Environment Project Pro-forma

Project Name: *Regenerating Hayle Harbour: environmental and socio-economic assessment of a sluicing programme to deepen access channels to the harbour and open up development opportunities.*

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Partners (if applicable):
Hayle Harbour Authority (Peter Haddock, Harbour Master)
University of Exeter (Dr Matt Witt, Dr Tony Bicknell, Prof Brendan Godley)
HR Wallingford Ltd (Prof. Andrew J. Manning)

Stakeholders (*who could be partners/sub-contractors/suppliers/advisors*)
Natural England
Wave Hub
Environment Agency
RSPB
Cornwall Wildlife Trust
Cornwall Marine Network
Cornwall Marine Operators Network
Cornwall Fish Producers Organisation

Description:

Few ports are operational in western North Cornwall capable of hosting larger fishing boats or commercial vessels. This poses an economic problem for servicing Wave Hub operations, for example (where vessels have to make a longer and more expensive journey to Newlyn, Penzance or Padstow) and limits the diversification and development of maritime industries in this area of Cornwall. Hayle harbour has the potential to provide support for vessels of the size required by Wave Hub customers for maintenance, and access for larger fishing boats to land catches, but the harbour channel has shallowed over recent years due to neglect of previous owners and the lack of maintenance dredging. This dredging has not been reinstated primarily because Hayle is also now an area of high conservation value, with SSSIs and important waterbird feeding and roosting areas, but also due to pressure from local campaign groups to not remove any sediment from the sand cell that feeds the beautiful tourist beaches in the area. If the potential of Hayle Harbour can be unlocked in a sustainable way that has minimal impact on the environment, then this will also have knock on consequences for quayside regeneration in the town and the expansion of local maritime (and other) industries such as shellfish farming.

A suggested solution is to use a method applied for centuries to maintain Hayle as a major port in the past, namely sluicing of water from adjacent lagoons to provide a way of flushing the estuary and, with a certain degree of plough dredging to agitate the sediment, allow the depth of harbour main channels to be increased. In this way, no sand is removed from the sand cell, but there is still

concern amongst local conservation groups that the activity will have detrimental impacts on, in particular, the local bird life. Whilst the MMO license for constructing the sluicing system requires an environmental impact study on the local SSSI where the sluice gate will be reinstated, there is no statutory requirement to provide a wider assessment of the sluicing on the whole estuarine physical environment and ecosystem, and the further consequences for associated birds that utilise the estuary. It is the potential wider physical and ecological impacts on the estuarine system that are of issue for local and national groups, and thus are the main impediment to port development.

The aim of this proposal is to provide a robust and extensive environmental monitoring programme, coupled with state-of-the-art hydrodynamic modelling and prediction, that will provide the evidence needed to determine the predicted and actual level of impact of the sluicing programme and address the concerns of local (and national) conservation groups. In this way, and if successful, the major barrier to redevelopment of Hayle harbour will be removed, unlocking its economic potential for the development of service facilities for Wave Hub; access to larger fishing and commercial vessels; the opportunity for development of new and larger shellfish farms within the estuary; the economic regeneration of quayside areas to support the increased business and the diversification of the economic base of the harbour. All these will improve the recreational and employment prospects of the local population.

This proposal is a partnership between Plymouth University Marine Institute, University of Exeter (Penryn), Hayle Harbour Authority and the leading hydraulics research company HR Wallingford. It will also include close liaison with key stakeholders such as the RSPB, Environment Agency, Natural England, Cornwall Wildlife Trust, Wave Hub and local fishing/aquaculture concerns. Five workpackages that make up the programme are:

1. WP1: Construction and operation of the sluicing and dredging programme (Lead: Hayle Harbour Authority)
2. WP2: Physical modelling of sediments and hydrodynamics (Lead: HR Wallingford)
3. WP3: Environmental changes to the estuary seabed ecosystem (Lead: Plymouth University Marine Institute)
4. WP4: Impact of the sluicing activity on bird assemblages and behaviour (Lead: University of Exeter)
5. WP5: Assessing the socio-economic costs and benefits of the estuary restoration scheme (Lead: Plymouth University Marine Institute)

Outline of each workpackage

WP1: Sluicing into Hayle Estuary was first introduced from Copperhouse pool c1768/9, to scour the channel entrance to Curnow's Quay and the Copperhouse complex. Carnsew pool and sluices were completed in 1830 specifically to sluice the channel and was used continually in conjunction with plough dredging until 1976 when the equipment fell into disrepair. Sluicing effectively cleared the channel without removing sediment from the St Ives Bay sediment system. It was so effective that large ships could bring in cargo to Hayle Harbour and also transport goods and people out of Hayle.

This workpackage will re-introduce sluicing within the harbour from Carnsew Pool which will be implemented during the South Quay development for a new Asda supermarket. As specified in the MMO licence, the Carnsew Channel and sluice gates will initially be reinstated and bought into operation so as not to interfere

with the tidal cycles of the pool when the next phase of the operation to coffer dam the sluice tunnels, which will enable the necessary inspection, repair and installation of the penstock gates within them to be completed. On completion, and with agreement of RSPB, Environment Agency and Natural England already secured, sluicing operations (in conjunction with plough dredging the main channel) will only be conducted between the months of April through to September on Spring tides so as not to interfere with the feeding of overwintering birds in the pool and estuary. Sluicing will be controlled remotely from the harbour office.

WP2: The ambient hydrodynamic conditions are a major controlling element of the bathymetry and sediment transport within estuaries and tidal inlets. The re-introducing of sluicing in Hayle Harbour will provide a range of additional flow inputs into the inlet, and could potentially lead to significant sedimentary process effects, in both the short-term and long-term within the harbour. This WP will aim to assess the physical effects of sluicing in the Harbour over a range of time scales in terms of hydrodynamic regime and subsequent sediment transport effects (e.g. accretion, erosion, bathymetric alteration).

Hydrodynamic (e.g. flow velocity, turbulence and mixing characteristics) and sediment transport (e.g. bed sediments types / composition, suspended sediment concentrations, particle grain size analysis, flocculation & mass settling fluxes, resuspension characteristics) data will be collected at a number of key identified sites within Hayle Harbour. Some data will be collected in-situ throughout a range of tidal conditions, with other data being generated in controlled laboratory simulations. This will provide baseline information on Hayle Harbour, plus laboratory simulations provide the opportunity to assess various hydrodynamic and sediment transport components in greater isolation. Existing bathymetric data will be utilised, and a new bathymetric survey (of specific areas of Hayle Harbour) may also be commissioned if deemed necessary. These hydrodynamic and sediment transport data sets will initially be assessed in order to produce specific 'process-based' algorithms/models that are unique to the Hayle Harbour environment.

A numerical model of Hayle Harbour (that extends to the nearby surrounding coastline) will then be used to conduct a series of 'runs' to assess the hydrodynamic and sediment transport effects of sluicing over a range of timescales (from spring/neap tidal cycles through to monthly/yearly projections). The process algorithms and data will also be utilised for calibration and tuning of the numerical model. It is envisaged that both the numerical and process modelling will provide a series of guidelines that will indicate an optimum scheme/strategy for sluicing in Hayle Harbour. Post sluicing monitoring surveys of key baseline hydrodynamic and sedimentary parameters will be conducted at approximately half yearly intervals in order to assess the resultant effects in Hayle Harbour.

WP3: The aim of this WP is to assess any changes to the estuary bed environment and organisms following the initial sluicing and dredging and then how any affected areas recover and develop. We will also be looking at if there is any wider impact beyond the target channel, which is where areas of concern lie, by also monitoring sites away from the channel across the estuary system, including the important bird sites to the SW of the main estuary entrance. This will include an assessment of any changes to the potential food supply for wading birds and wildfowl.

A series of comparable sites will be selected across the estuary, within the main channels and elsewhere, and samples of the estuary bed sediment will be taken

using cores and grabs in order to assess the physico-chemical nature of the sediment (particle size and distribution, organic carbon) and quantify the assemblage of organisms living within the sediment, focusing on the larger invertebrates >1 mm that are the key food items for birds and predatory fish (with a focus on biomass and assemblage structure changes). All samples will be taken directly before any sluicing is started, to provide the baseline situation, and then at 6 monthly intervals to capture seasonal variation following sluicing and allow for change over time and space to be assessed robustly across the next 2 years, giving in total two post-sluicing annual surveys (two sample occasions per year).

WP4: Hayle estuary provides important inter-tidal feeding and roosting habitats for migrant and wintering waterfowl, gulls and waders. The area also hosts sites of special scientific interest (SSSIs). To assess the potential effects of reintroducing sluicing activities (and dredging) on the habitat and visiting avifauna of the estuary it would be necessary to analyse existing and historical data on species distribution and abundance for the region, along with conducting baseline (pre-sluicing activities) and ongoing monitoring (after reintroduction of activities) of abundance and diversity of avifauna species within areas that could be influenced/effected by the activity.

The initial baseline bird surveys would cover potential feeding and roosting habitat from the mouth (sand dunes) of the estuary to the intertidal flats (mud) behind the harbour infrastructure. It may also be necessary to survey at control/reference sites (such as at Padstow) to ensure necessary contextualising data. Ongoing monitoring of important areas (identified during the baseline survey) would then be conducted (using point counts and activity assessment, such as feeding behaviour) year round and in particular during periods of significant dredging and sluicing activity.

WP5: To predict and document the wider socio-economic costs and benefits of the reintroduction of sluicing we will be undertaking a parallel study to document current economic and social value generated by the harbour and estuary and to look at changes to these values, and local stakeholder attitudes, over the course of the programme of work. We will also model ahead to understand the socio-economic consequences of further developments that will become possible as a result of dredging, such as the full completion and operation of the Hayle Marine Renewables Business Park, enhanced access for larger fishing vessels and development of mussel farms in the estuary. A tiered series of future scenarios could be investigated and economic benefits assessed depending on different plans for quayside and within-estuary developments.

Analyses will be based using standard social-science methodlogy, such as compiling existing economic data and interviews/questionnaires to all local stakeholders to poll attitudes and quantify economic activity directly resulting from the use of the estuary and the harbour. There will also be consideration of recreational benefits, and their value, including wildlife observation and outdoor activities, and these will be linked to the ecosystem services generated by the estuarine ecosystem and how these will vary with the sluicing programme.

Expenditure Profile (estimated)	
Item	**Estimated Cost**
WP1: Construction and operation of the sluicing and dredging programme (Lead: Hayle Harbour Authority)	**£80K**
WP2: Physical modelling of sediments and hydrodynamics (Lead: HR Wallingford)	**£125K**
WP3: Environmental changes to the estuary seabed ecosystem (Lead: Plymouth University Marine Institute)	**£80K**
WP4: Impact of the sluicing activity on bird assemblages and behaviour (Lead: University of Exeter)	**£70K**
WP5: Assessing the socio-economic costs and benefits of the estuary restoration scheme (Lead: Plymouth University Marine Institute)	**£50K**
Total	**£405K**

Expenditure Timeframe (estimated)				
2015	**2016**	**2017**	**2018**	**Total**
£125K	**£135K**	**£115K**	**£30K**	**£405K**

Match Funding Profile (estimated):		
Source	**Amount**	**Comments**
HR Wallingford Ltd	**£15000 + £10000**	**In kind value of provision of widescale hydrodynamic model of Hayle Harbour and environments; use of novel sediment transport instrumentation/techniques to quantify & assess depositional and resuspension characteristics.**
Hayle Harbour Commissioners	**£24000**	**HHA contributions to sluicing operations and associated dredging over course of project**
Total	**£49000**	

Thank you for completing the pro-forma

Please return to:
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