Subtidal mud,
  - Atlantic salt meadows,
  - Salicornia,
  - Spartina

## Pressure (potential risk identified)
- seabed, including abrasion

## Activity-pressure justification (Natural England Conservation advice)
- Maintenance dredging has been an ongoing activity within the Harbour throughout its extensive history of industrial and naval use and prior to the designation of the Portsmouth Harbour SPA and Ramsar site in 1995. Subtidal sediments are disturbed through dredging activity with accumulated fine sediments removed from the berths and channels and disposed of to sea. The ongoing maintenance dredging operations occur in areas that have been dredged on a regular basis historically and, as discussed in Section 4.1.8, the volumes of sediment removed from the Harbour (long term mean annual average of 30,500 dry tonnes annually) balance with the annual net import of sediment into the Harbour (excess of 47,000 dry tonnes annually). This balance of sediment allows the extent of supporting intertidal and subtidal habitats to be maintained in line with the conservation objectives for the site. The evidence for this balance of sediment is supported by the condition assessment for the SSSI units which underpin the SPA and Ramsar site and show no loss in the extent of intertidal habitat available to support the designated bird interest of the site.

## Assessment
- Both TSHD and plough dredging activity can lead to a localised increase in suspended sediment concentrations in the vicinity of the dredger. These areas of increase are known as the sediment plume. For maintenance dredging activity in Portsmouth Harbour quantities of material removed from each

## Likely Significant Effect
- No

### Supporting Habitat
- Coastal lagoons,
- Intertidal coarse sediments,
- Intertidal mixed sediments,
<table>
<thead>
<tr>
<th>Sensitive feature/s</th>
<th>Pressure (potential risk identified)</th>
<th>Activity-pressure justification (Natural England Conservation advice)</th>
<th>Assessment</th>
<th>Likely Significant Effect</th>
</tr>
</thead>
</table>
| • Intertidal mud,  
  • Intertidal seagrass beds,  
  • Subtidal mixed sediments,  
  • Subtidal mud,  
  • Atlantic salt meadows,  
  • Salicornia,  
  • Spartina | vertical sediment overburden) | about half the size of the dredge site itself. | berth tend to be small and dredging tends to be intermittent removing small volumes of material from each berth. This leads to small localised areas of temporary, increased turbidity whilst the dredger operates, the majority of material disturbed settles out close to the working area however some material may be carried in suspension away from the immediate area with prevailing currents. With the TSHD and plough dredging methods the majority of sediment settles out within the vicinity of the berth but a proportion can remain in suspension as a sediment plume. Plume modelling for the Portsmouth capital dredge showed worst case scenario dispersion of the plume did not have an adverse effect through siltation of supporting habitats within Portsmouth Harbour (Royal HaskoningDHV, 2012). These changes in suspended sediment associated with the maintenance dredging will be considerably less than that of the capital dredge as the works are small in scale and temporary. 
Any changes in siltation rates as a result of maintenance dredging activity would, not have a LSE on the supporting habitats of the SPA and Ramsar site. | | |

<p>| Supporting Habitat | Siltation rate changes (Low), | Dredging may cause local deposition of sediment in the area surrounding the dredge site. This sediment includes material disturbed at the drag | Both TSHD and plough dredging activity can lead to a localised increase in suspended sediment concentrations in the vicinity of the dredger. These | No |</p>
<table>
<thead>
<tr>
<th>Sensitive feature/s</th>
<th>Pressure (potential risk identified)</th>
<th>Activity-pressure justification (Natural England Conservation advice)</th>
<th>Assessment</th>
<th>Likely Significant Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>sediments,</td>
<td>including smothering (depth of vertical sediment overburden)</td>
<td>head of the dredger and also material from the overflow. Best available evidence suggests that such effects would be constrained to an area about half the size of the dredge site itself.</td>
<td>areas of increase are known as the sediment plume. For maintenance dredging activity in Portsmouth Harbour quantities of material removed from each berth tend to be small and dredging tends to be intermittent removing small volumes of material from each berth. This leads to small localised areas of temporary, increased turbidity whilst the dredger operates, the majority of material disturbed settles out close to the working area however some material may be carried in suspension away from the immediate area with prevailing currents. With the TSHD and plough dredging methods the majority of sediment settles out within the vicinity of the berth but a proportion can remain in suspension as a sediment plume. Plume modelling for the Portsmouth capital dredge showed worst case scenario dispersion of the plume did not have an adverse effect through siltation of supporting habitats within Portsmouth Harbour (Royal HaskoningDHV, 2012). These changes in suspended sediment associated with the maintenance dredging will be considerably less than that of the capital dredge as the works are small in scale and temporary. Any changes in siltation rates as a result of maintenance dredging activity would not have an LSE on the supporting habitats of the SPA and Ramsar site.</td>
<td></td>
</tr>
</tbody>
</table>
The potential impacts of maintenance dredging on the Solent and Dorset Coast pSPA have been assessed in a similar way and are shown in Table 5.3 below. There is no formal conservation advice available for this site however therefore the sensitivity to activities has been taken from the Departmental Brief for the site and associated reports. The Departmental Brief is a document produced by Natural England for Defra with recommendations on why a site should be put forward as a SPA. The Departmental Brief is used to inform the consultation on a proposed SPA.
Table 5.3 Assessment for Maintenance Dredging – Solent and Dorset Coast pSPA

<table>
<thead>
<tr>
<th>Sensitive Feature/s</th>
<th>Pressure (potential risk identified)</th>
<th>Activity-pressure justification (Natural England Conservation Advice)</th>
<th>Assessment</th>
<th>Likely Significant Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Species</td>
<td>Barrier to species movement</td>
<td>The pressure refers to obstructions to species movement caused by physical barrier or prolonged exposure to noise, light, visual disturbance or changes in water quality. The scale of the impact will depend on scale of activity and the location and will need to be considered on case-by-case basis to determine relevance to given feature/site. The noise and turbidity arising from dredging operations may pose a barrier to species migration when occurring on or in proximity of specific migratory routes.</td>
<td>The busy dockyard and commercial port within Portsmouth Harbour mean that there are continuous movements of large vessels in and out of the Harbour. Noise from dredging is likely to be lower than noise resulting from the operation of other regular shipping operations, such as ferry routes, recreational boating and naval operations. The dredging operations are intermittent but it is likely that the terns have become habituated to the regular movements of vessels within the Harbour and will be tolerant to the presence of dredgers. Terns have been anecdotally recorded following vessels to forage for food in the area and are known to have a low sensitivity to vessel movements when foraging (RSPB, 2012).</td>
<td>No</td>
</tr>
<tr>
<td>Species</td>
<td>Changes in suspended solids (water clarity)</td>
<td>Dredging causes local increases in suspended sediment, particularly in the direct vicinity of a dredge site. This sediment includes material disturbed at the drag head of the dredger and also some the overflow. The relative elevation of suspended sediment above background levels will depend on dredge location, natural background level, type intensity, and duration of dredging, sediment characteristics. The magnitude and spatial extent of the suspended sediment plume around dredging operations is a function of the type of dredge used, the physical and biological characteristics of the material being dredged (e.g., density, grain size, organic content) and site-specific hydrological conditions (e.g., currents, water body)</td>
<td>Both TSHD and plough dredging activity can lead to a localised increase in suspended sediment concentrations in the vicinity of the dredger. These areas of increase are known as the sediment plume. For maintenance dredging activity in Portsmouth Harbour quantities of material removed from each berth tend to be small and dredging intermittent. This leads to localised areas of temporary, increased turbidity whilst the dredger operates. With the TSHD and plough dredging methods the majority of sediment settles out within the vicinity of the berth but a proportion can remain in suspension as a sediment plume. Plume modelling for the Portsmouth capital dredge showed worst case scenario dispersion of the plume did not have an adverse effect on supporting habitats within Portsmouth</td>
<td>No</td>
</tr>
<tr>
<td>Sensitive Feature/s</td>
<td>Pressure (potential risk identified)</td>
<td>Activity-pressure justification (Natural England Conservation Advice)</td>
<td>Assessment</td>
<td>Likely Significant Effect</td>
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<td></td>
<td>size/configuration. A generalised &quot;worst case&quot; field can be defined as having suspended sediment levels less than or equal to 500mg/l at distances less than or equal to 500m from the dredge, with maximum concentrations generally restricted to the lower water column within 50-100m, decreasing rapidly with distance.</td>
<td>Harbour (Royal HaskoningDHV, 2012). The changes in suspended sediment associated with the maintenance dredging will be considerably less than that of the capital dredge as the works are small in scale and temporary. Given the extent of the pSPA total area (252 square nautical miles) and available foraging habitat within the Harbour itself, any changes in suspended solids within the water column would not have a LSE on tern feeding within the Harbour.</td>
<td></td>
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</tbody>
</table>
5.2 Maintenance Dredging Activity and the Marine and Coastal Access Act

The only site designated under the marine and Coastal Access Act within the vicinity of the maintenance dredging operations is the recommended Fareham Creek MCZ (Fareham Creek rMCZ). This site has not been formally designated as an MCZ but has been included within this Baseline Document as there is a possibility of it being designated in the future.

The site was recommended for native oyster and the sheltered muddy gravels that support the oyster beds. As the site is only at the recommendation stage, there is no formal advice on the interest features of this site.

An assessment of the potential impact of maintenance dredging activity on the native oyster has been based on sensitivity assessment data taken from the Marine Life Information Network (MarLIN) and presented in Table 5.4. The native oyster has a recommended conservation objective of maintain.

Table 5.4 Assessment of potential impacts on the Fareham Creek rMCZ

<table>
<thead>
<tr>
<th>Interest Feature</th>
<th>Sensitivity to pressure</th>
<th>Assessment</th>
<th>Significant risk of hindering achievement of conservation objectives</th>
</tr>
</thead>
<tbody>
<tr>
<td>Native oyster/native oyster beds</td>
<td>Native oyster has high sensitivity to activities associated with substratum loss or abrasion and is highly sensitive to smothering.</td>
<td>Maintenance dredging locations are outside of the rMCZ boundary and not within areas where native oyster is known to have been recorded. There will therefore be no direct impacts on this recommended feature of the rMCZ through abrasion or substratum loss. Oysters can be affected indirectly by increases in suspended sediment in the water column and smothering when sediments settle out onto the seabed. Survey work undertaken for the Portsmouth capital dredge EIA (Royal HaskoningDHV, 2012) identified an area with low numbers of native oyster to the north of the capital dredge area within the Harbour. A mitigation plan was put into effect for the potential impacts of smothering from the capital dredge plume. As detailed above, changes in turbidity following maintenance dredging will be lower than that of the capital dredge operations Any sediment re-suspended by TSHD or plough dredging tends to settle within the vicinity of the dredged berth and do not lead to an extended sediment plume with potential to cause smothering to native oyster species in the rMCZ.</td>
<td>No</td>
</tr>
<tr>
<td>Interest Feature</td>
<td>Sensitivity to pressure</td>
<td>Assessment</td>
<td>Significant risk of hindering achievement of conservation objectives</td>
</tr>
<tr>
<td>--------------------------</td>
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<td>-----------------------------------------------------------------------------</td>
<td>--------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Sheltered muddy gravels</td>
<td>Direct loss of habitat or a change in sediment feeds which could alter the sediment</td>
<td>Maintenance dredging locations are not within areas where native oyster is</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>composition of the habitat and make it unsuitable for native oyster as a substrate.</td>
<td>known to have been recorded and as detailed above, changes in turbidity</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>following maintenance dredging operations are highly localised and well</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>within the natural variation experienced within the estuary.</td>
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</tbody>
</table>
6 CONCLUSIONS AND RECOMMENDATIONS

There have been a number of major changes in legislation, licensing and regulation over the past five years and the Baseline Document has been written to account for these changes. Further legislative and regulatory changes are not anticipated in the next five year period, however, should there be any changes that affect the content of the Baseline Document it should be updated accordingly.

Marine licences for maintenance dredging at HMNB Portsmouth have applied a number of conditions to ensure that best practice measures are met and that the dredging does not have a negative environmental impact.

This Baseline Document concludes that the present maintenance dredging practices are sustainable and not having any likely significant effect on the features or achievement of conservation objectives of the designated sites in Portsmouth Harbour.

A five year update is recommended to ensure that the information presented in the Baseline Document remains relevant and up to date.
7 REFERENCES


EMU Ltd. (2006). HMNB Portsmouth Development, Final Results of the Macrofaunal Analysis of the Subtidal Grab Samples and Trawls.


HR Wallingford. (1997). East Solent Shoreline Management Plan, Volumes 1 and 2. Reports EX 3441(A) and (B) to East Solent SMP Project Group (Lead Authority Havent Borough Council).


SCOPAC. (2004). Sediment Transport Study. SCOPAC.

SMRU. (2016). Estimates of cetacean abundance in European Atlantic waters in summer 2016 from the SCANS-III aerial and shipboard surveys. Sea Mammal Research Unit, University of St Andrews.

