1. **General**
   Maintenance dredging is required at HMNB Devonport to maintain the operational depths in the approaches and berth pockets of the dockyard.

2. **Maintenance Dredging Operations**

2.1 **Trailer Dredging**

2.1.1 The trailer suction hopper dredger (tshd) will be the primary dredger carrying out the maintenance dredging operations.

2.1.2 The dredger lowers the suction pipe until the draghead rests on the seabed and sails through the dredging area, turning and lifting the pipe from the seabed as necessary, until a full load of silt (in suspension) is achieved. This is determined by reference to the ship’s draught and displacement. The dredger will generally not overflow the hopper (to improve the load density) as this is not effective when dredging fine material. Upon completion of the loading, the dredger will sail to the licensed disposal area. The dredger will deposit the load by opening the bottom doors to release the material. After all the material has been dumped, the dredger will return to the dredge area to restart the cycle again.

2.1.3 Grids are fitted to the dragheads to prevent large objects entering the pump. The grids are matched to the pumps and vary in size/dimension depending on the dredger. These grids will prevent a significant amount of manmade debris from entering the draghead (and hence the hopper). When the dragheads become clogged, they are lifted to the deck and cleared of the debris. This debris is put in to a dedicated waste skip on board and transfer to ashore when full/complete for disposal. The crew will also remove any noticeable manmade debris from the hopper and deposit in the waste skip.

2.1.4 Positioning information is obtained from the differential GPS receiver onboard. The dredge computer onboard displays all the information necessary for accurate dredging of the area. The positions of the vessel and the draghead are displayed, together with the latest survey information, which shows depths as different colour bands. The design dredge depths are shown as well as any other pertinent features such as coastline, navigation buoys and the disposal area limits. This information is displayed in both cross section and plan view to the Master and the pipe operator. Information from the dredge computer is continuously stored onto computer disc for future reference, and can be plotted out if necessary to show the movements of the dredger at any time. Other information can also be recorded such as draghead depth and vessel draught.

2.1.5 The trailer dredger will continue, on a 24hr basis, to methodically cover the prescribed area, supported by regular interim survey updates, until the design depth has been achieved.

2.2 **Plough Dredging**

2.2.1 Plough dredging is carried out in conjunction with trailer dredging and as a standalone bed levelling operation.
2.2.2 The plough vessel operates by lowering a beam, blade or box plough (depending on material) to the seabed and traversing the area with the plough set to the design depth. Positioning information is obtained from the differential GPS receiver onboard and the dredge computer, similar to that noted above (but simplified), displays all the information required for accurate ploughing of the area.

2.2.3 The plough vessel is an integral part of the trailer dredger operation as it improves the efficiency and effectiveness of the trailer work. The draghead of the trailer dredger creates 'tracks' (troughs & peaks) during the dredging work. The high & low spots reduce the contact area of the draghead and consequently reduces the dredging efficiency. The plough assists the process by levelling the bed, pulling material out of confined spaces that are not accessible to the trailer and reducing the height of peaks above the design depth.

2.2.4 Plough dredging is also carried out as a standalone operation between trailer dredging campaigns to reduce localised high spots that may have resulted form silt accretion.

2.3 Grab Dredging

2.3.1 Grab dredging will be used to carry out maintenance dredging in areas that are not generally accessible to a tshd or the material cannot be ploughed in to an accessible area.

2.3.2 The grab dredger can be a wire crane or hydraulic excavator mounted on a pontoon. The wire crane can be fitted with a wire or hydraulic clamshell. The hydraulic excavator can be fitted with a bucket or a hydraulic clamshell grab. The pontoon can be with or without a hopper. A pontoon with a pontoon is generally referred to as 'self loading'. If the barge is not self loading additional hoppers will be required. The hoppers will be loaded by the grab when it is alongside the pontoon and are used to transport the spoil to the disposal site. The hoppers can either be self propelled or 'dumb' barges which propelled (towed or pushed) by an independent tug(s). Hopper barges which are used for disposal at sea are generally split hopper barges.

2.3.3 The grab dredger positions itself, the aid of an assistant vessel/tug if required, in the dredging area. Bucket or clamshell is lowered to the seabed to the required depth. The dredging depth is controlled/monitored by the crane operator with the assistance of a 'dredging' computer (ie. depth & position control). The bucket/clamshell closes and fills. It is then brought to the surface and emptied into the barge. The cycle is repeated until the barge is filled.

2.3.4 Positioning information is obtained from the differential GPS receiver onboard (similar to tshd method noted above).

2.4 Dredging with Submersible Pump

2.4.1 Some pockets within the maintained areas cannot be accessed by conventional dredging plant (eg. tshd or grab), as the physical area is too small, and cannot be ploughed out as there is an obstruction (eg. sill, pipeline, etc) at the entrance (North Yard Camber & Longroom Camber). A bespoke set-up using a submersible pump will pump the accumulated silt (above ADD) from the restricted area to an adjacent maintained area (temporary discharge area). The material will then be taken to the disposal area during the course of the routine maintenance dredging.
2.4.2 Floating plant platform. A small pontoon with a small deck mounted crane (Hiab, A-frame or similar) will be used. A submersible pump will be slung from the crane hook and lowered in to the water to the required depth (ADD). The pump discharge will be connected to a floating line reaching to the temporary discharge area. The crane will make a sweep in front of the pontoon to clear the silt above ADD. The barge will then be stepped (approx 1m) to the next sweep position. The process will be continued until the required area has been covered.

2.4.3 Land based platform. The submersible pump can also be mounted from a land based crane, with sufficient reach, and a similar sweeping operation carried out to cover the area.

2.4.4 The barge (& pump) are located by pre-set out reference points alongside the quayside.

3. Survey
3.1 Pre, Interim & Post Dredge Surveys
3.1.1 Immediately prior to a dredging campaign, a pre-dredge survey will be undertaken. This survey will serve as the baseline for the dredging works and will be supplied to the dredging vessels for use in the onboard dredge computers.

3.1.2 During the dredging works, interim surveys will be conducted as required to monitor and supervise the works. Each interim survey will be supplied to the dredger to update the onboard computers in order to optimise the works.

3.1.3 A post dredge survey will be conducted immediately following dredging operations, or following completion of a discrete section if applicable.

3.2 Monitoring Surveys will be carried out at the end of each campaign as a record of the work and level of the seabed. These survey charts will be reviewed and signed by the Deputy Queens Harbour Master (DQHM).

3.3 Horizontal Control will be by Differential Global Positioning System (DGPS). Differential corrections will be provided by the nearest IALA Station. The GPS Receiver on board of the Survey Vessel will be checked for accuracy prior to deployment. Positions output will be in the OSGB 36 co-ordinate system.

3.4 Vertical control will be provided by a Radio Transmitting Tide Gauge installed at a suitable location close to the working area. The data will be continuously transmitted to the survey vessel and dredging plant. The transmitted levels will be checked regularly against a known Bench Mark relative to Ordnance Datum Newlyn or Chart Datum in order to ensure all readings are within acceptable tolerances. Vertical measurement will be provided by a precision single high frequency echosounder. This sounder will be calibrated by means of a bar check prior to any major survey being executed. All vertical measurements will be expressed relative to Chart Datum