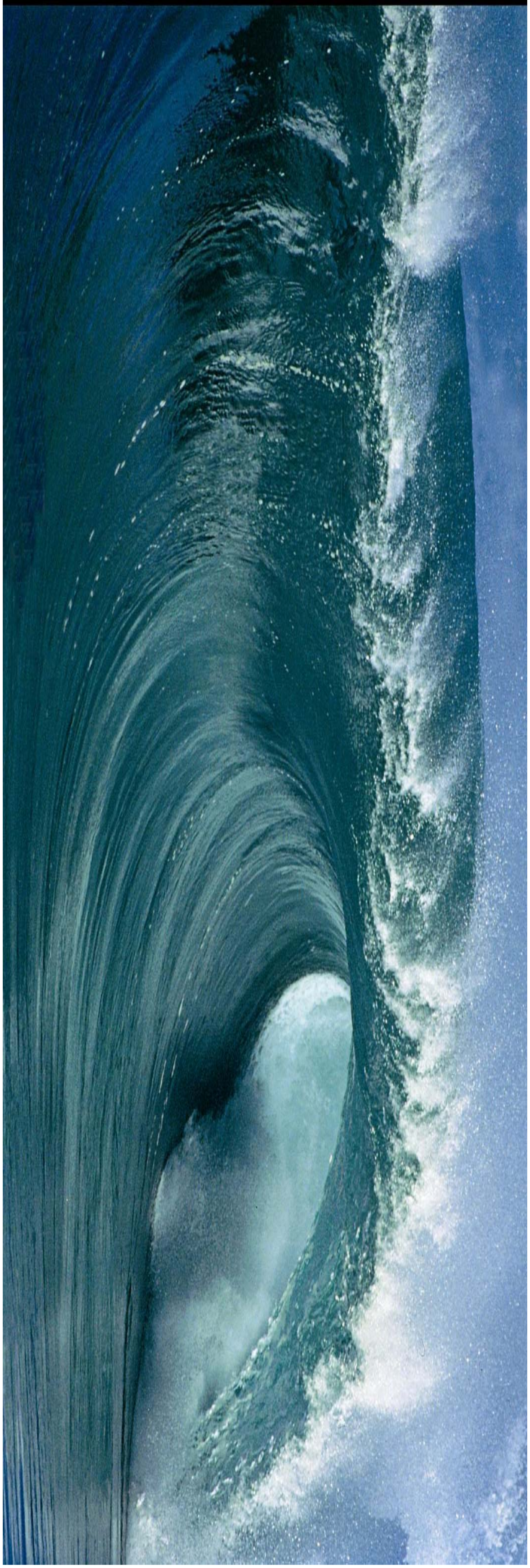

COASTAL ENGINEERING SOLUTIONS

St Helens Barway
Review & Update of Options

FINAL REPORT

Prepared for
Dept of Marine and Safety Tasmania

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Section 1

INTRODUCTION

Coastal Engineering Solutions Pty Ltd (CES) has been engaged by Marine and Safety Tasmania (MAST) to undertake a review of previous studies of The Barway at St Helens. Figure 1.1 shows a locality diagram.

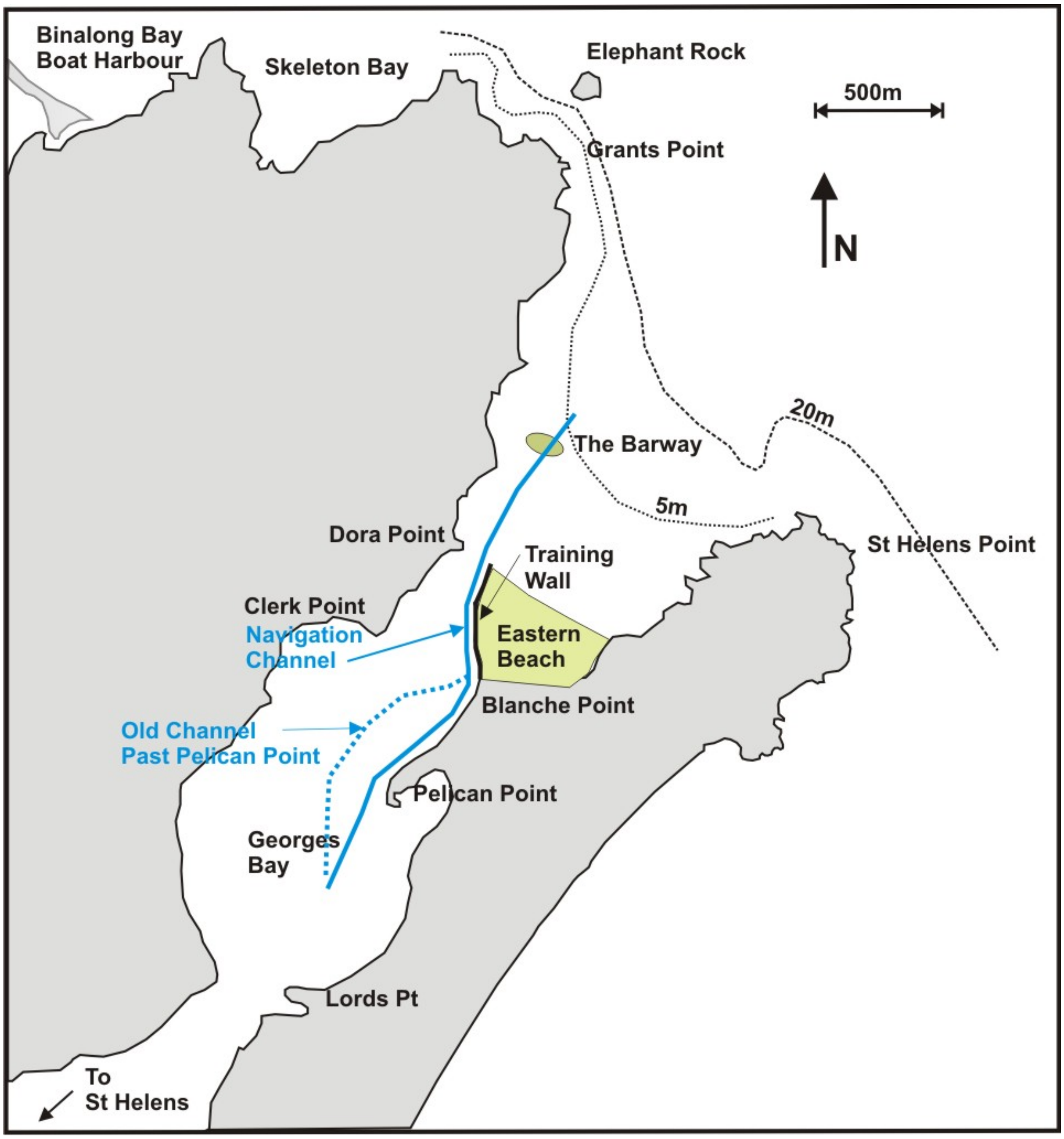

Figure 1.1: Locality Diagram

The two primary outcomes required from the study are:

1. Provide an opinion about the navigability of The Barway and the channels within the entrance over the next five years without any intervention.
2. Provide recommendations of long term solutions for improving navigation at the bar and entrance channels.

A brief history of access to the Port of St Helens in Georges Bay on the east coast of Tasmania is as follows:

- Prior to the 1960's the entrance to Georges Bay was in a natural state without any engineered modifications. Sand was gradually building up within the estuary and at its entrance so that navigation into the port was becoming more difficult and dangerous.
- In 1969 the construction of a training wall on the eastern side of the entrance commenced. Construction proceeded in many stages up until 1984 when the wall reached its present length of 650 metres.
- The foreshore area contained between the training wall and the St Helens Point headland filled up with sand to create a new beach. The rate of filling and the beach growth seaward was not far behind the rate of construction of the training wall.
- In 1986 the Water Research Laboratory of the University of New South Wales undertook a physical modelling study of the entrance and recommended a major extension to the training wall on the eastern side of the entrance and the construction of two training walls on the western side of the entrance. These works were not implemented, presumably because construction costs would have been very high.
- In 1999 Vantree (G. Byrne) was commissioned to review the history of the Barway and channels and previous studies and data. Conclusions drawn from this study were:
    i. Further training walls were not the solution to maintaining navigable channels.
    ii. The channels should be maintained by dredging. Periodic dredging, a fixed by-pass system and agitation dredging were considered.
    iii. Agitation dredging should be trialled as a relatively low cost option for channel maintenance.

- Agitation dredging has been trialled with some success, but costs have been higher than anticipated in relation to the benefits achieved. The contract for agitation dredging has expired and the vessel used decommissioned for this purpose.

MAST has decided to review the Barway performance and options for management, resulting in this study being commissioned.

Section 2
REVIEW OF PREVIOUS STUDIES

2.1 The University of New South Wales (WRL) Report

The full report has been read and CES's conclusions concur totally with those of G. Byrne – See Section 2.2. The conclusion with regard to the system not being closed is further reinforced in CES's commentary in Section 2.2 where it is concluded that about 350,000 cubic metres of sand has accumulated to the east of the training wall. For the system to be closed this material would have need to have been derived predominantly off the seabed immediately seaward of the beach. This area is characterised by shoals and bars that are growing rather than having diminished since the training walls have been constructed.

Consequently we must conclude that any impacts of new training walls or training wall extensions may not be beneficial to improved navigation over The Barway in the long term. There is likely to be a benefit in the short term as there was with the previous training walls and this benefit prevailed until the beach to the east of the training wall filled. The same outcome is predicted for any training wall extensions. In the long term the impact will be to move The Barway seaward where wave conditions are more severe and any maintenance dredging becomes more difficult.

2.2 Vantree (G. Byrne) Reports

In 1999 Gerry Byrne undertook the study "The St Helens Barway at Georges Bay – Review of Options for Maintaining a Navigable Entrance" for MAST and the Department of Primary Industry and Environment (DPIWE). The report:

- Documents the changes to The Barway and channels into Georges Bay up to Pelican Point area based on aerial photographs, available on an annual basis (with a few gaps) from 1966 to 1998. The changes have been documented by reducing all of the aerial photographs to a common scale. This allows the photographs to be overlain and changes in the position of the channels and bars and banks can be clearly distinguished. From this comparison the conclusions drawn *(with commentary in italics by CES)* were:

- o Inside the entrance (and later to the west of the training wall) the flood and ebb channels slowly move in the direction of the respective currents in a similar way to the gradual downstream progression of meanders in the river. *Agree except that with the presence of the training wall it is no longer possible for ebb channel to continue to migrate in a natural manner. Instead, it appears that the training wall is forcing the channel to attempt to meander eastward with the resultant undercutting of the dunes on the eastern side of the channel between Pelican Point and the start of the training wall. Photo 2.1, taken on 19th April, illustrates the erosion.*

Photo 2.1: Undercutting of the dune north of Pelican Point

- o The training wall has been very successful in reducing the number of channels at the entrance to one and so concentrating the flow of water. *Agree.*

- The sandbars caused by the flood channels inside the entrance appear to be moving progressively to the west and causing a slow net accretion of sand inside the entrance. *Agree, although the direction of movement is more to the south than to the west. The entrance channel near the trained entrance is aligned almost north-south. Also we would anticipate that the rate of sand accumulation within the entrance would have been greater prior to construction of the training wall. Consequently the training wall has the potential benefit of reducing the movement of sand to the inside of the entrance. Potentially this would have reduced the need for maintenance dredging inside the entrance until the beach to the east of the training wall filled with sand.*

- The beach immediately south (*actually east*) of the training wall accreted quickly as the training wall was extended. There is a large volume of sand accumulated behind this beach. This large amount of sand has been removed from the active beach/estuary system. If the estuary were a closed system from the point of view of the sand supply, as has been suggested in previous reports (*WRL*), then significant changes to the shape of the entrance bars could be expected as a result of this sand removal. No significant changes can be observed. *Whilst little change has occurred to the overall shape of the bars, the bar system has moved seaward in recent years suggesting that sand is continually being added to the system at the entrance, and indeed the system is not a closed one. Sand is still being added from the sea.*

- There is erosion on the north bank of the estuary between Dora Point and Granite Rock Point and on the southern bank to the west of Blanche Point. Some of this eroded sand might have moved onto the new beach *contained by the training wall* but there is insufficient sand eroded from these two locations to account for the growth of the beach. *CES estimate that the volume of sand collected at the new beach contained by the training wall is about 350,000 cubic metres. The volume of sand eroded from the two dune systems is of the order of 50,000 cubic metres. This reinforces the view that St Helens Barway and Georges Bay are not a closed system. Sand is being added to the system at an annual rate of 5,000 to 10,000 cubic metres.*

- Whilst the training wall has been good in concentrating the channels, it does not seem to have changed the position of The Barway (and probably its depth) to any significant extent over the 32 Year record period (*of photography*). *Agree, except there appears to be a shift in recent years with the formation of a secondary bar since 2000.*

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- The beach compartment just south (east) of the training wall is now "full" and any sand moving along the beach towards the entrance will flow into the entrance. *Sand will tend to flow into the entrance on the flooding tide. On the ebb tide sand will tend to feed on to the shoal on the eastern side of the channel seaward of the training wall.*

- Considers the geomorphological growth of sand within Georges Bay and the entrance area and concludes the average rate of infill that has occurred since sea level stabilised at present levels about 6,000 years ago is 7,000 to 10,000 cubic metres per year. *Agree and CES note that this rate of sand infilling appears to be consistent with present rates of sand deposition at the beach contained by the training wall.*
- Reviews the WRL report and questions the validity of the study, mainly in that the model study assumed that the system was closed and therefore no new sand was being added to the system. It is also concluded that a reason for the recommendations for extending training walls was not implemented was their high cost. *CES agrees with the interpretation on both accounts and categorically also conclude that it is not a closed system.*
- Considers alternative dredging strategies in lieu of training wall extensions:
  - Periodic dredging to remove a large part of the bar. The problems involved relate to either using a large cutter suction dredge that could work in wave conditions occurring at the bar and the mobilisation costs for such a dredge, as well as maintaining a pipe delivery system to the spoil area (on the beach), or mobilising a small trailing hopper dredge *such as "The Pelican" which works in the Australia – New Zealand area*. *CES agree and note mobilisation / demobilisation of a suitable dredge (of either type) and associated equipment would cost in excess of $0.5. This makes it a very expensive option to trial.*
  - Fixed Bypass System. Standard sand bypass systems such as have been installed at the Nerang in Queensland and *Tweed River entrance* are not suitable for a system where there is not a substantial longshore drift of sand. A fixed pipe system (with a number of water outlets through which water can be pumped on the ebbing tide) along the alignment of the desired channel through The Barway could produce an improved navigable channel. However the installation cost would be high because the pipe would need to be mounted on the seabed (probably piled) at a depth below that of the channel bottom. *CES note that whilst the pipe installation can operate to maintain a channel under present conditions, new sand is still being added to the system from the sea (at a rate of 5,000 to 10,000 cubic metres per year). This sand will need to be accommodated somewhere in the entrance area and could be expected to result*

in either the bar being moved seaward (away from the pipe system) or the bar may widen seaward with a similar effect, where the seaward part of The Barway channel shoals.

- o Agitation or Water Injection Dredging. Since The Barway is not wide and the ebb tidal current is strong – in excess of 0.5m/sec it was concluded that agitation dredging is likely to work and could be trialled at an acceptable cost. This is the option recommended for implementation and a concept design was prepared for a trial. *We understand that agitation dredging has been implemented with success. However, the costs are considerably higher than that anticipated - $200,000 to $300,000 per year. The effective cost is about $1,000 per hour of dredging.*

Since the 1999 report Gerry Byrne has had a continued involvement in providing expert opinion in relation to The Barway and other channel stability and erosion issues, including continued advice on agitation dredging at The Barway, attendance and making a presentation at the Georges Bay Dredging Forum (November 2006) and most recently proving advice in maintaining a channel through a shoaling area off Pelican Point. The advice has focussed on the continuation of agitation dredging – it works. More recently, shoaling off Pelican Point has become more serious and Gerry Byrne has suggested (April 16th 2007) that agitation dredging could be implemented there as well. Alternatively the channel could be formed using a small cutter suction dredge or a slurry pump system and the sand could be removed from shoal area and placed onshore near pelican Point. *CES concurs with the advice given, though the ongoing cost of agitation dredging appears to be relatively high as would the cost be to mobilise a cutter suction dredge for the small amount of dredging required off Pelican Point.*

2.3 Georges Bay Dredging Forum – November 2006

A dredging forum attended by the following interest groups was held in November 2006:

- Council Barway Committee
- Council
- Chamber of Commerce
- St Helens Sea Rescue
- Tasmania Police
- Commercial fishermen
- Commercial game fishing
- Game fishing
- Charter/game operators
- Dredging contractors

- DPIW (environmental representatives)
- MAST
- MHA member and an advisor
- Coastal Engineer
- Aquaculture Georges bay

Presentations were made by 12 delegates. After group discussion in the forum a number of resolutions were made under the following headings:

Resolutions – ongoing

1. Minimum depth 3.0 metres of channel at Barway and 2.5 metres for channel within Georges Bay – measured to low water.
2. Maintenance of a navigable channel at St Helens needs to be ongoing.
3. Accordingly, a 5 year contractual arrangement will be essential to recognize the nature of the task, to give contractor certainty and to bring cost efficiencies.

Resolutions – immediate actions

1. Some immediate action is required to improve conditions at The Barway and at Pelican Point.
2. MAST and local users will work together to continue to move navigation aids at Pelican Pt to provide guidance to users.

Funding was to be sought from the state government for emergency works and from the state and federal governments for longer term works, noting that Commonwealth funding has been made similar situations on the mainland.

CES note that whilst these resolutions are appropriate, the questions that still need to be addressed in more detail are how to achieve the desired channel depths and how can practical funding be achieved.

Section 3

HISTORICAL CHANGES TO THE BARWAY & CHANNELS

3.1 Update

Changes to The Barway down to Pelican Point have been noted via historical aerial photography from 1998 (last date reported in Vantree (1999)) to 2006. The Appendix shows aerial photos from 1998, 2001, 2002, 2003, 2004, 2005, 2006 and 2007. The major changes that were observed are:

- Significant erosion occurred between 1998 and 2001 at the shoreline to the south of Dora Point and between the southern end of the training wall and Pelican Point. Since 2001 further erosion has been minimal, even though it looks dramatic because of the high erosion scarps on the dune face.
- Vegetation of the beach/dune system of the foreshore to the east of the training wall increased significantly. The implication is that the vegetation can catch wind blown sand and the height of the beach/dune system is likely to increase.
- The sand bank north of the junction of the southern end of the training wall has increased in height and extent, particularly evident in 2005, 2006 and 2007.
- The bars/shoals on the western side of the channel opposite Pelican appear to be growing in height and emerging further from the seabed.
- Whilst the bars and shoals offshore from the entrance and the eastern beach undergo continual change, no clear trend of change is evident, except perhaps for the formation of a second semi-circular bar off Granite Rock Point – evident in the 2006 and 2007 aerial photographs.

3.2 Coastal Processes

The coastal processes, that is, the movement of sand by wind, waves and currents appears to be basically unchanged from that which occurred since sea level stabilised at present levels about 6,000 years ago. Gerry Byrne had concluded from geomorphological analysis that the average rate of sand infilling of Georges Bay was in the range of 7,000 to 10,000 cubic metres per year. CES (Section 2) have extended this analysis by estimating the volume of sand captured on the beach to the east of the training wall since its construction. The annual capture rate is about 10,000 cubic metres.

Since the construction of the training wall, most of the sand entering Georges Bay would have been caught on this beach. The beach is now "full" and sand is likely to migrate back inside the estuary and build up shoals and will also add to the shoals seaward of the beach.

In essence, sand continues to be fed from the ocean into Georges Bay at a rate of up to 10,000 cubic metres per year. This sand may be a proportion of the longshore transport from south to north along the coast of eastern Tasmania and/or it may be supplied by onshore sand movement by swell waves from the shelf offshore from Georges Bay.

Once the sand enters Georges Bay it is trapped and cannot readily be transported out of the bay again. The only times sand can be transported out of the bay is when the whole estuary is in flood and sand in suspension in the flood waters may stay in suspension until the water reaches deeper water beyond the headlands enclosing Georges Bay and during very severe storms where waves stir up the sand into suspension and the sand is moved outside the bay by the ebb tide.

Once sand enters the bay the waves will tend to work the sand southward towards the beach and the trained entrance. There is virtually no scope for longshore sand transport by waves to take sand away from the entrance.

3.3 Predicted Changes for the Future – Do Nothing Scenario

Coastal processes will continue to add up to 10,000 cubic metres of sand to Georges Bay annually and the sand will be distributed on the bars, on the beach and into the dunes (by wind) and into the estuary by currents. The latest IPCC predictions (2007) for sea level rise suggest that sea level will increase by 300 to 400 mm over the next 100 years. This projected increase in sea level does provide a capacity for more sand to be stored over the entrance area, and maintain the existing water depths. Over 100 years the volume of sand entering the bay will be about 1 million cubic metres. If the sea level rise occurred uniformly at the projected rate over the next 100 years, all the sand entering could be accommodated in Georges bay from Pelican Point out to the eastern limits of the headlands containing Georges bay without a change of seabed depth.

However, if climate change occurs which results in the projected sea level rise, there may be increased storminess which in turn may result in more sand entering Georges Bay. The other question mark is the actual rate of sea level rise. At present the sea level rise is less than 4mm per year and hence the incoming sand will add to the volume of sand that has to be distributed over the shoals and bars and water depths are likely to reduce.

In summary, for the "do nothing scenario" it is likely that channel depths will decrease and bar sizes will increase. If sea level rise reaches or exceeds the 4mm per year scenario, the channel and bars may no longer rise in level at a rate greater than the rate of sea level rise. For the immediate planning future of 5 years (to 50 years) the bars and shoals will continue to grow and navigation into Georges Bay will be come more dangerous and The Barway will be navigable on fewer occasions, than at present (2007), if nothing is done.

Section 4

DISCUSSION OF CONSIDERED LONGTERM SOLUTIONS

4.1 Extend Training Walls

WRL (1986) recommended that the eastern training wall be extended by 875 metres and that two shorter training walls be constructed on the western side of the channel. These recommendations were based on scaled physical modelling of a range of training wall options assuming that Georges Bay is a closed system with no sand being added to the bay from the ocean. Vantree (1999) and CES in Section 2 of this report have concluded that Georges Bay is not a closed system and in fact sand continues to be added to the bay from the ocean at a rate of up to 10,000 cubic metres per year. This addition of sand has resulted in the beach to the east of the training wall accreting with a total accumulation of the order of 350,000 cubic metres.

WRL (1986) suggested that sand which had accumulated on this beach was derived from the seabed seaward of the beach. There is very limited seabed hydrographic survey data available of the entrance to Georges Bay. Its resolution is also limited. The data that is available is:

- Hydrographic survey, by the Hydrographers Office of 1871. This data is the basis of the present day Australian Admiralty Chart of the area.
- A survey of the entrance area of 1972 which was taken in relation to the construction of the eastern training wall
- A mapping of seabed features (shoals and bars) from 1985 aerial photography.

This data does not support any suggestion that the seabed level offshore from the beach and training wall has lowered. The main feature evident is that the Barway had moved seaward from its 1972 position to 1985 by about 200 metres.

The construction of the existing training wall (about 650 metres long) from 1969 to 1983 provided a benefit to navigation into Georges Bay because it created an embayment between the training wall and St Helens Point headland. This embayment has filled with sand that enters Georges Bay from the ocean and removed this sand from the active shoal/channel/Barway system. Consequently whilst the embayment filled and created a new beach, navigation through the Barway was improved compared to that which occurred prior to the training wall construction. This new beach compartment had totally filled by about the mid 1990's. So since then navigation again became more difficult and this was presumably a catalyst for the commissioning of the Vantree (1999) study.

Extension of the eastern training wall would provide similar benefits to that provided by the existing training wall. The benefit results from the creation of an extension to the embayment to the east of the training wall. This extension of the embayment allows more sand to be washed ashore and stored in the beach which can extend seaward to the seaward limit of the training wall. The suggested training wall extension of 875 metres would create a reservoir for the collection of some 500,000+ cubic metres of sand. This embayment would take of the order of 50 years to fill with sand and therefore would provide an improvement to navigation over The Barway for about 50 years.

However, when the embayment is full of sand conditions at The Barway will tend to be worse than they are at present because The Barway will have moved further seaward, possibly by up to 1 kilometre. Moving The Barway further seaward means that navigation becomes more difficult because it is more exposed to waves, than it is at its present location. The construction of the training wall would be anticipated to cost $5 to $10 million.

4.2 Agitation Dredging

Agitation dredging has been used successfully to improve the safety of navigation through the Barway in recent years. Agitation dredging had been recommended in Vantree (1999). However, the vessel that had been set-up to undertake the agitation dredging has been decommissioned from this role and at present there is no other vessel with the appropriate rig to undertake agitation dredging. Whilst agitation dredging was relatively successful, it was also quite expensive, costing about $1,000 per hour of operation.

Agitation dredging could be re-instated with a similar success in Barway navigation improvement as in previous years, but its annual cost could expect to rise rather than reduce because of the continued accumulation of sand, at an approximate rate of 10,000 cubic metres per year, on the shoals and bars at the entrance to Georges Bay.

4.3 Removal of Sand Accumulation at Beach

The beach to the east of the training wall is completely full of sand. Sand that may be coming onshore from the annual supply of ~10,000 cubic metres from the ocean will tend to be carried westward towards the navigation channel past the end of the training wall. From here the sand is redistributed:

- Into Georges Bay on the flood tide
- Onto the shoals and bars seaward of the training wall and beach on the ebb tide and whenever flood flows come out of Georges Bay.

If a significant quantity of sand is removed from the beach to the east of the training wall, then sand approaching the beach from the offshore supply can deposit and remain on the beach system and be taken out of the shoal, bar and channel system.

Removal of 10,000 cubic metres annually is required to maintain the status quo of 2007 in terms of shoals and the Barway. Significantly larger quantities need to be removed for this "sand trap" to function as it did in the 1970's and 1980's. It is suggested that a minimum volume of sand that should be considered for removal is 100,000 cubic metres. It is understood that sand could be moved out of the beach relatively inexpensively provided it is placed in an adjacent area accessible by off-road haul trucks. This observation is made on the basis that there is a significant quantity of large sized earth moving equipment that is idle in the St Marys area due to it being surplus to present day coal mining requirements. If this is indeed the situation, it is suggested that of the order of 250,000 cubic metres of sand should be removed, since mobilisation/demobilisation of large earth-moving equipment may be costly. This provides a buffer for approximately 25 years in relation to some "natural" improvement in conditions at the Barway.

The sand that is removed could be disposed of by:

- Recycling sand to the perimeter of Georges Bay to create recreational beach(es).
- Placing it landward of the existing beach system by building up land levels to create dunes.
- Placing it on vegetated land which is presently 1 to 5 metres above high water. This land occurs to the south of the access road to Blanche Point and the start of the training wall.
- Placing it on low lying land to the east and south of Pelican Point. A potential restriction to placing sand on low lying land is that it be placed above high water level. This requirement relates to maintaining the tidal prism of Georges Inlet. If the tidal prism is reduced, there may be implications with respect to flow into and out of Georges Bay. Reduced flow could result in channel depth reduction. Sand stored on low lying areas could constitute a resource of sand for future sand fill, beach creation or other commercial use in the future.

Figure 4.1 indicates the general location of possible sites for storing/placing sand.

Figure 4.1: Potential sand storage areas south of the Training Wall Beach

4.4 Dredging using the April Hamer - Sidecasting

An alternative to agitation dredging for improving the depth of water across The Barway and in other channel areas that may be silting is dredging with a trailing suction hopper dredge (TSHD) or a cutter suction dredge and the removal of the sand from the active shoal/bar system.

Water depths across The Barway preclude the use of a large TSHD dredge. The only small dredge, capable of working over the Barway, and regularly working in SE Australian waters is the Pelican, a New Zealand based dredge. However, even though it is a small dredge with a hopper capacity of only 1,000 cubic metres, its mobilisation cost to St Helens would be in excess of $0.5million. It could cut a channel in a couple of days of operation. However, if a large storm occurs after the dredging is completed, there is the possibility that the channel will infill – a high risk scenario, since the availability of the dredge to return may be limited and the cost of re-mobilising the dredge to St Helens.

The alternative of dredging the channel with a cutter suction dredge is also questionable. A small cutter suction dredge that could handle the small volume of sand required to be removed, would have difficulty in working, even during the mildest swell wave conditions. A large cutter suction dredge could work in the non-storm wave conditions but its mobilisation cost would be the same or greater than for the TSHD. The same risks apply with respect to channel stability after the completion of dredging.

The April Hamer is trailing suction dredge, See Photo 4.1, that is owned by Gippsland Ports and operates at Lakes Entrance and disposes of sand by either Sidecasting or forward casting on the ebb tide.

Photo 4.1: The April Hamer dredging the bar at Lakes Entrance

It can operate in the water depths available over the Barway. Presently it is fully committed to keeping the Lakes Entrance channel through the bar and the internal channels adjacent to Lakes Entrance open.

However, the dredge is 30 years old and nearing the end of its practical life, unless it undergoes a major refurbishment. Gippsland Ports are now investigating and implementing alternative dredging strategies for the management of their channels and in March 2008 the April Hamer is scheduled to be free of its duties at Lakes Entrance whilst other dredging methods are being trialled. This provides a possible opportunity to trial Sidecasting dredging at St Helens Barway and other internal channels if desired. The steaming time from Lakes Entrance to St Helens is about 24 hours, as would be the return. The April Hamer dredges about 400 cubic metres per hour and side casts the sand about 30 metres. It could create a channel about 1 metre deeper than the existing depth across the bar for a width of about 50 metres in 3 to 4 days of 8 hours per day operation.

It is suggested that trial dredging of a channel with the April Hamer be further investigated with Gippsland Ports. The process of obtaining environmental approval for side cast dredging is likely to take some time and with some luck could be achieved to coincide with a trial in March/April 2008. At this time it is not possible to cost the dredging exercise accurately because Gippsland Ports has not released the dredge for external dredging since Gippsland Ports came into being in the 1990's and does not have a cost schedule in place for contracting the dredge out.

A ball park estimate can be deduced as follows:

- CES believe the annual operation cost of the dredge is about $3million. This includes staffing and fuel but excludes major maintenance.
- The April Hamer trial at St Helens would need to allow a 10 day duration, allowing for some down time. Therefore the cost from an operational view, pro-rated from the annual cost is about $100,000.
- Allowing for risk, insurance and profit, the cost of a trial would be expected to be about $250,000.

4.5 Dredging Near Pelican Point

A loss of depth in the channel is occurring near Pelican Point as the channel meanders from one configuration to another as indicated in Figure 1.1 from the dotted blue channel to the full blue channel. Some agitation dredging was undertaken recently, but further dredging is required to maintain an adequate water depth at low tide. If the April Hamer were trialled for dredging the Barway it could extend its stay for a couple of days and dredge this channel by side-casting the material onto the adjacent shoals.

This area could also be readily dredged by a small cutter suction dredge – as small as a 6 inch cutter. A small dredge would work because the area is sheltered from any significant wave action. The cutter suction dredge could work in a similar mode to a side-casting dredge and place the material dredged on the adjacent shoal areas. Alternatively it would be able to pump the spoil ashore to an area near Pelican Point.

Section 5
RECOMMENDED APPROACH

5.1 Removal of Sand

5.1.1 Recommended Sand Removal Strategy

Removal of sand from the beach to the east of the training wall is an essential component of any future management strategy for St Helens Barway and the approach channel into Georges Bay. Sand which arrives at about 10,000 cubic metres per year from the ocean, must as a minimum be removed so that there is no further build up of sand on the bars and shoals seaward of the training wall. Removing more sand will allow some of the existing sand on the bars and shoals to migrate and collect on the beach from where the sand has been removed. This should lead to some improvement of navigation into Georges Bay.

It is recommended that a large quantity of sand be removed because of the availability of large earth moving plant that is idle in nearby coal mining precincts. The sand needs to be moved out of the active beach system. Suitable areas, in a spatial context, are available behind the beach and further southwards to the east of Pelican Point and these have been indicated in Figure 4.1. Sand should be able to be moved at a rate of about $4 per cubic metre if a quantity in excess of 100,000 cubic metres is moved using large scale coal mining plant. Our recommendation is that 250,000 cubic metres of sand are moved in one operation. This in essence ensures that conditions at The Barway and the channels will not worsen over the next 25 years. The cost estimate is $1 million.

Further sand removal campaigns will need to be considered in 15 to 20 years time.

5.1.2 Wave Conditions at The Barway

Whilst this sand removal will improve conditions at the entrance to Georges Bay, similar to those which occurred following the original training wall construction, there will still be periods when the Barway will not be passable.

A mathematical model of wave conditions at the Barway has been run for a period of 6 years. The model was originally set up for Mallacoota and Lakes Entrance, Victoria, but the model extent included all of Tasmania. In order to run the model for St Helens, the local nearshore bathymetry was schematised as accurately as possible from the available hydrographic chart.

The modelling process involves:

- Accessing our 6 year offshore wave data base which was available from the previous project (for Mallacoota & Lakes Entrance) off Gabo Island.
- The wave data base provides deep water wave conditions as a time series at 3 hourly intervals over the 6 year period. These wave conditions are obtained from a global wave hindcasting model and the data used was from 1998 to 2003.
- The mathematical model transforms the deep water waves to offshore of The Barway where the water depth is 7 metres.
- The output from the model is a time series of waves where for every three hours the wave height, wave period and wave direction is tabulated off The Barway.

It is understood that the limiting wave condition at The Barway for safe navigation is when the wave height in deeper water (7m depth) seaward of the bar is 1 metre. A 1 metre high wave in deep water translates to a wave height of 2 to 3 metres at the bar during the typical ebb tide. It translates to about a 1.5 metre high wave at slack water and the incoming tide.

The 6 years of wave data has been assembled into a time series which depicts the wave conditions when waves are greater than 1 metre in deep water and shows the “windows” when waves are less than 1 metre and navigation across the bar can usually be negotiated. When waves are less than 1 metre they are shown as having a value of “0” so that opportunities for safely negotiating The Barway could be clearly identified. Figures 5.1 to 5.6 show the time series, one year per figure.

A discussion of the results in terms of wave conditions at The Barway follows:

1998

- There were extensive periods over the summer months Nov, Dec, Jan & Feb when wave conditions at The Barway were high and even with a channel maintained at 3 metres there would have been difficulty crossing the bar.
- 1998 would have been a difficult year for recreational and charter boat operations.
- The stormiest period when waves were high at The Barway were over the winter months – May to September.
- However, over the winter months there were also long periods where wave conditions were mild.

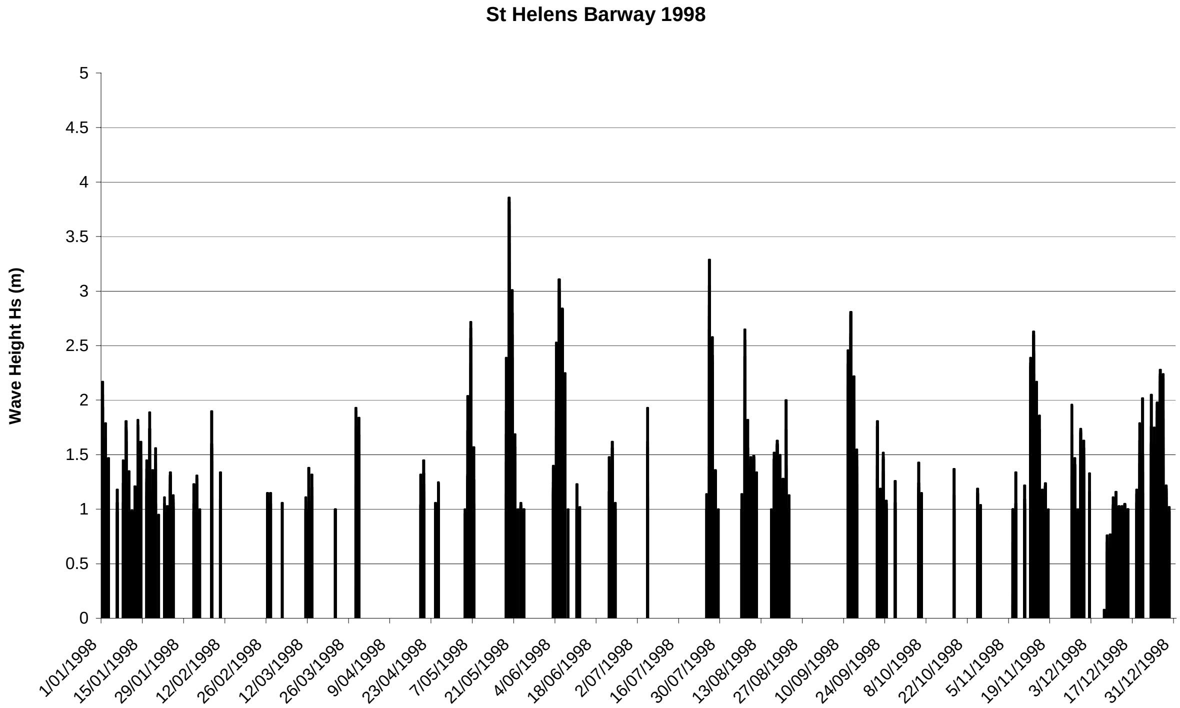

Figure 5.1: Waves at The Barway – 1998

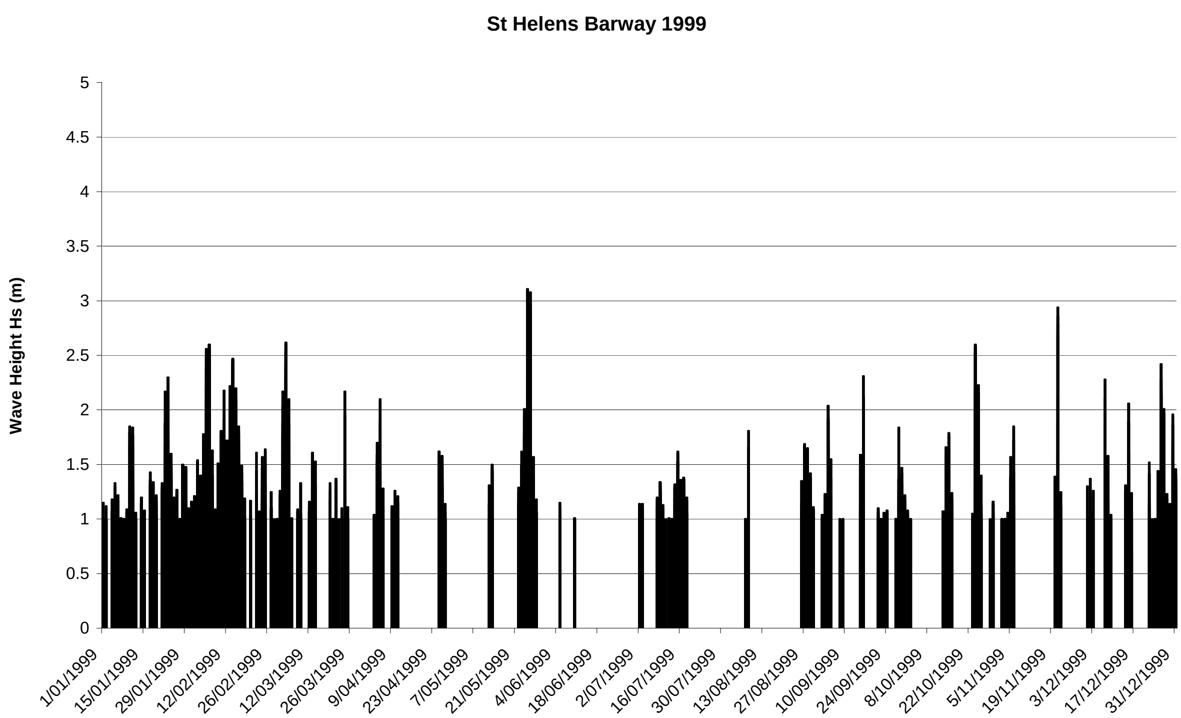

Figure 5.2: Waves at The Barway – 1999

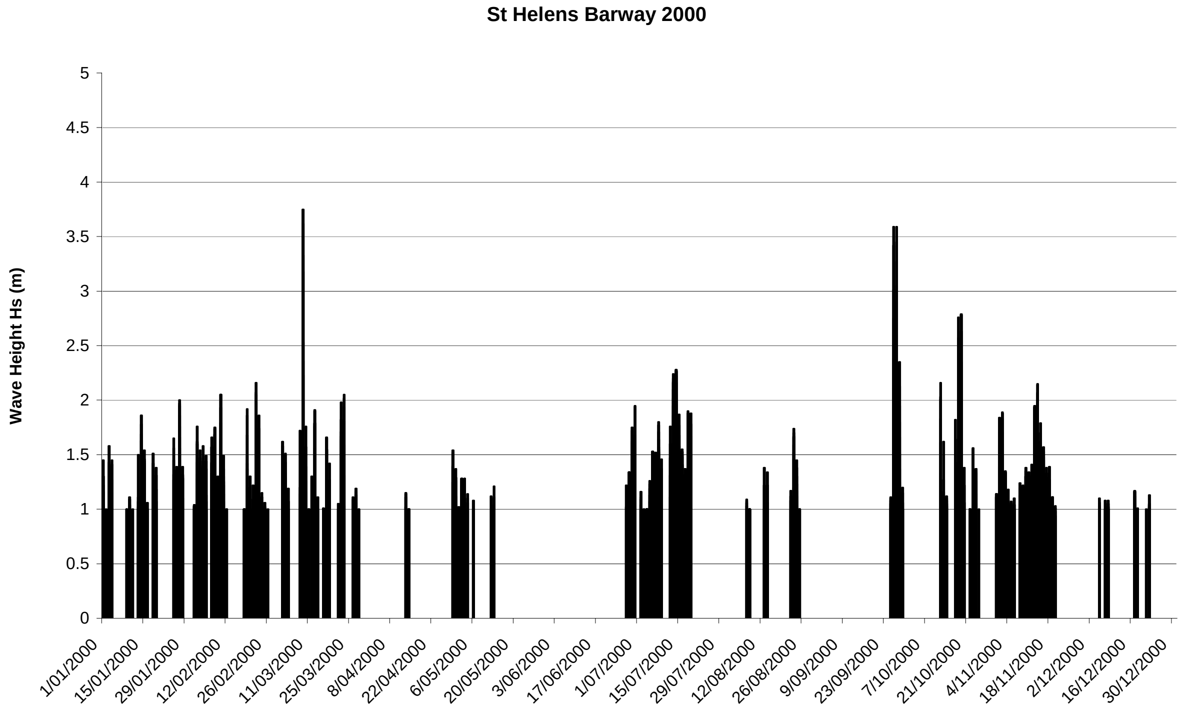

Figure 5.3: Waves at The Barway – 2000

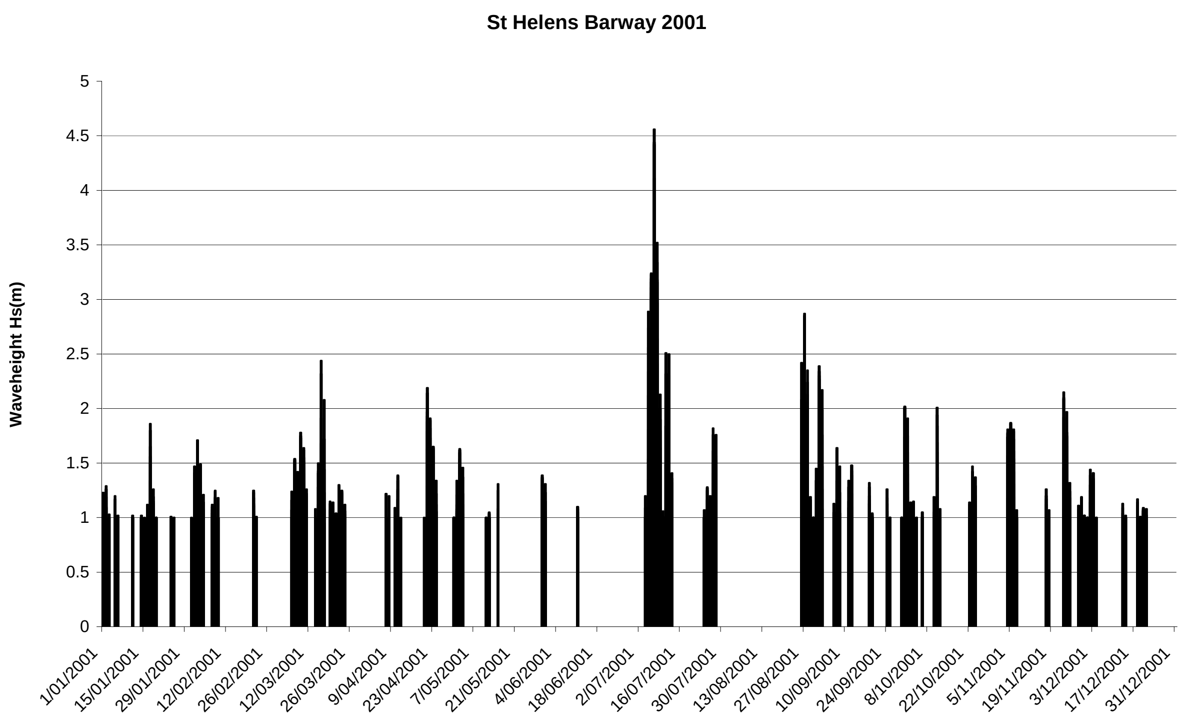

Figure 5.4: Waves at The Barway – 2001

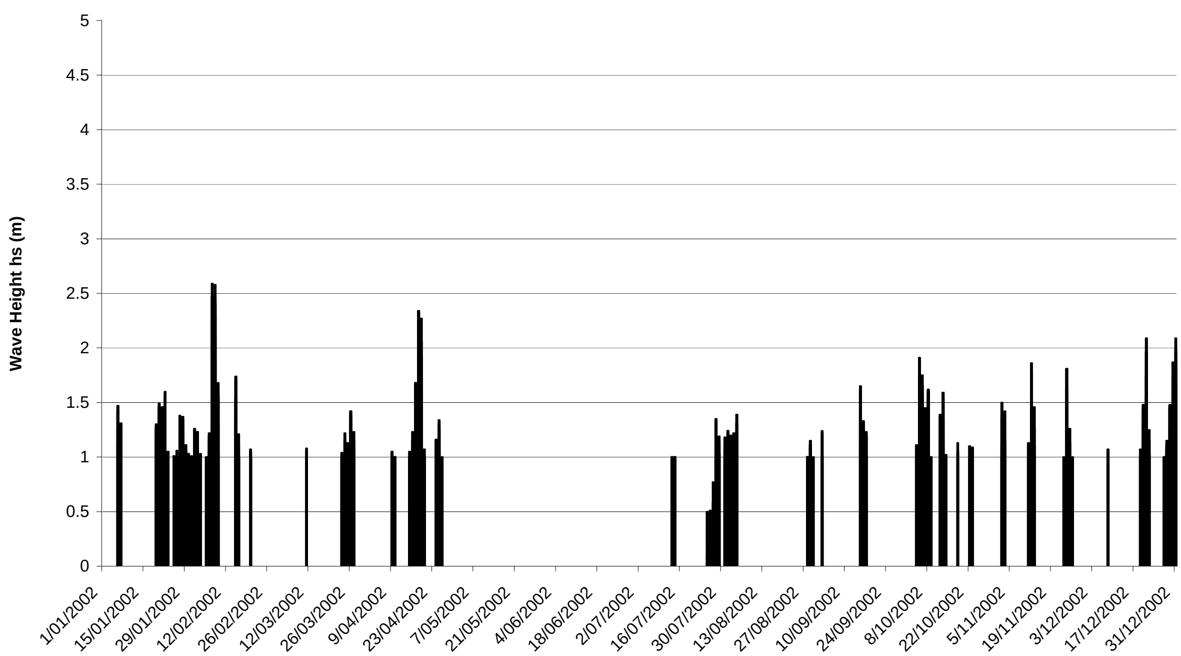

Figure 5.5: Waves at The Barway – 2002

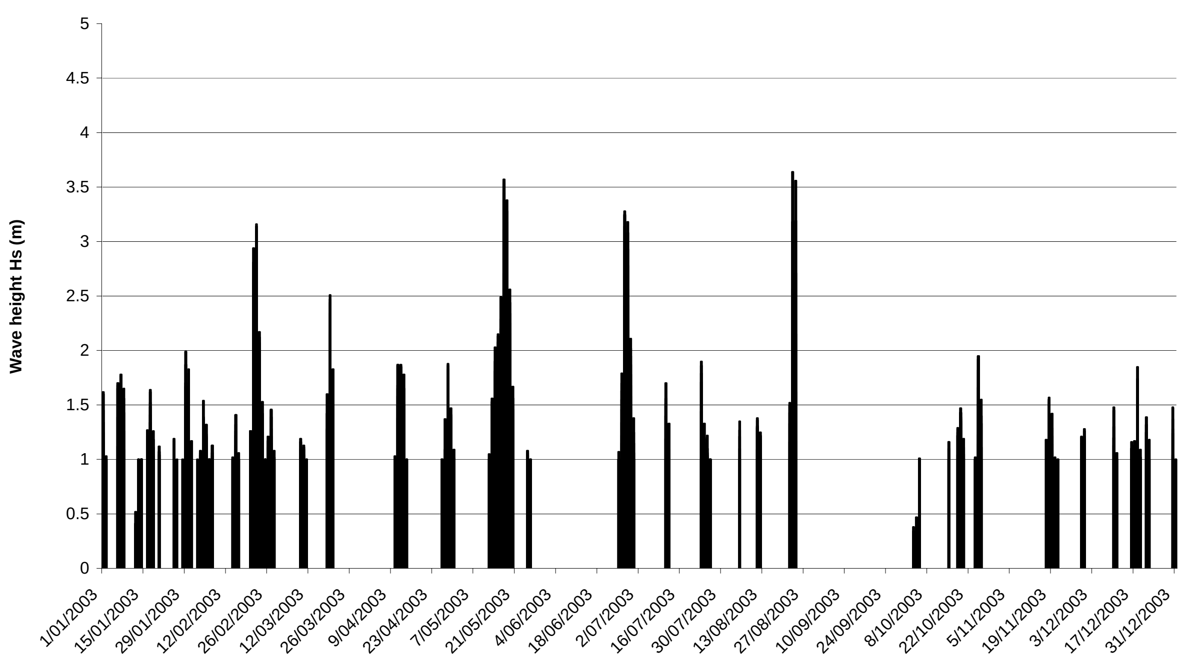

Figure 5.6: Waves at The Barway – 2003

1999

- The conditions over the summer period were even worse than in 1998, particularly over the November – December period, when The Barway may have been impassable for most of the time.
- Winter conditions were not as severe as 1998 in terms of wave height, but there were many extended periods of time when waves at The Barway were less than 1 metre.

2000

- The trend of wave conditions at The Barway were very similar to 1998 and 1999. Access over The Barway would have been very difficult throughout January and February and extending through March. Accessibility in December would have been better than the earlier years.
- The characteristic of accessibility for extended periods over the winter months is again evident. Over all of June, the waves would have been low and rarely exceeded 1 metre in height.

2001

- The trends in wave height are similar to previous years.

2002

- Overall this was a milder year in terms of wave conditions at The Barway.
- However, there would still have been an extended period from mid-January to mid-February where access across The Barway would have been difficult.
- There would have been almost continuous access over The Barway in May and June.

2003

- The wave height pattern throughout the year is again similar to that from 1998 to 2003.

In summary, wave conditions at The Barway tend to be naturally moderately high over the summer (tourism for boating) months. Even a channel depth maintained at -3m (LWD) may be difficult to for navigation over extensive periods of time during the summer months.

Wave height at The Barway is not the only factor affecting navigation. Other factors are:

- The direction of the navigation channel relative to the direction of the incoming waves across The Barway. The ideal situation occurs when the incoming waves are lined up with the channel. The incoming wave direction will vary depending on the offshore wave direction. From the mathematical modelling of the waves the swell wave direction at The Barway tends to range from 50° to 65° east of north. The ideal channel alignment is between 55 and 60 degrees relative to true north.
- The width of the bar, which determines the time taken to cross the bar and the time vessels may be exposed to high waves (that may not be aligned with the channel).

5.2 Dredging Strategy

There are two approaches that can be pursued for The Barway:

a. Seek tenders for agitation dredging and resume the program that was undertaken following the Vantree(1999) report, understanding that the annual cost is likely to be of the order of $250,000, and is likely to increase if sand is not removed from the beach to the east of the training wall – based on the experience of the previous agitation dredging.

b. Trial the use of the April Hamer, potentially at a similar cost to the agitation dredging. This assumes that the April Hamer will be relieved of its dredging duties at Lakes Entrance in March/April 2008.

There are three options for improving the channel near Pelican Point:

a. Agitation dredging – applicable if agitation dredging is resumed for The Barway. The cost increment on The Barway would be expected to be about $50,000.

b. Sidecasting dredging with the April Hamer, if the April Hamer is trialled for The Barway. A similar cost increment to that for (a) would be expected - $50,000.

c. Tender for a small cutter suction dredge to create a suitable channel. The cost depends on whether a small cutter suction dredge is operating in Tasmania. If a small dredge is available locally, the cost is still likely to be at least $100,000.

5.3 Environmental Issues

Agitation dredging required environmental approval (DPIWE) and was approved on the basis that "agitation dredging is a 'lesser grade' activity because the agitation dredging is not concentrating the spoil, it is moving small volumes, and is using natural transport processes" – the ebb tide. Other forms of dredging and the excavation of sand from the training wall beach and placing it on adjacent areas will need to be subjected to a more onerous approvals process in relation to dredging protocols and environmental approvals.

An approval for sidecasting dredging was recently obtained, in retrospect, for the dredging that was undertaken at Lakes Entrance by the April Hamer. Approval was also recently obtained for sidecasting dredging near Port Welshpool by the April Hamer. These approvals were co-ordinated by Dr Kowarsky of John Kowarsky & Associates of Victoria. It is likely that a similar approval process would be required if the April Hamer were to be deployed at St Helens. The time required for this approval process would be about 9 months, assuming that there were no significant environmental obstacles. The costs involved for the approvals studies and documentation tend to be site specific and can not be estimated without the involvement of the consultant co-ordinating the process.

If dredging were to be undertaken by a cutter suction dredge for the channel near Pelican Point, an approval process would need to be followed in relation to:

- The quality of the dredge spoil;
- The spoil ground; and
- The tailings water from the dredging.

Section 6

REFERENCES

Georges Bay Dredging Forum (2006). *Warrnambool Harbour – Siltation Study Including Concept Plans & Preliminary Designs for Improvements to the Harbour.* Report prepared for Warrnambool City Council & Dept of Natural Resources and Environment.

Marine and Safety Tasmania (2006) *Dredging of Entrance to Georges Bay.*

Vantree (1999) *The St Helens Barway at Georges Bay – Review of Options for Maintaining a Navigable Entrance.* Report prepared for Department of Marine and Safety Tasmania.

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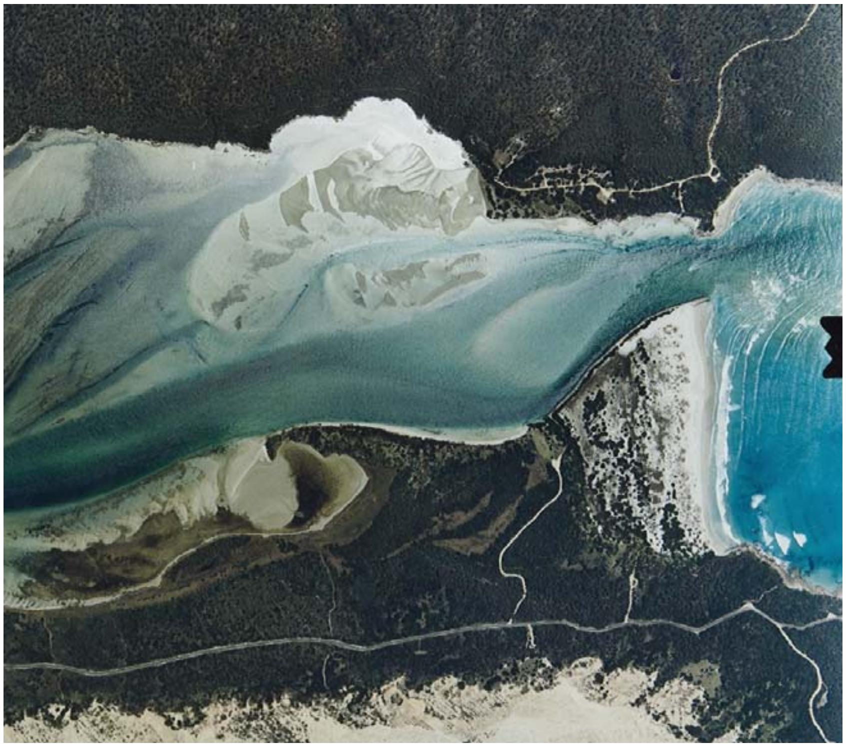
Water Research Laboratory, Uni of NSW (1986). *Model Study for St Helens Breakwater Wall, Tasmania.* Report prepared for Department of Main Roads Tasmania.

APPENDIX:

UPDATE OF AERIAL PHOTOGRAPHS 1998 TO 2006

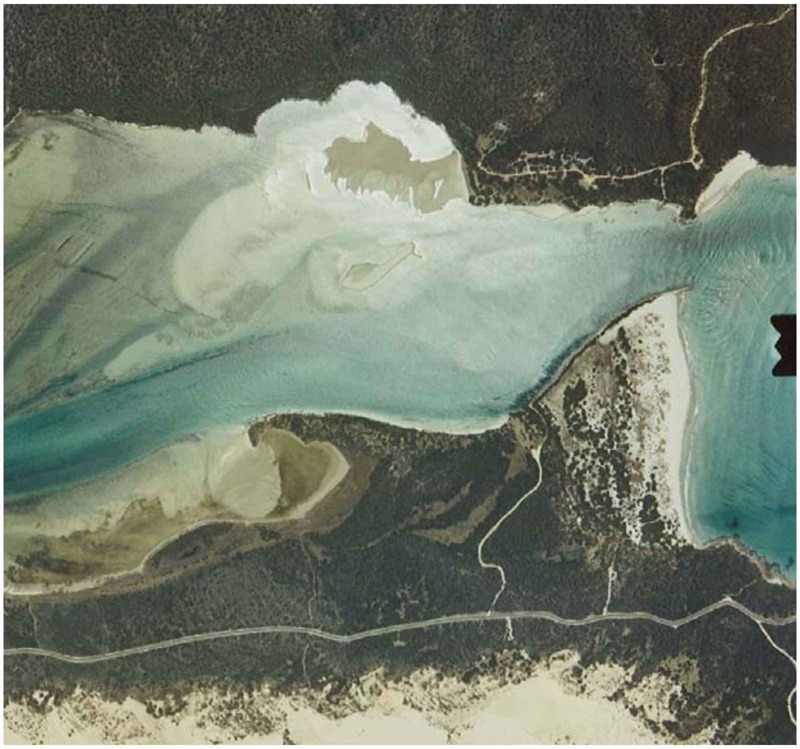
25/3/1998

28/1/2001



29/1/2002

24/1/2003



15/1/2004

21/2/2005

24/1/2006

15/1/2007