

Hamble Parish Council

Royal Southern Yacht Club & RAF Yacht Club
Harbour Works Application Jan 2013

Assessment of Potential Impacts of the Works

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1. BACKGROUND

The Royal Southern and Royal Air Force Yacht Clubs have applied for Harbour Works Consent to undertake dredging and pontoon works at their sites on the River Hamble.

LTS Ltd have been commissioned by the Hamble Parish Council to provide a professional opinion on the potential long-term effects of this development on the downstream foreshore. The area of concern is from the Public Hard to the Hamble River Sailing Club.

The documentation provided for the works is that downloaded from the Harbour Authority website and consists of the following documents:

Marina Projects Ltd –

- a. Project Description
- b. Environment Note
- c. Navigation Risk Assessment
- d. Method Statement
- e. Drawing MP189-A-200 Existing Layout
- f. Drawing MP189-A-201 Site Boundary
- g. Drawing MP189-A-202 Site Location
- h. Drawing MP189-A-203 General Arrangement (*Proposed*)
- i. Drawing MP189-A-203.1 General Arrangement – Dimensions (*Proposed*)
- j. Drawing MP189-A-203.2 Existing and Proposed Layout
- k. Drawing MP189-A-204 Dredge Plan and Cross Section
- l. Drawing MP189-A-205 Indicative Sections

ABP Mer Ltd –

Report R2021 – Royal Southern Yacht Club : Hydrodynamic and Geomorphological Assessment

In order to assist the Councillors in understanding the technical components of the application this report has been structured to provide an overall view of each of the supplied documents and a more specific assessment in detail. Text in **green** is background information to aid understanding, text in **blue** is LTS comment within the report summaries.

2. A BACKGROUND NOTE ON DREDGING & SEDIMENT

This section is provided to explain the differences between Capital and Maintenance dredging in both geomorphological and licencing terms and provide a brief background on sediment behaviour locally.

In the dredging industry Capital Dredging is classified as ‘new’ or ‘one-time’ dredging as it is intended to refer to dredging an area to increase the depths beyond what they have been historically.

Once an area is dredged it is often necessary to 'maintain' these depths which will reduce due to the natural process of siltation (deposition). This is regarded as Maintenance Dredging.

It is obvious that locally deepening an area beyond historic depths is likely to encourage future deposition (try digging a hole at the waters edge). This is why maintenance dredging virtually always follows capital dredging.

In the River Hamble all the marinas have been constructed (using Capital Dredging at their construction) on the shallow margins of the estuary forming unnaturally deeper areas. These now all require regular (typically every 3-5 years depending upon location) maintenance dredging.

The material that deposits in these areas arrives via the Solent and travels upriver (so the sediment supply is from seawards rather than from the river). This material (fine suspended material) settles towards the bed slowly during slack water periods (high water, young flood stand – see later).

The material is fairly evenly spread throughout the estuary width but due to the depths and the slower flow velocities (tidal currents) in the marina areas most of the material is deposited within the marinas (and similar deeper pockets on the margins). Virtually none is deposited in the main channel. Some class this as 'self-scouring' (a process where deposited material is eroded from the bed by tidal currents) but it is more likely that the material does not actually deposit here.

One negative point about this is that there is a concern that the mudflats do not receive as much material as they did prior to marina dredging. This is well known and both operators and authorities are examining ways to maintain this supply (a technique known as beneficial disposal/reuse). In other rivers the dredge spoil is placed back in the estuary but the Hamble is many years away from such a scheme.

To confuse matters the authorities (Marine Management Organisation, Natural England, Environment Agency) have taken the view that if an area is not dredged to a certain depth within the last 10 years then any dredging in that area will be regarded as Capital.

This means that any site that suffers small levels of deposition might not need to dredge very often and perhaps with gaps of more than 10 years. This would mean that what is (in operational terms) a Maintenance Dredge would be classed as a Capital Dredge (Deacons is a good example here).

Now, this becomes difficult when applications for dredging are made as there are effectively 2 types of Capital Dredging (the industry and the 10 year limit). It is important that authorities understand the distinction between what the industry regards as 'true' Capital (which has geomorphological implications) and the 10 year Maintenance Dredge (which has less or already agreed geomorphological implications).

3. BRIEF SUMMARY OF SUPPLIED DOCUMENTS AND THEIR RELEVANCE TO THE HARBOUR WORKS DECISION

a. Project Description

Mention is made of Capital Dredging (in this case the Industry definition applies) to create additional water depths to berths.

Note – this is misleading as the dredging will create depths for new berths

Reference is made to the RHHA Strategic Vision 2012 regarding Capital Dredging.

Note - The Vision document actually states that 'The Board also recognises that maintenance dredging and, occasionally, capital dredging is necessary to maintain navigable depths for access and to safeguard useable River space'. The proposed capital dredging is clearly not what this refers to.

b. Environment Note

Key point – intertidal area of approximately 3000m².

Reference is made to the BAP Habitat. *Note – it is implied that as the area has high levels of human activity then it is of little value especially considering the much larger area on the opposite side of the river. Whilst this is true it has often been seen as the 'thin end of the wedge' and many authorities are concerned about such approaches (using the small percentage arguments). The same argument might be applied to the mudflats downstream of the development – easily another 3000m².*

Reference is made to 'Flow Modelling' undertaken by ABP Mer. *Note – this is NOT the case, a desk study has been undertaken using some data but no modelling – as ABP Mer clearly state.*

Reference is made to the dredging increasing the sub-tidal area and hence the SAC area. *Note – the crucial question is whether the intertidal habitat is more important than the sub-tidal. The answer most would argue is yes.*

Reference is made to Port Hamble and the SAC boundary. *Note – this is well a known anomaly and in all cases the SAC should exclude well developed areas.*

Reference is also made to the maintenance dredging at Port Hamble. *Note – this is unlikely to be affected and certainly impossible to quantify – see also later.*

Reference is made to Mitigation for the works. *Note – it is common for developers to attempt to find some mitigation for marine works and the removal of old debris is often utilised. It is not at all clear how the 50m² pontoons equate to 200m² of impact. If they are floating at high waters (looks doubtful on image) then navigation safety might require their*

removal/securing so not mitigation. In some cases there is a view that accessing such areas and removal of items has a negative impact.

Reference is made to vertical habitats within the pans of the sheet piles. *Note – this is a fairly standard detail encouraged by the Environment Agency. It is intended to ‘soften’ the impact.*

The letter from Natural England states that the works ‘will not adversely affect the functioning of the Hamble Estuary’. *Note – this is a view from an environmental body and does not relate directly to hydrodynamics.*

c. Navigation Risk Assessment

This document is largely outside the brief for this report. However, reference is made to the Hydrodynamic and Geomorphological Assessment so comments are below.

Executive Summary –

It is stated that there will be reduced rates of tidal flow through the mooring areas. *Note – locally the velocities are likely to increase.*

It is stated that the flow will be more linear and predictable. *Note – makes no real sense.*

It is stated that there will be a reduction of the complex flows (all flows are complex) at RAFYC. *Note – it is expected that this effect will be transferred downstream.*

It is stated that deep water eases navigation. *Note – the area to be dredged is not highly utilised (see picture on drawing MP189-A-202) so cannot ease existing navigation.*

It is stated that it will be possible to manage the local tidal flows as a result of the capital dredging in the SW corner. *Note – highly doubtful see later.*

Section 8 - Hydrodynamic and Geomorphological Assessment

See later for full comments on this assessment.

d. Method Statement

This document is not directly relevant to the decision process as any items can be conditioned. *Note – the use of ‘tidal-lift’ methods of pile extraction should be viewed with caution. There are serious health and safety issues to be taken into account.*

e. Drawing MP189-A-200 Existing Layout

f. Drawing MP189-A-201 Site Boundary

g. Drawing MP189-A-202 Site Location

Note that the green area on the chart inset from the edge of the RSrnYC northwards will turn to blue after the works

h. Drawing MP189-A-203 General Arrangement (Proposed)

i. Drawing MP189-A-203.1 General Arrangement – Dimensions (Proposed)

j. Drawing MP189-A-203.2 Existing and Proposed Layout

k. Drawing MP189-A-204 Dredge Plan and Cross Section

Note – this drawing is important with regard to the dredging. Note also that the dredge area extends well south of the site boundary indicated on drawing MP189-A-201

l. Drawing MP189-A-205 Indicative Sections

m. Hydrodynamic and Geomorphological Assessment

This report is the most technically complex so will be commented upon in sections to aid understanding.

Section 1

Note that ABP Mer considered that numerical modelling (i.e. flow modelling as referred to elsewhere) would not be effective so it has not been undertaken. *Note – this is correct but note that the earlier references to flow modelling are therefore misleading.*

Section 2

Note dredge volumes of 3400m³ intertidal and 5140m³ of subtidal. A total of 8540m³. *To put this into perspective the larger marinas typical undertake a maintenance dredge of around 3-5000m³ per annum.*

Section 3

Bathymetry - In terms of the bathymetry (depths) it is stated that no data (apart from indicative) is available from the shore to 48m off the quay. *Note – this is the actual area that the dredging is proposed so some caution must be placed on assessments (it is highly unusual for no survey data to have been collected). It is known that depths at the existing wall at shallower than 2m ACD so the depth of removal at this point will be around 4m.*

Tidal Flows - With regard to the existing tidal flows 4 historic data sets have been examined. In order to explain what these represent the following section describes the data at Point B.

The Figure 4 graph for Point B shows the velocities plotted relative to the tidal state. The tidal curve (Fig 2) shows a typical Spring tide curve.

Examining Fig 2 in more detail – the first high water (HW) is at approximately 0645 so call this 0 hours. The second HW is around 0900 (so HW + 2 hours approx.). On the left of the graph low water is at around 0020 and then the first part of the flood tide is evident from 0020 to 0300 when the tidal rise slows (so first part of flood tide is from HW -6.5 hours to HW – 4 hours). The tide then remains slack for around 1.5 hours – the Young Flood Stand. After this the flood tide then resumes from HW -2.5 hours until HW. After the second HW the tide then ebbs until low water.

To summarise for the purposes of the velocity graphs –

First part of flood tide HW-6.5 hours to HW-4.0 hours

Young Flood Stand from HW-4.0 hours to HW -2.5 hours

Second part of flood from HW-2.5 hours to HW

High water slack (between the two high tides) HW to HW +2hours

Ebb tide from HW + 2hours

Now, considering Figure 4 Point B.

Each of the 3 coloured lines represents velocity measurements at one point in the depth (1m below surface, mid-depth and 1m above the bed), this is all standard practice but it is important to realise that the distance vertically between these readings varies with the tide.

For the purposes here there is no necessity to consider the variations between the individual lines (a feature which can contain direction changes throughout the depth).

Starting at HW-6 hours the flow velocity reduces slightly to the Young Flood Period (around HW-3.5 hours) and then increases during the second part of the flood tide. During the high water slack period (HW to HW+2hours) the velocities are low. As the ebb commences the velocities increase and peak around 2 hours into the ebb tide and then slowing to low water.

All 4 provided graphs show the same basic results with some expected variations –

Point A shows the lowest flow velocities as would be expected because it is showing flow along the edge of an existing shallow area.

Point B shows similar velocities to Point C. Both these locations are on the edge of deep channels although the data at C was taken during a much larger tide so it is to be expected that the velocities are higher.

Point D is a true mid-channel set of readings and are on a high spring tide.

It is important to note here that Points A&B were measured on significantly different tides to Points C & D. Therefore any direct comparison is flawed.

*With regard to the report it states on the flood tide that 'flows are generally pulled towards the western bank (on the outside of the bend) due to the location of the deeper channel but also to accommodate the deepened areas of Port Hamble Marina, situated to the north, whilst flows within the main channel generally follow the alignment of the estuary'. *Note – this is a little confusing, it is true to say that Port Hamble will attract the flow (because the water takes the path of least resistance) but this effectively means that the flow velocities will be lower in this region. There is insufficient information provided to demonstrate flow directions, if the bend is significant (in hydraulic terms) then one would expect the flow directions to alter with depth (the so called 'helical flow').**

It is true that there will be a small eddy in the SW corner of Port Hamble.

It is also true that the flood tide passes through Port Hamble and exits to the NE towards the main channel. Because of the shape of the dredging at the upstream end of Port Hamble the formation of an eddy at the upstream location is unlikely. The reference to the peak flow velocities being higher at Points C & D should be ignored as they were taken on a much larger spring tide (i.e. Points A & B cannot directly be compared to Points C & D).

For the ebb tide much of the above is still valid.

Sediment – already dealt with

Section 4

This deals with the impact assessment of the proposed development. The first paragraph states that the flow regime in the vicinity of RSrNYC is largely controlled by the bend of the estuary and to a lesser degree by the flow through Port Hamble Marina. This is misleading in that Port Hamble does have a significant effect on the flows in this region.

Tidal effects – The capital dredge will increase the cross-section locally to RSrNYC by 114m², this increase will have an effect on the tidal flows. The reference to intertidal is misleading (actually intertidal means between low water and high water not MLW) although due to the size of the estuary tidal prism (the volume of water that enters and then leaves the estuary per tide) any dredging of intertidal will produce very small percentages. In terms of tidal prism the effect will be negligible.

The reference to blockage on flows by pontoons and boats etc states that this influence will be offset by the greater increase in cross-section from the capital dredge. This is slightly irrelevant as it is the overall flow changes that are of interest.

Tidal Effects Flood Tide - It is broadly correct that the flood tide will move slightly to the west and also true that this will lead to local acceleration at the SW edge of the dredge (Hamble Hard and to a lesser degree Hamble Jetty). The references to variations in peak flow velocities are stated without sufficient supporting information and should be disregarded.

To a degree the flow velocities within the new pontoons are more likely to increase slightly due to the main flow moving towards the west bank, the eddy in the SW corner may cause issues for the pontoon areas within the development.

The eddy in the SW corner of Port Hamble is likely to alter because the approach direction of the flood is at a shallower angle. However this will naturally allow slightly faster flow velocities (although this is not seen as a major issue in terms of hydraulics only).

Tidal Effects Ebb Tide – It is agreed that the ebb tide will flow longer through Port Hamble before being re-directed to the east. In terms of the eddy generation (not a significant issue at this location) it may well lessen but currently the shallow bank offers the flow a gentle encouragement back to the main channel. With this bank removed the flow will now meet the right angle of the new wall and this is likely to generate some noticeable changes. (Note – in cases when you are trying to alter tidal or river flow directions smooth transitions are the norm).

It is suggested that at the southern end of the works (a right angle dredge) the tidal flows will head back to the main channel directed by the remaining section of intertidal area near the slipway. This seems to ignore the effect of the proposed dredge profile which will have a much more significant impact than implied and it is doubtful that the remaining intertidal area will smooth this out quickly.

It is accepted that the Port Hamble SW eddy will effectively move into the RSrNYC area and this is a crucial point as this eddy (originally tucked away from the main channel in a corner) will now be much closer to the main channel and the slipway/jetty.

In terms of navigation it is agreed that such flows will not cause an adverse impact on the basis that the flows are already strong in this region on spring tides. It does not, however, improve the situation.

It is stated that these ebb flows will be constrained within the development site as tide levels lower but this suggests that the flow directions will alter. Mention of LW slack is largely irrelevant as the time period is so short.

Sedimentary Effects – A key point to remember is that sediment travels up river on the flood tide, some deposits at slack periods only (Young Flood and HW), the remainder leaves the estuary.

It is stated that under flood conditions there will be a small amount of erosion between the Hamble Jetty and the RSrNYC (i.e. across the end of the hard) which will cease after a few tidal cycles. This is considered rather conservative, the change in flow direction locally will be significant and no evidence has been provided to support a stable regime occurring after a few tides.

It is stated that the ‘removal of the intertidal in front of the RSrNYC will further increase the efficiency of tidal flows’. In order to increase the efficiency of flow it is necessary to align the channel with the flow so that no local disturbances (corners etc.) impact on the flow. This is not the case here. The comment regarding reducing siltation rates at the SW corner of Port Hamble is considered unlikely and any change would not be measureable. (Note – this area is not currently dredged due to concerns regarding the stability of the slipway and quay wall.)

Several comments are made regarding sedimentation changes during the ebb tide. As previously stated sediment will deposit during slack water periods (Young Flood and HW Slack). On the ebb the flow velocities are such that there is virtually no opportunity for sediment to deposit unless the flow is reduced to slack velocities for a reasonable time, which it does not (it takes time for the sediment to settle – probably at least 30mins).

It is stated that on the ebb tide there will be some erosion to the south of the development and this is stated as being limited in duration and scale. As for the flood tide this is questioned and the effect is likely to be greater than implied.

It is agreed that the disturbance during piling will be minimal.

Geomorphological Effects – nothing of relevance to comment on here

Capital Dredging Effects – This all relates to work undertaken previously in a document produced for maintenance dredging of some sites. This document is not in the public domain but most of the points stated are correct. **The one necessary clarification is the in-situ production rate. In practice a dredger (typical for this estuary) will fill a barge with approximately 250m³ of material within about 2 hours. The maximum possible production rate per tide (12 hours for simplicity) is for 2 barges per tide giving 500m³ in a 4 hour period. The maximum production rate is therefore 125m³/hour. If you assume this is (in terms of impact) spread evenly over the 12 hour period (doubtful) then you arrive at 42m³/hour.**

None of this is actually relevant to the decision process.

Regarding the Conclusions –

- It is true that the main flows will be more attracted to the western side of the estuary. It is also true that the eddy might move from Port Hamble to the RSrNYC. However, the flows at the southern margin of the dredge are likely to cause issues which will not be short term. The suggested changes in sedimentation are unlikely; it is more likely that Port Hamble will remain as is. It is obviously true that the RSrNYC will suffer increased sedimentation.
- It is not agreed that the erosion potential to the south of the development will be short-lived. The dredge will increase the flow velocities (as the report states) but such flows are likely to cause erosion at points of discontinuity such as the southern end of the dredge which the flows will meet nearly head-on. This is why in all recent cases of capital dredging on the river the dredge profiles have been designed with a flare to allow smooth flow to minimise erosion (**compare the difference between a T junction and a slip road and you get the idea**).
- The cross-section calculations are relatively meaningless
- Changes to the tidal prism are also meaningless in real terms (**it's a bit like saying if you dig a big hole, how much will this affect the tidal level**).

- To assume that the increase in area from capital dredging somehow offsets the increased surface blockage by vessels is ambitious.
- Similarly for the pontoon piles
- In terms of sediment budget it is likely to remain similar (ignore the reference to tidal prism here as irrelevant). Local knowledge suggests that the sedimentation in the dredge area will be greater at the inshore edge and the southern edge (perhaps of the order of 0.3m pa)
- Sediment plumes – this may be ignored as this relates to specific studies to demonstrate the relatively low impact of backhoe dredging which is accepted to be best practice in minimising sediment disturbance. (For information this is as compared to more intrusive methods such as a trailer or injection methods both of which can generate very large sediment plumes).
- Impacts during dredging are also not relevant as these may occur at any site and with backhoe dredging there is no indication of any such impacts in operation.

The document concludes that overall the impact will be small and local to the development site – **this is not agreed with.**

4. KEY POINTS AND SUMMARY OF THIS INDEPENDENT ASSESSMENT

In order to determine the possible hydrodynamic and geomorphological (in terms of sediment) impacts of the proposed works there are a number of areas to consider:

- a. How will the proposed capital dredge affect the existing tidal flows?
- b. How will the capital dredge affect the existing sediment behaviour?
- c. How will the vessels and mooring structures affect the responses to a-b above
- d. What are the environmental implications of these works gaining consent?
- e. Is there a more acceptable solution?

a. How will the proposed capital dredge affect the existing tidal flows?

The supplied documents are correct in assuming that the additional dredge will tend to attract the main flow towards the western bank of the estuary. This is exactly what has happened at Port Hamble and other marinas.

On the flood tide the flow will tend to attract towards the new sheet pile wall but this requires it to pass over the southern dredge boundary. As the tide rises this is likely to generate an overfall where the tide passes over the shallower area off the slipway and down into the deeper dredged area.

This generates higher flow velocities and localised erosion at the dredge boundary and progresses southwards until equilibrium is reached. The time to equilibrium is difficult to estimate but it is to be expected to occur when the dredge slope (shown on the drawings as alarmingly steep) reduces to a gradient that allows smooth flows to occur. It is likely that this

slope will shallow by the top section being eroded and so moving in a southerly direction. The length of slope generated is likely to be of the order of 15m in width so encroaching well south of the development boundary.

Note that in all other recent similar dredges the upstream and downstream dredge boundaries have been flared to avoid precisely this problem.

On the ebb tide the flow will run parallel to the Port Hamble sheet pile wall as it does currently and then continue (with a slight disturbance from the corner by the RAF slipway – which will now be much deeper) through the new dredged area before being required to move sharply back towards the main channel flow by the southern dredge boundary. As for the flood this is likely to generate higher flow velocities over the shallow area to the south.

Note that this does not happen at present because of the combination of the RAF slipway wall and the existing angled bank (see drawing MP189-A-204). At depth the flow will be affected by the dredge boundary and is likely to be deflected to the east generating some varying currents within the proposed berthing areas. This is not considered an issue as it remains within the development area.

To summarise – The downstream dredge boundary is considered too close to 90° to the flow direction for smooth flow to occur. This is likely to lead to erosion of the shallow area to the south of the dredge boundary. The generation of an overfall (on the flood tide particularly) is considered likely, this may cause concerns regarding the operation of the slipway at lower tidal levels.

b. How will the capital dredge affect the existing sediment behaviour?

There will be relatively little change to the existing sediment budget (the amount of sediment within the water body for transport) but localised changes will occur. It is expected that the dredged area will encourage sediment to deposit (because of the poor flow distribution and hence potential longer periods of slack water) with most material being deposited closer to the new wall. No measureable changes to Port Hamble are anticipated.

Where changes are likely however is at the southern dredge boundary. It is expected that erosion will occur of the shallow area to the south of the dredge boundary as the dredge slope migrates downstream.

c. How will the vessels and mooring structures affect the responses to a-b above

The addition of vessels and moorings will add drag to the tidal flows and this is difficult to quantify. However as the flow will also pass through Port Hamble the impact will be slight and will make no alteration to the above comments. It might be argued that the large pontoons above the southern dredge boundary will actually reduce the cross-section thereby increasing

the local velocities and their capacity for erosion. (Note this 'throttling' of the flow is often used in hydraulic engineering to keep artificial channels free of sediment).

d. What are the environmental implications of these works gaining consent?

Bearing in mind the earlier descriptions of Capital Dredging it is important to understand that dredging up to a vertical quay wall is clearly deeper than the area has been in the past. Despite the surprising response of Natural England, the areas to the south (and in other areas of this estuary) could be seen as potential development areas whereas in the past such areas have been discounted on environmental grounds.

e. Is there a more acceptable solution?

This is outside the brief of this report but included to offer future advice to the Parish Council.

The main issue with the proposed dredge is the southern boundary and its impact with the tidal flows. In order to reduce this impact the boundary must be angled to conform more to the preferred smooth flow direction.

This is not easy to do whilst maintaining the developer's aims in berthing and berth depths. The best solution is to accept that the SW corner will silt up and modify the dredge area so that an angled (say 45° to the sheet pile wall) walkway is introduced above a revised dredge boundary. This will affect perhaps 3-4 berths.

Assessment Summary – due to the boundary design the proposed capital dredge area is considered likely to generate a potentially significant negative impact on the shallow areas to the south of the development area. This is likely to take the form of erosion of the shallow areas over time.