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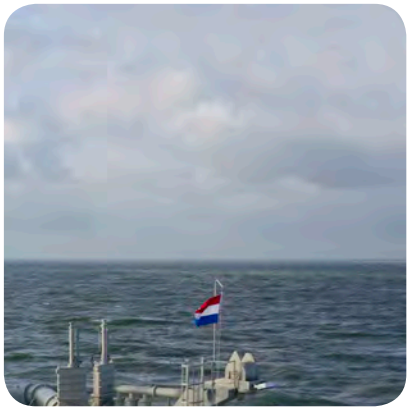
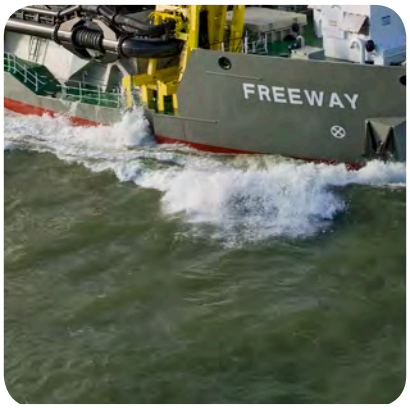
DUBLIN PORT COMPANY

Dublin Port Company

2016 Maintenance Dredging Campaign

Non Technical Summary





Contents

Introduction

This report has been prepared to summarise the findings of a range of environmental monitoring activities which took place as part of a recent maintenance dredging campaign in Dublin Port. The purpose of the monitoring was to detect and prevent any potential impact on the environment and the interests of numerous stakeholders so that intervention and mitigation could be undertaken if required. Although much of the monitoring was required by licence and permit conditions, Dublin Port Company committed to additional safeguards in the interests of best practice and environmental protection.

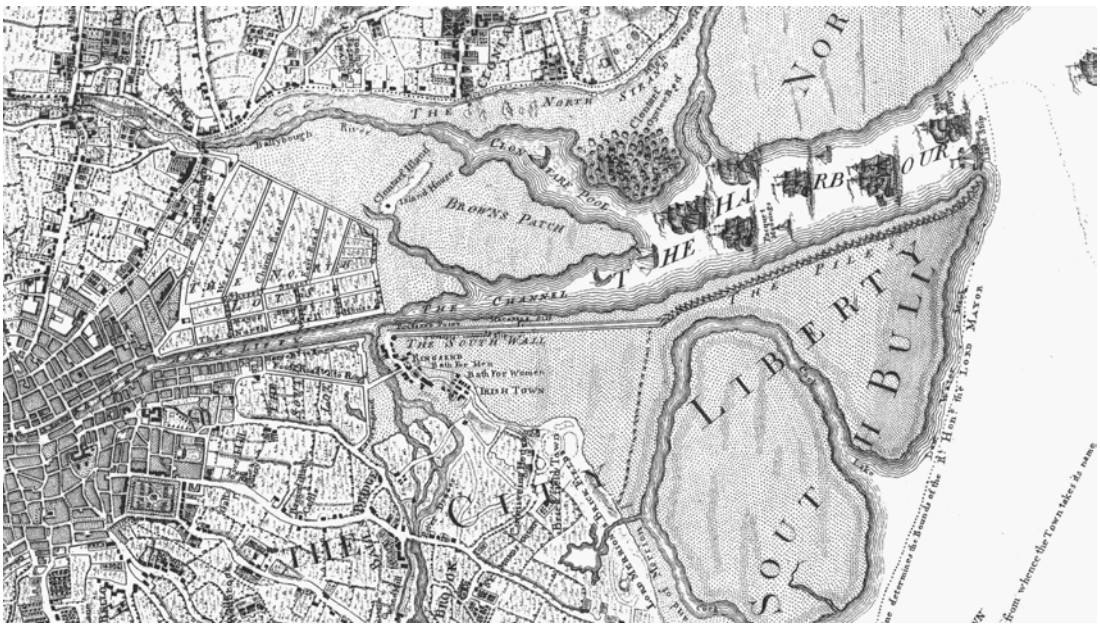
This report summarises the findings in a non-technical way and is intended to make the information accessible to the many stakeholders that share our concerns for the protection of Dublin Bay. Significant quantities of data and information support the findings of this report and are reported elsewhere in a more technical manner. Some of these documents are mentioned in this report. The information reported here is confined to monitoring that happened during the 2016 maintenance dredging campaign. It does not include other important monitoring activities which are ongoing continuously over the years and months between dredging campaigns. This is reported in the Annual Environmental Reports by Dublin Port Company.

This report includes; some background information on the history of Dublin Port, the process of dredging and the important environmental aspects requiring protection and how they were monitored. The information gathered is considered and interpreted to determine whether any impact on the environment has occurred.

Dublin Port History

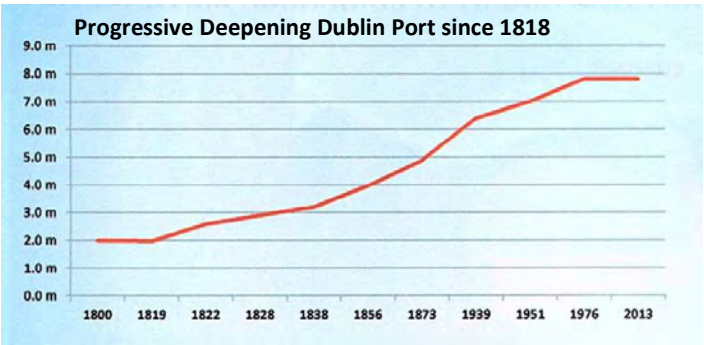
Dublin has a long history of difficult ship access to the port area due to sand bars across the mouth of the river. Over the centuries many ships have run aground on these banks and sunk. The Great South Wall and the Bull Wall were built in the early 18th and 19th Centuries to help address this problem along with regular dredging. Dredging is the process used to clear the unwanted and dangerous accumulations of sediment from areas that ships use when entering and using ports. Such areas include access channels, turning basins and waterside facilities, such as berths. Dredging has been a regular activity in Dublin Port since the foundation of the State with over three quarters of a million tons of sediment dredged in 1922.

Dredging is an important part of the essential maintenance activities of every port. Tides, currents and rivers that run into ports carry suspended sediment with them. These sediments include sand and silt that upon reaching slower, calmer waters, settle to the bottom. Over a period of time the settled sediments will build up on the seabed and if these aren't removed, choke ports and channels preventing ships from entering and berthing. In some areas this process happens faster than others and so these locations need attention more frequently. Dublin Port, due to its location at the mouth of the Liffey is one such location where natural processes deposit around 200,000 tonnes of sediment in the port area every year.

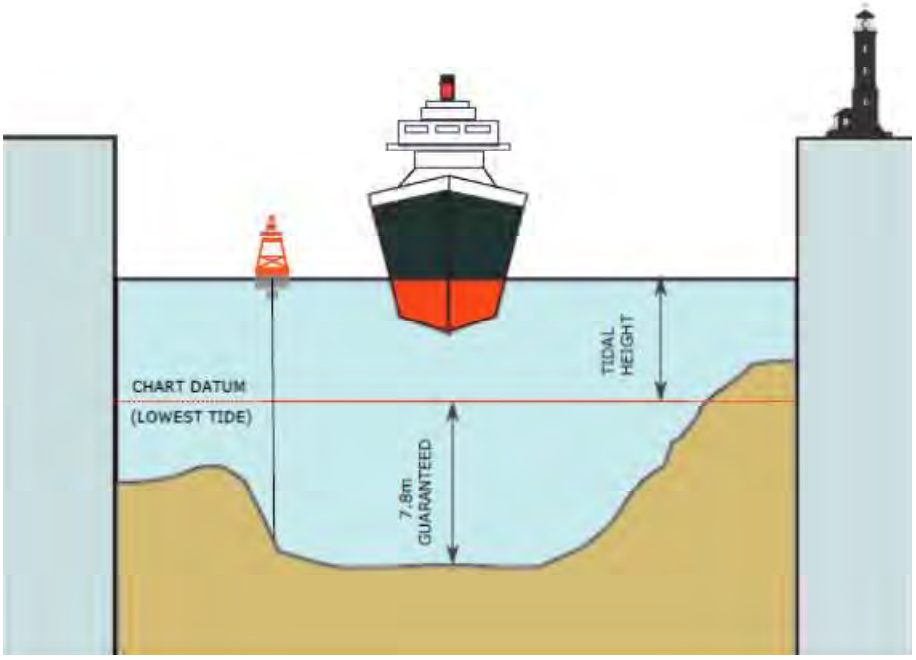


18th Century Map of Dublin (ca 1760) showing the extensive sand banks at the harbour entrance

Port authorities and those controlling shipping movements must be sure that there is a sufficient depth of water available to allow safe passage of vessels. Over the years, as the size of ships has increased, it has been necessary to deepen the port and its approach channels. The figure below shows how the port has been progressively deepened from about 2m in the early 1800s to its present depth of 7.8m which has been maintained since the 1970s.



The Dublin Port Company (DPC) is obliged to maintain this depth for safety purposes and the operational needs of the port and guarantees to shipping that there is a channel into the port the bed of which is 7.8m below Chart Datum. Chart Datum is a reference level which is roughly the same as the level of the lowest tide that can be expected to occur under normal weather conditions. This means that vessels that need up to 7m of water to float can enter the port at any state of the tide without fear of running aground.



Prior to the 2016 maintenance dredging campaign, DPC had not carried out a dredging campaign since 2012. In the intervening time, surveys of the port have shown that siltation has resulted in some areas becoming shallower. This has necessitated the Harbour Master issuing a Notice to Mariners in January 2016 warning that the minimum depth had reduced to 7.4m in places and restricting entry of some vessels to periods around high water. A maintenance dredging campaign was therefore essential to restore the declared depth to 7.8m and allow safe use of the port and its facilities.

Dredging Operations

Boskalis, a leading international marine dredging company, was procured to carry out the necessary dredging operations. The principal method used was *'trailer suction hopper dredging*'. Trailing suction hopper dredgers are equipped with one or two trailing suction heads. When the ship reaches the location requiring dredging, they reduce speed and lower the suction heads to the seabed. The trailing suction head moves slowly over the bed, collecting the sand/silt in a similar way to a giant vacuum hoover. The water and material mix is then pumped up the arm of the suction head to the ship where it is stored in the hopper. Once full, the dredger retracts its suction head and begins to sail slowly to the dumpsite.

When in position over the dumpsite, the ship slowly sails in the desired direction as doors in the underside of the vessel open up and the material is released from the hopper. This allows the operators to control accurately where the material is deposited.

This method of retaining all the sediment and dirty water in the dredger helped to limit the amount of sediment disturbed, reducing the amount of sediment that ended up suspended in the water and subsequently, the turbidity (murkiness) of the water. Dumping at the spoil grounds takes place through doors in the bottom of the hull and it takes about 10 minutes to release a load.

Freeway - Trailing Suction Hopper Dredger

The entire dredging campaign lasted for a period of only 42 days. Dredging operations started on the 20th June 2016, and were completed by 31st July 2016. Throughout this period the dredger maintained a detailed record of all its activities including the locations at which it operated. These records allowed comparisons to be made with results of the monitoring programme to assess any potential environmental impacts caused by the dredging and dumping operations. The charts below are examples of the dredger location and activity records. The first chart shows the dredger as it is

leaving for the dump site after dredging along the South Bank Quay. Each dredge track is shown by the irregular white lines running parallel to the quay walls. In the second chart the hatched area shows precisely where this load was dumped at the spoil site.

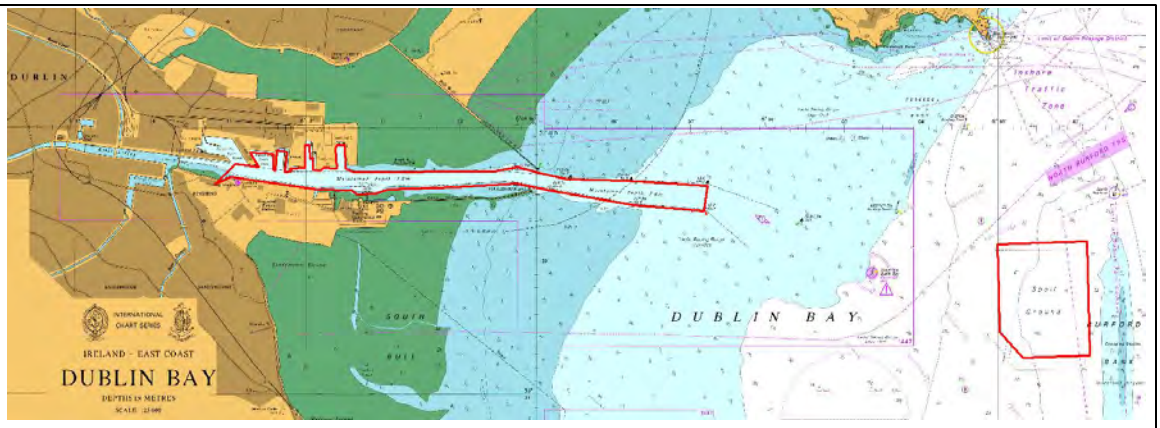
Locations

The permitted areas to be included in the dredging campaign are set out in a Foreshore Licence issued by the Department of Environment, Community and Local Government (AKC/2016/00262) and the Dumping at Sea permit issued by the EPA (S0004-01). These allow for the removal of dredge material from the navigational channel and berths of Dublin Port and for the dumping of the dredge material at the approved Spoil Ground near Burford Bank off the coast of Dublin. The Spoil Ground is marked on the Dublin Bay Admiralty Chart (No. 1415). It is also referred to as the 'dumpsite' in this report.

DPC determined that the actual area that needed dredging in 2016 was less than that allowed for in the Dumping at Sea permit. The area from East Link Bridge to Ocean Pier (identified as North Quay Extension - B006, and River Area A - B007 in the Permit) did not require dredging and was excluded from the 2016 campaign.

The spoil dumpsite has been used by Dublin Port and a number of other permit holders since 1996. The site lies just west of the Burford Bank and is about 7km from the Poolbeg Lighthouse at the entrance to Dublin Port. The dumpsite is roughly 1¼ kilometres from east to west and about 1½ kilometres from north to south. It has an average depth of 20 metres.

Dredge spoil has been dumped in this general area going back 100 years or more as this is the closest point where a north – south current is encountered to take dredged silts away to the open sea. The site was first licensed in 1996 after the previous dumpsite located nearby closed and it has been subjected to regular dredge spoil disposal since then. The tonnages licensed for disposal at the site varied each year and ranged from about 6,400 to 1,500,000 tonnes. Although this may not indicate the amounts actually disposed at the site under those permits, it highlights the active nature of the dumpsite on a continual basis. The amount of material disposed of in the 2016 maintenance dredge campaign was about 1,100,000 tonnes.



Areas dredged in the 2016 campaign and the offshore spoil site are outlined by the heavy red line.

Environmental Considerations

Dublin Bay and the surrounding area is a vital natural resource, providing valuable environmental, economic, cultural and tourism services to the many inhabitants of the region. DPC recognizes the importance of this resource and is committed to carrying out all its operations, including essential dredging operations, in a sustainable manner. The Chief Executive Officer has endorsed the Dublin Port Company's environmental policy which states that

> '***It is our policy to manage our obligations to the environment in a responsible manner and to take a sustainable approach to developing the port's business.***'

Indeed DPC has received accreditation to international standards (ISO 14001) for its environmental management systems.

However, there are many demands on this resource and reconciling conflicting demands is not always a simple matter. Many stakeholders have a role to play and a partnership approach offers the best chance of successfully protecting our environment. DPC recognizes that it has a key role in this process and has been a proactive partner in many projects aimed at protecting and improving the Dublin Bay environment. Since the designation of the Dublin Bay Biosphere by UNESCO in 2015, DPC, as a member of the Dublin Bay Biosphere Partnership, has been working to encourage people to experience, understand and appreciate nature in the bay.

Environmental Designations

In addition to the Dublin Bay Biosphere mentioned above, the bay area has numerous designations that recognize the quality and richness of its environment. The licensed offshore disposal site lies within a bigger Special Area of Conservation (SAC), called the *Rockabill to Dalkey Island SAC* (site code: 003000). This SAC was only recently designated in 2012 and one of the reasons it has been designated as special is because of its resident harbour porpoise population. Other Marine Mammals also frequent or live in the area including grey Seals, Harbour Seals (also called common Seals) and sometimes bottlenose dolphins.

Recreational Users

People also use the Bay and surrounding areas for many different types of recreation such as boating and yachting, angling, bird watching, walking, scuba diving and of course swimming. There are many traditional bathing spots, some within the Port area such as those at the Bull Wall and the South Wall.

Measures to Protect

All these interests and uses deserve protection and DPC has taken measures to ensure that its dredging activities will have no impact on them. The measures taken include the sampling and monitoring described below. Some measures were required by conditions set in licences or permits, but DPC committed to and implemented additional measures to ensure best practice and to better safeguard the environment.

Monitoring Activities

This section gives an overview only of what was measured during the 2016 maintenance dredging operations. Other measurements are made in the months and years between dredging campaigns. These include:

- analysis of sediment samples from the port and the dumpsite
- surveys of the seabed levels
- surveys of the communities of animals living on the sea bottom in and around the dumpsite
- surveys of nesting seabirds in the port area
- surveys of wetland birds that use the bay area and adjacent estuaries during winter months.

All of this other monitoring is reported elsewhere in the ***Annual Environmental Reports*** prepared by DPC.

Marine Mammals


Harbour Porpoise surfacing
Photo: Randal Counihan IWDG

Because the spoil dumpsite is within a conservation area where harbour porpoise is one of the features of interest, DPC committed to implementing the requirements set out by the National Parks and Wildlife Service[1] in relation to protecting Marine Mammals from disturbance during the dredging and dumping operations. This meant recruiting a number of independent, trained observers through the ***Irish Whale and Dolphin Group*** to operate on the dredger and onshore for the duration of the campaign. The observers had the authority to prevent works commencing when Marine Mammals were close enough to be at risk. This included not just harbour porpoises, but also Seals. No whales other than porpoises were observed during the dredging campaign although the same protection applies to them if present.

[1] NPWS. Guidance to Manage the risk to Marine Mammals from Man-made Sound Sources in Irish Waters. (January 2014)

Noise

Underwater noise levels from dredging were of concern because of the damage or disturbance that might result for Marine Mammals. These are well known to be sensitive to sounds (especially the harbour porpoise) and loud noise can cause permanent damage to them. Studies done by DPC had already indicated that risk of harm could be avoided once the NPWS requirements described above were implemented. However, DPC monitored the actual underwater noise emitted by the dredging and dumping operations to confirm that there would be no risk.

Water Quality

One of the main concerns expressed about water quality was that dredging and dumping might lead to large amounts of sediment being widely dispersed in the water. This could lead to murky water where visibility might be greatly reduced. To have information on the amount of sediment being suspended in the water DPC set up monitoring stations in the port and outer Bay. Sensors at these stations measured turbidity every 15 minutes and relayed the data back onshore. This gave real-time information about what was happening during the dredging and dumping operations.

The information from the monitoring stations was also supplemented by data collected by boat surveys. While the dredger carried out its dumping operations at the spoil site, a separate survey boat took samples at fixed locations and along set paths. These were strategically located near to, and within the dumpsite, to measure any sediment impacts and the area, tidal stage and depths over which they might be detected.

During several dumping sessions DPC also flew a drone over the dredger to film any sediment plume that might be apparent and witness its dispersal in the water.

Monitoring Results

Marine Mammals - Underwater Noise

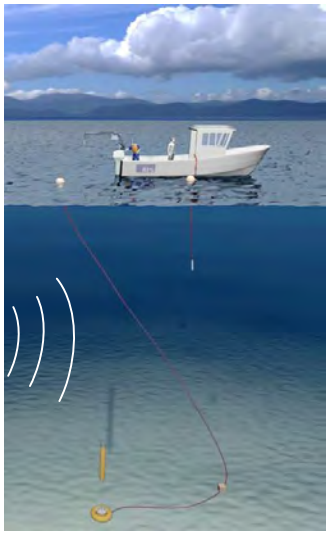
Underwater Noise Measurement

When dredging is taking place, it usually generates a low-frequency, low-pitched, continuous noise. The noise varies depending on a number of factors including, how the ship operates, the dredging area or the type of material being dredged. Of course Dublin Port is a busy shipping area and there is often relatively high levels of background underwater noise during normal operations.

Measurements are made by placing an underwater microphone (a hydrophone) a known distance from the dredger and recording the noise. The amount of noise can be expressed in different ways such as the peak noise level, an average level or the total amount of noise that something is exposed to. These recorded noise levels are then compared to levels that have been shown to disturb or injure whales or Seals.

Each type of animal has its own particular sensitivity to noise. Harbour porpoise are known to be the most sensitive of the species present within Dublin Bay and so they were used as a benchmark species, knowing that if nothing was done to disturb, or harm it, then it is highly unlikely that other animals would be affected.

Underwater Noise Results



Measurements were made on July 14th at three locations in the Liffey channel near the North Bank Lighthouse and at one location in the spoil grounds. The dredger was removing silty sand and dumping this dredge material at the offshore spoil ground during the noise measurements.

On one of the measuring occasions in the channel, it was impossible to distinguish the dredger noise from the noise of other passing ships. On the other two occasions, one when the hydrophone was 213m from the dredger
and the other when it was 268m away, the sound levels were below the levels that cause any disturbance for the sensitive harbour porpoise.

The measurements at the dumpsite were made only 90m away from the operating dredger. At this distance the noise was marginally above the disturbance level for porpoises, but it was still below the disturbance level for Marine Mammals in general. It is important to note, as explained below, that work would not be allowed to start if a porpoise was this close to the dredger in the first instance.

CONCLUSION

The underwater noise measurements confirm predictions that the dredging would not significantly impact any Marine Mammals, even if they were well within the normal exclusion zones that were operated by the Marine Mammal Observers as described below.

It is also worth noting that although noise can potentially injure fish, the dredging noise levels measured would not harm fish, even at short ranges.

Marine Mammals - Exclusion Zones

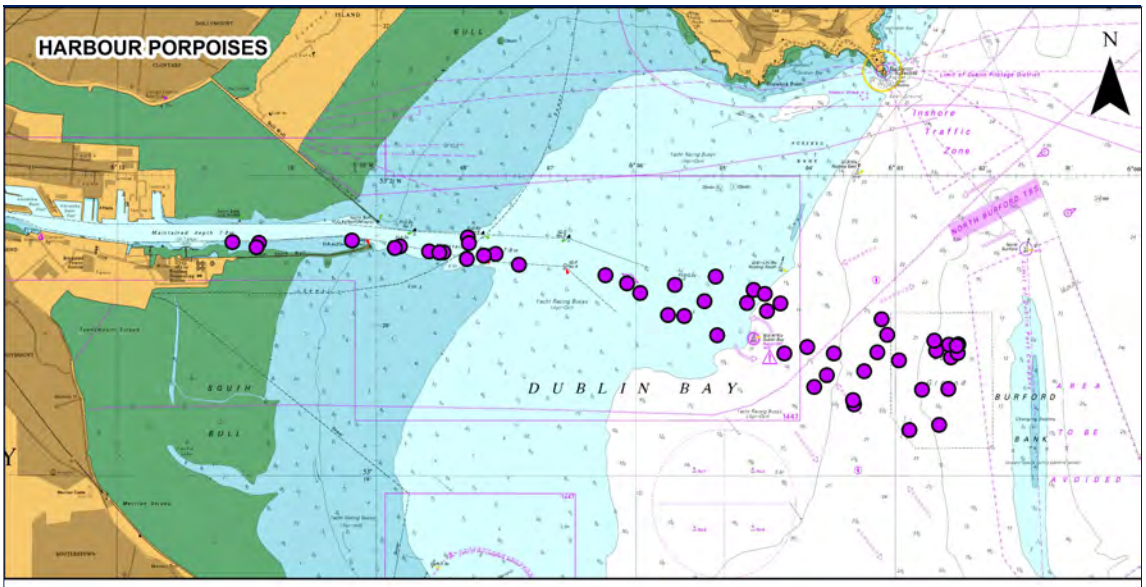
The Irish Whale and Dolphin Group (IWDG) were contracted by DPC to provide experienced Marine Mammal Observers (MMOs) to implement protection measures for Marine Mammals during the dredging campaign. IWDG is an independent organisation dedicated to the conservation and understanding of whales, dolphins and porpoises in Irish waters. Altogether, 5 MMOs were involved in this campaign; usually three were working at any one time. Two were stationed on the dredger full-time for the entire 42 days of dredging operations and the others carried out watches from suitable vantage points along the shore in the port.

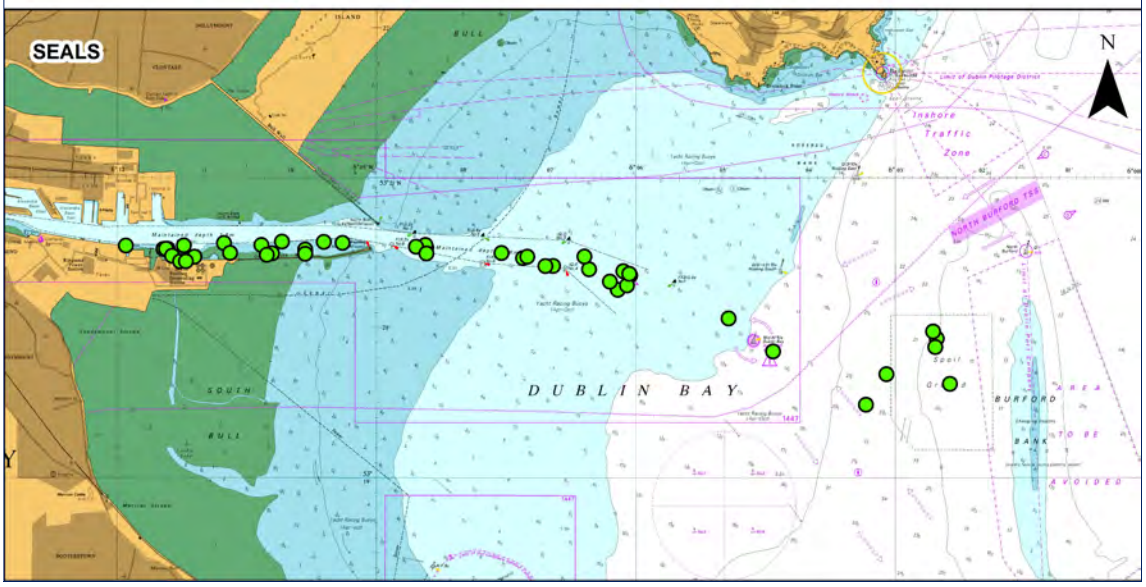
The recommended approach for protecting Marine Mammals is set out in guidelines prepared by the National Parks and Wildlife Service and these formed the basis for our measures. Basically, the observers carried out visual scans with telescopes and binoculars for 30 minutes before the dredging started to ensure that no Marine Mammals were within 500m of the dredging noise source. If a Seal or porpoise was within this exclusion zone, then dredging was not allowed to start until the animal(s) left the area. Once normal dredging operations commence, there is no requirement to halt or discontinue the activity at night-time, nor if weather or visibility conditions deteriorate nor if Marine Mammals occur within a 500m radial distance of the sound source, i.e., within the monitored Zone.

Once started, dredging was continuous except for repairs, refuelling and taking on supplies. If an animal comes within the exclusion zone while dredging is ongoing, there is no requirement to stop work. However, if operations stopped for more than half an hour, another 30 minute visual scan was completed before a restart was allowed. As we saw above when discussing underwater noise, a 500m exclusion zone is more than adequate to protect even the sensitive harbour porpoise during the type of dredging that was done in this campaign.


Grey Seal (left) and Seals hauled out on Bull Island (right)

In total, the MMOs carried out about 780 hours of watches covering the port area, the channel, in the bay and the dumpsite. Sea conditions and visibility were good for the vast majority of this monitoring period. They spotted Marine Mammals on 134 occasions. Some of these will have been repeat sightings of the same animals and some sightings were groups of animals. The grey Seal was the most commonly recorded species (76 sightings), followed by the harbour porpoise (56 sightings). A single Harbour Seal and a Seal that could not be clearly identified as either Harbour or Grey were also seen. About two thirds of the Seals spotted were in the harbour area i.e. inside the Bull and South Walls. By contrast, all except 3 of the porpoise sightings were in the bay outside the walls.





In nearly all of the sightings the animals were more than 500m away from the dredging operations and therefore no action was required. In a small number of cases dredging was delayed to allow the animal to move away or the dredger moved to another area to operate if possible.

CONCLUSION

The independent IWDG expert observers concluded that it is highly unlikely that the dredging and dumping activities during this campaign had any significant impact on Marine Mammals in the area, and that the objectives of the NPWS guidelines to protect Marine Mammals had been achieved.

Water Quality

Measuring Water Clarity

During dredging there were two main areas of operation. The dredger loaded sediment in the port area and channel and then dumped the dredged material at the spoil ground in the outer bay. Sediment released into the water during either loading or dumping could result in murky water with low visibility. To quantify the 'murkiness' of the water the water's turbidity is measured.

Turbidity is the cloudiness or haziness of water. It is caused by material suspended in the water such as soil particles, sediment or small floating algae. The individual particles are often small and may be almost invisible to the naked eye. This means they can remain in suspension in the water for lengthy periods. Turbidity is caused by natural events such as flooding, algal growth, water currents, wind and wave action as well as human activities.

Turbidity has a big influence on what scuba divers refer to as 'visibility' or 'viz'. However, viz is a very subjective measure of water clarity and is also affected by light levels and the nature of the object being looked at. As turbidity is caused by particles suspended in the water, it provides a measure of the total amount of suspended solids in the water column. While suspended solids can be measured directly by filtering volumes of water and weighing the residue, turbidity is easier and quicker to measure and can be done by using a meter on-site to provide immediate results. The exact relationship between turbidity and suspended solids varies depending on the nature of the solids causing the turbidity. However, some data that provides a rough estimate of the amount of suspended solids in the water based on turbidity measurements was collected.

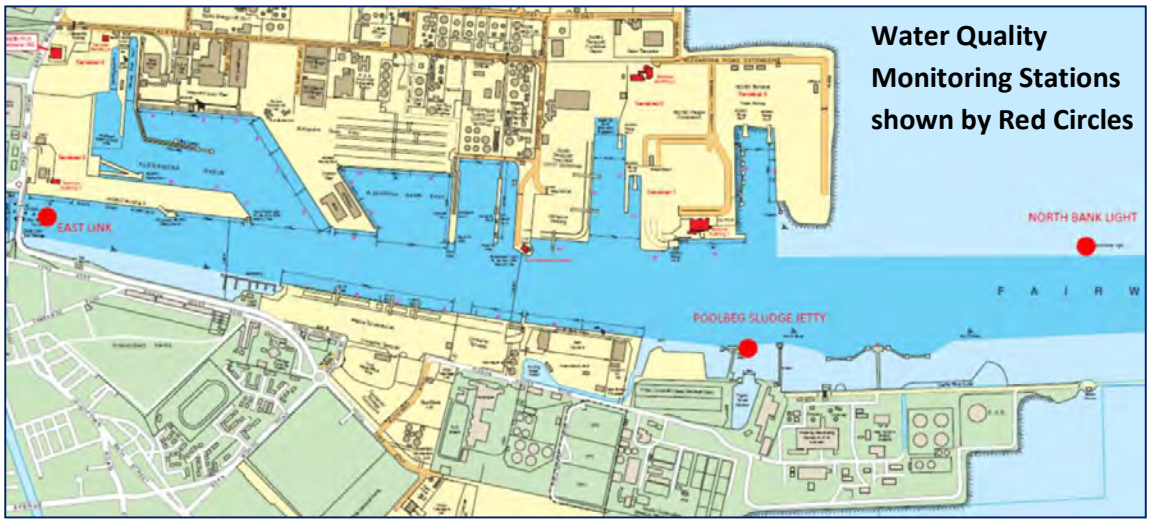
Turbidity is measured in NTU, which is basically a measure of the amount of light scattered by the particles in suspension when a light is shone through the water. The following examples help to give some sense of what turbidity measurements look like or mean. Irish regulations suggest that drinking water production plants should try to achieve a value of 1 NTU in drinking water leaving the plants. However, about one third to one half of plants are presently producing drinking water with turbidity greater than 1 NTU. The picture below shows what water at different turbidity levels looks like. Water with a turbidity value below 4 NTU is visibly clear to the human eye and is generally very acceptable aesthetically.

BACKGROUND CLEARLY VISIBLE → **BACKGROUND OBSCURED**

CLEAR WATER → **CLOUDY WATER**

Water Clarity Dublin Port

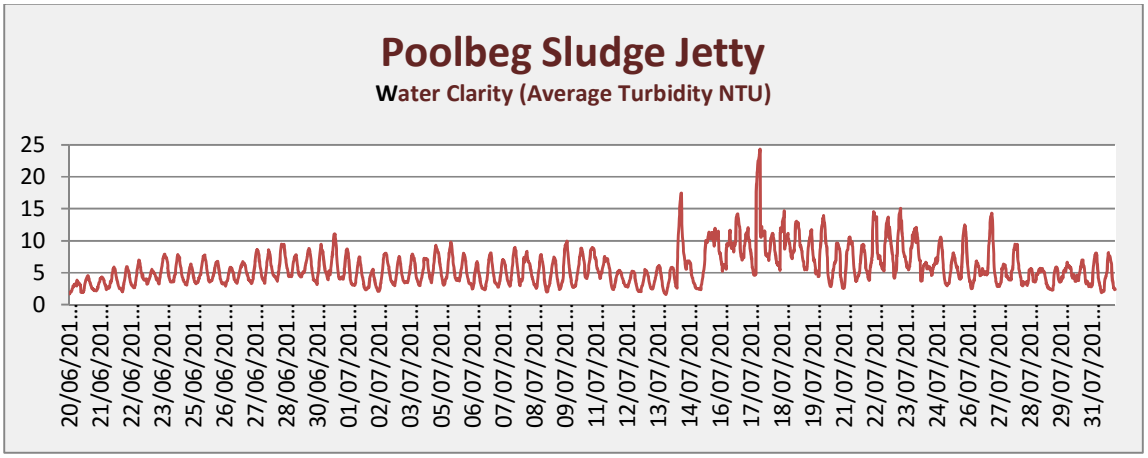
Monitoring equipment was set up at East Link Bridge, Poolbeg Sludge Jetty and North Bank Light in the harbour area to measure turbidity during the dredging campaign. Measurements were usually made every 15 minutes. However, it is always difficult to keep sensors in good condition in the marine environment and some problems occurred with fouling by dirt and algal growth at East Link during the monitoring period. Regular visits were made to clean and calibrate the instruments to minimise the affect this had on the results.



It is usual for turbidity to vary substantially over short time intervals in natural waters such as estuaries. This can be due to tide and wind changes, flood waters in rivers or just bits of debris drifting past the sensor. Very short term changes (one or two measurements in succession) are unlikely to reflect an actual impact from activities like dredging and are not of any real environmental significance. For example, a period of low turbidity interrupted by a single high value is of no real significance.

It should be noted that in a busy port like Dublin, the normal passage and manoeuvring of ships also creates turbidity and affects water clarity on an ongoing basis.

The average turbidity measured during the dredging campaign was very low, less than 10 NTU at all our sites; the highest average was 7 NTU at Poolbeg Sludge Jetty. In fact 95% of all the thousands of measurements made were 15 NTU or less. A close examination of the measurements shows that fluctuations in turbidity appear to be influenced by the tidal cycle, slightly higher turbidity often occurring at low tides. Other local factors, such as port works and shipping movements, undoubtedly play a big role in influencing turbidity in the port area.



This graph is an example to show how turbidity has fluctuated at Poolbeg Sludge Jetty during the maintenance dredging campaign. It shows the average turbidity every four hours from the 20th June until the 31st July. The regular up and down movements of the red turbidity line reflect tidal changes and how they can influence turbidity at this location.

CONCLUSION

In summary, there is no evidence that the dredging activities in the harbour area have had any measurable effect on water clarity over significant periods of time, or large areas. Regular fluctuations in turbidity were detected that were often associated with tidal conditions and not dredging related.

Water Clarity Dublin Bay

During the maintenance dredging campaign, turbidity was also measured in the outer bay area using monitoring equipment fixed to the Dublin Bay buoy and in the vicinity of the dumpsite using a boat. The survey boat sailed along 4 different fixed paths (transects) while taking measurements every few seconds near the surface of the water. These transects were located inside and outside the dump site, to the north and south. The positions of the Dublin Bay buoy, the transects and the dump site are shown on the map below.

Measurements at the buoy were made every fifteen minutes, while the measurements from the boat were repeated at different stages of the tide and on different days. In total, about 120 transects were completed by the boat on 27 different days yielding more than a quarter of a million turbidity measurements. On the 29th July, the boat also took a series of samples at four locations along the transects. These samples were taken roughly every hour at different water depths during a full 12 hour tidal cycle.

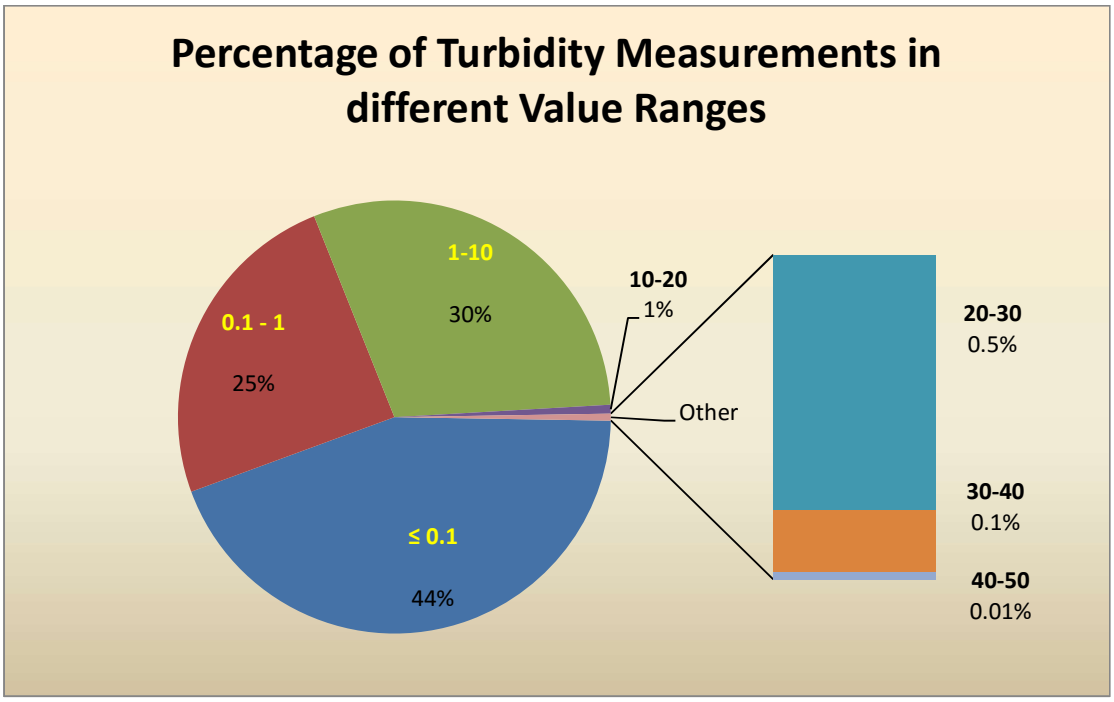
All of these measurements (the transects, at the buoy, at different depths and tidal stages), were carried out to detect any plumes of sediment spreading from within the dump site when dredge spoil was released. The results from each approach are discussed next.

The approximate location of the dump site (white shape) and paths taken by the survey boat (yellow lines). The bull's-eyes show fixed locations where depth samples were taken.

SAMPLING ALONG TRANSECTS

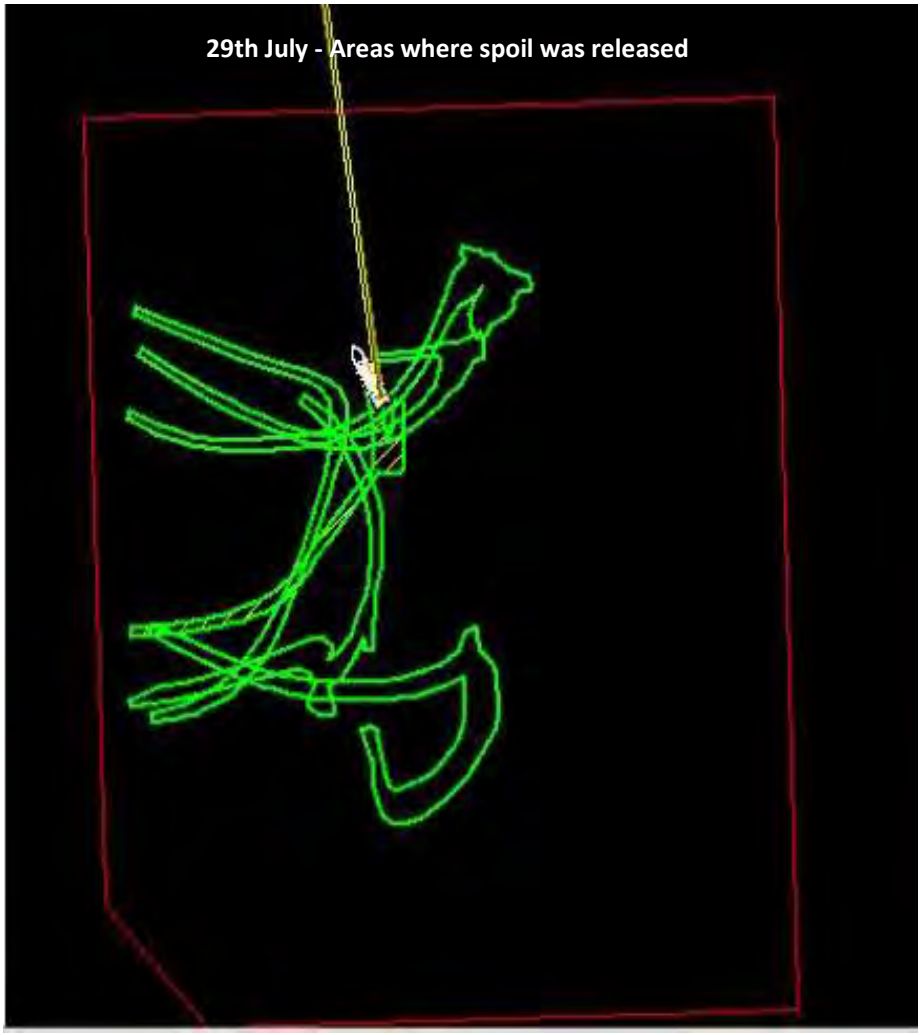
The pie chart below shows how the quarter of a million turbidity measurements were distributed ranging from very low values of less than 1, to values over 50. The chart shows that 99% of the measurements (i.e. the three biggest slices of the pie) were 10 NTU or less.

These results demonstrate that turbidity was low and water clarity was good during the dredging campaign. In fact turbidity greater than 30 was only measured during monitoring of four of all the transects taken; one of these on the 23rd July and the other three on the 25th July. On both the days the transects were being sampled the sea was calm and there were only light breezes. When the data is examined, there is no connection obvious between periods when dumping occurred and water clarity. Indeed the highest turbidity values on these days were recorded 1 to 2 hours after the dredger had left the dump site. As mentioned earlier, turbidity can also result from algal growth (small plant cells suspended in the water) and the calm conditions occurring during this interval are ideal for such algal blooms to occur.



DEPTH AND TIDAL CYCLE SAMPLING

In addition to the transects, the survey boat measured turbidity during a full tidal cycle on the 29th July at the four fixed locations shown by the bull's-eyes on the map. Turbidity was measured near the surface, in mid water and near the sea bed roughly every hour. The dredger made nine trips to the dump site on this day and released its loads near the centre of the dump site in the area between the two inner bull's-eye markers. These are about 1km apart, so dumping took place well within 500m of these sampling points. The precise locations where dredge spoil was released on the 29th July are shown by the paths marked in green on the chart below.



Once again the turbidity results indicate that water clarity was very good throughout the tidal cycle and at all water depths at the four fixed locations. The average turbidity was less than 1 NTU and the highest value recorded was 10.

DUBLIN BAY BUOY MEASUREMENTS

The measurements taken at the Dublin Bay buoy show that water clarity was good throughout the duration of the dredging campaign. Altogether 456 measurements were made between the 21st June and the 7th July. During this period the dredger made over 160 trips to the dumpsite. The average turbidity was just less than 5 NTU and 90% of the results were between 3.5 and 6.6 NTU. Only three measurements were above 10 NTU; two just marginally and a third single value of 88.3 NTU on the 5th July.

This range of values is similar to values recorded by the Marine Institute in Dublin Bay between 2011 and 2015. Three quarters of the turbidity measurements they made were less than 10 NTU and the average was 17.7 NTU. It is not unexpected that their values are a little higher than those recorded during the dredging campaign because they sampled over a longer period of time and during winter conditions.

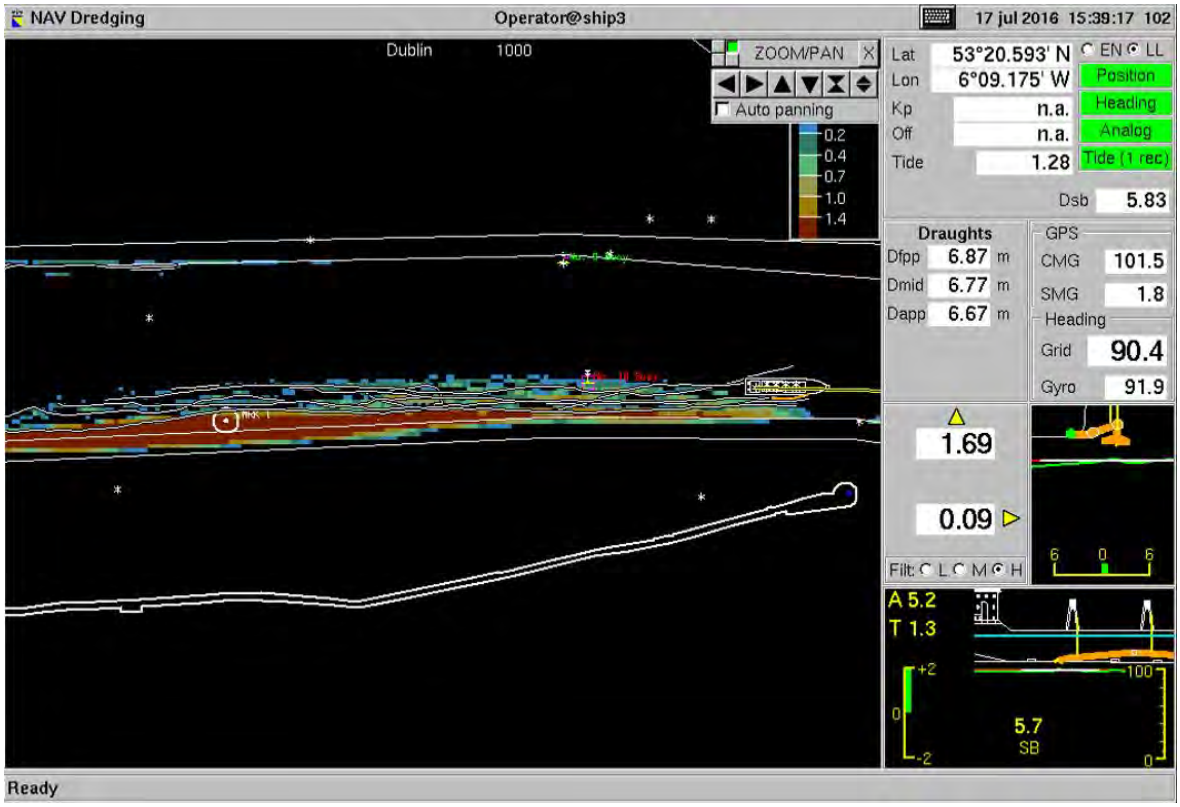
CONCLUSION

In summary, the data collected provides evidence that the dumping of dredge material at the Spoil Ground had no measurable effect on water clarity outside the dumpsite or even within the dump site at relatively short distances away from the spot where the dredger released its load.

Drone Video Records

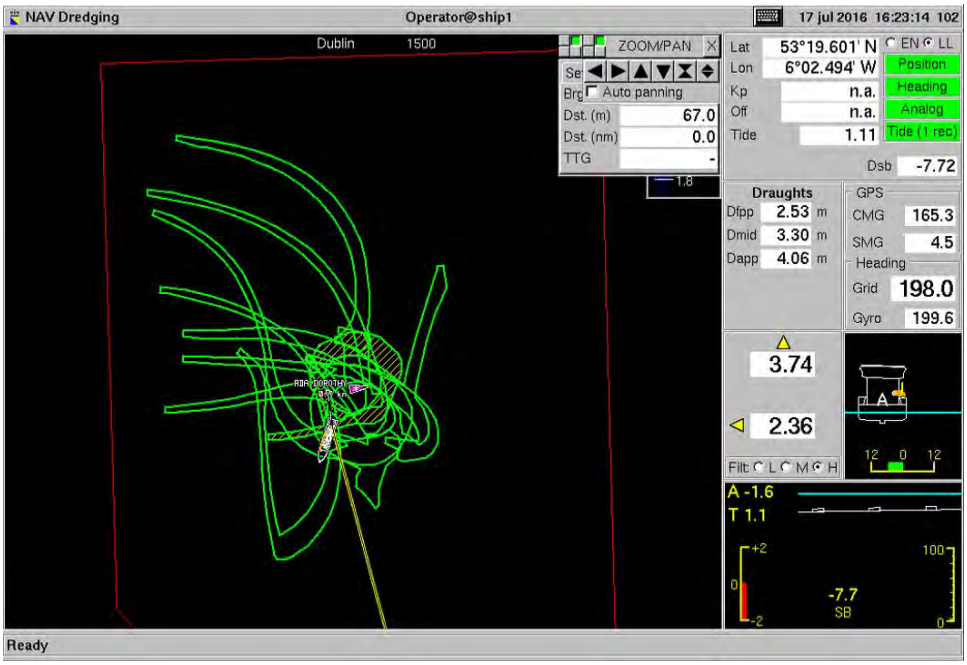
An aerial drone was used to film dredger operations at the dumpsite on seven different days and for 14 dredger runs. The description below gives an example of one of these runs on Sunday the 17th July and is typical of the sequence of events observed.

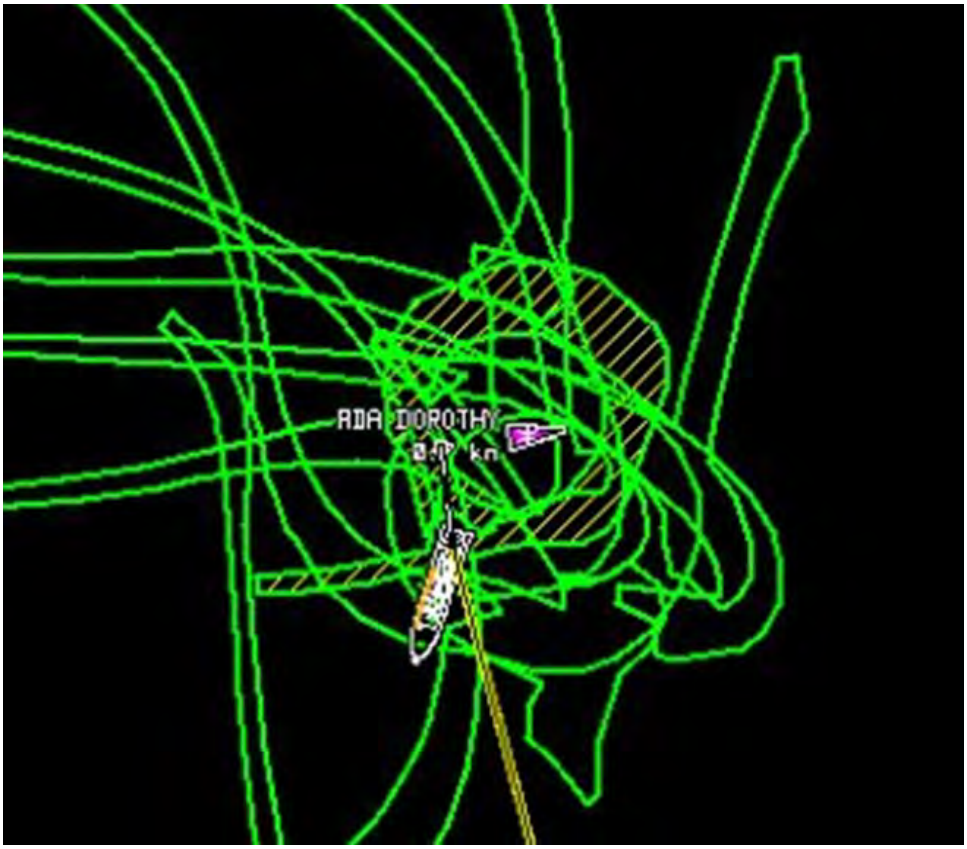
Dredger movements and operation were recorded in detail during the entire period of the campaign. The chart below for the run we are describing shows that the dredger loaded in the inner channel near the mouth of the harbour at the Poolbeg Lighthouse. Loading took place during an ebb tide and finished at 15.40h, approximately 50 minutes before the low tide.



The trip to the dumpsite takes about 30 minutes. The Freeway began dumping at 16.06h and the load was completely released by 16.23h, i.e. over a period of about 17 minutes. This was just before a low tide of 1.14m at 16.31h on the 17th July.

These next charts show where loads on the 17th July were dumped (the second chart is just an enlargement of the central area to help with clarity). The red lines that can be seen mark the boundary of the licensed dumpsite, and it is clear that all dumping takes place in the allowed area.





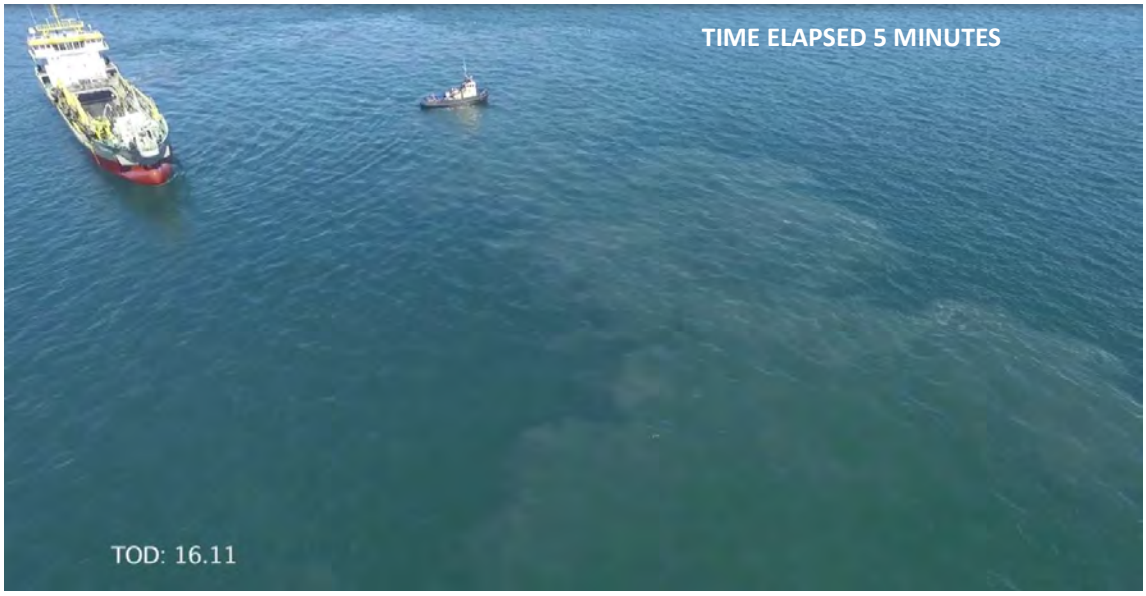
The Freeway's course during the dumping operation we are describing here is marked by the hatched green circular area. Other green lines show previous dumping runs. The tug ADA Dorothy carried the drone and was on site to start filming when the dredger arrived. Her position is marked on the chart at the centre of the dumping run. The ADA Dorothy remained anchored at that location throughout the period of filming and she provides a good reference point when looking at the photographs below.

The images that follow are taken from the video sequence of the entire dumping run. In the following description the elapsed time is measured from the time that dumping commenced at the licensed site. 'TOD' shown at the bottom left of the photographs is the Time of Day.

1

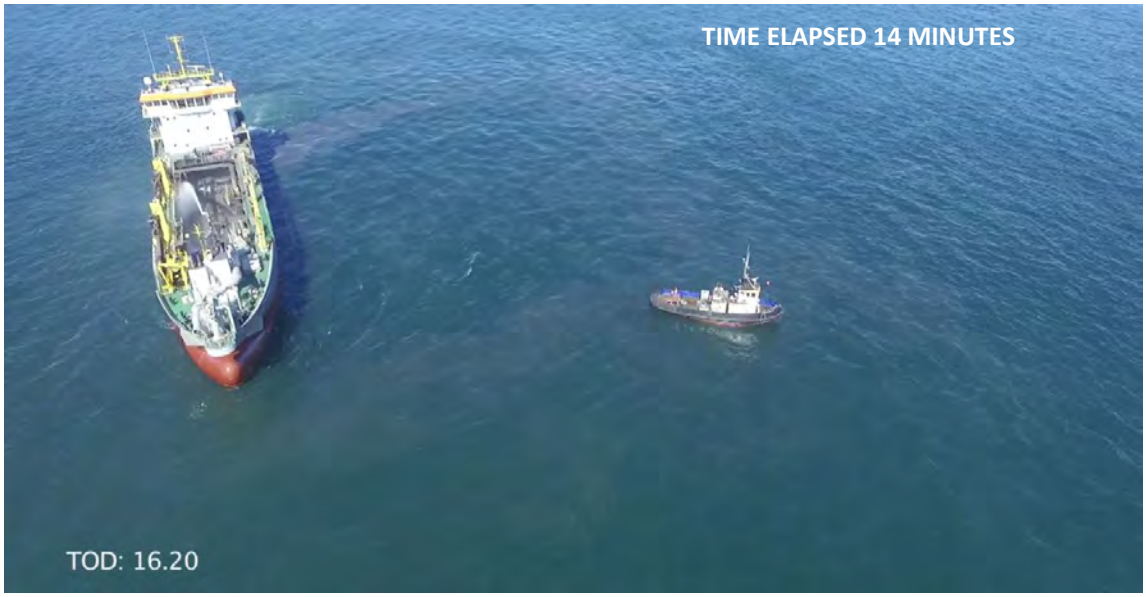
The Freeway arrives at the dumpsite, reduces speed and begins releasing her load. Most of the dredge spoil is released in the first few minutes. The ADA Dorothy is just visible on the left of the photograph.

2



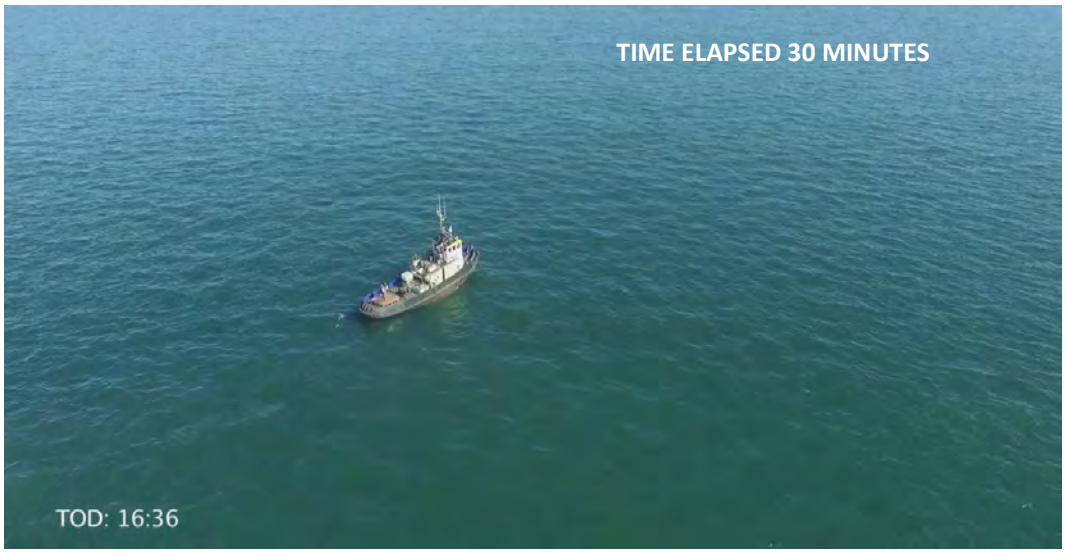
The plume of released sediment remains relatively concentrated along the release path and has already begun to settle below the surface. The dredger is circling and still releasing the remainder of its load.

3



The dredger is now empty and hosing out her hold to clear remaining spoil before leaving the dump site. The hose jet is visible in mid ship. Even at this stage the sediment released in the first pass is no longer obvious. The run is complete in just 15 minutes and the dredger is returning to the Port. The ADA Dorothy remains on site to film with the drone.

4



Within 15 minutes of the Freeway completing the release of spoil and leaving the site, the surface water at the dumpsite appears clear. So within half an hour of beginning operations there is no visible evidence of spoil dumping.

CONCLUSION

Footage filmed from an aerial drone shows that when dredged material is released at the dumpsite it is visible in the immediate vicinity of the dredger and along the dump path for a short period afterwards. The material tends to remain close to the point of release while settling below the surface. Dumping is completed in about 15 minutes and within a half hour of the beginning of operations the water appears clear at the surface and is aesthetically acceptable with no visible evidence of a silt plume.

Summary

Dublin Port Company adopts a proactive role with many other stakeholders in relation to the quality of the environment in Dublin Bay and plays an active part in protecting it. DPC had to undertake a dredging campaign to maintain sufficient water depth in the port and its approaches to ensure the safe passage of ships. This is part of normal port practices and has happened at intervals over many years. The latest campaign took place between the 20th June and the 31st July in 2016.

Dredging was carried out by a trailing suction hopper dredger and measures were taken to limit release of sediment into the water column while loading. This included preventing overspill from the dredger.

DPC put extensive monitoring in place to protect the environment and ensure best practice during these dredging operations, including commitments to additional monitoring beyond that required by its licence conditions.

The monitoring programme checked important aspects of the environment and made measurements at a number of locations within the port and Dublin Bay. These included real time measurements of water clarity at four locations and surveys using boats.

The features of the environment that were monitored included:

- levels of underwater noise during dredging in the port and during dumping at the spoil grounds
- watches by trained, independent Marine Mammal Observers to ensure that Seals and Porpoises were at safe distances before allowing works to commence
- water quality (particularly water clarity), measured every 15 minutes at a number of locations during dredging and dumping operations
- water quality at locations around the dump site and at different depths and states of the tide to measure any effects of dumping in the area
- visual recording of dumping operations using an aerial drone

Having reviewed all the results it is clear that the maintenance dredging operations did not have any significant impact on important aspects of the environment. The recorded levels of underwater noise were low and within acceptable limits. Marine mammal observers were engaged to ensure that no significant disturbance or injury of any Marine Mammals occurred. Water quality remained satisfactory throughout the dredging operations and did not deviate from expected background condition either within the port or at the dumpsite.

It is important to note finally that; all material was loaded and dumped in permitted areas in accordance with licence requirements.

CONCLUSION

Dublin Port Company is satisfied that it has ensured best practice in relation to all dredging and dumping operations and the protection of the local environment throughout the 2016 Maintenance Dredge Campaign. It will continue with this sustainable approach to all its activities to secure the future of the vital natural resource that is Dublin Bay and its environs.