Penwith District Council

Penzance Harbour Option Review

January 2004

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Hyder Consulting

Penwith District Council

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1 Executive Summary

Hyder Consulting Ltd has been appointed by Penwith District Council to undertake Technical Investigations in Mounts Bay. The contract follows a staged process through initial feasibility studies, marine investigations, numerical modelling, environmental impact assessments to deliver final costed concept designs as a final deliverable.

Aim

The aim of the contract is to deliver a study that presents accurate, coherent, sustainable, innovative and realistic schemes, backed by sound engineering judgement and appropriate investigations, to enable Penzance, Penlee and Newlyn to determine the viability of future development.

Purpose

The purpose of the investigations is to collate baseline information and data to enable a number of conceptual designs to be developed within the environs of Penzance Harbour, Newlyn Harbour the Western Promenade and Penlee Quarry.

Current situation

Penzance Harbour is used by the Isles of Scilly Steamship Company (IOSSC) to support its freight and passenger operations to the Isles of Scilly. It is also used by the Penzance Dry Dock Company for commercial ship repair activities and by recreational users. Of primary importance are the operations of the IOSSC that provide not only vital employment to Penzance but supplies the main strategic freight and passenger connection to the Isles of Scilly.

Currently the IOSSC operate two vessels, a cargo ship (the Gry Maritha) and a passenger ship (the Scillonian III). However they intend to replace these two vessels with a single ship to undertake both freight and passenger activities. A Ro Ro ferry has been identified as the possible future vessel.

However, the current arrangements within Penzance Harbour constrain the effectiveness of the service provided. These constraints include:-

- Poor freight storage facilities.
- Inadequate space for the freight operations leading to both uneconomic and potentially dangerous operations.
- Inadequate passenger handling facilities and an absence of space for such facilities.
- The existing facilities are spread out over the harbour area making command and control difficult.
- The existing operations are insecure.

- An absence of a suitable all weather berth meaning that facilities have to be moved around the harbour depending upon the sea state thus effectively sterilising large areas of the harbour that could be used for other purposes.

Apart from the IOSSC operations, the Penzance Dry Dock Company uses a tidally controlled wet dock to assist in their activities. This dock is also used for berthing deep keeled recreational vessels on an ad hoc basis. The remainder of the harbour areas dry out at low tide and are used primarily for recreational craft berthing as well as access to the Dry Dock (at high tide) and minor commercial uses.

Review

Fourteen separate options have been reviewed, which were derived from previous studies or were introduced during the initial study period. They have been compared using a mixture of technical requirements and costs. As a result of this three options have been selected as being suitable for further consideration. Two options are very similar in so far that they locate new harbour facilities built on a reclamation at the end of the existing Lighthouse Pier. The other option creates new harbour facilities built on a new reclamation within the existing harbour.

The selection of the final option will be dependant upon technical issues as well as costs. These issues will be refined as the study progresses and the options narrow.

This document identifies a series of investigations, which will be used to resolve a number of issues which will mean that more accurate costings and technical assessments can be made. These investigations include marine and land based marine bore investigations, topographical surveys, hydrographic and geophysical surveys, structural inspections as well as a series of related reports.

The final selection is also highly dependant upon fully identifying the exact requirements of the scheme. The requirements that need defining include:-

- The exact details of the proposed IOSSC vessel. The selection of which is dependant on not only implications of the new infrastructure at Penzance but also on the Isles of Scilly and of the vessel itself. It is understood that a report will be prepared by others on this issue. It is realised that this selection process will partially rely on information that will need to be supplied by the Penzance/Newlyn/Penlee study.

- All the options are dependant on the creation of new reclamation. This reclamation will need to be minimised to save costs. The reclamation is partially driven by the type of vessel being proposed and the size of the envisaged passenger and freight facilities. Although a preliminary assessment of these facilities have been made they need to be refined through future discussions with the IOSSC.

The costs of the preferred three options are listed below.

Option	Cost
Developed Inner Harbour Option	£13.6 Million
Outer Preferred Option I	£19.7 Million
Outer Preferred Option II	£23.1 Million

These costs are preliminary and are based upon assumptions that will be clarified by the technical investigations and by refining the needs of the project.

2 Introduction

2.1 Background

Hyder Consulting Ltd have been appointed by Penwith District Council to undertake Technical Investigations in Mounts Bay. The purpose of the investigations is to collate baseline information and data to enable a number of conceptual designs to be developed within the environs of Penzance Harbour, Newlyn Harbour and Penlee Quarry.

The contract will build on work carried out previously and specifically the following reports;

- WS Atkins: "Penzance Harbour and Town Regeneration Phase 1 Action Plan" August 2001.
- Atlantic Consultants: "Newlyn Strategy for the Regeneration of a Cornish Fishing Port" August 2002.
- Fisher Associates: "Moving On – A Transport Strategy for the Isles of Scilly" February 2003.
- Beckett Rankin Partnership: "Penzance Harbour Feasibility Phase 1 Study" May 2003.
- Beckett Rankin Partnership: "Isles of Scilly Transport Strategy 2003, St Mary's Harbour Feasibility Study" May 2003.
- Burness, Corlett & Partners: "Route Study" May 2003.
- Posford Duvivier: "Penlee Quarry, Newlyn: Marina Due Diligence and Feasibility Study Report" April 2001.

For the purposes of the study, the study area has been split into four distinct sites via:

- Penzance Harbour
- Western Promenade
- Newlyn Harbour
- Penlee Quarry

This report relates to the Penzance Harbour only.

It is noted that, although the study area has been split as above, that developments within any one of the sites are likely to have an impact on the other sites and adjoining coastal areas. This report deals exclusively with Penzance Harbour, but does identify (generally at this stage) the potential impacts of the proposed developments on adjoining areas. Further stages of work will identify these impacts in more detail.

The report forms the first part of a staged approach to the overall study.

2.1.1 The Aim

The aim of the contract is to deliver a study that presents accurate, coherent, sustainable, innovative and realistic schemes, backed by sound engineering judgement and appropriate investigations, to enable Penzance, Penlee and Newlyn to determine the viability of future developments.

2.2 Scope of Work

The Scope of work follows the following general stages:

- Initial Option Review
- Maritime Data Acquisition
- Numerical Modelling
- Environmental Impact Assessments
- Costed Conceptual Designs
- Application for Harbour Revision Orders (where applicable)

It should be noted that this initial option study seeks to identify the key issues and develop preferred options for discussion and to determine the extent of technical investigations required. It is not intended at this stage to deliver confirmed designs.

2.2.1 Initial Option Review

The intention of this review is to identify the background to the project or site, it's constraints and drivers. Then to review and compare the previous options developed along with a number of new ones that have been proposed recently. The comparison is made on a technical and financial basis.

It should be noted that this initial review seeks to identify the key issues and develop preferred options for discussion and to determine the extent of technical investigations required. It is not intended at this stage to deliver confirmed designs.

The output is intended to be a preferred outline solution for the site and an indication of the site and other technical investigations that will be required to be undertaken to deliver the preferred solution

In parallel with this Option Review Study, Environmental Scoping Studies have been undertaken and submitted to the Environment Agency for their comment. Following their response, any requirements for sampling, surveys or investigations will be incorporated into future site investigations.

2.2.2 Maritime Data Acquisition

Once preferred solutions have been determined from the Option Review, the site and technical investigations will be scoped. This scope will also

incorporate the requirements of the environmental scoping studies and the numerical modelling scoping studies and will identify the level of site investigations carried out previously to prevent repetition of obtaining data.

Contracts will be let with a number of contractors to obtain this technical information.

2.2.3 Numerical Modelling

Following the receipt of the site investigation information, numerical models will be created of the site to enable the preferred options to be evaluated with respect to wave climate, overtopping of structures, currents, sediment regime, environmental impact, flooding and scour.

The numerical models will prove the technical viability of the preferred solutions and allow modifications to proposals to be undertaken to optimise layouts and configurations.

2.2.4 Environmental Impact Assessments (EIAs)

In conjunction with the numerical modelling, EIAs will be undertaken to identify the key impacts of the proposed developments on the environment, with a view to modifying proposals to mitigate those impacts.

2.2.5 Costed Concept Designs

Following an evaluation of the numerical modelling and the EIA's, the proposals developed in 2.2.1 will be modified where necessary to deliver costed concept designs.

2.3 Deliverables

This report sets down the findings of the Option Study stage in the following sections.

Section 1	Executive Summary
Section 2	Introduction
Section 3	Project Drivers and Constraints
Section 4	Marine Physical Process Evaluation
Section 5	Option Review
Section 6	Cost, Programme and Risks
Section 7	Conclusions

It is intended that the findings from this Option Review Study will inform the extent and type of site investigations that will be necessary to allow the development of conceptual designs. These requirements will be checked against existing available site investigation information and a scope produced for future technical investigations.

3 Project Drivers and Constraints

3.1 IOSSC – Scillonian

Details of the Isles of Scilly Steamship Company (IOSSC) operations have been provided in the report entitled, '"Moving On" Transport Strategy for the Isles of Scilly' produced by the Fischer Associates 2003, from which the following information has been taken.

The current operating vessel, the Scillonian III is a flat-bottomed vessel allowing her to cope with the shallow waters around the islands. She has an overall length of 68 metres, beam of 11.9 metres and a draft of 2.9 metres. There is provision for 600 passengers with a small provision for freight.

The Scillonian III currently caters for 37% of the island passenger transport, the remaining 63% being by the Skybus light aircraft and British International helicopter service.

A dedicated vessel (Gry Maritha) handles the majority of freight transport demand to the islands.

3.2 Importance of the link

The Isles of Scilly generate a considerable tourism demand for passengers making journeys between the islands and the mainland. In addition to this is the strategic demand for freight provision to supply the permanent and seasonal population of the islands.

If the sea passenger link to the islands were lost the alternative operations would not have sufficient capacity to meet demand through the summer season. In addition, if the sea passenger link were lost hotel accommodation would be insufficient if poor weather meant that the alternative air transport routes were unviable

The freight volume carried to and from the islands by the Gry Maritha has shown only a small increase in demand. The link is however vital to provide the imports of foodstuff, building materials, fuel and general goods required by the residents and tourist trade.

3.3 Future capacity demands

An annual increase of 2.1% since 1996 for the transport link between the mainland and the Isles of Scilly shows a continued growing demand for the popular service. The inability to extend the islands only runway and the limited expansion possible to the British International helicopter link requires the sea link to be improved as the only remaining option for growth.

The exposure of the harbour to south-easterly weather limits the operational size of the harbour to just the tidally impounded dock this has led to a conflict between leisure and commercial activities.

A potential market for the mooring of passing cruise liners has also been suggested. The harbour is currently not equipped for such vessels. The current facilities available to the harbour master and HM Coastguard have been identified as inadequate.

3.4 Current situation

The Existing Facilities

Figure 2 illustrates the existing facilities and berths at Penzance. It comprises of four main areas.

The Dock

This Dock is an impounded structure controlled by a pair of lock gates. It is currently used by the IOSSC for berthing of the Gry Maritha vessel and for winter berthing for the Scillonian. The IOSSC use the north arm of the dock for cargo handling operations and use the South Pier for access to the Scillonian III.

The dock is also used by the Penzance Dry Dock Company where it can work upon floating vessels.

A number of private deep keeled recreational craft also berth in this dock on an ad hoc basis.

Drying Berths

A significant proportion of the overall harbour is tidal with a relatively high bed level meaning that at low tides it dries out. This area is used primarily for mooring small recreational craft although this area is traversed by vessels accessing the dry dock and is used as a foul weather berth for the Scillonian during the summer. There are a small number of commercial users who moor up their vessels in this area.

The Dry Dock

This facility is used solely by the Penzance Dry Dock Company. Vessels access this facility by passing through the drying berth portion of the harbour at high tide. This facility is outside of the scope of the study.

Lighthouse Pier.

This pier is used for berthing the Scillonian during good weather in the summer months.

Tidal restrictions

Figure 1 shows the Admiralty Chart for the harbour area. As the Scillonian has a draught of 2.9 meters it can be seen that the relatively high existing sea bed contours will only allow vessel movements at certain tide states.

IOSSC Operations

The IOSSC uses the existing Penzance Harbour and quays for berthing of both the Scillonian III for passenger traffic and the Gry Maritha for cargo traffic. However there are significant problems with the existing operations most of which are caused by the existing infrastructure. These include:-

Freight Traffic

- Freight is delivered by road to the North Arm of the dock where some of it is stored within the existing Rank building. This building is in a state of structural distress and it lacks the space sufficient for storage of all the freight.
- Dry goods often have to be stored on the quayside and are exposed to the environment leading to them becoming damaged.
- There are no provisions for freight that either need to be chilled or kept frozen such as certain foodstuffs.
- Due to the limited width of the North Arm the delivery area can only receive one lorry at a time. Lorries have to reverse onto the Arm and then drive off. The problem is compounded by the fact that there is inadequate storage in the building. This means that delivery lorries have to deliver directly to the cargo vessel just before it leaves. As a result there can be multiple lorries stacked up or manoeuvring dangerously on the congested pier and on the public highway.
- Freight deliveries are made to all the islands forming the Isles of Scilly. However there is inadequate space for the sorting of the goods prior to them being loaded up, this leads to complex and time consuming operations at the points of delivery.
- The existing loading location is within the dock which can only be accessed at certain states of the tide. This leads to the tides dictating sailing times.

Passenger Traffic

- Foot traffic is embarked along the South and Lighthouse Piers in good weather conditions or along the Albert Pier during foul weather. This means that the facilities for loading have to be relocated depending upon the weather conditions.
- Most passengers access the loading area either from coaches or from cars. There is inadequate parking or manoeuvring space for the number of vehicles involved which leads to a dangerous and inefficient traffic/pedestrian movements. New Dock Regulations will require cargo and pedestrian traffic to be separated.

- Currently passengers place their luggage into containers and then register to go on board. It is likely that due to security concerns that this process will have to change with passengers having to register their luggage on board and possibly they may even need to have their luggage X-rayed. Undertaking either of these activities on the existing quayside where there is no space for permanent buildings will be almost impossible to perform adequately.
- During foul weather waves overtop the existing pier walls drenching passengers and leading to obvious health and safety problems. It is worth noting that the volume of water overtopping the walls can be sufficient to create problems with the berthing of the ferry. It is during these conditions that the passenger loading operations are moved to the more sheltered Albert Pier.
- There are no holding areas for passengers. This can mean that they are left to stand in the rain.

The Other Users

Apart from the IOSSC operations Penzance Harbour is also used to support operations undertaken by the Penzance Dry Dock Company and for ad hoc recreational usage. All three operations currently utilise the tidally controlled dock area of the harbour. Although current operations are controlled by the Harbour Master there is a strong potential for a conflict of interests and of health and safety problems.

3.5 Importance of the harbour to Penzance

Penzance town was originally formed around the harbour. However with time the harbours importance has reduced. It currently maintains the essential task of supporting the major transport link to the Isles of Scilly, as well as facilities for the Penzance Dry Dock and recreational users.

Due to increased demand, safety and security requirements the infrastructure for the transport links must improve or possibly be lost.

Similarly although the harbour supports some recreational boat usage its capacity could be greatly increased which would raise the harbours importance to Penzance in terms of employment and economic generation.

3.6 Existing harbour revision orders

Two existing Harbour Revision Orders (HROs) are in place for Penzance, entitled:

1) Penzance South Pier Extension Act 1990.

2) Penzance Albert Pier Extension Act 1990.

The exterior lines of the HROs are shown on Figure 2.

3.7 Development Proposals

It is understood that Penwith District Council are seeking to enter into a Developers Agreement with Sutton Harbour Holdings Ltd (SHH). At the time of writing of this report heads of terms have been agreed. The aim of this agreement is to secure private sector investment for the regeneration of Penzance. Although initial discussions have been held with SHH, it will be necessary to continue this liaison throughout the project development, to ensure that the developers are kept abreast of the proposals for the harbour and to identify where opportunities for wider scale development can be realised at minimum extra cost.

3.8 Land ownership

Land ownership in the study area is to be confirmed.

4 Marine Physical Processes Evaluation

4.1 General

Any of the proposed developments for the site will need to take into consideration the existing environmental processes currently influencing in the study area. This section details those environmental processes and issues.

4.2 Sea Level Rise and Surge Allowance

To determine the safe development levels within Mounts Bay, it is necessary to establish the range of water levels likely to be experienced at the site. Of particular importance is the maximum likely still water level (SWL) that may be experienced at the site.

The British Oceanographic Data Centre gives the following tide levels for Newlyn, which are considered relevant to the whole study area.

Table 4.1 – Newlyn Tidal Statistics Published by BODC

	Level to Ordinance Datum (m)	Level to Chart Datum (m)
HAT	3.07	6.12
MHWS	2.48	5.53
MHWN	1.29	4.34
MLWN	-1.04	2.01
MLWS	-2.28	0.77
LAT	-2.90	0.15
MSR	4.76	
MNR	2.33	

Definitions of the terms given in Table 4.1 are given below:

a) HAT (Highest Astronomical Tide). LAT (Lowest Astronomical Tide): The highest and lowest levels respectively which can be predicted to occur under average meteorological conditions and under any combination of astronomical conditions; these levels will not be reached every year. HAT and LAT are not the extreme levels that can be reached, as storm surges may cause considerably higher and lower levels to occur. Volumes of water held in the earth's oceans are also increasing due to temperature rises causing expansion.

b) MHWS (Mean High Water Springs). MLWS (Mean Low Water Springs): The height of mean high water springs is the average, throughout a year when the average maximum

declination of the moon is 23.5° of the heights of two successive high waters during those periods of 24 hours (approximately once a fortnight) when the range of the tide is greatest. The height of mean low water springs is the average height obtained by the two successive low waters during the same periods.

c) MHWN (Mean High Water Neaps) MLWN (Mean Low Water Neaps). The height of mean high water neaps is the average, throughout a year as defined in b) above, of the heights of two successive high waters during those periods (approximately once a fortnight) when the range of the tide is least. The height of mean low water neaps is the average height obtained from the two successive low waters during the same periods.

d) MSR (Mean Spring Range) MNR (Mean Neap Range) are the range between MHWS and MLWS and MHWN and MLWN.

The value of MHWS, MHWN, MLWN and MLWS vary from year to year in a cycle of approximately 18.6 years. In general the levels are computed from at least one year's predictions and are adjusted for the long period variations to give values that are the average over the whole cycle. The values of Lowest Astronomical Tide (LAT) and Highest Astronomical Tide (HAT) are determined by inspection over a span of years.

4.3 Sea Level Rise

Long Term changes in sea levels can be considered under two headings:

a) *Changes in the volume of water held in the Worlds Ocean* – caused by melting of the ice caps as a result of the gradual rise in the temperature of the atmosphere. These are the increases predicted to occur as a result of global warming.

b) *Isostatic Changes* – or changes in the level of the land in relation to the sea. The main causes for such changes in the British Isles are those resulting from the last glacial period i.e. the melting of the ice, which formed over Scotland. The removal of the weight of the ice from the Scottish landmass has meant that Scotland is slowly rising, whilst southern England is slowly sinking.

4.4 Surge Effects

Meteorological conditions can cause dramatic short-term local sea level changes. An effect known as 'wind set-up' occurs when a persistent on-shore wind forces the sea surface toward the land causing amplification in

water depth at the shoreline. The opposite is true for offshore wind directions and is known as 'wind set-down'.

Barometric pressure changes also have an effect on sea level. Under a high-pressure system the ocean surface will be depressed and similarly under a low-pressure system (depression) there will be amplification in sea level. The Admiralty suggests that a difference of 34 millibars in atmospheric pressure as a pressure system passes can cause a difference of 0.3m on the ocean surface.

4.5 In-Shore Wave Predictions

To determine the crest elevation of the coastal developments in Mounts Bay it is necessary to establish the likely wave climate that the structures must withstand and provide reasonable protection and shelter against them.

For the developments in Mounts Bay a typical design life of 50 years has been allowed for in the prediction of the water level with sea level rise and a 100 year return period for surge level. Actual design return periods will need to be confirmed. The wave height predictions will also be based on a 100-year return period. British Standard 6349 suggest the probability of the 100-year wave event occurring within the 50-year design life to be 43%.

The 100-year directional design offshore wave condition was obtained from the MET Office at a location offshore from Mounts Bay (49.8N 5.7W). The location from which the wave data was analysed for the 100-year condition is some 35km offshore of Mounts Bay.

A linear wave model (WENDIS), has been used during this study to transform the offshore wave to a reduced inshore wave found at Newlyn, Penzance and the adjoining promenade. The wave heights can be viewed in Table 4.2 below.

Table 4.2- In-shore Wave Heights Resulting from 100-Year Off-Shore SSW Direction Wave Event

Location	Off-shore Hs (m)	In-shore Hs (m)
Newlyn	10.8	4.30
Promenade	10.8	2.00
Penzance	10.8	3.90

Hs – Significant wave height

No local wave records have been identified to confirm these values.

The WENDIS model used only calculates wave transformations due to shoaling (changes in wave height due to changing depth of water through which wave propagates).

Diffraction (bending of waves around headlands, structures, etc) and refraction (bending of waves due to irregular depth contours) will act to reduce wave height as the wave propagates into Mounts Bay. These are not shown in the WENDIS results and so the wave heights show have a degree of over estimation.

It is intended that the more detailed models produced after the site investigations have been carried out will provide more information on the wave climate of the site. However, the values shown above are deemed sufficiently accurate for the purposes of the study at this stage.

4.6 Currents

Site Investigations carried out as part of the Penzance and St Ives Sewage Treatment Scheme in 1987 at the offshore rock outcrop known as The Gear identified that the areas of Penzance and Newlyn are dominated by weak tidal constituents and the effects of wind induced currents. In general it appears that winds from the Northwest through Southwest induce a clockwise circulation whilst winds from Southeast through Northeast induce a counter clockwise flow within the bay. Normal reversing tidal flow only appears important with light and variable winds or those predominantly from the south.

The maximum current speed recorded during the investigation phase was 0.18m/s adjacent to Gear Rock.

4.6.1 Local Currents

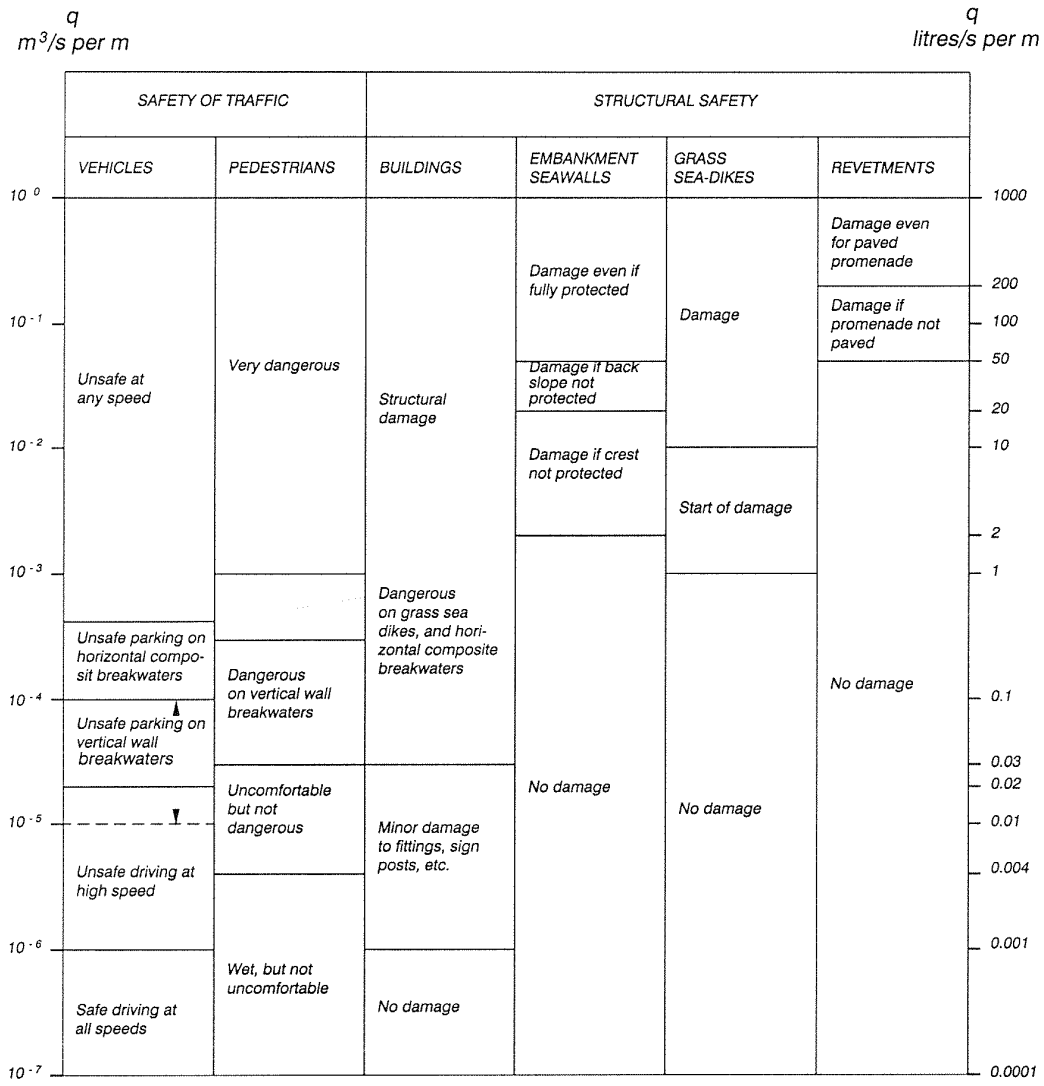
No information is currently available on local currents in and around the harbour environment. It is intended that this level of information be obtained during the site investigations.

4.7 Overtopping Thresholds

It has been reported that heavy spray overtops the existing breakwaters around the Harbour on a regular basis.

Guidance on allowable overtopping thresholds is provided in the Coastal Engineers Manual and reproduced overleaf.

Critical Values of Average Overtopping Discharges
Table V1-5-6



4.8 Overtopping Calculations

Calculations have been carried out to determine the overtopping volumes at the new southern breakwater under differing wave conditions. These calculations have indicated that provision of a crest level of +12.5mCD will only limit overtopping to 1.4 x 10^{-2} m3/m/s. Whilst raising the crest level will reduce overtopping volumes, there remains a practical limit to the crest level which will need to be determined in further stages of the project.

4.9 Implications to Mounts Bay Developments

Both sea level rise and storm surge will have an implication on the coastal developments planned in Mounts Bay. The known increase in sea level will need to be accommodated in any proposals. The degree of the accommodation will depend on the design life of any planned development.

For use in this study, the guideline recommended by the Department of Environment Food and Rural Affairs (DEFRA) of 5mm per year sea level rise will be used. This value is intended to be an average over a 50-year design life from 2003 for sea defence and coastal protection structures on the Southwest coastline. This also allows for isostatic changes in the same time period.

The theoretical maximum water level that could be achieved is created from a combination of the maximum surge as well as HAT. The joint probability of the two occurring simultaneously would, however, be so small that in the typical design life of coastal structures, the risk associated with two occurring simultaneously is considered very small.

A pragmatic solution is to relate the risks of a 100-year surge coinciding with MHWS to give a 100-year design water level.

The resulting extreme SWL is calculated to be 6.30m above chart datum (ACD). It can be seen that this level allows 0.77m above the level of MHWS for surge. Guidelines for 50-year return period surge height increase published by the Department of Energy give between 0.75m and 1m addition for surge, which offers some confidence in the result calculated.

It is proposed that with an allowance of 5mm/year over a 50-year design life the design extreme SWL will be taken as 6.55m above Chart Datum (3.50m above Ordnance Datum).

It must be realised that the extreme sea level of 6.55m ACD given is the design extreme still water level. In addition to this figure will be allowance for the design wave height for an appropriate design return period (i.e. 1 in 100 year wave height for a 50 year design life). The choice of return period and design life is related to a level of acceptable risk. These will need to be confirmed during the course of the study.

Overtopping thresholds will need to be determined in conjunction with design life and return periods for the marine structures. It is recommended that a design basis statement be produced which identifies the potential mix of return periods and design life which can be adopted to allow a decision to be made on an acceptable level of risk.

4.10 Contamination

It is understood that there is a contamination problem with the existing sea bed within the harbour including materials contaminated with TBT.

Although historically contaminated sediments in harbours prevented dredging being undertaken, environmental dredging is now becoming more

widespread. Recently TBT contaminated material at Mylor Yacht harbour was treated on site and re-engineered to create landfill for a new car park.

Options for treatment and re-use on site should be investigated as there are potential cost savings to be made.

5 Option Review

5.1 Review Introduction

A number of options have been identified in past reports. Additionally a number of new options have also been proposed by the Penzance Harbourmaster, Penwith District Council or have been further developed from the original options.

All of these options have been reviewed in Section 5.3 with the results presented in a comparison matrix in Section 5.4.

5.2 Basis of the Review

The following requirements have been identified by the IOSSC as being needed to ensure that the Isles of Scilly communication route can be run safely and economically.

1 Ideally there should be a single berthing area for all seasons and weather conditions so that shipping operations can be contained and centralised. The IOSSC have indicated that it is their intention to replace the existing Scillonian and Gry Maritha vessels with a single vessel and hence in any future development only one berth is thought to be necessary.

2 Currently cargo is loaded onto the Gry Maritha using cranes. However in the future a Ro Ro style vessel where cargo is pulled onto the ferry has been indicated as desirable. The ferry is not anticipated to be loaded heavily with cars. The selection of the type of ferry is however subject to a separate study as the implications of utilising such a vessel is significant, particularly on the necessary infrastructure at both Penzance and on the Isles of Scilly.

3 There should be an adequate cargo storage building which should include provision for frozen storage, chilled storage, dry food storage and ancillary dry storage areas this building should also incorporate an area large enough for freight to be sorted and containerised for delivery to the separate islands.

4 There will need to be exterior storage areas for heavy freight (such as building materials) which can be also be used for the storage of large passenger related items such as boats, etc.

5 The cargo handing facility will need good road access for lorries making deliveries and for receiving freight.

6 A new fuel bunkering supply will be needed.

7 The new facilities should be made secure. This is not only to protect against theft and vandalism but also to ensure that any future nationally designated security requirements can be implemented.

8 There must be good road access to allow for coaches and cars to drop off and to pick up passengers and their luggage. It should be noted that although passenger car parking is not required at the new facility there is a requirement for car parking in the Penzance area to service the Harbour. This is a separate subject to the matters covered by this document. However under the Newlyn Harbour project the need for a park and ride scheme has been identified. It would be prudent for any study for a park and ride to take on board any requirements for Penzance Harbour as well.

9 A passenger terminal building. This will need:-

- A passenger processing area.
- A passenger holding area large enough for up to 600 people although only allowing for approximately 200 seats.
- There should be canteen and toilet facilities in the holding area.
- There will need to be an area sufficient for the processing of baggage, security checks and for stowing into containers.
- A passenger baggage reclaim area.

10 The building will need to incorporate the offices for the Steamship company, the floor area for this has been identified as being approximately 360m^2. The provision of approximately 10 staff car parking spaces should also be made.

Apart from the IOSSC operations there are other item that should be considered in any future development. These are:-

11 In recent years recreational vessels have been using the tidally controlled dock. From evidence presented by the Harbourmaster this market appears to be growing. Although the revenue generated from such activities is small when compared to those of the IOSSC they should be encouraged if possible.

12 The Penzance Dry Dock Company use the tidally controlled dock to assist in their operations. Any proposed development should not compromise these operations.

13 A large proportion of the overall harbour is a tidal area that dries out at low tide and is used primarily for mooring of recreational vessels which can bottom out. It has been indicated that it is an aspiration that this area should become impounded with a tidal lock so that deeper keeled recreational vessels can be accommodated. This would effectively create an attractive marina that could create employment and economic benefits for Penzance.

It must be stressed that these items are not the direct subject of this document but that they should be taken into consideration when reviewing any option.

5.3 The Review

The options below are all reviewed in the following tables.

Option Title	Figure No
Beckett Rankine Partnership Intermediate Option A	3
Beckett Rankine Partnership Full Scheme Option A	4
Beckett Rankine Partnership Intermediate Option B	5
Beckett Rankine Partnership Full Scheme Option B	6
Beckett Rankine Partnership Full Scheme Option C	7
Steering Group Improved Berthing for Scillonian (Modified)	8
Steering Group Improved Scillonian Berthing Option A1	9
Steering Group Improved Scillonian Berthing Option A2	10
Steering Group Improved Scillonian Berthing Option B	11
Penzance Harbour Master Proposal	12
WS Atkins Proposal Phase 1 Action Plan	13
Developed Outer Option I	14
Developed Outer Option II	15
Developed Inner Harbour Option	16

OPTION TITLE: Penzance Harbour Beckett Rankin Partnership Intermediate Option A	**FIG No.** 3

Advantages:

- Designated areas for cargo Handling/passengers.
- Minimalist/relatively cheap.
- North Arm freed for other uses.
- Provides new passenger terminal
- Minimal environmental impacts
- Relatively little dredging
- Pontoons for liners accommodated (although weather dependant)
- Within existing Harbour Revision Order (H.R.O).
- Allows for multiple berthing.

Disadvantages:

- Does not provide an all weather berth
- Reclaimed area expensive relative to area gained.
- Road access to Ro- Ro/cargo handling is potentially dangerous.
- Passenger and cargo areas too small.
- Summer lay-by berth distant from cargo and passenger areas.
- Requires closure of South Pier during construction.
- Complex strengthening of Albert and Lighthouse pier required.
- Provides no additional protection to Lighthouse pier berth.
- Fixed Ro-Ro offers limited tidal window.
- Queuing problems likely on road.
- Limited tidal access for new vessels.
- Adjacent to listed structure.

OPTION TITLE: Penzance Harbour Beckett Rankin Partnership Full Scheme Option A	**FIG No.** 4

Advantages:

- Full tidal operation of Scillonian from summer berth.
- Nominally improved protection from Southeast weather.
- Improved passenger and cargo handling facilities.
- Provides better passenger terminal.
- Designated areas for cargo handling and passengers.
- Pontoons for liners accommodated (although weather dependant).
- Within existing Harbour Revision Order (H.R.O).
- Allows for multiple berthing

Disadvantages:

- Does not provide an all weather berth
- Reclaimed area expensive relative to area gained.
- Road access to Ro- Ro/cargo handling is sub-standard.
- Passenger and cargo areas small.
- Summer lay-by berth distant from cargo and passenger areas.
- Requires closure of South Pier during construction.
- Complex strengthening of Albert and Lighthouse pier required.
- Provides little additional protection to Lighthouse pier berth.
- Fixed Ro-Ro within the dock offers limited tidal window.
- Queuing problems likely on road.
- Adjacent to listed structure.
- Significant dredging required.
- Environmental impacts increased.
- New revetment wall required.
- Impact on wave climate and sediment movement within harbour.

OPTION TITLE: Penzance Harbour Beckett Rankin Partnership Intermediate Option B	**FIG No.** 5

Advantages

- Designated areas for cargo Handling/passengers.
- North Arm freed for other uses.
- Provides new passenger terminal
- Relatively small environmental impacts
- Relatively less dredging
- Pontoons for liners accommodated (although weather dependant)
- Within existing Harbour Revision Order (H.R.O.).
- Allows multiple berthing

Disadvantages

- Reclaimed area expensive relative to area gained.
- Road access to Ro- Ro/cargo handling is sub-standard.
- Passenger and cargo areas too small.
- Foul weather lay-by berth distant from cargo and passenger areas.
- Requires closure of South Pier during construction.
- Complex strengthening of Albert and Lighthouse pier required.
- Provides no additional protection to Lighthouse pier berth.
- Fixed Ro-Ro offers limited tidal window.
- Queuing problems likely on road.
- Limited tidal access.
- Adjacent to listed structure.

OPTION TITLE: Penzance Harbour Beckett Rankin Partnership Full Scheme Option B	**FIG No.** 6

Advantages

- Full tidal operation of Scillonian in good weather.
- Improved passenger and cargo handling facilities.
- Pontoons for liners accommodated (although weather dependant).
- Improved security control.
- Provides transport interchange.
- Multiple berthing allowed

Disadvantages

- Does not provide an all weather berth.
- Large scale expensive reclaimed area.
- Road access to foul weather Ro- Ro/cargo handling is sub-standard.
- Summer foul weather berth distant from cargo and passenger areas.
- Requires closure of South Pier during construction.
- Complex strengthening of Albert pier required.
- Fixed Ro-Ro in the foul weather berth offers limited tidal window.
- Queuing problems likely on road.
- Limited tidal access to foul weather berth.
- Significant dredging required.
- Significant environmental impacts.
- New revetment wall required.
- Significant Impact on wave climate and sediment movement within harbour.
- Outside of the existing H.R.O.

OPTION TITLE: Penzance Harbour Beckett Rankin Partnership Full Scheme Option C	**FIG No.** 7

Advantages

- Designated areas for cargo Handling/passengers.
- Full tidal access and egress from Lighthouse pier berth.
- Reduction in waves overtopping lighthouse pier.
- North Arm freed for other uses.
- Provides new passenger terminal.
- Relatively small environmental impacts.
- Relatively less dredging.
- Pontoons for liners accommodated (although weather dependant).
- Multiple berthing

Disadvantages

- Does not provide all weather berth.
- Reclaimed area expensive relative to area gained.
- Road access to Ro- Ro/cargo handling is sub-standard.
- Passenger and cargo areas too small.
- Summer foul weather lay-by berth distant from cargo and passenger areas.
- Requires closure of South Pier during construction.
- Complex strengthening of Albert and Lighthouse pier required.
- Fixed Ro-Ro offers limited tidal window of operations.
- Requires extensive dredging.
- Queuing problems likely on road.
- Limited tidal to foul weather berths.
- Outside of the existing H.R.O.

OPTION TITLE: Penzance Harbour Improvements to Berthing for Scillonian (Modified)	**FIG No.** 8

Advantages

- Increased cargo handling area adjacent to South Pier.
- Reduction in waves overtopping Lighthouse and South Piers.
- North Arm freed for other uses.
- Relatively small environmental impacts.
- Relatively less dredging.
- Pontoons for liners accommodated (although weather dependant).
- Multiple berthing.

Disadvantages

- Does not provide all weather Berth.
- Reclaimed area expensive relative to area gained.
- Passenger and freight areas are not adequate.
- Existing summer foul weather lay-by berth distant other facilities
- Requires closure of South Pier during construction.
- No provision for foul weather Ro-Ro berth.
- No separation of passenger and cargo handling areas.
- Queuing problems likely on road.
- Limited tidal access for new vessel.
- Not within existing Harbour Revision Order (H.R.O.).

OPTION TITLE: Penzance Harbour Improved Scillonian Berthing Option A1	**FIG No.** 9

Advantages

- Greater tidal window for operation of Scillonian.
- Potential all weather berth (with slight modifications).
- Improved passenger and cargo handling facilities.
- Frees up dock area and potentially the Albert pier for alternative use.
- Provides better passenger terminal.
- Designated areas for cargo handling and passengers.
- Improved security control.
- Provides transport interchange.
- Minimal impact on listed structure.
- Multiple berthing if usage of Dock assumed.

Disadvantages

- Large scale reclaimed area –expensive.
- Allows full tidal berth but not access and egress.
- No Ro-Ro facility provided.
- Requires closure of Lighthouse Pier during construction.
- New revetment wall required.
- Impact on wave climate and sediment movement within harbour.
- Not covered by existing H.R.O.
- Significant environmental impacts.
- Overtopping may still be substantial on South Pier.

OPTION TITLE: Penzance Harbour Improved Scillonian Berthing Option A2	**FIG No.** 10

Advantages

- Greater tidal window for operation of Scillonian.
- Potential all weather berth (with slight modifications).
- Ro-Ro and link span facilities provided.
- Allows for two vessels or frees Lighthouse pier for alternative use.
- Improved passenger and cargo handling facilities.
- Frees up dock area and potentially the Albert pier for alternative use.
- Provides better passenger terminal.
- Designated areas for cargo handling and passengers.
- Improved security control.
- Provides transport interchange.
- Minimal impact on listed structure.
- Multiple berthing-not dependant on the existing Dock.

Disadvantages

- Large scale reclaimed area- expensive.
- Allows full tidal window for berthing but not access and egress.
- If not modified summer lay-by berth distant from cargo and passenger areas.
- Requires closure of Lighthouse Pier during construction.
- New revetment wall required.
- Impact on wave climate and sediment movement within harbour.
- Not covered by existing H.R.O.
- Significant environmental impacts.
- Overtopping may still be substantial on South Pier.

OPTION TITLE: Penzance Harbour Improved Scillonian Berthing Option B	**FIG No.** 11

Advantages

- Full tidal window for operation of Scillonian.
- Potential all weather berth.
- Ro-Ro and link span facilities provided.
- Frees entire dock for alternative uses.
- Improved passenger and cargo handling facilities.
- Provides better passenger terminal.
- Designated areas for cargo handling and passengers.
- Improved security control.
- Adjacent to better transport interchange facilities.
- Construction will have less impact on harbour operations.

Disadvantages

- Large scale reclaimed area – expensive.
- Impact on wave climate and sediment movement within harbour.
- Not permitted by existing H.R.O.
- Significant environmental impacts.
- Vessel manoeuvring tight and will obstruct harbour entrance.
- Requires two breakwater constructions.
- Requires extensive dredging of rock.
- Could result in vehicular conflict within the existing bus terminal.
- Could up-set current users of Albert pier.

OPTION TITLE: Penzance Harbour Masters Proposal	**FIG No.** 12

Advantages

- Greater tidal window for operation of Scillonian.
- Potential all weather berth (with slight modification).
- Frees up dock area and Albert pier for alternative use.
- Provides better passenger terminal and cargo handling area.
- Designated areas for cargo handling and passengers.
- Provides Ro-Ro facility
- Improved security control.
- Provides limited transport interchange.
- Minimal impact on listed structure.
- Provides designated yacht berthing area.

Disadvantages

- Large scale reclaimed area –expensive.
- Requires closure of Lighthouse Pier during construction.
- Impact on wave climate and sediment movement within harbour.
- Not permitted by existing H.R.O.
- Significant environmental impacts.
- Overtopping may still be substantial on South Pier.
- Expensive cost of providing a small yacht area.
- Yachts must still pass through commercial area to dock.

OPTION TITLE: Penzance Harbour W.S. Atkins Proposal Phase 1 Action Plan	**FIG No.** 13

Advantages

- Greater tidal window for operation of Scillonian.
- Frees up dock area and Albert pier for alternative use.
- Provides better passenger terminal and cargo handling area.
- Designated areas for cargo handling and passengers.
- Improved security control.
- Provides transport interchange and extensive car parking.
- Minimal impact on listed structure.
- Provides 200 berth yacht marina and facilities for visiting vessels.
- Provides extra housing and tourist facilities.

Disadvantages

- Large scale reclaimed area – very expensive.
- Needs substantial modification to provide an all weather berth.
- Substantial Impact on wave climate and sediment movement within harbour.
- Substantial environmental impacts.
- Not permitted by existing H.R.O.
- Expensive cost of providing yacht area.
- No Ro-Ro link span facility provided.
- Potential need for winter/foul weather berth within dock.

OPTION TITLE: Developed Outer Option I	**FIG No.** 14

Advantages

- All weather Berth
- Improved cargo and passenger handling facilities
- Frees up dock and Albert Pier for alternative uses
- Pontoons for liners accommodated
- Improved security control
- Provides Transport Interchange
- Multiple berthing if usage of dock assumed
- Provides protected route along South Pier

Disadvantages

- Reclamation is relatively expensive when compared to others.
- Tidal access restricted unless dredged channel installed
- Requires closure of Lighthouse Pier during construction
- Impact on wave climate and sediment movement within the harbour.
- Not covered by the existing HRO
- Would require re-siting and disruption of Scillonian berthing during construction

OPTION TITLE: Developed Outer Option II	**FIG No.** 15

Advantages

- All weather Berth
- Improved cargo and passenger handling facilities
- Frees up dock and Albert Pier for alternative uses
- Pontoons for liners accommodated
- Improved security control
- Provides Transport Interchange
- Multiple berthing if usage of dock assumed
- Provides protected route along South Pier

Disadvantages

- Reclamation is relatively expensive when compared to others.
- Tidal access restricted unless dredged channel installed
- Requires closure of Lighthouse Pier during construction
- Impact on wave climate and sediment movement within the harbour.
- Not covered by the existing HRO
- Would require re-siting and disruption of Scillonian berthing during construction

OPTION TITLE: Developed Inner Harbour Option	**FIG No.** 16

Advantages

- All weather Berth
- Improved cargo and passenger handling facilities
- Frees up dock and Albert Pier for alternative uses
- Pontoons for liners accommodated
- Improved security control
- Provides Transport Interchange
- Multiple berthing if usage of dock and Lighthouse Pier assumed
- Provides protected route along South Pier
- Manner of construction of reclamation potentially cheaper than other forms of reclamation.
- Can be used to assist future development of the remainder of the Harbour.
- Environmental implications of reclamation minimal when compared to other options.
- Would not require re-siting and disruption of Scillonian berthing during construction.

Disadvantages

- Relatively expensive
- Tidal access restricted unless dredged channel installed
- Makes access to the existing dry dock more complex.
- Relatively difficult vessel manoeuvring needed
- Impact on wave climate and sediment movement within the harbour.
- Not covered by the existing HRO

5.4 Option Costs

Table 6.1 identifies the cost of each option.

The cost identified are exclusive of VAT, associated finance costs and do not include for professional, legal or planning fees or the costs of environmental, physical or numerical studies

5.5 Overall Comparison

A comparison Matrix is presented overleaf. This matrix identifies a series of requirements against which each option is marked out of 10. Each issue is then weighted so that a final comparison score is achieved. This final score is also marked out of 10. Technical issues account for 70% of the total score and cost for 30%.

The following notes apply to the requirements in the matrix.

1) The tidal dependency of each option is scored 5 for options that allow only limited tidal window for access/egress and 10 for options that are not restricted by the tide.
2) Options are scored out of 10 on their potential to provide adequate size passenger and cargo handling areas and separate the areas.
3) Options are scored on how condensed the proposed operations will become.
4) Options are scored 0 if the existing wet dock will continue to be needed for use by the IOSSC and 10 if it is freed up for alternative uses.
5) Options are scored 0 if no Ro-Ro link-span is provided, 3 if a fixed link-span is provided and 10 if a full length link-span allowing full tidal operation.
6) Options that require separate foul weather and fair weather berths are scored 0 whereas options providing an all weather berth are scored 10.
7) Options are scored on their interface with the existing pubic highway.
8) Environmental impact is assessed on the areas of reclaimed land, its location and the dredging required for each option and scored out of 10
9) Requirements (1) to (8) are totalled to give the option that best satisfies all technical requirements.
10) A cost score is given out of 10. Each option is scored on a sliding scale with any scheme costing £30 million or more scoring 0 and any score costing £5.24 million scoring 10.

		Requirements										
		1) Tide Dependency	2) Adequate Passenger & Cargo Facilities	3) Condensed Passenger and Cargo Facilities	4) Free up space in existing dock	5) Provide RoRo Ferry Link span	6) Provide year round berth for ferry	7) Improve/minimise obstruction to highway	8) Environmental impact	9) Technical Score	10) Cost (See Section 6)	
		Weighting [$]										
Option Title	**Figure No**	**0.08**	**0.08**	**0.08**	**0.08**	**0.08**	**0.08**	**0.11**	**0.11**	**-**	**0.30**	**Total Score**
Penzance Harbour Becket Rankin Partnership Intermediate Option A	**3**	5	2	0	0	3	0	0	9	**1.79**	10	**4.79**
Penzance Harbour Becket Rankin Partnership Full Scheme Option A	**4**	10	5	0	0	10	0	5	4	**2.99**	6	**4.79**
Penzance Harbour Becket Rankin Partnership Intermediate Option B	**5**	5	5	0	0	3	0	5	4	**2.03**	7	**4.13**
Penzance Harbour Becket Rankin Partnership Full Scheme Option B	**6**	10	10	8	0	10	0	5	1	**3.7**	2	**4.3**
Penzance Harbour Becket Rankin Partnership Full Scheme Option C	**7**	10	2	0	0	3	0	0	8	**2.08**	10	**5.08**
Penzance Harbour Improvements to Berthing for Scillonian (Modified)	**8**	5	2	8	0	10	0	2	7	**2.99**	8	**5.39**
Penzance Harbour Improved Scillonian Berthing Option A1	**9**	5	8	10	10	0	10	10	7	**5.31**	7	**7.41**
Penzance Harbour Improved Scillonian Berthing Option A2	**10**	5	8	10	10	10	10	10	6	**6**	6	**7.8**
Penzance Harbour Improved Scillonian Berthing Option B	**11**	5	10	10	10	10	10	10	6	**6.16**	3	**7.06**
Penzance Harbour Masters Proposal	**12**	5	10	10	10	3	10	10	6	**5.6**	5	**7.1**
Penzance Harbour W.S. Atkins Proposal Phase 1 Action Plan	**13**	5	10	10	10	0	10	10	1	**4.81**	0	**4.81**
Penzance Harbour Preferred Outer Option I	**14**	5	10	10	10	10	10	10	6	**6.16**	5	**7.66**
Penzance Harbour Preferred Outer Option II	**15**	5	10	10	10	10	10	10	6	**6.16**	3	**7.06**
Penzance Harbour Preferred Inner Harbour Option	**16**	5	10	10	10	10	10	10	8	**6.38**	7	**8.48**

It should be noted that due to the preliminary status of most of the options there are a number of issues that could be relatively easily amended which would have nominal impacts on the scoring. However the matrix rapidly demonstrates that those options that are clear leaders.

These are;

- Developed Inner Harbour Option…Fig 16.
- Outer Preferred Option I……...Fig 14
- Outer Preferred Option II……...Fig 15

It is therefore considered that the scope of technical investigations should be determined on the basis of one of the options above.

6 Costs, Programme and Risks

6.1 Basis of costs

Section 5 indicates a number of potential options for the developments at Penzance. Table 6.1 identifies the indicative costs for each of these options.

Table 6.1 Costed Options

Option Title	Cost (£ Millions)
Beckett Rankine Partnership Intermediate Option A	5.2
Beckett Rankine Partnership Full Scheme Option A	16.3
Beckett Rankine Partnership Intermediate Option B	14.7
Beckett Rankine Partnership Full Scheme Option B	25.2
Beckett Rankine Partnership Full Scheme Option C	6.9
Steering Group Improved Berthing for Scillonian (Modified)	12.5
Steering Group Improved Scillonian Berthing Option A1	14.6
Steering Group Improved Scillonian Berthing Option A2	16.2
Steering Group Improved Scillonian Berthing Option B	22.6
Penzance Harbour Master Proposal	19.6
WS Atkins Proposal Phase 1 Action Plan	57.6
Developed Outer Option I	19.7
Developed Outer Option II	23.1
Developed Inner Harbour Option (Note this excludes the cost of the lock or any other feature intended to impound the existing drying section of the harbour)	13.6

Analysis of costs have been carried out by Currie & Brown Widnell Ltd. Costs are based on year 2003 rates and no allowance has been made for inflation and price index changes in the interim period between the study and the commencement of construction work.

The cost identified are exclusive of VAT, associated finance costs and do not include for professional, legal or planning fees or the costs of environmental, physical or numerical studies

It should be noted that costs are at this stage indicative and further more rigorous costing will be undertaken once the technical investigations are complete.

6.2 Programme

The significant developments proposed for Penzance will require detailed planning and programming to ensure the correct sequence of delivery to obtain best value for money. In particular the technical investigations that are needed are considerable and the findings from which will significantly influence the construction methods and programme.

However, assuming that the technical investigations prove that the three preferred options identified in section 5.5 are technically achievable and that Harbour Revision Orders can be gained for the relevant proposals the indicative programme durations identified in table 6.2 could apply.

Table 6.2 Programme

Option Description	Construction Programme
Developed Inner Harbour Option	12-18 months
Outer Preferred Option I	12-18 months
Outer Preferred Option II	12-18 months

It is intended that a more detailed programme is developed at Concept Design Stage, which will indicate the sequence of works, once the technical feasibility of the proposals have been determined.

6.3 Risks

It is suggested that a risk register is developed for each of the proposals listed in Section 5, to identify the potential risk, the potential for that risk to occur, the financial and programme implication of that risk and to propose mitigating measures. In this way, proactive management of risks is encouraged and best value can be gained from any investigations proposed to mitigate the risk.

7 Conclusions

Introduction

The existing operational harbour infrastructure for the Isles of Scilly cargo and passenger vessels is causing an operational environment that is difficult to manage either efficiently or safely. The main problems are caused by:

- The exposure of the harbour to the marine environment which causes the better operational berths to become unusable during poor weather.
- The limitations on the available space.

Review

Fourteen options have been reviewed and compared on both technical merit and cost. Three Options stand out as being preferential. The first two are similar in that they locate a new reclaimed harbour facility at the end of the existing lighthouse pier. The latter option places a new facility within the existing drying berth of the harbour. All of these options share the following common benefits:

1. The freight and passenger operations will be concentrated into one area and not spread out over the entire harbour as this makes the operation of the shipping safer and more efficient.
2. The proposed handling areas will create facilities where freight can be sorted and stored in a manner that would be a significant improvement to what is possible at present.
3. With the removal of the need for IOSSC vessels to enter the tidal dock or into the drying basin these sections of the harbour can be used to enhance other activities such as recreational uses or the existing dry dock operations.

Further Clarification

The exact nature and layout of the future facility needs to be further identified, this can only be achieved after clarifying the following:-

i. The nature of the future vessel creating the Isles of Scilly link needs to be identified. Specifically whether or not it will be a Ro Ro ferry and hence needing a linkspan or if it will just need craning facilities. It is noted that this decision is a complex one and depends not just upon the cost of the vessel but also the berthing facilities necessary on the Isles of Scilly and at Penzance. It is understood that a report is being prepared by others that will recommend the future vessel. To assist in the vessel selection it is proposed that costs will be identified for Penzance showing both linkspan connections and simple berths with cranage. It is proposed that these options should be drawn up only once other factors such as the freight and passenger handling

requirements have been fully identified as these will have significant influences on the layout and costs.

ii. The costs associated with dredging a channel to allow constant non tidal access is significant. However it is not possible to accurately assess the costs due to the absence of accurate ground investigation data. To better assess the costs a full hydrographic survey will be needed which should include a geophysical survey so that the various strata beneath the sea bed can be identified. This survey should be supported by a number of boreholes to help identify the characteristics of the strata and to assist in calibrating the geophysical surveys. The extent of dredging will be greatly affected by the possible future vessel as its draught will have an obvious effect along with its turning capabilities both of these issues will need to be resolved.

Iii The existing harbour suffers significantly from wave attack, the proposed options identify new sea walls and enhancements to existing ones based upon a preliminary assessment of the magnitude of these waves. This assessment will need to be clarified and any results incorporated into any proposed options.

iv. The overall size of the reclamation (and hence the costs) is influenced by the spatial requirements for the freight and passenger handling. Although an indicative idea of the requirements has been identified these need to be refined such that the overall footprint can be accurately identified and minimised. This exercise will include the need to identify how freight and passenger traffic can safely manoeuvre.

v. The proposed new facility will affect the marine environment in terms of wave propagation and sediment transfer. It will be necessary to model these issues and if the scheme is found to be detrimental it should be adjusted to minimise any negative effects.

vi. It is understood that the existing piers are listed. Under some options significant modifications are proposed to these walls. It will be necessary to identify if the modifications will be granted listed building consent.

vii. New services to the facility will be needed (i.e. electricity, gas water, telephone, etc) it has been assumed that these will be available locally however this will need to be confirmed with the appropriate utilities.

viii. The method of construction of any new facility is likely to be complex and be influenced by a number of significant factors such as geology, access to the site, the exposure of the site, the 'buildability' of the individual elements of the project and the ongoing operations associated with the harbour. All of these areas will be studied further at concept design stage to assess their impacts on any future scheme.

ix. Costs will be a major influence on the final selection of the desired option. Currently the level of information available makes accurate costing difficult. However, indicative costs have been presented. As the number of unknowns and risks become rationalised and quantified during the study process they should be constantly reviewed to help in strategic planning.

Site Investigations

Appendix B identifies the envisaged site investigation that will be needed to progress the study. The investigation identified will produce information for both the areas that show the strongest potential. If the site selection process can be further tightened up it may be possible to reduce the scope of this investigation and hence costs. However this should be counterbalanced by the fact that if both sites are investigated the costings for both the sites will become more accurate thus ensuring that the final concept design has taken full advantage of an informed economic appraisal.

Appendix A

Drawings

Appendix B

Site Investigation Outline Scope

The following table identifies the areas that need to be investigated and the proposed methods of investigations.

Areas of Investigation	Method Of Investigation
Dredging To ensure non tidally restricted access to the berth a dredged channel will be needed. To assess the viability and extent of dredging the sea bed profile needs to be identified along with the strata beneath it.	A full hydrographic and geophysical survey of the area shown on drawing DV01104/1224 will be needed. This survey will need to be calibrated against a number of boreholes and rock probes.
The material being dredged will need to be tested for its physical characteristics to assess its 'dredgibility'.	Samples obtained from the boreholes will need thorough testing.
The Marine Consents Unit (part of DEFRA) will want to have the dredged material tested for various environmental considerations including the possibility of disposing of the dredged material at sea.	The Marine Consents Unit will need to be referred to so that they can identify what they will be wanting to have tested. This will be one of the main drivers on the number of boreholes. If they only request surface samples these may be obtained by divers which would be substantially cheaper.
A strategic sewerage tunnel runs beneath the harbour. The effects of dredging (particularly if rock removal is anticipated) over this tunnel needs to be investigated.	Details of this tunnel need to be pursued and the operators of this tunnel (South West Water Ltd.) liased with.
Lighthouse Pier Integrity The structure of the existing pier is unknown and a deepened berth adjacent to this pier may undermine it.	Boreholes lowered through the pier itself will hopefully identify its founding strata (note that these holes may need listed building consent). At least two boreholes should also be inserted in the water adjacent to the pier will be needed to confirm the continuation of the founding strata.
New Sea Wall and Reclamation's The depth of the sea bed and any underlying strata will be essential for the design of any walls or reclaimed areas. If areas of piles and concrete decking are going to be needed good geotechnical information on the nature of the underlying rock will be invaluable.	As with the dredging areas all areas of possible reclamation will need a hydrographic and geophysical survey these will need to be backed up by boreholes. In areas where piled quay structures are possible a closer density of boreholes will be needed.

Areas of Investigation	Method Of Investigation
	It should be noted that if the boreholes indicate the areas of reclamation are underlain by significant depths of compressible material this material may need to be removed. For this material to be dredged the Marine Consents Unit will need to be referred to. Reference to the MCU should be undertaken at an early stage to identify their possible requirements.
Existing Sea walls The existing Lighthouse Pier may be utilised for assisting in berthing or as a sea wall. The South Pier may be enhanced as a sea wall and used for access. A berthing pontoon or a new concrete pier may be inserted on the Eastern face of the North Pier.	 A condition survey of this pier will be needed. This will need to include a diver inspection. A condition Survey of this pier will be needed. This will need to include a diver inspection. A localised condition survey of the affected pier is needed. This will need to include a diver inspection. Also a trial pit will be needed to assess the structure of the pier for where any new interface is anticipated.
Access Route A number of structures may need to be demolished depending upon the final site selection. One of the structures that may need demolition is a bunded above ground fuel tank that is reportedly unused. There is a risk that these tanks may have leaked oil in the past and this has seeped into the underlying soil.	 The ownership of these structures needs to be identified before any firm proposals can be made on them. If it can be confirmed that they can be demolished a Type 3 asbestos survey will be needed on each one of them. This type of survey is now statutory for any building that is to be demolished or to be heavily modified. A trial pit inserted adjacent to the tanks can be used to help clarify if any leakage has occurred however further testing would be needed once the tanks have been demolished.
Future usage of the dock area The tidally locked dock area will be freed up for further recreational usage or usage by Penzance Dry Dock.	

Areas of Investigation	Method Of Investigation
If it is to be retained for recreational use it is likely that a series of pontoons will need to be inserted which will probably need to supported by piles.	This is outside of the current scope of the project and so no investigation works are proposed at this stage. It should however be noted that reportedly there are fuel pipes that run under the wet dock from the existing fuel tanks on the southern pier. These should be located prior to any intrusive investigation or pile driving in the wet dock.
Once the shipping facilities have relocated to the new area the Rank building will be largely redundant apart from some small inadequate offices occupied by the Harbour Master. With the Inner Harbour Option the partial demolition of this building will be needed.	A structural inspection of the building should be made backed up with a Type 3 asbestos survey.
Topographical Surveys The new facilities will affect the entire dock area along with portions of the adjacent highways the Lighthouse pier and to some extent the end of the Albert Pier. Knowing the exact levels and locations along all these areas will be essential	A Topographical survey of the affected areas will be needed.
Other Surveys The Environmental and numerical modelling scoping studies will identify other surveys that will be needed.	Refer to the Environmental and Numerical Scoping Studies for details of these proposed investigations.

Appendix C

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