HR Wallingford
Working with water

Royal Southern Yacht Club

Hydrodynamic and geomorphological assessment

DKR5098-RT001-R01-00 February 2013

Document information

Document permissions	Confidential - client
Project number	DKR5098
Project name	Royal Southern Yacht Club
Report title	Hydrodynamic and geomorphological assessment
Report number	RT001
Release number	R01-00
Report date	February 2013
Client	Marina Projects Ltd.
Client representative	Mike Ward
Project manager	Jamie Holmes
Project director	Dr Mike Dearnaley

Document history

Date	Release	Prepared	Approved	Authorised	Notes
28 Feb 2013	01-00	MPD	DSM	MPD	

Document authorisation

Prepared	Approved	Authorised
		

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1. Introduction

1.1. Purpose

HR Wallingford was commissioned by Marina Projects Ltd. to undertake an independent review of the hydrodynamic and geomorphological assessment of the impacts associated with the proposed reconfiguration of the berths and berthing pocket at the Royal Southern Yacht Club (RSrnYC) on the Hamble. The assessment was undertaken by ABPmer in October 2012 and comments have been made regarding that assessment by Dr Paul Tosswell of Lymington Technical Services Ltd. on behalf of Hamble Parish Council.

1.2. HR Wallingford

HR Wallingford was originally set up as the Hydraulics Research Laboratory of the UK Government in 1947 and was privatised in 1982. HR Wallingford provides analysis, advice and support in engineering and environmental hydraulics and in the management of water and the water environment. This review has been undertaken by Dr Mike Dearnaley who is a Director of HR Wallingford with responsibility for Coast, Estuary, Dredging and Environment studies. Dr Dearnaley joined HR Wallingford in 1989 and has considerable experience of leading and undertaking hydraulic studies in the coastal and estuarine environment. He and his team provide independent advice to developers, government, regulators and other stakeholders. Dr Dearnaley has worked throughout the world and appeared as an expert witness on behalf of developers and opponents at a number of high profile public inquiries associated with port development in the UK.

1.3. Documents Considered

The following documents were provided by Marina Projects to HR Wallingford:

- ABPmer (2012) Royal Southern Yacht Club: Hydrodynamic and Geomorphological Assessment, Report No R2021, October 2012, Prepared for Marina Projects Ltd;
- Lymington Technical Services Ltd (2013) Royal Southern Yacht Club & RAF Yacht Club Harbour Works Application Jan 2013: Assessment of Potential Impacts of the Works, Document No. 10264v1, February 2013, Report by Dr Paul Tosswell prepared for Hamble Parish Council; and
- ABPmer (2013) Response to Lymington Technical Services Ltd Comments Document 10264v1, February 2013, Prepared for Marina Projects Ltd.

In addition to these reports and following discussions with Mike Ward of Marina Projects Ltd four photographs of the intertidal area to the immediate south of RSrnYC were provided along with some measures of the thickness of the soft overlying sediments adjacent to the public slipway. This additional information is presented in Appendix 1 of this report.

1.4. Structure of this review

The main purpose of this review is to provide an independent assessment of ABPmer (2012) and to consider areas where there are significant differences between the professional views of ABPmer and Dr Tosswell.

In the following sections comments of a more general nature are first dealt with and then the area of greatest difference relating to the potential erosion of the inter-tidal area to the south of RSrnYC is addressed. Conclusions arising from this review are provided in the final section.

2. General Comments

Both parties (ABPmer and Dr Tosswell) agree that the scale of the proposed development merits a desk based assessment using available information and application of expert judgment rather than the application of numerical modelling. HR Wallingford would also recommend this type of approach for this scale of development.

ABPmer have used available bathymetric and LiDAR data to describe the site. This is appropriate for a study of this nature. It is presumed that this data has also been used to infer the capital volume of material to be dredged which is quoted as being about 8,500m^3. Neither the bathymetric data nor the volume calculation has been checked by HR Wallingford but we have no reason to question the evidence presented on behalf of Marina Projects Ltd. Pre and post dredge surveys can be used to measure the actual in-situ volume of material removed if required.

The tidal current measurements used in the assessment were undertaken in 1977 and 1979. ABPmer (2012) state that they do not consider that changes in the estuary since that time will have significantly altered the flow regime, hence the historic current measurements are appropriate for use. Dr Tosswell does not challenge the use of this data for this study and on the basis that the dredged areas of Port Hamble Marina are broadly similar today as compared to 1977 we consider it sensible best practice for an assessment of this type to make use of available data sources rather than collect new data for the assessment.

Both parties agree that presently on the flood tide the bend in the River Hamble and the deeper water of Port Hamble Marina both influence the current direction. It is to be anticipated that around a bend the flow will typically be distributed so that more of the discharge is towards the outside of the bend. It is also often the case that deepened water adjacent to a main channel will tend to attract more discharge, albeit the actual current speed in the deepened area may reduce as a result of the deepening. Hence it is agreed that on the flood tide the tidal discharge is likely to be slightly drawn toward the west compared to its present regime.

Dr Tosswell raises some relevant points about comparing the magnitude of tidal currents measured on tides of different ranges. ABPmer (2013) acknowledge this and provide further information relating to some additional neap tide measurements which clarifies the interpretation they presented in ABPmer (2012).

Both parties agree that the dredging represents an increase in both the local estuary cross section and in the tidal prism of the estuary (because of the removal of a small volume of intertidal material). Both parties agree that the effect on tidal prism is negligible. Both parties agree that the dredging will give rise to a small redistribution of the tidal discharge through the enlarged cross section area on the flood tide, with a slight increase in discharge through the deepened area. HR Wallingford agrees with this assessment.

ABPmer judge that as a result of the change in cross sectional area velocities at Point A, where measurements have previously been taken, will increase by about 5% on the flood tide and by about 5-10% on the ebb tide. Given that Point A is on, or towards, the offshore part of the enlarged cross section arising from the dredging this provides a helpful context with which to consider potential effects on navigation in the main channel. Dr Tosswell suggested that in the absence of clarification over how the changes were calculated that the magnitude of change estimated by ABPmer should be disregarded. We consider the ABPmer estimate of magnitude of change a reasonable basis for considering the wider effects of the scheme on navigation which must necessarily be assessed as part of considering the overall impacts of the scheme. The approach adopted by ABPmer is justified and the clarification in ABPmer (2013) is helpful.

Both parties agree that the main sediment source for the Hamble that will lead to infill in the dredged areas is downstream from Southampton Water. This is agreed by HR Wallingford.

ABPmer take the view that as a result of improvements to flow alignment through the Port Hamble Marina and because there will be siltation in the new RSrnYC basin, that in the future overall sedimentation in the Port Hamble Marina basin will be reduced. ABPmer also suggest that overall siltation and maintenance dredging requirements will be unchanged with a shift of some of the infill in the existing deepened areas towards the new dredged area. Dr Tosswell does not think that infill/maintenance in Port Hamble Marina will be affected and also that any changes would be unquantifiable. He suggests that up to 0.3m of siltation will occur in the parts of the new RSrnYC basin. We consider that there is little difference between these two assessments. We agree with ABPmer that the total amount of siltation and consequently maintenance dredging will be broadly comparable to the existing volumes after the works have been completed. However, we note that it might be more prudent to assume a small increase in overall sedimentation as a result of the increased footprint of dredged area associated with the RSrnYC basin. That is not to say that any such increase in sedimentation results in a direct reduction in supply to the intertidal areas but rather an increase in trapping of the proportion of sediment that presently moves up and down in the main channel of the estuary and is not being deposited in the marinas or the intertidal areas.

With respect to potential impacts from the dredging we agree with the view that mechanical back hoe dredging will cause least disturbance in terms of losses of fine material. Whilst the quantities that may redeposit in the adjacent basin during routine maintenance dredging may be small we caution that with two the two basins in such close proximity it will be prudent to consider how maintenance dredging is undertaken to avoid detrimental impacts on either marina.

3. Potential Erosion of the inter-tidal to the south of RSrnYC

The main area of disagreement between the two parties relates to the southern end of the RSrnYC basin and the potential for erosion of the adjacent intertidal area. This is considered further in this section.

Both parties agree that the flood tide flow will be drawn westward over to the new dredged basin. This will result in a small increase in velocities over the intertidal area immediately downstream of the dredged area. Both parties agree there will be some erosion of the intertidal area adjacent to and at the top of the dredged slope as a result.

Both parties also agree that ebb tide discharge through the RSrnYC will increase as a result of the dredging. Again this will lead to the potential for erosion of the intertidal area adjacent to the southern dredged slope as the ebbing flow exits the dredged basin .

We are also in agreement with this part of the assessment. Where the differences between the two parties lie is in the interpretation of the extent of erosion of this area. Dr Tosswell suggests that the southern end of the dredged area will represent a barrier to the ebbing flow at 90^{o} to the flow resulting in changes in direction of flow within the dredged basin and the potential for erosion of the intertidal to the south of the dredged area. Dr Tosswell suggests that the width of the erosion will be of the order of 15m encroaching well south of the development boundary.

The southern dredged slope will only be a barrier to flow of this form at certain stages in the tide. The barrier will be greatest in the inshore part of the basin. Indeed an eddy may form in this area on both flood and ebb tides (in the area of the new berths/dredge pocket rather than affecting the slipway) resulting in a higher rate of deposition in this location than elsewhere. ABPmer recognise this potential effect in terms of the likelihood of a small anticlockwise eddy forming on the flood tide and a clockwise eddy forming on the ebb tide.

In the offshore part of the basin the change in depth after the dredging will be of the order of a metre or less and there will be 3-4m of water depth at times of peak flow (as inferred from Figures 2 and 4 of ABPmer(2012)). The highest currents in the shallowest water depths will occur in this area on the ebb tide.

ABPmer assume that large scale erosion of this intertidal area will not occur because the bed is reasonably consolidated (we assume they mean a bulk density of 1,300kg/m^{3}) and that erosional stresses from the tidal flows will be insufficient to erode material. They anticipate erosion, such as will occur, will be of soft surface sediments only and that the adjustment will take place quickly.

Based on information provided by Marina Projects (see Appendix) the intertidal muds appear to include some gravels and are, if anything, likely to be denser and more stable than ABPmer suggest in the vicinity of the proposed slopes (see Photo 1 of Appendix), suggesting a conservative assessment on the part of ABPmer. Adjacent to the slipway there appears to be a degree of accretion and the surficial material is soft and reported by Marina Projects to be of depths 50-200mm. The drainage channel running across this intertidal area is also incised only to a small extent and is probably controlled by the strength of the underlying material see Photo 2 of Appendix). It is also worth noting the relatively steep slopes on this drainage channel.

We agree with ABPmer's interpretation of the risk of erosion in this area and do not consider that it will be extensive post development.

It is understood that Marina Projects propose that the dredged slopes will be constructed within the development boundary and that the south western area will be dredged first. This phasing will enable the dredge slope stability to be assessed visually in the intertidal area before the full basin is created and the additional effects of increased flow through the RSrnYC basin influence the slope. If required Marina Projects could make the first phase of dredging in this area some distance to the north of where the final slope is to be positioned. This would enable them to then go back and further trim the slope as the last stage of the dredging after slope stability and intertidal erosion have been observed.

It is acknowledged that, as proposed by Dr Tosswell, dredging a flared approach to the berth area would provide an engineered solution to managing the flow alignment in the southernmost part of the dredged basin. Such an approach might also help to reduce siltation in the south west corner of the new dredged basin. However, the practicality of engineering such an approach is questionable given the location of the slipway immediately to the south. The economic benefit of dredging such an area is also unproven

The photographs of this area provided in the Appendix illustrate another important point, namely that the slipway is proud of the adjacent intertidal and must therefore also be providing a control on the tidal flows across this area during periods when the water depths are shallow.

4. Conclusions

Overall we are in agreement with the assessment provided by ABPmer (2012). We consider that the responses provided by ABPmer (2013) provide helpful clarification. The review by Dr Tosswell is focused on long term effects on the downstream foreshore. In our opinion and in agreement with ABPmer (2013) we consider that Dr Tosswell's assessment exaggerates the potential for effect in this area.

Appendices

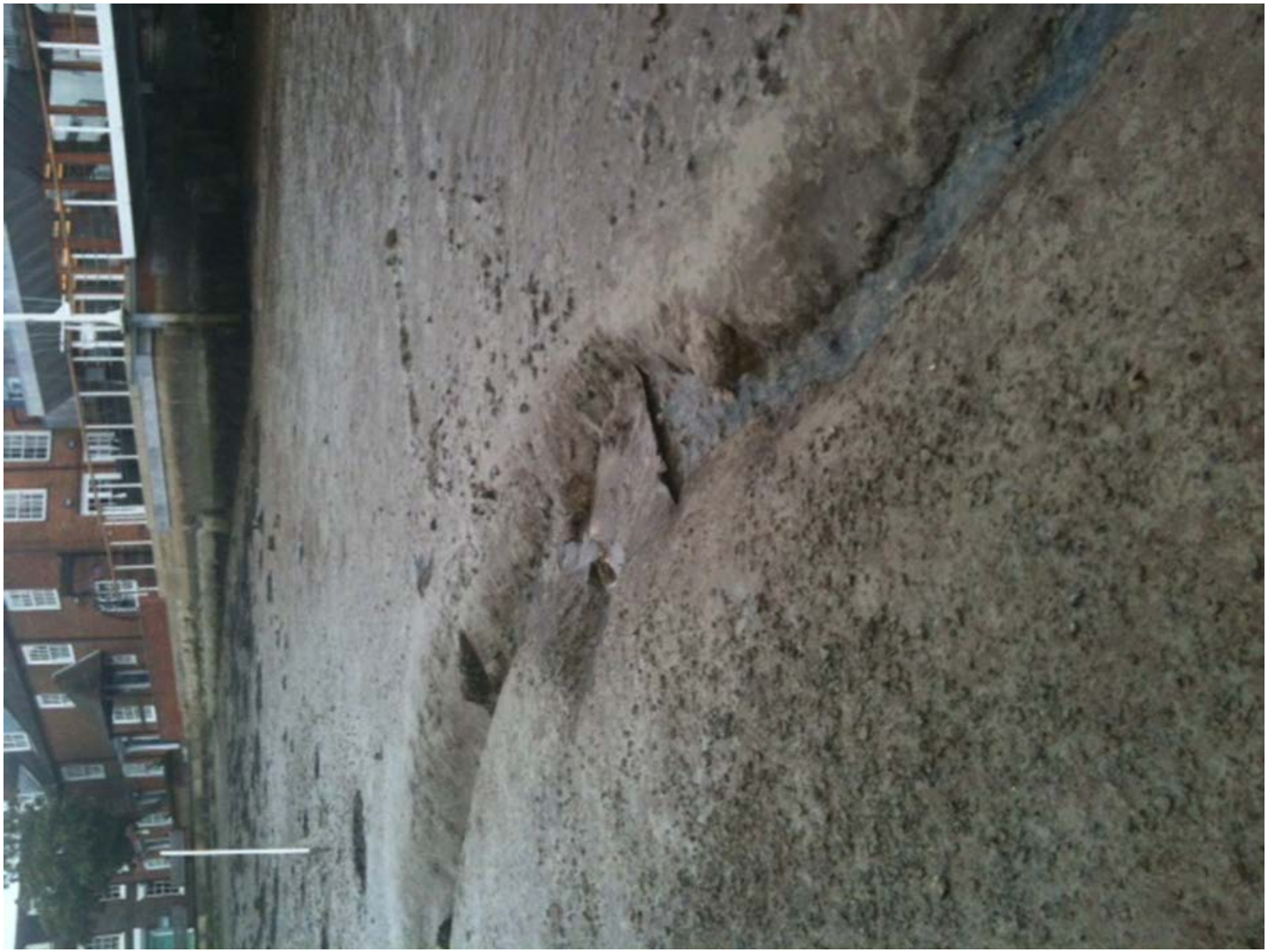
A. Photographs

Following a request from Dr Dearnaley Marina Projects obtained photographs of the slipway immediately to the south of the RSrnYC and undertook some probing of the depth of soft sediments adjacent to the slipway. The following text (from Mike Ward or Marina Projects Ltd) describes the photographs and the results of the probing.

"A few photos of the Hamble Slipway to assist your review – the location of the photos is more or less self-explanatory but refer below. Photos taken this afternoon (22nd February 2013) at low-water (1430) approximate height of tide was +1.6m – I had some probes taken of the silt depth over the Public Hard to the upstream of the slipway.

- *Photo 1 is taken from the slipway looking upstream toward the existing fixed jetty structure this is more or less along the inshore edge of the dredge.*
- *At approximately the level of MLW the silt just upstream of the slipway is no more than 50-60mm deep above solid hard material – 10m further up the slope it is 100-200mm deep.*
- *About 6m further upstream the silt is up to 200mm deep but reducing in depth as it comes down the gradient Photo 5 – is in this location looking up the "hard" and you can observe the flow from an outfall that cuts through the silt to the harder material below – I think you can clearly make out how the silt reduces in depth.*
- *Photo 6 and 7 show how the slipway is at a higher level than the inter-tidal zone to the upstream side.*
- *The sign on the pile to the right of slipway in Photo 6 confirms that the slipway extends approximately 5m beyond the sign."*

Photograph A.1: Photo 1



Photograph A.2: Photo 5

Photograph A.3: Photo 6

Photograph A.4: Photo 7

HR Wallingford
Working with water

HR Wallingford is an independent engineering and environmental hydraulics organisation. We deliver practical solutions to the complex water-related challenges faced by our international clients. A dynamic research programme underpins all that we do and keeps us at the leading edge. Our unique mix of know-how, assets and facilities includes state of the art physical modelling laboratories, a full range of numerical modelling tools and, above all, enthusiastic people with world-renowned skills and expertise.

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