Port of Hastings Development Project

Dredging History in Western Port

Port of Hastings Development Authority

March 2015
Final Working Draft (Revision 0)
8A0300

Royal HaskoningDHV
Enhancing Society Together

In May 2016 the Special Minister of State asked Infrastructure Victoria to provide advice on the future capacity of Victoria's commercial ports. Specifically, the Minister has asked for advice on when the need for a second container port is likely to arise and which variables may alter this timeline. The Minister has also asked for advice on where a second container port would ideally be located and under what conditions, including the suitability of, and barriers to investing in, sites at the Port of Hastings and the Bay West location.

In undertaking this task, Infrastructure Victoria reviewed work that was completed as part of the Port of Hastings development project before it was cancelled in 2014. This document forms part of the initial work undertaken for the proposed port development at Hastings. Infrastructure Victoria considers that much of the previous Hastings work, although preliminary in nature, is relevant and suitable for informing a strategic assessment. Therefore, Infrastructure Victoria has made the reports previously commissioned for the development project part of the evidence base on which Infrastructure Victoria will use in providing the Minister with advice.

The opinions, conclusions and any recommendations in this document are based on conditions encountered and information reviewed at the date of preparation of the document and for the purposes of the Port of Hastings Development Project.

Infrastructure Victoria and its consultants have used the information contained in these reports as an input but have not wholly relied on all the information presented in these reports.

HASKONING AUSTRALIA
MARITIME & WATERWAYS

Level 14
56 Berry Street
NORTH SYDNEY NSW 2060
T: +61 (0) 2 8854 5000
F: +61 (0) 2 9929 0960
www.royalhaskoningdhv.com
ABN 66 153 656 252

Document title	Port of Hastings Development Project Dredging History in Western Port
Document short title	Dredging History
Status	Final Working Draft (Revision 0)
Date	March 2015
Project name	Port of Hastings Dredged Material Management
Project number	8A0300
Client	Port of Hastings Development Authority
Reference	HAS-CEP0-HY-REP-0007

The contents of this document reflect Haskoning Australia's current position on the subject matter of this document. It is provided for discussion or information purposes and is intended to be a guide only. The contents of this document should not be relied upon as representing Haskoning Australia's final position on the subject matter, except where stated otherwise. Any views expressed by Haskoning Australia in this document may change as a consequence of Haskoning Australia finalising formal technical studies or specifications, or legislative, or procedure and regulatory developments. Any figures provided are indicative only, are subject to change and are dependent upon a number of factors.

Cover Photo:
The photo on the cover page is of the Bucket Dredger 'Beverwijk', which was used for dredging campaigns within Western Port at Stony Point Jetty and Crib Point between 1964 and 1965.

Drafted by	Matt Potter / Greg Britton
Checked by	Greg Britton
Date/initials check	03/03/15
Approved by	Greg Britton
Date/initials approval	13/03/15

This report has been prepared by Haskoning Australia Pty Ltd solely for its client in accordance with the terms of appointment, the methodology, qualifications, assumptions and constraints as set out in the report and may not be relied upon by any other party for any use whatsoever without prior written consent from Haskoning Australia Pty Ltd.

CONTENTS

EXECUTIVE SUMMARY

Dredging in Western Port

The earliest reported dredging activity in Western Port occurred between the 1870s and 1920s when oyster leases were created by dredging in the muddy parts of the north and east arms. Available dredging records from historical dredging campaigns extend from 1916 and include dredging for Port expansion and maintenance, and the establishment and maintenance of access to small craft facilities.

The total dredging volume from the first recorded campaign in 1916 to the present time is approximately 2.75 million m^3 (measured in situ). The total dredging volume disposed offshore over this period (1916 to present) was approximately 810,000m^3, whilst the onshore disposal volume was approximately 1.94 million m^3.

The above totals exclude unknown, but minor, dredging volumes from 15 campaigns associated with access to small craft facilities (e.g. jetties, boat ramps, marinas). If it was conservatively assumed that each of these campaigns comprised an average of 10,000m^3, the total dredging volume would increase by around 150,000m^3 or about 5%.

Port Related Dredging

A total of 1.6 million m^3 has been dredged as part of Port development and maintenance of declared depths within navigable areas of the Port. Around 757,000m^3 has been disposed at offshore Dredged Material Grounds (DMGs) within Western Port and the remaining 845,000m^3 has been disposed of onshore.

Major offshore disposal locations used for disposal of Port related dredged material include:

- Tankerton DMG (453,000m^3);
- Peck Point DMG (294,000m^3); and,
- Grossard Point DMG (10,000m^3).

Major onshore locations used for disposal of Port related dredged material include:

- among the band of mangroves that existed around Long Island Point and adjacent to the extensive tidal flats within Hastings Bight to create two mounds of dredged material (Watson, 1974), including an artificial island (153,000m^3); and,
- the Old Tyabb Reclamation Area, located to the immediate south of the BlueScope Steel Wharf (692,000m^3).

A summary of major Port related dredging campaigns is provided in **Table 1**.

Table 1: Port related dredging campaigns in Western Port

Date	Dredging Location	Disposal Location	Method	Volume (m^3)
1964-1965	Crib Point	Tankerton DMG	Bucket Dredger loading hopper barges	384,000
1968-1969	Long Island Point (Phase 1)	Hastings Bight	Cutter Suction Dredger pumping direct	153,000
1969-1970	Long Island Point (Phase 2)	Peck Point DMG	Bucket Dredger loading hopper barges	294,000
1971-1972	John Lysaght (Australia)	Old Tyabb Reclamation	Cutter Suction Dredger pumping direct	676,000
1975-1976	Main Shipping Channel	Grossard Point DMG	unknown	10,000
1980	Main Shipping Channel	Tankerton DMG	Trailer Suction Hopper Dredger	10,000
1988	Main Shipping Channel	Tankerton DMG	Trailer Suction Hopper Dredger	24,000
1994	Main Shipping Channel	Tankerton DMG	Trailer Suction Hopper Dredger	35,000
2002	BHP Berths	Old Tyabb Reclamation	Cutter Suction Dredger pumping direct	16,000

Other Dredging

A total of 1.14 million m^3 has been dredged in Western Port for non-Port related purposes. Around 50,000m^3 has been disposed offshore and around 1.1 million m^3 has been disposed of onshore.

A significant proportion of dredged material disposed of onshore has been derived from the historical dredging of the access channel into Hanns Inlet (810,000m^3 disposed within the foreshore areas of the inlet) and the establishment and maintenance of Yaringa Boat Harbour (112,000m^3 disposed adjacent to the access channel and surrounds).

Minor dredging campaigns have been undertaken to establish and maintain a number of small craft facilities located around Western Port, including Hastings Boat Ramp, Stony Point Jetty, San Remo Jetty, Hastings Basin, Stony Point Boat Ramp, Tooradin Boat Ramp, Tankerton Jetty and Newhaven Marina. Dredging has also been undertaken to provide boating access to localities within Western Port, including Sawtells Inlet, Watson Inlet, Tooradin, Rutherford Channel, Warneet and Blind Bight. In recent times, minor dredging campaigns undertaken at Tankerton Jetty and San Remo Jetty have involved the use of a small Cutter Suction Dredger to deposit sandy textured material onto nearby shorelines for beach nourishment purposes.

1 INTRODUCTION

1.1 Background

In 2012 the Victorian Government established the Port of Hastings Development Authority (the Authority) to fast track the development of a second container port at Hastings. The Authority is progressing staged planning of the Port of Hastings Development Project (the Project) from 2014 to 2018, culminating in a rigorous business case and full environmental and social impact assessment. It is envisaged that the container port will begin operations in the mid-2020s with a capacity of 3 million twenty-foot equivalent (TEU) per year, increasing to 9 million TEU by 2060.

1.2 Dredged Material Management

Port development will require a significant quantity of capital dredging. The management of dredged material is a key component of the port development as it will be one of main drivers for capital expenditure. Management of dredged material will also be a key consideration in the environmental impact assessment for the project.

A proportion of dredged material may be beneficially reused as fill within land reclamation. The management of this proportion of the dredged material falls within the scope of the Dredging and Reclamation work package. The remainder of the dredged material, considered either unsuitable for use as reclamation material or surplus to the volumetric requirements of reclamation, will be disposed of elsewhere. Management of this material falls within the scope of the Dredged Material Management (DMM) work package.

1.3 Objectives and Scope

The objective of this investigation was to research existing available information about previous dredging activities within Western Port to improve understanding of the following aspects:

- past dredging activities including dates, locations, design levels, volumes, material types and methods of dredging and disposal;
- behaviour of dredged material during dredging;
- behaviour of the dredged material following placement;
- problems or issues encountered during dredging relating to operational conditions or environmental impacts; and,
- sediment transport processes.

The investigation involved the compilation and review of available information as part of an initial desk study. This information comprised material contained within the Shapiro (1975) Westernport Bay Environmental Study and documentation passed on by key personnel involved in Western Port dredging in the past. Interviews with key personnel were also undertaken to obtain additional observations and information about dredging in more recent times (i.e. the last 10-15 years). Former dredged material disposal sites on land were also

selected for field inspection to gain an appreciation of the long term performance and management of land disposal areas.

This Paper is structured into the following main sections:

- Review of Existing Information (refer **Section 2**);
- Former Dredged Material Disposal Sites (refer **Section 3**);
- Interviews with Key Personnel (refer **Section 4**);
- Key Findings (refer **Section 5**); and,
- References (refer **Section 6**).

2 REVIEW OF EXISTING INFORMATION

2.1 General

A desktop review was undertaken to compile dredging history information from the following sources:

- Preliminary Study of the History and Environmental Effects of Dredging and Dredge Spoil Disposal in Westernport Bay Victoria (Watson, 1974);
- The Western Port Marine Environment (EPA Victoria, 1996);
- Best Practice Environmental Management - Guidelines for Dredging (EPA Victoria, 2001);
- Maintenance Dredging of Yaringa Channel EPBC Act Referral No. 2004/1360 (4 February 2004);
- Port of Hastings Stage One Investigations – Review of Hydrodynamic and Water Quality Data and Analysis (AECOM, 2009a);
- Port of Hastings Stage One Scoping – Dredging and Reclamation Methods Assessment (AECOM, 2009c)
- Information passed on by Dick Cox (former Harbour Master);
- Information provided by Patrick Ports Hastings (refer **Appendix B**); and,
- Victorian Notice to Mariners from 2005 to 2014 available on the Victorian Regional Channels Authority website (accessed 4th November 2014).

An outline of findings from review of the above material, relevant to the objectives of this study, is provided below. A tabulated summary of dredging history based on available information obtained for recorded dredging campaigns is provided in **Appendix A**. **Map 1** within **Section 5.1** shows the location of former dredging and disposal sites.

2.2 Outline of Dredging History in Western Port

2.2.1 Early Dredging

The earliest reported dredging activity in Western Port occurred between the 1870s and 1920s when oyster leases were created by dredging in the muddy parts of the north and east arms. The oyster industry in Western Port has since collapsed and oysters are now considered to be rare in the area. The quantities of material removed, dredging equipment used and disposal locations for these campaigns are unknown.

The initial dredging of an access channel into Hanns Inlet to provide access for shallow draft vessels to the H.M.A.S. Cerberus naval depot was carried out between 1916 and 1921. Deepening of the existing natural channel to around -3m CD to create a 37m wide access channel was initially attempted by a Cutter Suction Dredger (CSD). However, the CSD had difficulty dredging the stiff clays encountered in the area and broke down. A Bucket Dredger was subsequently contracted to complete the work which involved the removal of an estimated 760,000m^3 of material. The dredged material was disposed of onshore within

Hanns Inlet at three possible locations (placement records are not available); along the southern side of Hanns Inlet; on the northern side of Hanns Inlet or at the site of the H.M.A.S. Cerberus jetty (Watson, 1974).

2.2.2 1960s to 1970s

In the 1960s and 1970s a relatively busy period of dredging was undertaken primarily in the Lower North Arm to provide access to boating and shipping infrastructure at Yaringa Boat Harbour, Hastings Boat Ramp, Stony Point Jetty, Crib Point and Long Island Point. Minor dredging campaigns were also undertaken at Watsons Inlet, Sawtells Inlet, Rutherford Channel and Blind Bight to provide small craft access through the shallow intertidal areas that exist at the northern limit of Western Port.

During this time material was typically dredged with a CSD, although a Bucket Dredger and Dragline were used on occasions and drilling and blasting was used to break up rock at Stony Point. The significant dredging campaign undertaken with a CSD to establish shipping access to the John Lysaght (Australia) Limited[1] facility in 1971-1972 (see below) was reported to have generated a widespread turbidity plume (Watson, 1974).

Material disposed of onshore was either pumped ashore to create land reclamation areas or pumped onto shallow mudflat areas in close proximity to dredging sites. Significant deposits of dredged material are known to have been placed on land at the following locations (Watson, 1974):

- behind Stony Point Jetty to create a land reclamation area (142,000m^3, 1965);
- in two separate mounds among the mangroves WSW of Long Island Point Jetty (153,000m^3, 1968-1969);
- rubbish dump reserve near H.M.A.S. Cerberus Jetty and interior flats within Hanns Inlet (50,000m^3, 1971); and,
- south of the warehouse of John Lysaght (Australia) Limited (676,000m^3, 1971-1972).

The reclamation area south of the warehouse of John Lysaght (Australia) Limited (known as the 'Old Tyabb Reclamation Area') was reported to have been the cause of turbidity generated from rainfall runoff (Watson, 1974). This area is located along the shoreline to the south of the BlueScope Steel Wharf, adjacent to Long Island Drive, and is the largest area of land reclamation in Western Port. The Old Tyabb Reclamation Area has subsequently consolidated, been protected to some degree with the placement of rock around its seaward perimeter and is vegetated with grass.

Major projects involving offshore[2] disposal of material included dredging at Crib Point (1964-1965) and Phase 2 of Long Island Point dredging (1969-1970). In both cases a Bucket Dredger was used to load hopper barges, which transported material to Dredged Material Grounds (DMGs) as noted below.

[1] Now BlueScope Steel.
[2] Disposal in underwater areas or designated Dredged Material Grounds (DMGs) but still within the Internal Waters of Western Port.

Dredged material from Crib Point (384,000m^3) was placed at a DMG located between Middle Spit and French Island, north of Tankerton (i.e. the 'Tankerton DMG') in 12m to 15m of water depth. Subsequent underwater inspection of this DMG around 9 years after the Crib Point dredging determined that patches of broken clay nodules existed over much of the area. The clay was soft and unconsolidated and subject to resuspension into a clay floc with minor seabed disturbance (Watson, 1974).

Dredged material from Phase 2 of Long Island Point dredging (294,000m^3) was placed at a DMG located between Peck Point and Tortoise Island, south of French Island. This was known as the 'Peck Point DMG' and was located in an area that was exposed to occasional swells from the south west and regularly subjected to strong tidal currents. Underwater inspection of the Peck Point DMG 4 to 5 years after completion of dredging determined that the placed material had completely dispersed as no trace of it was found on the seabed (Watson, 1974).

A minor dredging campaign (10,000m^3) utilising a third DMG was also reported to have been undertaken within the main shipping channel in the mid-1970s. This material was placed in a DMG located offshore of the north western coast of Phillip Island, at Grossard Point near the town of Ventnor. This area was known as the 'Grossard Point DMG'.

2.2.3 1980s to 1990s

In the 1980s to mid-1990s a number of minor dredging campaigns were undertaken to provide access to small craft facilities such as boat ramps. A larger campaign (35,000m^3) was undertaken in 1988 to improve boating access to the Yaringa Boat Harbour. This material was reported (EPA Victoria, 1996) to have been disposed at an onshore location but other details are unknown.

Dredging of the main shipping channel into Western Port was undertaken periodically with material disposed at the Tankerton DMG. In the mid-1990s the Trailer Suction Hopper Dredger (TSHD) 'A. M. Vella', owned by the Port of Melbourne Authority, was used on several occasions to dispose of dredged material at the Tankerton DMG. A total of around 82,000m^3 of dredged material was disposed at the Tankerton DMG between 1980 and 1994. Monitoring of the Tankerton DMG during and following the 1994 dredging campaign, involving placement of medium to coarse sand from the main channel, determined that (Port of Melbourne Authority [PMA] Dredging Strategy for Western Port, 1994-1997):

- turbidity exceeded background levels for 20 minutes following disposal and then returned to background;
- there did not appear to be any net gain or loss of sediment in the DMG area based on hydrographic survey data and observation of sediment stakes; and,
- sediment deposition in the intertidal zone adjacent to the DMG was not evident from photo plots.

The Port of Melbourne Authority (PMA) managed the shipping channels within Western Port on behalf of the Victorian Channels Authority (VCA) until 1997. Their approach to dredging was outlined in the Dredging Strategy for Westernport 1994-1997 (refer **Appendix B**) and is summarised below:

- dredging 35,000m^3 to 50,000m^3 from the main channel between Buoy No.19 and No.21 every 2 to 3 years[3];
- dredging 4,000m^3 from the BHP berths every 7 to 10 years and disposal to land;
- dredging 10,000m^3 to level a local high spot within the BHP turning basin in a single ('one-off') campaign; and,
- dredging 10,000m^3 to level a local high spot within the Long Island Point turning basin in a single ('one-off') campaign.

The 1994-1997 dredging strategy also identified several potential offshore and land based disposal sites for dredged material. Potential offshore disposal sites included Grossard Point DMG, Bass Strait, within the shipping channel south of Sandy Point, and Tankerton DMG. Land disposal sites comprised Middle Spit and Old Tyabb Reclamation Area. The possibility of beneficial reuse of sand as beach nourishment material for Somers Beach or as material for the construction industry was also considered within the document, however additional (double) handling, possible environmental issues and significant costs were identified as constraints to beneficial reuse.

It is understood that none of the proposed works in the 1994-1997 dredging strategy were completed due to the State Government decision to privatise the management of the Port of Hastings. This resulted in Patrick Ports Hastings being given the rights to manage the Port from 1st July 1997.

[3] It was also thought that moving the main channel 50m to the west between Buoys No.19 and No.21 could significantly reduce or eliminate the ongoing maintenance dredging requirement in this area.

2.2.4 Recent Dredging History

General

Dredging activities within Western Port from 2000 to the present time have mainly comprised maintenance of existing assets including the main shipping channel, BHP berths and minor works at small craft facilities.

BHP Berths

Under the management of Patrick Ports Hastings the BHP berths were dredged in 2002 with approximately 16,000m^3 of material being dredged by a CSD and disposed within the Old Tyabb Reclamation Area. The build-up of sediment within the BHP berths had been previously managed by issuing a Notice to Mariners (No.8/97, 6 February 1997), which advised that the maintained depths within Berths No.1 and No.2 had been amended to -11.0m CD and -10.0m CD at the extreme southern end of Berth No.2.

Prior to the execution of dredging several studies were undertaken to characterise the sediments at the berths.

A contamination assessment (Marine Science & Ecology, 1998) determined that the sediment within the BHP berths comprised silty brown/black muds and contained elevated levels of copper, lead, zinc and tributyltin (TBT). These contamination levels were partly attributed to the visitation of large vessels using a combination of TBT and metalliferous antifoulant paints. A comparison of these levels with EPA (1998) guidelines at that time determined that TBT levels exceeded the minimum screening level and required additional testing for comparison with water quality standards. It was also determined that surface sediments at the Tankerton DMG comprised medium to coarse sand with very little silt or clay (0-2.8%) and contained significantly lower concentrations of contaminants. It was concluded that the sediments within the BHP berths should be placed at a land based disposal site.

In 2000, a dredging strategy for execution of dredging in the BHP berths was prepared by Lawson & Treloar. This determined that based on a 1999 hydrosurvey around 2,000m^3 of material existed above the target declared depth of -12.1m CD and the total in situ dredging volume could be up to 5,000m^3 including overdredging. The strategy also identified a low lying bunded area at the southern end of the Old Tyabb Reclamation as having sufficient storage capacity for land based disposal of the dredged material with a CSD.

Several months prior to execution of dredging in 2002, a diver inspection of the seabed at the BHP berths was undertaken. This confirmed that a depth of 1m to 2m of soft silts had accumulated over a hard clay bottom within the berths. The deepest areas of silt deposition were located at the southern end of each berth and under the loading ramp structure. The build-up of silt extended under the wharf structures at relatively steep slopes (25 to 45 degrees) that were expected to slump into the berth following dredging.

Records of correspondence between Toll (Patrick) and the dredging contractor, Birdon Marine, indicates that a dredging volume of 5,000m^3 to 12,000m^3 to a target dredging depth of -12.3m CD was specified in the Contract. However, overdredging of an area adjacent to

Berth No.2 to -13m CD is also referred to in correspondence and dredging records state that a total of 16,000m^3 was dredged.

Sand Wave Management

Following privatisation of the Port in 1997, the approach to management of sand waves within the main channel involved monitoring of problem areas with 6 monthly hydrographic surveys rather than dredging. This strategy resulted from the experience gained from previous dredging campaigns, which showed sand waves reforming and peaking above the declared depth after only a short period following dredging. The dynamic nature of the sand wave field in the vicinity of the No.19 and No.21 buoys was confirmed in a study of historical survey data undertaken by Lawson & Treloar in 2001. This study determined that sand waves were moving in a southerly direction and had maximum peaks (crest elevations) at -13.9m CD.

There have been two previous Notice to Mariners issued in relation to reduction of maintained depths due to sand wave shoaling in the shipping channel between the No.19 and No.21 buoys. Notice No.7/97 (1997) advised a reduction in the maintained depth to -14.2m CD and Notice No.61/00 (2000) advised a peak of -14.0m CD as being due to sand waves. The recovery of maintained depths due to the dynamic nature of the sand wave field was evidenced by a hydrosurvey undertaken in April 2008. This identified only two spots in the vicinity of Buoy No.19 (eastern channel boundary) where sand waves had peaked at -14.2m CD indicating a recovery (lower seabed level) from the earlier peak of -14.0m CD reported in 2000.

A Notice to Mariners (No.64T-2008) was also issued in 2008 to identify a localised shoal extending 100m into the eastern side of the shipping channel halfway between Buoy No.13 and Buoy No.15 that reduced the least (minimum) depth to -13.4m CD. This area was monitored with annual hydrographic surveys.

The Port of Hastings Dredging Strategy 2006-2012 was prepared by Patrick Ports Hastings and outlines a general strategy of no planned dredging, and monitoring of problem sand wave areas and the Steel Works, Long Island Point and Crib Point berths with annual hydrographic surveys.

Minor Dredging Works

From the early 2000s to the present time there have been a number of minor dredging campaigns that have been primarily associated with maintaining access to small craft facilities.

Stony Point Boat Ramp

The Stony Point boat ramp access channel was dredged in 2000. Records of correspondence between the Crib Point Foreshore Committee and the Harbour Master indicate that the material was dredged with a CSD and disposed at an EPA-approved onshore location approximately 900m along Stony Point Road. According to the issued Notice to Mariners, the access channel was subsequently dredged in a similar manner in maintenance campaigns undertaken in 2007 and 2012.

Tankerton Jetty

The access channel and area around the Tankerton Jetty (on the west coast of French Island) was first dredged in 1994 with the construction of the jetty structure. Maintenance dredging campaigns to restore the navigable depth within the access channel were undertaken in 2000, 2007, 2010, 2011 and 2012. These campaigns were performed by a CSD with the dredged material being pumped onto the adjacent beach area to the south between the rock groyne and the pier abutment. The dredged material was reported to be predominantly sandy and therefore suitable for use in beach nourishment. Records of correspondence between Parks Victoria and the Harbour Master describe the material as being initially dark in colour and having a potentially sulphurous odour. However, with exposure to air and light, the material was expected to lose it odour and change to a lighter colour.

Tooradin Boat Ramp

The first records of dredging at the Tooradin Boat Ramp indicate that 500m^3 was removed and disposed of onshore in 1991. A Notice to Mariners was issued in 2012 for maintenance dredging at the facility by a CSD. The dredged material was pumped through a floating pipeline and disposed 1km downstream.

San Remo Jetty

Maintenance dredging in the vicinity of the inner arm of the San Remo Jetty facility was undertaken in 2008 and subsequently in 2013. Although the 2013 Notice to Mariners does not detail the dredging equipment that was used, it refers to the use of dredged material for beach nourishment purposes. Discussions with Parks Victoria (refer **Section 4.3**) confirmed that the maintenance dredging material is sandy in this area and removed by a CSD.

Newhaven Marina

Dredging of the entrance and access channel to the Newhaven Marina (east coast of Phillip Island) was completed in 2005. This was undertaken by a CSD which deposited dredged material by pipeline to a bunded onshore storage area.

Yaringa Boat Harbour

The access channel into Yaringa Boat Harbour is dredged periodically to maintain access for deep-drafted yachts. The channel is subject to siltation and this material is typically removed with a small CSD and pumped to an approved disposal site within the waterway around 50m south of the channel alignment. The 2004 EPBC Act Referral for maintenance dredging of the channel reports that 20 years of routine maintenance dredging has enhanced the ecological value of the region by providing a bird roosting area at the disposal site (refer **Figure 1**).

Figure 1: View of shallow areas of dredged material placement that provide bird roosting sites to the south of the Yaringa access channel (Google Earth Pro, 2014)

3 FORMER DREDGED MATERIAL DISPOSAL SITES

3.1 Old Tyabb Reclamation Area

The Old Tyabb Reclamation Area is located to the immediate south of the BlueScope Steel Wharf as shown on **Figure 2**. It is currently predominantly covered with lucerne (see **Figure 4**), with the exception of the access road around its northern and eastern perimeter and a low-lying salt marsh area (see **Figure 5** and **Figure 6**) at the southern end. The area covered with lucerne is used as a paddock for cattle grazing. The salt marsh area is believed to be the result of the former use of this area as a drainage basin during the original reclamation of the site (AECOM GHD, 2013).

The land behind the BlueScope Steel Wharf, to the north of the Old Tyabb Reclamation Area, is understood to have been formed by land-based reclamation during development of the site in 1971 (refer **Figure 3**).

Figure 2: Aerial view of BlueScope Wharf facility and Old Tyabb Reclamation Area to the south (Google Earth Pro, 2014)

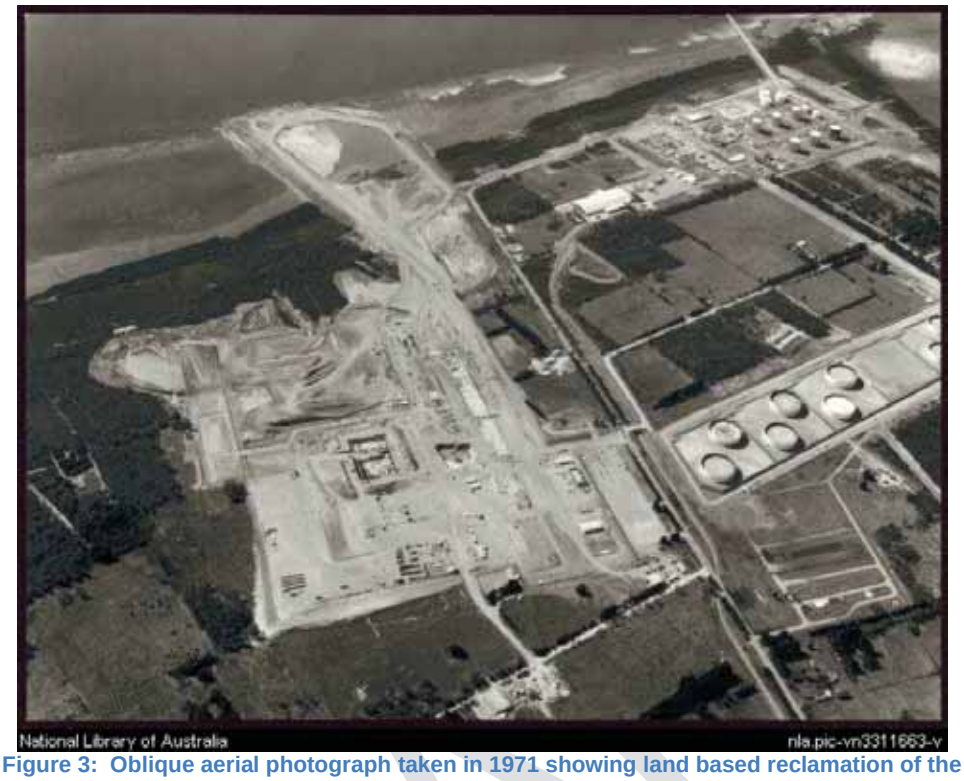


Figure 3: Oblique aerial photograph taken in 1971 showing land based reclamation of the BlueScope site (AECOM GHD, 2014)

Figure 4: Looking south across the Old Tyabb Reclamation Area from northern boundary (AECOM, 2009b)

Figure 5: Looking south across the salt marsh area at the southern end of the Old Tyabb Reclamation Area (AECOM, 2009b)

Figure 6: Looking west across the salt marsh area at the southern end of the Old Tyabb Reclamation Area (AECOM, 2009b)

Geotechnical investigations have been undertaken by AECOM (2009b) to characterise the subsurface conditions across the Old Tyabb Reclamation Area. This determined that the fill thickness (i.e. reclamation material) overlying the natural soils beneath the reclamation was variable and ranged from a maximum thickness of 4m to a minimum thickness of 1.3m within the salt marsh area to the south (i.e. the fill thickness reduced from north to south). The reclamation material generally comprised a mixture of sand and clay, with the clay in some areas presenting as cobble sized lumps within a sand/sandy clay matrix (see **Figure 7** and **Figure 8**). This was thought to be the result of the remnant "balling" of clay materials from

CSD operations (AECOM, 2009c). The reclamation material was generally dry and desiccated in places near the surface and the soil strength inferred from DCP testing generally indicated decreasing strength with depth. The material within the lower portion of the reclamation profile typically comprised very loose to medium dense sand and soft to firm sandy silt/clay.

The natural material beneath the reclamation fill was typically dark grey to black very loose and loose clayey/silty sand and very soft to firm silts and clays and was inferred to be Quaternary marine lagoon/swamp deposits. Underlying these marine deposits were materials inferred to be part of the 'Baxter Formation' and comprised clayey sand and stiff sandy clay layers.

Based on the results of geotechnical investigations, the Old Tyabb Reclamation Area is thought to have been formed in an uncontrolled manner without systematic placement and compaction of the reclamation material (AECOM, 2009c).

Figure 7: View into Test Pit TPL16 within the Old Tyabb Reclamation Area showing clay balls within soil profile (AECOM, 2009b)

Figure 8: Material excavated from Test Pit TPL16 showing clay balls (AECOM, 2009b)

3.2 Long Island Point Disposal Area

During Phase 1 of the dredging works associated with the Long Island Point development in 1968-1969, 153,000m^3 of material was pumped into two separate mounds located WSW of the Long Island Point jetty (refer **Figure 9**). The placement of dredged material was "among the mangroves" (Watson, 1974) that existed around Long Island Point and adjacent to the extensive tidal flats within Hastings Bight. A photo of the two mounds of dredged material was taken several years after the completion of the Long Island Point dredging campaign (refer **Figure 10**) as part of investigations undertaken by Watson (1974). Watson (1974) states that "the tailing heaps have now eroded down to two low mounds visible among the mangroves". The island formed by the placement of dredged material within Hastings Bight is also shown in the top right hand corner of **Figure 3**.

Figure 9: Aerial view of Long Island Point Jetty and artificial island formed by placement of dredged material to the south (Google Earth Pro, 2014)

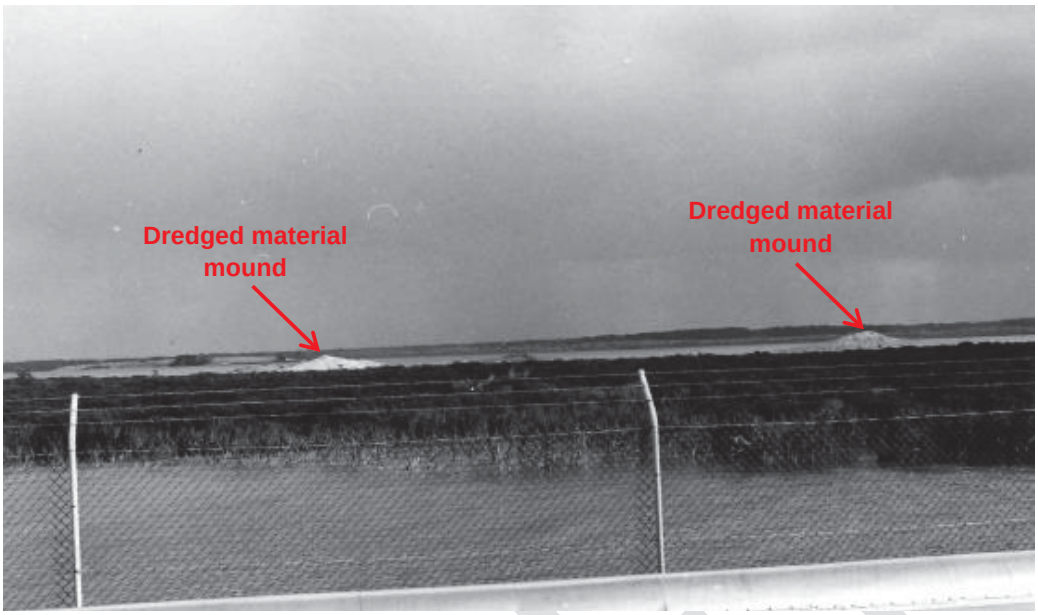


Figure 10: View looking south from Long Island Point Jetty showing remains of dredged material mounds from Phase 1 dredging (Watson, 1974)

Recent aerial photographs indicate that vegetation has been established on the artificial island formed by the material placement. This appears to consist of shrubs rather than mangroves or saltmarsh, possibly due to the elevation of the island above high water mark and the sandy nature of the placed soils. Mapping of waterbird and shorebird roosting and feeding areas within the Victorian Biodiversity Atlas (DEPI, 2012) indicates that the western and southern beach areas around the artificial island (refer red shaded area on **Figure 11**) have been identified among the limited number of waterbird and shorebird roosting sites within Western Port.

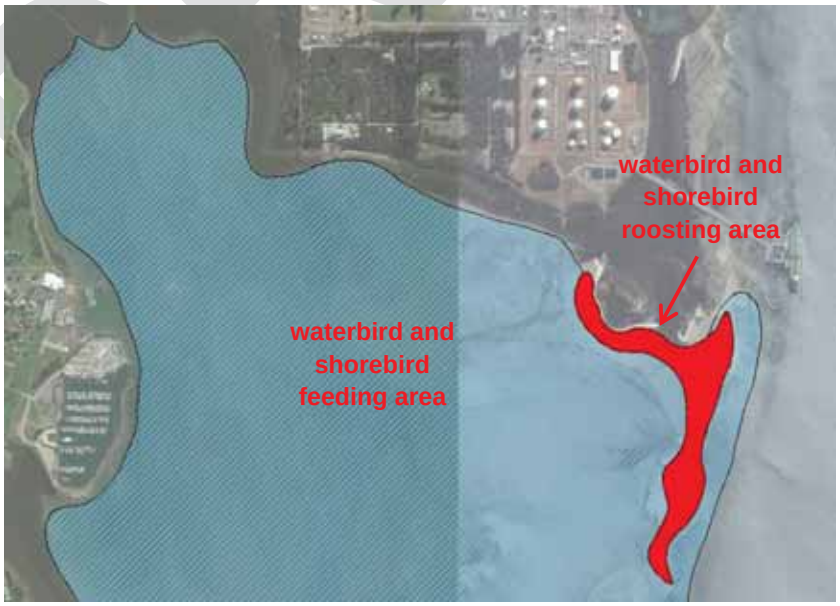


Figure 11: Mapping of waterbird and shorebird roosting area at Long Island Point (DEPI, 2012)

3.3 Stony Point Jetty Reclamation

The reclamation area behind Stony Point Jetty was created in 1965 from 142,000m^3 of material dredged in the vicinity of the jetty by a CSD and pumped behind the jetty to provide a land area for public carparking and port authority workshop and office areas (see **Figure 12**). The reclamation area is currently used as the Patrick Ports Hastings depot, which comprises an administration building and several sheds and workshops, including a machinery shed, buoy workshop, dangerous goods store, tug office and amenities (see **Figure 13**). Road access to the depot and carparking area is provided along the southern perimeter of the reclamation area, which is protected by a sloped masonry seawall structure (see **Figure 14**). The eastern and northern perimeter of the reclamation area is protected by a rock revetment (refer **Figure 15**). The nearshore area in the vicinity of the reclamation comprises intertidal mudflats that support a stand of mangroves to the immediate north (see **Figure 16**).

Figure 12: Aerial view of Stony Point Jetty and reclamation area (Google Earth Pro, 2014)

Figure 13: Stony Point administration building

Figure 14: View of the southern side of the reclamation area

Figure 15: View of the rock revetment along the northern perimeter of the reclamation area

Figure 16: View of mangroves to the north of Stony Point reclamation area (Google Earth Pro, 2014)

Previous geotechnical investigations undertaken in 1978 determined that the reclamation fill comprised gravelly sandy clayey silt and sandy clayey silt to a depth of 3.5m (0.9m CD) (AECOM GHD, 2013). This was underlain by sand becoming very dense overlying hard silty clay to a depth of 27.5m (-23.1m CD). DCP testing undertaken in adjacent areas determined that the loose surface sediments encountered along the shoreline were relatively shallow and overlay stiff clays. This indicates that the reclamation material was placed on a reasonably solid foundation of natural soils.

3.4 Tankerton DMG

The Tankerton DMG (refer **Map 1** in **Section 5.1**) was first used as a disposal location for clayey material dredged at Crib Point with a Bucket Dredger in 1964-1965. A diver inspection of the area was undertaken 9 years after disposal operations as part of the Shapiro (1975) Westernport Bay Environmental Study (Watson, 1974). This observed patches of broken clay nodules throughout the DMG area that had a similar grey colouration and texture as that found on the seafloor of the dredged areas. The clay patches were interspersed between larger patches of silty sand mixed with occasional pebbles and cobbles. The clay nodules were soft and unconsolidated due to a process of hydration, which resulted in the clays resuspending in a floc after only minor disturbance of the seabed. It was observed that the abundance and diversity of the marine ecology over the DMG was characteristic of the deep water channels of the Lower North Arm and it was considered that the invertebrate communities had completely re-established in the area. It was also noted that changes in sediment texture (i.e. clay nodules to silty sand) altered the species composition of infaunal communities.

After the 1974 diver inspection, the Tankerton DMG was used on several following occasions for disposal of dredged material from the main shipping channel (1980, 1988, 1994) and the Tankerton Jetty approach channel (1994).

The last dive over the Tankerton DMG site was undertaken in 1995 (Jan Watson 2014, pers. comm., 12 Nov., refer **Section 4.2**). During this inspection, the texture of the clay material placed within the DMG was still evident and had the consistency of 'soup' indicating that further hydration had broken down the clay nodules. It was reported that there was no difference in benthic infauna at the DMG site in comparison to a reference site.

3.5 Peck Point DMG

The Peck Point DMG (refer **Map 1** in **Section 5.1**) is only known to have been used in 1969-1970 for disposal of material removed with a Bucket Dredger during Phase 2 of Long Island Point dredging. The area of the DMG was inspected in a diver survey undertaken 4 to 5 years after disposal activities (Watson, 1974). This inspection did not find any evidence of the dredged material and it was concluded that the entire volume of 294,000m^3 disposed as part of the Long Island Point dredging campaign had been lost. It was thought that this was attributed to several factors including the siting of the DMG in an exposed area subject to occasional wave action from the south west, strong tidal currents (up to 0.93m/s), the bedload transport through the area evidenced by ripple marked mobile sand deposits, and anecdotal reports (Watson, 1974) that the dredged material was disposed in a wider area than the designated DMG boundary resulting in spreading of the volume in a thin layer over

the seabed. The area was noted as being subject to strong currents and consequently a highly dispersive site in recent discussions with Dr Jan Watson (refer **Section 4.2**).

The location of the Peck Point DMG is approximate only and is based on the location shown as a marker point on a figure within Watson (1974) and not its designated boundary coordinates which are unknown.

3.6 Grossard Point DMG

The Grossard Point DMG (refer **Map 1** in **Section 5.1**) is only known to have been used to dispose material from single , small-scale (10,000m^3) dredging campaign undertaken within the Main Channel in 1975-1976. After this campaign, the Tankerton DMG was used to receive material from subsequent shipping channel maintenance dredging campaigns. Disadvantages of this DMG location outlined in information provided by Patrick Ports Hastings include:

- close proximity to the main navigation channel;
- exposed site location; and,
- difficulty in monitoring the site (potentially due to exposed site conditions).

An inspection of the Grossard Point DMG area following the small-scale dredging campaign is not known to have been undertaken.

The location of the Grossard Point DMG is approximate only and is based on the location sketched by Captain Dick Cox (2014, pers. comm., 8 Oct.) and not its designated boundary coordinates which are unknown.

4 INTERVIEWS WITH KEY PERSONNEL

4.1 Discussion with Captain Dick Cox

A meeting was held with Captain Dick Cox on 8th October 2014 at the PoHDA office in Hastings. Dick started as the assistant Harbour Master at Western Port in 1990 and became the Harbour Master when the Port was privatised in 1997. He retired from the Port in August 2008 and is now a consultant and member of the Western Port Seagrass Partnership.

Dredging Activities

During Dick's tenure at Western Port the Tankerton DMG was used as a disposal area by the Port of Melbourne TSHD 'A. M. Vella', which came across for several maintenance campaigns (1980, 1988 and 1994) to dredge sand waves located between marker buoys No.19 and No.21. The Tankerton DMG was also used in1994 for placement of clay balls and slurry material from dredging undertaken by a small CSD pumping from a dredging area at Tankerton Jetty. Dick advised that concerns were held by the community regarding the location of the Tankerton DMG with complaints being made about turbidity generation and an incident where one of the marker buoys for the DMG was moved by another party.

Following privatisation of the Port in 1997, less funding was allocated to dredging and periodic dredging of sand waves ceased. Bed levelling of the sand wave area between buoys No.19 and No.21 was considered but never implemented. A study undertaken by Lawson & Treloar (2001) determined that sand waves were moving from north to south down the Lower North Arm at a rate of approximately 8m per year.

Dick also advised that BHP undertook maintenance dredging at the BlueScope Wharf berths in 2002, which involved pumping of dredged material to the south western area of the Old Tyabb Reclamation Area. It was understood that the BHP berths are generally self-cleansing as they are aligned with tidal currents, although periodic dredging was still required. Very little sedimentation occurred within the berth pocket at Long Island Point.

Dick was also aware of potential dredging obstructions off Long Island Point. These were detected by a magnetometer survey and comprised wires, pipes, barges and other metallic objects. In addition, some boulders exist in the corner of Berth No.2 at the BlueScope Steel Wharf, which were relocated there by a dredger during a previous campaign.

Issues Encountered

Dick advised that the reduction in seagrass areas in the 1970s was initially blamed on the major dredging campaigns of the 1960s and early 1970s. It is Dick's understanding that government agencies now accept that the seagrass was killed off by a combination of land-based sediment input and agricultural chemicals. He also explained that there is a hypothesis that the sedimentation raised mudflat levels to that which were too high for seagrass growth. This elevation of bed levels in combination with low tides and hot weather was thought to have 'cooked' the oils out of the seagrass causing mortality. Dick has observed oil slicks over the water in these conditions.

4.2 Discussion with Dr Jan Watson

A meeting was held with Dr Jan Watson on 11th November 2014 at her residence in Clifton Springs on the western side of Port Phillip Bay. Jan is a marine ecology consultant with extensive experience in the survey and monitoring of ecological habitats within Western Port, having undertaken annual seagrass surveys for BlueScope Steel since 1974.

Survey of Former DMGs and Dredging Sites

Jan dived over the Pecks Point and Tankerton DMG sites several years after disposal of dredged material in these areas. There was no evidence of dredged material at the Pecks Point DMG 4 to 5 years after dredging (refer **Section 3.5**) as the area is subject to strong currents and consequently is highly dispersive. At the Tankerton DMG, dredged material on the seabed was evident by the different texture of the clays and 'soup' like material (refer **Section 3.4**). In her last dive at Tankerton DMG, no difference in benthic fauna was found in comparison to the reference site.

Within the Lysaght (now BlueScope Steel) dredging area previous surveys observed cut marks on the clay from CSD operation and furrows where material had been sidecast. The material was red/grey clay and produced a strong plume after rain.

At Hanns Inlet, multiple dredging campaigns were undertaken and material was disposed on land.

Dredged spoil was disposed within Hastings Bight around the wreck (known as 'Redbird') located a few hundred metres offshore from the Hastings Jetty.

Issues Encountered

The loss of seagrass in the east of Western Port occurred in the late 1970s and 1980s and was primarily lost in intertidal areas rather than subtidal areas. Although sometimes blamed on dredging, it is Jan's view that a significant cause of the die-off was fishermen anchoring or running aground at low tide. This caused damage to seagrass, cut furrows into the mudflats and set off base erosion. Pooled water drained into the furrows, exposing seagrass which would die on a hot day at low tide. Jan recalls that the amount of recreational fishing increased in the 1970s, facilitated by the construction of a number of new boat launching ramps.

4.3 Discussion with Parks Victoria Representatives

A meeting was held with two representatives of Parks Victoria (PV) on 25th November 2014 at Parks Victoria office in Albert Park, Melbourne. Ledene Ellis (Manager Maritime Infrastructure) and Peter Kemp (Environmental Programs Manager) attended the meeting.

It was advised that Parks Victoria currently undertakes maintenance dredging at two boating facilities under their management within Western Port, which comprise Tankerton Jetty and San Remo Jetty.

In 2004, the old Tankerton Jetty was demolished and replaced with a shorter jetty and the access channel was extended landwards to the new jetty head. The dredged material that was removed to lengthen the access channel comprised consolidated clays and gravels and was excavated and placed into barges for disposal at the Tankerton DMG. This work was undertaken by the then Port of Melbourne Authority (PMA).

The current maintenance regime for the existing configuration of the Tankerton Jetty comprises periodic (less than 10,000m^3 every 3 to 5 years) dredging of silty sands, which enter the access channel from the north. Dredging works are typically undertaken by a small CSD which pumps the sandy material to a beach south of the jetty. PV advised that studies are currently underway to investigate the option of disposing the dredged material in deeper water as the accumulation of dredged material placed on the beach may encroach into nearby seagrass beds at some time in the future.

Maintenance dredging at the San Remo Jetty is undertaken every 3 years with a quantity of around 7,000m^3 of relatively coarse sand being pumped with a CSD to a beach located to the west of the facility.

It is understood that very few complaints have been received as a result of PV dredging activities, although education of local communities has been required to explain the bleaching process that occurs when initially discoloured sand is placed on beaches. Short term turbidity has been observed during campaigns and has been explained to affected communities. Monitoring of water quality is not undertaken during the dredging works due to the small scale of each maintenance campaign and clean nature of sandy materials that are dredged. The dredged material is characterised prior to each campaign with a program of sediment sampling and analysis of physical and geochemical properties.

There are several other boating facilities within Western Port that require periodic dredging to maintain navigable access and are outside the PV managed area of responsibility. These facilities are managed by private owners, local government or committees of management and include:

- Tooradin Boat Ramp;
- Yaringa Boat Harbour;
- Newhaven Marina and Boat Ramp;
- Hastings Boat Ramp and Hastings Yacht Club Boat Ramp; and,
- Stony Point Boat Ramp.

The land ownership and estimated frequency and quantity of dredging at each of the above facilities and those managed by PV is summarised in Table 2.

Table 2: Western Port Small Craft Facility Dredging Summary

Site	Land Ownership/Responsibility	Dredging Frequency	Annual Dredging Volume
San Remo Jetty	Parks Victoria	3 years	5,000m^3
Tankerton Channel and Jetty	Parks Victoria	3 to 5 years	2,000m^3

Tooradin Boat Ram	Tooradin Foreshore Committee of Management	3 to 4 years	1,000m^3
Yaringa Boat Harbour	Yaringa Boat Harbour	10 years	5,000m^3
Newhaven Marina and Boat Ramp	Newhaven Yacht Club	unknown	unknown
Hastings Boat Ramp and Hastings Yacht Club Boat Ramp	Mornington Peninsula Shire Council	Annual	500m^3
Stony Point Boat Ramp	Crib Point & Stony Point Foreshore Committee of Management	1 to 2 years	1,000m^3

PV passed on an extract of information from a dredging study undertaken by GHD in 1999. This study covered potential dredging sites within Western Port at a range of facilities and navigation areas including channels, moorings, piers/jetties and boat ramps. The site specific summary sheets that were prepared for this study are included within **Appendix C**. There are a number of sites included within these sheets that are additional to those discussed above and either require infrequent dredging of small quantities or do not require maintenance dredging. These sites include:

- Rutherford Channel (1,000m^3 every 10 years);
- Tooradin access channel (1,000m^3 every 20 years);
- Tooradin Jetty (1,000m^3 every 20 years);
- Stony Point mooring area, south of jetty (not dredged);
- Rutherford Inlet mooring areas around Warneet (not dredged);
- Cowes Jetty (not dredged);
- Flinders Jetty (not dredged);
- Newhaven Jetty (not dredged);
- Rhyll Jetty (not dredged);
- Warneet North Jetty (not dredged); and,
- Warneet South Jetty (not dredged).

PV also advised that a maintenance dredging strategy is currently being prepared for PV management areas within Port Phillip Bay and Western Port. This document will be used to support an application for a 10 year maintenance dredging approval and will be made available to PoHDA in final draft form for review.

4.4 Discussion with Captain Shane Vedamuttu

A meeting was held with Captain Shane Vedamuttu on 4th December 2014 at the PoHDA office in Hastings. Shane has spent a total of 10 years at Western Port, 4 years as Deputy Harbour Master and the last 6 years as Harbour Master.

In discussions about historical dredging within port areas, Shane recalled that dredging of sand waves had been practiced in the past with maintenance campaigns of 10,000m^3 to 15,000m^3 being undertaken every 5 to 8 years. This practice was stopped in the early 1990s after a study found that the sand waves only impinged 10cm into declared depths.

Shane advised that there had been no historic dredging in the Western Channel or in the Anchorage area of Cowes and that there had been no dredging carried out for shipping purposes in the last 10 years. However, it was noted that dredging will need to be undertaken in the future near Buoy No.1 (located off Cat Bay) in the Western Channel.

Due to the relatively infrequent shipping traffic, maintenance dredging of the channels is only considered if the actual depth is more than 10cm less than the declared depth, as ships can be scheduled to readily 'work the tides' (i.e. arrive or depart on the high tide). Depths in navigable areas are monitored with Port surveys that are currently undertaken by 3D Marine. These surveys are generally performed every 5 years, with the sand wave area north of Sandy Point being surveyed every 2 years due to the higher risk of reduced depth.

As noted by Captain Dick Cox (refer **Section 4.1**), Shane advised that there were potentially a significant number of metallic obstructions within the anchorage area off the BlueScope Steel berths. This is due to the dumping of construction plant that was used to build the BlueScope Steel Wharf in 1971/1972. A magnetometer survey was recommended to detect these obstructions prior to any dredging in the area. Shane also mentioned that currents in the area of the BlueScope Steel Wharf are limited to around 2 knots (1m/s).

4.5 Discussion with Hadyn Pike

A meeting was held with Hadyn Pike on 4th December 2014 at the PoHDA office in Hastings. Hadyn is a former employee of Australian Dredging & General Works Pty Ltd, who undertook several dredging major campaigns within Western Port in the 1970s.

Hadyn was personally involved in the 1969-1970 Long Island Point dredging campaign. This involved the dredging of stiff clay material with the new Bucket Dredger 'AD Victoria', which loaded a fleet of barges (three self-propelled and two dumb barges towed by a tug) for transport and bottom dumping at the designated dredged material ground at Peck Point (the 'Peck Point DMG'). Hadyn recalled that dredging activities were undertaken on a 24/7 basis and that the stiff clay came out of the buckets easily and was bottom dumped easily. Environmental monitoring was not undertaken during the dredging works and Hadyn did not recall that a post dumping survey of the DMG was performed.

Hadyn also relayed some information describing the 1972 dredging campaign for John Lysaght (Australia), which was also undertaken by Australian Dredging & General Works Pty Ltd. This information was obtained from a colleague Lyle Newbold, who was involved in this campaign. The dredging was undertaken by the CSD 'Crocodile' which pumped predominantly clay material (some sand waves were encountered on the inside of the channel) into the Old Tyabb Reclamation Area. It was noted that during the construction of the containment bunds for the reclamation, by the method of end-tipping, some 'mud waves' were created and were subsequently removed (pumped ashore to the reclamation) by a smaller CSD 'Platypus'. The progress of the reclamation proceeded from north to south with

the fines being collected in the south western corner of the reclamation area and return water allowed to run back into the waterway.

Hadyn advised that heavy fog can be experienced in Western Port and that currents experienced during the 1969-1970 Long Island Point campaign were strong but not high enough (i.e. greater than 4 knots or 2m/s) to disrupt dredging operations.

4.6 Discussion with Port of Melbourne Corporation Representatives

A brief telephone discussion was held between Christian Taylor (PoHDA) and Paul Downie of Port of Melbourne Corporation on 4th December 2014.

Paul was aware of two previous dredging campaigns within Western Port, including:

- 1988 dredging campaign involving dredging between the No.19 and No.21 buoys by the TSHD 'A. M. Vella', owned by Port of Melbourne Authority, with disposal at the Tankerton DMG; and,
- a late 1990s dredging campaign involving maintenance dredging of the steel industry berth (now BlueScope Steel) with a small CSD pumping ashore to settling ponds (i.e. Old Tyabb Reclamation Area).

5 KEY FINDINGS

5.1 Dredging and Disposal Areas

As shown on **Map 1**, a number of dredging and disposal areas have been identified within Western Port. These areas are predominantly located within the western and northern areas of Western Port, although dredging has also been undertaken to the east around the San Remo area.

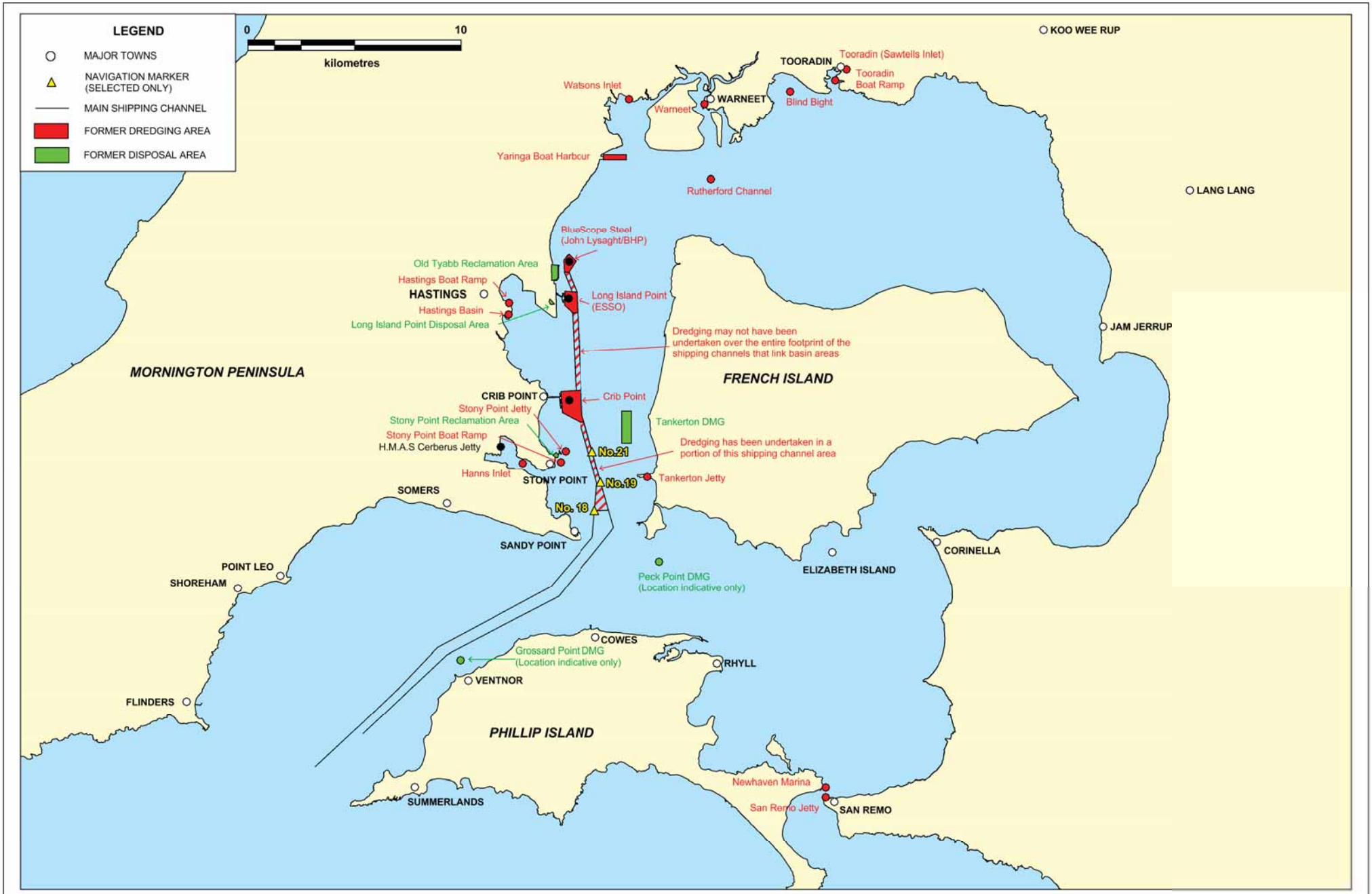
The extent of dredging areas is dominated by the footprint of the main shipping channel and swinging basin and berths, north of Sandy Point, which provide navigation access to wharf and jetty structures associated with the Port. Material dredged in these campaigns has been typically disposed in a designated offshore DMG at some distance from the dredging area or at significant land reclamation sites.

DMGs that have been used within Western Port include the Grossard Point DMG (10,000m^3) and Peck Point DMG (294,000m^3), which have been used in single dredging campaigns only. The Tankerton DMG (466,000m^3) has received material from multiple dredging campaigns including those at Crib Point, the main shipping channel (maintenance dredging) and Tankerton Jetty.

Significant land reclamation and disposal sites within Western Port include:

- Stony Point reclamation area – currently occupied by an access road to the Stony Point Jetty and the Patrick Ports Hastings depot (142,000m^3);
- Long Island Point disposal area – among the mangroves including the creation of an artificial island, where the beach areas on its western and southern foreshore have provided an additional area for waterbird and shorebird roosting (153,000m^3); and,
- Old Tyabb Reclamation Area – the largest land reclamation in Western Port, currently used as a paddock for cattle grazing (692,000m^3).

The dredging footprints for access channels to small craft facilities are much more localised, as are the corresponding disposal areas which are typically located on the shoreline, intertidal mudflats or beaches (i.e. for nourishment purposes) in close proximity to the dredging areas.



NORTH

PAGE SIZE A3

PROJECT NO: 8A0300 WORKPACKAGE: 16

PROJECT TITLE: PORT OF HASTINGS - STAGE 1 GEOMORPHOLOGY

MAP 1 FORMER DREDGING AND DISPOSAL SITES

CO-ORDINATE SYSTEM: Datum: GDA94 Projection: MGA Zone 55 REVISION A

CREATED BY: B. MACKENZIE DATE 13/03/2015

FILEPATH C:\Users\Beau Mackenzie\Documents\8A0300 - Hastings Contraints Mapping\Mapinfo

Royal HaskoningDHV
Enhancing Society Together

5.2 Dredging Volumes

A summary of dredging volumes from known campaigns is provided in **Appendix A**. This shows that the total dredging volume from the first recorded campaign in 1916 to the present time is approximately 2.75 million m^3 (measured in situ). The total dredging volume disposed offshore over this period (1916 to present) was approximately 810,000m^3, whilst the onshore disposal volume was approximately 1.94 million m^3.

The above totals exclude unknown, but minor, dredging volumes from several campaigns associated with access to small craft facilities, which are likely to be minor (hundreds to thousands of m^3 per campaign) in comparison to the size of campaigns undertaken for Port development dredging undertaken in the 1960s and 1970s (tens of thousands to hundreds of thousands of m^3 per campaign). There are 15 historical dredging campaigns that have been recorded without a known dredging volume (refer **Appendix A**). These include some earlier campaigns at Hastings Boat Ramp (1964), San Remo Jetty (1966), Hastings Basin (1973) and minor campaigns associated with small craft facilities since 2000. These minor campaigns have been recorded in Notice to Mariners, correspondence records and discussions with Parks Victoria and include dredging at Stony Point boat ramp, Tankerton Jetty, Newhaven Marina, San Remo Jetty, Tooradin Boat Ramp and Yaringa Boat Harbour. If it was conservatively assumed that each of these campaigns comprised an average of 10,000m^3, the total dredging volume would increase by around 150,000m^3 or about 5%.

As noted above, the most significant dredging campaigns associated with Port development were undertaken in the 1960s and 1970s and comprised the following dredged volumes:

- 142,000m^3 – Stony Point Jetty (1965);
- 384,000m^3 – Crib Point (1964 to 1965);
- 447,000m^3 – Long Island Point (1968 to 1970); and,
- 676,000m^3 – John Lysaght (Australia) Swinging Basin (1971 to 1972);

Other significant dredging campaigns include the dredging of 760,000m^3 to create the access channel into Hanns Inlet between 1916 and 1921 and the dredging of 76,500m^3 to establish Yaringa Boat Harbour between 1963 and 1970.

As noted above, the largest reclamation area in Western Port is known as the Old Tyabb Reclamation Area and has received a total of 692,000m^3 of dredged material within its containment bunds.

The Tankerton DMG has been the most utilised DMG for offshore disposal of dredged material with approximately 466,000m^3 being placed at this location.

5.3 Dredging Methods

The dredging methods employed within Western Port have included the use of a range of dredging equipment, including Draglines, Bucket Dredgers, CSDs, and TSHDs.

Several early dredging campaigns in the 1960s involved the use of Bucket Dredgers to dredge stiff to hard clays. These dredgers would load dredged material into hopper barges

for transport and bottom dumping at offshore DMGs. Drilling and blasting was also used to break up rock at Stony Point.

The most common dredger used in Western Port was the CSD. CSDs were used to pump a range of dredged materials (including silty muds, stiff/hard clays and sand) ashore via floating pipelines to bunded reclamation and settlement pond areas. CSDs were also used to pump dredged material to offshore disposal areas in close proximity (achievable pumping distance) to dredging sites. Sandy material has typically been pumped by CSDs to nearby beaches for nourishment purposes.

TSHDs have only been used in Western Port for dredging of sands found within the main shipping channel. This involved the use of the TSHD 'A. M. Vella' owned by the Port of Melbourne Authority to dispose sand within the Tankerton DMG on three occasions prior to 1994 (1980, 1988 and 1994).

5.4 Issues Encountered

Environmental issues associated with historical dredging campaigns have been related to the physical characteristics of the dredged material, which for capital dredging projects has typically comprised stiff to hard clays. These issues have included:

- generation of turbidity plumes by CSDs dredging clays;
- turbidity resulting from runoff flowing over onshore disposal areas;
- deposition of fine sediments onto the seabed (including seagrass beds) and associated impacts on ecological habitat; and,
- disposal of stiff clays at offshore DMGs resulting in soft and unconsolidated clay nodules, due to the process of hydration over time, which readily resuspend in a floc after only minor disturbance of the seabed.

A number of issues were identified in relation to the impacts of dredging on the ecological habitat within Western Port, including:

- recolonisaton of dredged areas within the North Arm begins concurrent with bedload transport into the area. After attainment of a suitable depth of substrate, gross community structures form within 1 to 2 years after dredging. The species composition of the developing community is largely dependent upon the grain size of the sediments. Late settling and slower growing species, common in the Western Port fauna, may however, retard community maturation for a period of 4 to 5 years after dredging (Watson, 1974);
- recolonisation of underwater disposal areas has occurred at the Tankerton DMG, however changes in sediment texture (i.e. clay nodules to silty sand) had altered the species composition of infaunal communities (Watson, 1974);
- initial blame was placed on dredging for the loss of seagrass areas in the 1970s, however additional factors are now considered to have led to the die-off including:
    - increases in fishing (boating) activity in the 1970s facilitated by the construction of new boating launching ramps, fishermen anchoring or running aground cut furrows into seagrass beds setting off base erosion and

providing channels for water to drain into at low tide which exposed seagrass to the heat of the day (Jan Watson 2014, pers. comm., 12 Nov.);

- a combination of land-based sediment input and agricultural chemicals (Dick Cox 2014, pers. comm., 8 Oct.); and,
- sedimentation raising mudflat levels to that which were too high for seagrass growth (Dick Cox 2014, pers. comm., 8 Oct.).

5.5 Sedimentation and Maintenance Dredging

Navigable shipping areas within Western Port experience generally low rates of sedimentation, as evidenced by the approach of 'no dredging' and monitoring of Port areas with periodic hydrographic surveys outlined within the 2006-2012 Dredging Strategy. Recent discussions with the current Harbour Master (Shane Vedamuttu 2014, pers. comm., 4 Dec.) also indicated that the declared depths in the Port are fairly stable as hydrographic surveys are currently undertaken relatively infrequently, every 5 years generally and every 2 years in the sand wave area north of Sandy Point. Sand waves are currently managed with survey monitoring and issue of a Notice to Mariners to identify high spots that have reduced declared depths in localised areas.

Known maintenance dredging campaigns within the Port have comprised dredging of sand waves between Buoys No.19 and No.21 and dredging within the BHP Berths. A summary of maintenance dredging campaigns is provided in Table 3.

Table 3: Maintenance dredging campaigns in shipping areas

Date	Dredging Location	Disposal Location	Method	Volume (m^3)
1980	Main Shipping Channel (between Buoys No.19 and No.21)	Tankerton DMG	Trailer Suction Hopper Dredger	10,000
1988	Main Shipping Channel (between Buoys No.19 and No.21)	Tankerton DMG	Trailer Suction Hopper Dredger	24,000
1994	Main Shipping Channel (between Buoys No.19 and No.21)	Tankerton DMG	Trailer Suction Hopper Dredger	35,000
2002	BHP Berths (between Buoys No.19 and No.21)	Old Tyabb Reclamation	Cutter Suction Dredger pumping direct	16,000

A more detailed analysis of the sedimentation rates within the navigable areas of Western Port is provided in the Preliminary Siltation Analysis (Document No. HAS-CEP0-HY-REP-0016) that has recently been prepared by RHDHV (2014).

6 REFERENCES

AECOM (2009a), *Port of Hastings Stage One Investigations – Review of Hydrodynamic and Water Quality Data and Analysis*, Work Package – M16, prepared for Port of Hastings Corporation, 30 June 2009.

AECOM (2009b), *Port of Hastings Stage One Scoping – Geotechnical and Environmental Investigation*, Work Package – M8: Geomorphology, Geology and Geotechnical, prepared for Port of Hastings Corporation, 15 July 2009.

AECOM (2009c), *Port of Hastings Stage One Scoping – Dredging and Reclamation Methods Assessment*, Work Package – M7, prepared for Port of Hastings Corporation, 30 July 2009.

AECOM GHD (2013), *Port of Hastings 2013 – Descriptive Report*, prepared for Port of Hastings Development Authority, 18 December 2013.

AECOM GHD (2014), *Port of Hastings Container Expansion – Design and Engineering, Geotechnical Interpretive Report*, draft report, 5 November 2014.

Department of Environment and Primary Industries [DEPI] (2012), *Victorian Biodiversity Atlas*, accessed by GHD (2013) as part of a data sharing agreement with DEPI.

EPA Victoria (1996), *The Western Port Marine Environment*, Publication 493, March 1996.

EPA Victoria (1998), *Draft Best Practice Environmental Management Guidelines for Dredging*, draft report, June 1998.

EPA Victoria (2001), *Best Practice Environmental Management - Guidelines for Dredging*, Publication 691.

GHD (2013), *Port of Hastings Container Expansion Project: Ecology Description – Final Report*, prepared for Port of Hastings Development Authority, October 2013.

Marine Science & Ecology (1998), *Sampling & Analysis of Marine Sediments: Steel Industry Wharves*, prepared for Toll Western Port, 26 November 1998.

Royal HaskoningDHV [RHDHV] (2014), *Preliminary Siltation Analysis, Western Port Shipping Channel and Berth Pockets*, Document No. HAS-CEP0-HY-REP-0016, prepared for Port of Hastings Development Authority, December 2014.

Shapiro (1975), Westernport Bay Environmental Study.

Watson (1974), Preliminary *Study of the History and Environmental Effects of Dredging and Dredge Spoil Disposal in Westernport Bay Victoria*, prepared for Westernport Bay Environmental Study.

APPENDIX A
Dredging History Summary Table

Date Start	Date Finish	Dredging Location	Material Type	Dredging Depth (m CD)	Dredging Volume (cum)	Dredging Area (sqm)	Equipment Used	Onshore/Offshore Disposal	Disposal Location(s)	Fate of Material	Issues	Primary Source	Secondary Source(s)
1916	1921	Hanns Inlet	included heavy clays	10'6" deep below LWST	760,000	unknown	Cutter Suction Dredger and Bucket Dredger	onshore	southern side of Hanns Inlet, northern side of inlet, or at the site of the HMAS Cerberus Jetty	unknown	CSD had difficulty dredging heavy clays and broke down. Work completed with a bucket dredge.	Watson (1974), information obtained from review of Australian Government Archives (Brighton, VIC)	1. Summary table provided by Captain Dick Cox 2. EPA Victoria Publication 493 (1996)
1964	1964	Hastings Boat Ramp	stiff clay with sandstone rubble in boat ramp access channel	unknown	unknown	unknown	Cutter Suction Dredger owned by Duncan & Russell Pty Ltd	unknown	unknown	unknown		Watson (1974), information obtained from VIC Ports & Harbours Division and Duncan & Russell Pty Ltd dredging contractors	None
1965	1965	Stony Point Jetty	unknown	-7.3	142,000	24,000	Cutter Suction Dredger "Platypus" and Bucket Dredger "Beverwijk" (0.8 cum) owned by Australian Dredging and General Works and drilling and blasting of rock	onshore	dumped behind jetty to provide public car parking, workshop and office area for the Westernport Bay Port Authority buildings	retained within disposal area by seawall structures		Watson (1974), information obtained from VIC Ports & Harbours Division and Public Works Department	1. Summary table provided by Captain Dick Cox 2. Port dredging summary table within Port of Hastings Dredging Strategy 2006-2012 3. EPA Victoria Publication 493 (1996) 4. Appendix B of Dredging and Reclamation Methods Assessment report (AECOM, 2009)
1964	1965	Crib Point	hard clay	-14m channel, berth boxes -15.9m	384,000	330,000	Bucket Dredger "Beverwijk" (0.8 cum) loading hopper barges, owned by Australian Dredging and General Works	offshore	DMG between Middle Spit and French Island north of Tankerton in 12-15m water depth, known as the 'Tankerton DMG'	clay nodules in spoil ground were very soft and unconsolidated, resuspension of clay floc with minor seabed disturbance	resuspension of unconsolidated clay	Watson (1974), information obtained from VIC Ports & Harbours Division and Public Works Department	1. Summary table provided by Captain Dick Cox reports 324,000 cum 2. Port dredging summary table within Port of Hastings Dredging Strategy 2006-2012 reports 324,000 cum 3. EPA Victoria Publication (1996) reports 324,000 cum
1966	1966	San Remo Jetty (first phase)	unknown	unknown	unknown	unknown	Cutter Suction Dredger owned by Duncan & Russell Pty Ltd	unknown	unknown	unknown		Watson (1974), information obtained from VIC Ports & Harbours Division and Duncan & Russell Pty Ltd dredging contractors.	None
1968	1968	Sawtells Inlet	unknown	unknown	2,300	unknown	Cutter Suction Dredger "Sandpiper" (Ports & Harbours Division dredge)	offshore	pumped onto surrounding tidal flats	unknown		Watson (1974), information obtained from VIC Ports & Harbours Division	1. Summary table provided by Captain Dick Cox reports dredging was completed in 1971 2. EPA Victoria Publication 493 (1996)
1964	1969	Watson Inlet	moderately stiff clay and saltmarsh muds	1m deep	15,000	10,500	Cutter Suction Dredger owned and operated by Mr G. Vowell	onshore	pumped onto the banks at either side of the channel	unconsolidated clay spoil washed into channels by heavy runoff from rain and banks collapsing into channel		Watson (1974), information obtained from Mr G. Vowell of Tyabb (former owner of estate)	1. Summary table provided by Captain Dick Cox 2. EPA Victoria Publication 493 (1996)
1968	1969	Long Island Point (Phase 1)	unknown	unknown	153,000	192,000	Cutter Suction Dredger (24"/20"), owned by Dredging Industries (Australia) Pty Ltd	onshore	pumped ashore 0.5km approx. WSW of LIP Jetty, existed in two separate tailings heaps among the mangroves	unknown		Watson (1974), information obtained from VIC Ports & Harbours Division and Public Works Department	1. Summary table provided by Captain Dick Cox reports 157,000 cum 2. Port dredging summary table within Port of Hastings Dredging Strategy 2006-2012 reports 157,000 cum 3. EPA Victoria Publication 493 (1996) reports 157,000 cum
1969	1970	Long Island Point (Phase 2)	stiff clays	approach channel -14.3m CD, berth -15.8m CD	294,000		Bucket Dredger "AD Victoria" (0.7 cum) loading hopper barges, owned by Australian Dredging and General Works	offshore	DMG located between Peck Point and Tortoise Island south of French Island, known as the 'Peck Point DMG'	material completely dispersed from spoil ground after 4 years		Watson (1974), information obtained from VIC Ports & Harbours Division and Public Works Department	1. Summary table provided by Captain Dick Cox reports 295,000 cum 2. Port dredging summary table within Port of Hastings Dredging Strategy 2006-2012 reports 295,000 cum 3. EPA Victoria Publication 493 (1996) reports 295,000 cum 4. Discussions with Hadyn Pike 4/12/14
1963	1970	Yaringa Boat Harbour	Shell sands and moderately stiff clays	<1m to 2.5m depth	76,500	9,000	Dragline operated by Mr G. Ralph, owner of Boat Harbour	onshore	drawn up into a batter on each side of the dredged channel	erosion of batters near channel mouth by tidal action, collapse of batters back into the channel	flushing of lower water column in boat harbour appeared to be poor, mildly anaerobic conditions	Watson (1974), information obtained from Mr G. Ralph (owner of Boat Harbour)	EPA Victoria Publication 493 (1996)

Date Start	Date Finish	Dredging Location	Material Type	Dredging Depth (m CD)	Dredging Volume (cum)	Dredging Area (sqm)	Equipment Used	Onshore/Offshore Disposal	Disposal Location(s)	Fate of Material	Issues	Primary Source	Secondary Source(s)
1971	1971	Hanns Inlet	variable, soft black mud and sands, occasional bars of hard clay	unknown	50,000	unknown	Cutter Suction Dredger "Platypus" owned by Australian Dredging and General Works	onshore	pumped to several sites ashore in the rubbish dump reserve near the HMAS Cerberus Jetty and on the interior flats	unknown		Watson (1974), information obtained from Australian Dredging and General Works Pty Ltd dredging contractors	1. Summary table provided by Captain Dick Cox 2. EPA Victoria Publication 493 (1996)
1971	1972	John Lysaght (Australia) Limited Swinging Basin	generally clay with some sand waves encountered on the inside of the channel	basin and channel -9.1m CD, berth -12.1m CD	676,000	307,000	Cutter Suction Dredger "Crocodile" (22 inch) owned by Australian Dredging and General Works	onshore	pumped ashore for reclamation purposes south of the warehouse of John Lysaght (Australia) Ltd, known as the 'Old Tyabb Reclamation Area'	consolidated and seeded with grass	1. Mud waves were created during containment bund construction for the reclamation. These were subsequently removed (pumped ashore to the reclamation) by the small CSD "Platypus" (12 inch). 2. Generation of a widespread turbidity plume during dredging, initial excessive water turbidity from runoff after rain from the onshore spoil dump.	Watson (1974), information obtained from VIC Ports & Harbours Division and Public Works Department	1. Summary table provided by Captain Dick Cox 2. Port dredging summary table within Port of Hastings Dredging Strategy 2006-2012 3. EPA Victoria Publication 493 (1996) 4. Discussions with Hadyn Pike on 4/12/14
1971	1972	Tooradin (meander in Sawtells Inlet on the upstream side of South Gippsland Bridge)	unknown	unknown	19,000	unknown	Cutter Suction Dredger owned by Duncan & Russell Pty Ltd	offshore	pumped into the middle of a proposed swimming pool area to form an island	formed an island	dredge spoil unconsolidated, unstable and waterlogged in winter, clay under submarine and subaerial weathering breaks down to a glutinous consistency and disintegrates into a finely divided floc when disturbed	Watson (1974), information obtained from Cranbourne Shire Council	1. Summary table provided by Captain Dick Cox reports 19,100 cum 2. EPA Victoria Publication 493 (1996) reports 19,100 cum
1972	1972	San Remo Jetty (second phase extensions to original basin)	unknown (likely sand)	unknown	2,600	unknown	Cutter Suction Dredger owned by Duncan & Russell Pty Ltd	onshore	pumped onto beach near Phillip Island Bridge	beach nourishment		Watson (1974), information obtained from VIC Ports & Harbours Division and Duncan & Russell Pty Ltd dredging contractors.	1. Summary table provided by Captain Dick Cox 2. EPA Victoria Publication 493 (1996)
1972	1972	Rutherford Channel (area between markers at channel entrance)	fine sand and stiff clay	unknown	2,700	unknown	Cutter Suction Dredger owned by Duncan & Russell Pty Ltd	offshore	pumped across tidal flats onto the subtidal slope of the main channel of Bagge Harbour	fines spread down the slope and carried away by currents, tailing cone of clay nodules remains at 3-7m depth		Watson (1974), information obtained from VIC Ports & Harbours Division and Duncan & Russell Pty Ltd dredging contractors	1. Summary table provided by Captain Dick Cox 2. EPA Victoria Publication 493 (1996)
1972	1972	Warneet (in the vicinity of the jetty near Warneet Motor Yacht Club)	shell sands and silty sand	unknown	1,500	1,500	Cutter Suction Dredger owned by Duncan & Russell Pty Ltd	offshore	unknown	unknown		Watson (1974), information obtained from Mr W. Tamo (President of Warneet Progress Association)	1. Summary table provided by Captain Dick Cox 2. EPA Victoria Publication 493 (1996)
1972	1972	Blind Bight	clays	6-7m deep	11,000	1,000	Cutter Suction Dredger owned by Duncan & Russell Pty Ltd	offshore	pumped ashore on the mangroves at the head of the bight to provide a foundation for an artificial beach, retaining walls for a swimming pool and car park, remainder pumped onto mangroves at the western entrance to Blind Bight	spoil at head of the bight was stabilised with artificial beach sand, clay actively eroded from spoil dump at entrance to Blind Bight	turbidity generated from winnowing of clay spoil, washing back into Blind Bight and deposition across clay flats	Watson (1974), information obtained from Duncan & Russell Pty Ltd dredging contractors	1. Summary table provided by Captain Dick Cox 2. EPA Victoria Publication 493 (1996)
1972	1973	Hastings Basin	stiff clay with sandstone rubble in boat ramp access channel	unknown	unknown	16,000	Cutter Suction Dredger owned by Duncan & Russell Pty Ltd	onshore	pumped ashore behind boat ramp to provide car park area	reclaimed land stabilised with asphalt surfacing and seawall	turbidity in water within channel due to runoff from tidal flats and clay walls at low tide	Watson (1974), information obtained from VIC Ports & Harbours Division and Duncan & Russell Pty Ltd dredging contractors	1. Summary table provided by Captain Dick Cox 2. EPA Victoria Publication 493 (1996)
1975	1976	Main Shipping Channel	unknown	unknown	10,000	unknown	unknown	offshore	Grossard Point DMG (McHaffies Point)	unknown		Summary table provided by Captain Dick Cox	1. Port dredging summary table within Port of Hastings Dredging Strategy 2006-2012 2. EPA Victoria Publication 493 (1996)
1980	1980	Main Shipping Channel	unknown	unknown	10,000	unknown	Trailer Suction Hopper Dredger, "A. M. Vella" owned by Port of Melbourne Authority	offshore	Tankerton DMG	unknown		Summary table provided by Captain Dick Cox	1. Port dredging summary table within Port of Hastings Dredging Strategy 2006-2012 2. EPA Victoria Publication 493 (1996)
1988	1988	Main Shipping Channel	unknown	unknown	24,000	unknown	Trailer Suction Hopper Dredger, "A. M. Vella" owned by Port of Melbourne Authority	offshore	Tankerton DMG	unknown		Summary table provided by Captain Dick Cox	1. Port dredging summary table within Port of Hastings Dredging Strategy 2006-2012 2. EPA Victoria Publication 493 (1996) 3. Phone discussion with Paul Downie of PoMC on 4/12/14
1988	1988	Yaringa Boat Harbour	unknown	unknown	35,000	unknown	unknown	onshore	unknown	unknown		Summary table provided by Captain Dick Cox	EPA Victoria Publication 493 (1996)

Date Start	Date Finish	Dredging Location	Material Type	Dredging Depth (m CD)	Dredging Volume (cum)	Dredging Area (sqm)	Equipment Used	Onshore/Offshore Disposal	Disposal Location(s)	Fate of Material	Issues	Primary Source	Secondary Source(s)
1990	1990	Stony Point Boat Ramp	unknown	unknown	500	unknown	unknown	onshore	unknown	unknown		Summary table provided by Captain Dick Cox	EPA Victoria Publication 493 (1996)
1991	1991	Tooradin Boat Ramp	unknown	unknown	500	unknown	unknown	onshore	unknown	unknown		Summary table provided by Captain Dick Cox	EPA Victoria Publication 493 (1996)
1994	1994	Stony Point Boat Ramp	unknown	unknown	500	unknown	unknown	offshore	mudflats	unknown		Summary table provided by Captain Dick Cox	EPA Victoria Publication 493 (1996)
1994	1994	Tankerton Jetty	stiff clays	unknown	12,500	unknown	Cutter Suction Dredger	offshore	Tankerton DMG	unknown		Summary table provided by Captain Dick Cox	1. EPA Victoria Publication 493 (1996) 2. Discussions with Captain Dick Cox on 8/10/14
1994	1994	Hastings Boat Ramp	unknown	unknown	4,000	unknown	unknown	offshore	island	unknown		Summary table provided by Captain Dick Cox	EPA Victoria Publication 493 (1996)
1994	1994	Long Island Point between No.19 and No.21 buoy	mainly medium to coarse sand	unknown	35,000	unknown	Trailer Suction Hopper Dredger, "A. M. Vella" owned by Port of Melbourne Authority	offshore	Tankerton DMG	unknown		Summary table provided by Captain Dick Cox	1. EPA Victoria Publication 493 (1996) 2. Port dredging summary table within Port of Hastings Dredging Strategy 2006-2012
2000	2000	Stony Point boat ramp access channel	unknown	unknown	unknown	unknown	Cutter Suction Dredger	onshore	pumped 900m up the road to a site selected by the EPA	unknown		Correspondence between Crib Point & Stony Point Public Parks & Foreshore Reserve Committee of Management Inc. and Harbourmaster (Captain Dick Cox) dated 18th April 2000	None
2000	2000	Tankerton Jetty approach channel	silty sand	-2m CD	unknown	unknown	Cutter Suction Dredger	onshore	deposited onto beach area between the rock groyne and the pier abutment	beach nourishment		Correspondence between Parks Victoria and Harbourmaster (Captain Dick Cox) dated 6th June 2000	None
2002	2002	BHP Berths	unknown	unknown	16,000	unknown	Cutter Suction Dredger	onshore	Old Tyabb Reclamation Area	retained within reclamation area		Summary table provided by Captain Dick Cox	Port dredging summary table within Port of Hastings Dredging Strategy 2006-2012
2004	2004	Tankerton Jetty	consolidated clays and gravels	-2m CD	unknown	unknown	material excavated and loaded into barges	offshore	Tankerton DMG	unknown		Discussions with Parks Victoria representatives on 25/11/14	Notice to Mariners 45T-2004 advising demolition of Old Tankerton Jetty in May 2004
2005	2005	Newhaven Marina	unknown	-1.4m CD	unknown	unknown	Cutter Suction Dredger	onshore	bunded area onshore	retained within bunded area		Notice to Mariners 42T-2005	None
2007	2007	Stony Point boat ramp access channel	unknown	unknown	unknown	unknown	Cutter Suction Dredgers "Darwin" and "Elsie L"	onshore	unknown	unknown		Notice to Mariners 53T-2007	None
2007	2007	Tankerton Jetty approach channel	silty sand	-2m CD	unknown	unknown	Cutter Suction Dredger "Darwin"	onshore	deposited onto beach area between the rock groyne and the pier abutment	beach nourishment		Notice to Mariners 49T-2007	None
2008	2008	San Remo Jetty inner arm	unknown	unknown	unknown	unknown	unknown	unknown	unknown	unknown		Notice to Mariners 45T-2008	None
2010	2010	Tankerton Jetty approach channel	predominantly sand	-2m CD	unknown	unknown	Cutter Suction Dredger	onshore	deposited onto beach area between the rock groyne and the pier abutment	beach nourishment		Notice to Mariners 111(T)-2010	None
2011	2011	Tankerton Jetty approach channel	predominantly sand	-2m CD	unknown	unknown	Cutter Suction Dredger	onshore	deposited onto beach area between the rock groyne and the pier abutment	beach nourishment		Notice to Mariners 029(T)-2011	None
2012	2012	Stony Point boat ramp access channel	unknown	unknown	unknown	unknown	Cutter Suction Dredger	onshore	unknown	unknown		Notice to Mariners 117T-2012	None
2012	2012	Tankerton Jetty approach channel	silty sand	-2m CD	5,306	unknown	Cutter Suction Dredger	onshore	deposited onto beach area between the rock groyne and the pier abutment	beach nourishment		2012 Post-dredging survey provided by Parks Victoria	Notice to Mariners 181T-2012
2012	2012	Tooradin Boat Ramp	unknown	unknown	unknown	unknown	Cutter Suction Dredger	offshore	1km downstream	unknown		Notice to Mariners 125T-2012	None
2013	2013	San Remo Jetty	sand	-1.2m to -1.8m CD	1,798	3,518	Cutter Suction Dredger	onshore	beach to the west of the jetty	beach nourishment		2013 Post-dredging survey provided by Parks Victoria	Notice to Mariners 038T-2013
2013	2013	Yaringa Boat Harbour access channel	unknown	unknown	unknown	unknown	Cutter Suction Dredger	onshore	south of the access channel	unknown		Notice to Mariners 187T-2013	None

APPENDIX B
Information Provided by Patrick Ports Hastings

DREDGING STRATEGY FOR WESTERNPORT

1. INTRODUCTION

The Port of Melbourne Authority (PMA) manages the shipping channels within Westernport on behalf of the Victorian Channels Authority (VCA).
The State has an obligation under the Western Port (Steel Works) Act 1970 and Westernport Development Act 1967 to maintain the navigable channels and berthing pockets through the North Arm of Western Port Bay.
The channels are generally self clensing , however there are a few areas that require periodic dredging. In addition there are two areas that could be improved as far as navigation is concerned by the dredging of local high spots.
It is also believed that a significant reduction in maintenance dredging could be achieved by moving the alignment of the channel to the west between 19 and 21 buoys.
The PMA recognises the need to achieve practical environmental protection when planning and conducting dredging operations.
This strategy has been prepared in accordance with the Trial Dredge Protocol (TDP), Schedule E.

2. PROPOSED DREDGING

- between 19 and 21 buoys
- alongside BHP berth
- east of BHP berth
- east of LIP berth
- re align channel between 19 and 21 buoys

The above areas are indicated on Figure 1.

2.1 BETWEEN 19 AND 21 BUOYS

This area was last dredged in October 1994 when approximately 35,000 cubic metres were deposited at the Tankerton spoil ground.
This section of the channel is in an active sand wave field and is the only area currently within the Port boundary that requires regular maintenance.

2.1.1 Consequences of not dredging

Loss of available draft which increases the risk of groundings or reduces the cargo capacity of the vessel with consequential increase in costs
State will not be fulfilling its statutary obligations.

2.1.2 Methods employed to reduce the need for dredging

There are no long term methods of reducing the amount of dredging other than channel re alignment

2.1.3 Quantity and frequency of dredging

About 35,000 m3-50,000 m3 is required every 2 to 3 years depending on sandwave action

2.1.4 Dredging timetable

It is proposed to dredge this area around October 1997

2.1.5 Sampling and testing

Samples were taken and tested just prior to the 1994 dredging. The results showed medium to coarse clean sand with about 2% fines.Tests for contaminants showed that the material was acceptable for transfer. It is not proposed to retest prior to the next dredging.

2.1.6 Known sediment data

The dredged sediment grain size and contaminant analysis are as follows:

Site No	Mesh Size um	Fraction Wt.	% of Sample
HC5	1000	325	32.2
	710	35	3.5
	500	278	27.6
	250	134	13.3
	63	215	21.3
	<63	21	2.1
HC3	1000	457	43.4
	710	46	4.4
	500	229	21.7
	250	245	23.2
	63	54	5.1
	<63	23	2.2

.

CONCENTRATIONS OF SELECTED METALS AND HYDROCARBONS
(ug/g dry weight; ND = not detected)

SITE	CU	ZN	PB	SN	HG	TPH
HC1	ND	2.5	<4.5	<1.5	0.003	5.67
HC2	ND	3.2	ND	<1.7	0.04	-
HC3	7.6	5.8	ND	<2.7	0.048	-
HC4	ND	4.7	ND	<1.9	0.048	-
HC5	5.2	15.0	ND	<3.3	0.079	9.69

2.1.7 Justification for testing

Testing followed the guidelines of the TDP

2.1.8 Possible sources of contamination

None known

2.1.9 Results of previous studies

A PWD report of December 1978 indicates that there were no adverse effects from earlier dredgings.The 1995 MSE report on the 1994 dredging also indicates that there were no adverse effects from that operation.

2.1.10 Adherence to guidelines of the Protocol

The guidelines are being followed. Some localised turbidity can be expected but of a short term nature. No lasting impact from the turbidity is expected.

2.2 ALONGSIDE BHP BERTH

This area was given authority to proceed in 1994. At that time it was estimated that 2,000 m3 needed to be removed. Subsequent survey indicates that some 4,000 m3 should be removed.

2.2.1 Consequence of not dredging

Loss of draft will effect export of steel product
State will not be fulfilling its statutary obligations

2.2.2 Methods employed to reduce the need for dredging

There are no longterm methods available to reduce the need for dredging

2.2.3 Quantity and frequency of dredging

About 4,000 m3 is required to be removed every 7 to10 years

2.2.4 Dredging timetable

It is proposed to carry out these works in 1996

2.2.5 Sampling and testing

Samples were taken in 1994 and tested.Results indicated that the spoil should be disposed of on land as the concentrations for both copper and zinc were unacceptable for sea disposal.

2.2.6 Known sediment data

The dredged sediment contaminant analysis is as follows

CONCENTRATIONS OF SELECTED METALS AND HYDROCARBONS
(ug/g dry weight; ND = not detected)

SITE	CU	ZN	PB	SN	HG	TPH
BW1	6.0	80.0	ND	<4.8	0.12	-
BW2	-	-	-	-	-	76.75

The sediments were very fine silts,no grain size analysis was undertaken.

how are we managing liquid runoff- ie evaporation tanks etc

2.2.7 Justification for testing

Testing followed the guidelines of the TDP

2.2.8 Possible sources of contamination

BHP has an EPA approved factory waste outlet in the vicinity.

2.2.9 Results of previous studies

None known prior to 1994

2.2.10 Adherence to guidelines of the Protocol

The guidelines are being followed. Some localised turbidity is expected but of a short term nature. No lasting impact from the turbidity is expected.

2.3 EAST OF BHP

This area is a local high spot within the navigable turning parameters of vessels berthing at BHP.

2.3.1 Consequence of not dredging

Investigation of the Iron Monarch collision with the berth in October 1991 suggested that the collision could have been avoided with the improvement of the approach turning area.This would indicate that further collision could be expected if this dredging were not undertaken.

2.3.2 Methods employed to reduce the need for dredging

There are no longterm methods available to reduce the need for dredging

2.3.3 Quantity and frequency of dredging

About 10,000 m3 is required to be removed as a single event.Maintenance should not be

required.

2.3.4 Dredging timetable

It is proposed to carry out these works in 1997

2.3.5 Sampling and testing

Samples will taken in 1996 and tested.Results will form part of this strategy.

2.3.6 Known sediment data

Not known at this stage.

2.3.7 Justification for testing

Testing will follow the guidelines of the TDP

2.3.8 Possible sources of contamination

None known.

2.3.9 Results of previous studies

None known

2.3.10 Adherence to guidelines of the Protocol

The guidelines are being followed. Some localised turbidity is expected but of a short term nature. No lasting impact from the turbidity is expected.

2.4 EAST OF LIP

This area is a local high spot within the navigable turning parameters of vessels berthing at LIP.

2.4.1 Consequence of not dredging

The safe berthing of vessels could be impaired.

2.4.2 Methods employed to reduce the need for dredging

There are no longterm methods available to reduce the need for dredging

2.4.3 Quantity and frequency of dredging

About 10,000 m3 is required to be removed as a single event.Maintenance should not be required.

2.4.4 Dredging timetable

It is proposed to carry out these works in 1997

2.4.5 Sampling and testing

Samples will taken in 1996 and tested.Results will form part of this strategy.

2.4.6 Known sediment data

Not known at this stage.

2.4.7 Justification for testing

Testing will follow the guidelines of the TDP

2.4.8 Possible sources of contamination

None known.

2.4.9 Results of previous studies

None known

2.4.10 Adherence to guidelines of the Protocol

The guidelines are being followed. Some localised turbidity is expected but of a short term nature. No lasting impact from the turbidity is expected

3 DISPOSAL OPTIONS (SITES)

.By sea at

Grossard Point
Bass Strait
Channel south of Sandy Point

options eg barges etc. plant selection type of material operation area sources available

Tankerton spoil ground

By land at

Middle Spit
Old Tyabb Reclamation Area

3.1 GROSSARD POINT

3.1.1 Quantities to be deposited

The quantities vary depending upon the site to be dredged and the timing. The maximum would be about 100,000 m3 and the minimum 10,000 m3.

3.1.2 Material uses

Up to 80,000 m3 could be medium clean sand which could be used for beach renourishment at say Somers beach.Another possible use would be in the constuction industry.To utilise the material in either of these ways would probably require double handling, possible environmental issues and significant costs.

3.1.3 Results of previous studies

The site was used previously (1975/76) but monitoring was not undertaken,however by observation it is evident that this site has the disadvantages of being close to a navigation lane,is very exposed and it would be difficult to monitor the effects of disposal. In addition there would be a premium on costs due to the distance from the dredge sites.

3.1.4 Selection of site

The site was selected using the guidelines of section 10 of the TDP.

3.1.5 Disposal operations

The disposal of spoil will be carried out in accordance with the guidelines of section 9 of TDP if this site is selected as the preferred option.

3.2 BASS STRAIT

3.2.1 Quantities to be deposited

The quantities vary depending upon the site to be dredged and the timing. The maximum would be about 100,000 m3 and the minimum 10,000 m3.

3.2.2 Material uses

Up to 80,000 m3 could be medium clean sand which could be used for beach renourishment at say Somers beach.Another possible use would be in the constuction industry.To utilise the material in either of these ways would probably require double handling, possible environmental issues and significant costs

3.2.3 Results of previous studies

No previous studies are known,however it is apparent that the site has several disadvantages such as significant increase in costs and time to dredge due to the distance from the dredge sites,extremely exposed site where the environmental effects would be unknown and which would be very difficult to monitor.

3.2.4 Selection of site

The site was selected using the guidelines of section 10 of the TDP.

3.2.5 Disposal operations

The disposal of spoil will be carried out in accordance with the guidelines of section 9 of TDP if this site is selected as the preferred option.

3.3 CHANNEL SOUTH OF SANDY POINT

3.3.1 Quantities to be deposited

The quantities vary depending upon the site to be dredged and the timing. The maximum would be about 100,000 m3 and the minimum 10,000 m3.

3.3.2 Material uses

Up to 80,000 m3 could be medium clean sand which could be used for beach renourishment at say Somers beach.Another possible use would be in the constuction industry.To utilise the material in either of these ways would probably require double handling, possible environmental issues and significant costs

3.3.3 Results of previous studies

There are no known results of previous studies,however by observation the site has the disadvantages of being in the navigation lane,would be a new disposal site,disposal would have an unknown environmental effect and it would be difficult to monitor the effects of disposal.Possible advantages of this site are that it is relatively close to the dredge sites and has very deep water (27 - 35 m).

3.3.4 Selection of site

The site was selected using the guidelines of section 10 of the TDP.

3.3.5 Disposal operations

The disposal of spoil will be carried out in accordance with the guidelines of section 9 of TDP if this site is selected as the preferred option.

3.4 TANKERTON SPOIL GROUND

3.4.1 Quantities to be deposited

The quantities vary depending upon the site to be dredged and the timing. The maximum would be about 100,000 m3 and the minimum 10,000 m3.

3.4.2 Material uses

Up to 80,000 m3 could be medium clean sand which could be used for beach renourishment at say Somers beach.Another possible use would be in the constuction industry.To utilise the material in either of these ways would probably require double handling, possible environmental issues and significant costs

3.4.3 Results of previous studies

Monitoring results from the 1994 dredging operations have indicated that there were no deliterious effects.Turbidity measurements marginally exceeded background levels for a very short time after disposal (20 minutes) and then returned to normal.Sediment stakes and hydrographic survey indicated no nett gain or loss although there are active sandwaves in the area.Photo plots showed no sign of sediment deposition in the intertidal zone.Whilst this monitoring was not exhaustive it does indicate that the spoil ground could be used again for disposal of sands.Monitoring of the spoil ground is continuing.For future monitoring programmes other methods of tracing sediment movement such as dye tracing will be considered.

3.4.4 Selection of site

The site was selected using the guidelines of section 10 of the TDP.

3.4.5 Disposal operations

The disposal of spoil will be carried out in accordance with the guidelines of section 9 of TDP if this site is selected as the preferred option

The advantages of each are indicated above and it could be considered that each could be used for a different dredging operation.For instance the sand from the main channel could be deposited at Tankerton and the spoil from both LIP and BHP could go to Old Tyabb as the material dredged may be different and may require different dredging equipment.

In addition by moving the channel 50M. to the west between 19 and 21 buoys future dredging in this area could be significantly reduced or even no longer required. An estimated once off dredging of 70 to 80,000M3 could be balanced within 4 to 6 years of maintenance dredging at 35,000M3 every 2 to 3 years.It is believed that dredging 30,000M3 every 10 years would be the worst situation arising from this scenerio The channel markers would then be moved 50M to the west if this option were to be selected.

3.3 CHANNEL SOUTH OF SANDY POINT

3.3.1 Quantities to be deposited

The quantities vary depending upon the site to be dredged and the timing. The maximum would be about 100,000 m3 and the minimum 10,000 m3.

3.3.2 Material uses

Up to 80,000 m3 could be medium clean sand which could be used for beach renourishment at say Somers beach.Another possible use would be in the constuction industry.To utilise the material in either of these ways would probably require double handling, possible environmental issues and significant costs

3.3.3 Results of previous studies

There are no known results of previous studies,however by observation the site has the disadvantages of being in the navigation lane,would be a new disposal site,disposal would have an unknown environmental effect and it would be difficult to monitor the effects of disposal.Possible advantages of this site are that it is relatively close to the dredge sites and has very deep water (27 - 35 m).

3.3.4 Selection of site

The site was selected using the guidelines of section 10 of the TDP.

3.3.5 Disposal operations

The disposal of spoil will be carried out in accordance with the guidelines of section 9 of TDP if this site is selected as the preferred option.

3.4 TANKERTON SPOIL GROUND

3.4.1 Quantities to be deposited

The quantities vary depending upon the site to be dredged and the timing. The maximum would be about 100,000 m3 and the minimum 10,000 m3.

3.4.2 Material uses

Up to 80,000 m3 could be medium clean sand which could be used for beach renourishment at say Somers beach.Another possible use would be in the constuction industry.To utilise the material in either of these ways would probably require double handling, possible environmental issues and significant costs

3.4.3 Results of previous studies

Monitoring results from the 1994 dredging operations have indicated that there were no deliterious effects.Turbidity measurements marginally exceeded background levels for a very short time after disposal (20 minutes) and then returned to normal.Sediment stakes and hydrographic survey indicated no nett gain or loss although there are active sandwaves in the area.Photo plots showed no sign of sediment deposition in the intertidal zone.Whilst this monitoring was not exhaustive it does indicate that the spoil ground could be used again for disposal of sands.Monitoring of the spoil ground is continuing.For future monitoring programmes other methods of tracing sediment movement such as dye tracing will be considered.

3.4.4 Selection of site

The site was selected using the guidelines of section 10 of the TDP.

3.4.5 Disposal operations

The disposal of spoil will be carried out in accordance with the guidelines of section 9 of TDP if this site is selected as the preferred option

"K1"

DREDGE PROTOCOL - PORT OF HASTINGS
DREDGING STRATEGY - 1994 TO 2004

MAINTENANCE DREDGING

Statutory Requirement

Westernport Development Act 1967 requires the State to provide an entrance channel of 14.3 mts and berth of 15.8 mts depth.

Westernport Steelworks Act 1970 requires the State to provide an entrance channel of 9.1 mts and berth of 12.1 mts depth.

Hydrographic Survey Monitoring

The PMA surveys the berthing pocket and swing basin annually, and the approach channel every six months.

Past Experience

It has been found that the channel in the vicinity of 19-23 buoys passes through an active sand wave field, and this needs dredging every two/three years.

Berths have generally been free of siltation, with some siltation build up at SW2, probably due to prop wash material transfer from SW1. Berth pockets have been dredged about every 10 years.

IMMEDIATE REQUIREMENTS

Shipping approach channel is currently operating at 13.7 mts and requires immediate dredging to restore statutory requirement.

Swing basin off LIP needs to be maintained at 11 mts.

SW2 is currently operating at 11 mts and requires immediate dredging to restore statutory requirements.

Material Monitoring

Study of material to be dredged and disposal site (Tankerton) in accord with TDP being undertaken in February 1994.

Dredging Project

During April/May 1994 (depending on availability) it is proposed to utilise PMA's AM Vella (trailing suction) dredger over a two week period to remove approximately 50,000 cubic metres of material.

Material is mainly sand with no expected contaminants.

"K2"

FUTURE PROGRAM

- Hydrographic and materials monitoring will be carried out on a regular basis. Hydro surveys every six months and annually, and material monitoring as required.

- It is not expected to conduct any capital dredging in the next 5 years.

- **Shipping Channel**

  This will need dredging every 2 to 3 years in the area of the sand wave field. PMA are currently examining alternatives that may alleviate the necessity for this regular dredging project.

- **Berthing Pockets**

  Every 7 to 10 years the berthing pockets will need to be dredged out.

PORT OF HASTINGS

DREDGING PROJECTS

DATE	LOCALITY	DISPOSAL	M3 SHORE	M3 SEA
1921	HANNS INLET	SHORE	760000	
1965	STONY POINT	SHORE	142000	
1965	CRIBPOINT	TANKERTON		324000
1969	LIP	PECKS POINT		295000
1969	LIP	HASTINGS BIGHT	157000	
1969	WATSONS INLET	SHORE	15000	
1970	YARINGA	SHORE	76500	
1971	STAWLES INLET	MUD FLATS		2300
1971	HANNS INLET	SHORE	50000	
1972	BHP	OLD TYABB	676000	
1972	RHTHERFORD INLET	MUD BANK		2700
1972	WARNEET	LOCAL		1500
1972	BLIND BIGHT	BEACH		11000
1972	SAN REMO	SHORE	2600	
1972	TOORADIN	ISLAND		19100
1973	HASTINGS	SHORE		
1975	SHIP CHANNEL	GROSSARD POINT		10000
1980	SHIP CHANNEL	TANKERTON		10000
1988	SHIP CHANNEL	TANKERTON		24000
1988	YARINGA	SHORE	35000	
1990	STONY POINT	SHORE	500	
1991	TOORADIN	SHORE	500	
1994	STONY POINT	MUD FLATS		500
1994	TANKERTON	TANKERTON		12500
1994	HASTINGS	ISLAND		4000
1994	SHIP CHANNEL	TANKERTON		35000
			1915100	751600

The following table summaries dredging within the Port of Hastings since 1965.

Date	Locality	Disposal	M3 Shore	M3 Sea
1965	Stony Point	Shore	142,000	
1965	Crib Point	Tankerton		324,000
1969	LIP	Pecks Point		295,000
1969	LIP	Hastings Bight	157,000	
1972	BHP	Old Tyabb	676,000	
1975	Shipping Channel	Grossard Point		10,000
1980	Shipping Channel	Tankerton		10,000
1988	Shipping Channel	Tankerton		24,000
1994	Shipping Channel	Tankerton		35,000
2002	BHP Berths	Old Tyabb	16,000	

1.0 Introduction

Patrick Ports Hastings a division of Asciano Ltd manages the Port Waters of the Port of Hastings under the Channel Operating Agreement (Hastings) with the State Government of Victoria. The Victorian Regional Channels Authority administers this agreement. This agreement commenced on July 1st 1997, with an initial term of ten years. Two further terms of five years each are available to Patrick Ports Hastings if they so desire. Notice for a second term has been issued and subsequently approved, granting Patrick Ports Hastings management rights to June 30th 2012.

2.0 Strategy Scope

This strategy has been developed for the Port of Hastings Waters over the period 2006 to 2012 and excludes all capital dredging which may occur with any one off proposals or the future expansion of the Port in the vicinity of the BlueScope Wharves, Crib Point Jetty and any associated channel deepening.

3.0 Agreement Obligations

Under the terms and conditions of the operating agreement, Patrick Ports Hastings, with respect to dredging, are required to;

a) Clause 6.1 Maintain the channels to a navigable standard and to dredge the channels to at least the depths required under Marine Safety Victoria standards and specified depths as contained in the agreement, Schedule A.
b) Clause 6.2 If so required and at Toll's expense establish, develop and maintain new channels during the term of the agreement.
c) Clause 6.3 Dispose of dredged material lawfully and in accordance with guidelines or standards published by any authority.
d) Clause 9.3 In consultation with the Dredge Protocol Management Committee prepare and implement a dredge protocol for the Port Waters.
e) Clause10 Perform all of the States obligations under the State agreements.
    - Western Port (Steel Works) 1970 - Provide and maintain channels, berths and swing basins as maybe reasonable required by the company (BlueScope) from time to time.
    - Westernport Development 1970 - Provide and maintain a navigable channel of 14.3metres minimum depth, north of the Crib Point jetty to the Long Island Point berth, with a berth pocket of 15.8 metres.

With respect to the abovementioned acts, only north of Crib Point Jetty is considered. For the Western Entrance and the southern section of the north arm, the WesternPort (Oil Refinery) Act stipulated the required minimum channel depths. 14.9 metres from Point Grant to Tortoise Head, 14.3 metres from Tortoise Head to the Jetty area and 15.8 metres alongside the jetties. With the closure of the refinery in 1985 the Act was amended to waiver certain obligations, including clause 3 (b), which relates to dredging and maintaining the required depths.

3.1 Reduced Depths

Under clause 6.4 of the agreement, references are made to two Notices to Mariners, advising of reduced depths.

- Notice 7/97 Advises of reduce maintained depth to 14.2 metres in the North Arm Channel between No. 19 to No. 21 Buoys.
- Notice 8/97 Advises of Silting in the two berthing pockets of the Steel Works berths 1 and 2, reducing depths to approximately 11.0 metres.

As a consequence of the hydrographic survey of the Western Channel in 2007 in the vicinity of No.13 to No. 15 Buoy an area of shoaling was discovered. This area is approximately 100 metres in length, 10 metres wide and runs perpendicular to the channel and reduces the depth to 13.3 m. Closer inspection by divers in July 2008 reviled that the materials was coarse sand. Notice to Mariners 64T -2008 was issued in April 2008 advising of the reduced depth and to exercise caution in the vicinity. Further hydrographic surveys are programmed on a annual basis for monitoring purposes.

4.0 Declared Depths

For the purposes of this strategy, depths as specified in Schedule 2 of the Agreement have been adopted. These are as follows:

Western Channel Fairway to Tortoise Head	14.90 metres
North Arm Channel Tortoise Head to Long Island Point including swing basin	14.30 metres
Crib Point Jetty No. 1 swing basin	14.30 metres
Crib Point Jetty No. 2 berth southern approach	12.8 metres
Steel Works channel and swinging basin	9.10 metres
Crib Point jetty No. 1 berth alongside	15.80 metres
Crib Point Jetty No. 2 berth alongside	12.80 metres
Long Island Point Jetty berth alongside	15.80 metres
Steel Works No. 1 berth (RORO) alongside	12.10 metres
Steel Works No. 2 berth (Conventional) alongside	12.10 metres

It is noted that no depths are declared for the channels and berths at Stony Point and the anchorages.

5.0 Port Dredging Summary

The following table summaries dredging within the Port of Hastings since 1965.

Date	Locality	Disposal	M3 Shore	M3 Sea
1965	Stony Point	Shore	142,000	
1965	Crib Point	Tankerton		324,000
1969	LIP	Pecks Point		295,000
1969	LIP	Hastings Bight	157,000	
1972	BHP	Old Tyabb	676,000	
1975	Shipping	Grossard Point		10,000

	Channel			
1980	Shipping Channel	Tankerton		10,000
1988	Shipping Channel	Tankerton		24,000
1994	Shipping Channel	Tankerton		35,000
2002	BHP Berths	Old Tyabb	16,000	

6.0 Hydrographic Survey

In accordance with Marine Safety Victoria Standard for Dredging and Maintenance of Navigation Channels in Specified Ports in Victorian State Waters, 1998, a Channel Operator is required to undertake hydrographic surveys of channels managed and controlled by the operator. The purpose of these surveys is to ascertain that depths are maintained and whether changes are occurring, necessitating dredging. To comply with this standard a program of surveys for Port Waters has been developed with frequencies taking into account past knowledge of areas which may have the propensity for change, or have depths which are nearing the minimum declared depths.

In summary the program of surveys is:

Area	**Survey Frequency**
Berths	
Steel Works berths 1 and 2	Annually
Long Island Point berth	Annually
Crib Point No. 1 and 2 berths	Annually
Crib Point No. 3 berth	As required
Stony Point Jetty	4 Years
Swing Basins	
Steel Works	Biennial
Long Island Point	Biennial
Crib Point Jetty 1 and 2	Biennial
Stony Point Jetty	4 Years
Special Surveys	
No. 19 to 21 Sand wave area	Annually
Tankerton Spoil ground	4 years
Western Entrance 13 to 15 buoys	Annually
Anchorages	
East Arm	5 years
North Arm	5 years
Channels	
North Arm	5 years
North Arm Secondary Channel	5 Years
Western Entrance	8 years

7.0 Previous Dredging Strategy

The previous dredge strategy was developed in 1994 by the Port of Melbourne Authority and covered the period from 1994 to 1997. In this strategy it proposed to dredge:

- The channel between19 and 21 buoys in the sand wave field in 1997
- The berthing pockets of the two Steel Works berths in 1996
- An area within the Steel Works swing basin in 1997
- An area within the LIP swing basin in 1997
- Re alignment of the channel between 19 and 21 buoys.

None of these works proceeded due to the State Governments decision to contract out the management of the Port of Hastings

8.0 Dredging Activity Since 1997

At the commencement of the Operating Agreement, two areas were noted as having reduced depth, Steel Works Berths and sand wave formations between No.19 and 21 buoys. As previously mentioned above Notices to Mariners where issued in both instances.

The Steel Works berths were dredged under consent from the Department of Natural Resources and Environment in 2002, with approximately 16,000 cum of material removed and deposited on the Old Tyabb reclamation area. Subsequent Notices to Mariners 57/02 were issued declaring depths being re-established to 12.1 metres within both berthing pockets.

With respect to the sand wave field in the vicinity of No. 19 and 21 buoys, as the reduction of depth was caused by only a few isolated waves peaking at 14.00, it was viewed as not necessary to instigate dredging of the channel. This decision was taken in light of previous dredging activities and the dynamic nature of the seabed topography, which resulting in declared depths only being maintained for a relative short period post dredging, with sand waves reforming and peaking above the declared depth of 14.3 m. Instead it was decided to monitor the depths closely by Hydrographic surveys at six monthly intervals.
In 2001, Lawson and Treloar were engaged to analysis the survey data gathered over several years in an attempt to better understand the sand wave behaviour and thereby optimise a management strategy. In summary, it was discovered from this analysis that sand is progressively moving in a southerly direction, with waves peaking at a maximum of around 13.9m. It was also determined that as the sand wave field was highly dynamic in its movements of material and that dredging would not provide a long term solution in maintaining depth. Further comparisons of survey data were carried out in 2003, which confirmed these previous findings.

In the most recent survey of April 2008, only two spots on the channel's eastern boundary, in the vicinity of No. 19 had peaked at 14.2m, further confirming previous analyses.

9.0 Proposed Dredging 2006 to 2012

Based on the hydrographic survey data collected over the previous ten years and in accordance with the specified depths, the following strategy has been developed.

Location	Comments	Strategy
Western Entrance to Tortoise Head	Depths exceed specified minimum, no changes to seabed profile.	Continue current survey frequency. No Dredging.
North Arm No. 19 to 21 Buoys.	Seabed profiles continually changing, with depth reduction not exceeding 13.90 m. from time to time. Notice to Mariners issued as required.	Continue monitoring through annual surveys. No dredging
Western Entrance in the vicinity on No. 13 to No. 15 Buoys.	Shoaling on Eastern side of channel. Notice to Mariners issued in April 2008 64T-2008	Continue to monitor area with 12 monthly surveys. No dredging in the immediate term.

Location	Comments	Strategy
North Arm No. 21 to LIP Swing Basin	Depths exceed specified minimum, no changes to seabed profile.	Continue current survey frequency. No dredging
Channel to Steel Works Berths	Depths exceed specified minimum, no changes to seabed profile	Continue current survey frequency. No dredging
Eastern Anchorage.	No Depths Specified. No changes to seabed profile	Continue current survey frequency. No dredging
North Arm Anchorage	No. Depths Specified. No changes to seabed profile	Continue current survey frequency. No dredging
Tankerton Spoil ground	No Specified depth. No changes to seabed profile	Cease surveying this area.
Swing basin Crib Point Jetties	Depths exceed specified minimum. No changes to seabed profile	Continue current survey frequency. No dredging
Swing basin LIP jetty	Depths exceed specified minimum. No changes to seabed profile.	Continue current survey frequency. No dredging
Swing basin Steel Works Wharves	Depths exceed specified minimum. No changes to seabed profile	Continue current survey frequency. No dredging
Stony Point jetty and channels	No specified depths. No changes to seabed profile.	Continue current survey frequency. No dredging
Crib Point Jetty No. 1 berth	Minor reduction in depth at northern end of berth pocket (15.10 m.) and along berthing line. This situation was also previously evident in surveys going back to 1992. No significant change over this period from 1992.	Continue current survey frequency. No dredging. Maintenance dredging could be scheduled in conjunction with capital dredging for Port expansion in 2015.
Crib Point Jetty No. 2 berth	Depths exceed minimum. No changes to seabed profile.	Continue current survey frequency.
LIP jetty berth	Minor reduction in depth at northern end of berth pocket (15.6 m.) and along berthing line. This situation was also previously evident in surveys going back to 1992. No significant change over this period from 1992.	Continue current survey frequency. No dredging. Maintenance dredging could be scheduled in conjunction with capital dredging for Port expansion in 2015.

10.0 Conclusion

For the foreseeable future, up to 2012, no maintenance dredging will be required within the Port of Hastings. However areas with the propensity for change or have marginal under keel clearance will need to be monitored closely. In particular the sand wave field between no. 19 and 21 buoys and the berthing pockets for Crib Point, Long Island Point jetties and the Steel Works. It is considered that the existing frequency of surveys will provide a sufficient level of confidence with respect to maintaining minimum depths.

With respect to clause 9.3 (b) of the Operating Agreement requiring consultation with the Dredge Protocol Management Committee or its successor, this has occurred previously, during the one off project to dredge the berthing pockets at the Steel Works wharves. For this strategy as no dredging is to occur in the foreseeable period, no consultation is warranted.

Written and amended by
Rick Purton
Works Engineer_____

Authorised by
Captain Dick Cox
Harbour Master
23rd November 2006 _____

VICTORIAN NOTICE TO MARINERS

PORT OF HASTINGS

The following Notice to Mariners is published for general information.

STONY POINT, 6 February 1997

AUSTRALIA - VICTORIA

NO. 8/97 (T)

PORT OF HASTINGS

REDUCED DEPTH STEEL INDUSTRY WHARVES

Date: With immediate effect.

Reference Position: WGS 84 38°17.5'S 145°13.74E

Details: No 1 Wharf (RoRo)

Silting has occurred in the vicinity of the wharf berthing dolphins. Maintained Depth amended to 11.0 metres.

No 2 Wharf

Silting has occurred in the vicinity of the wharf generally amending the maintained depth to 11.0 metres with 10.0 metres at the extreme southern end.

Charts affected: AUS 156, AUS 156.

Further Notice : Further notice will be issued.

WILLIE SMITH
HARBOUR MASTER
PORT OF HASTINGS

VICTORIAN NOTICE TO MARINERS

TOLL
WesternPort

The following Notice to Mariners is published for general information.

STONY POINT, October 3, 2002

AUSTRALIA - VICTORIA
N0. 57/02

PORT OF HASTINGS
DEPTH STEEL INDUSTRY WHARVES RESTORED

Date: With immediate effect.

Reference Position: WGS 84 $38^{0}17.55'$ S $145^{0}13.74'$ E

Details: **The depth at the Steel Industry wharves No's 1 & 2 has been restored to the declared depth of 12.1 Metres**

Charts affected: AUS151 AUS801

Further Notice: No further Notice will be issued.

for **DICK COX**
HARBOUR MASTER
PORT OF HASTINGS

PATRICK

PATRICK PORTS HASTINGS

VICTORIAN NOTICE TO MARINERS

The following Notice to Mariners is published for general information.

Port of Hastings 21st April 2008

Australia – Victoria

64T – 2008

Shoaling in Channel between Nos 13 and 15 buoys

Date: 21st April 2008

Details: A narrow band of shoaling (10metres wide) has been detected extending from the 14.2 metre sounding at 38°25'32"S 145°13'54"E (chart AUS 151) approximately halfway between Nos.13 & 15 buoys in the shipping channel off Sandy Point into the shipping channel (maintained depth 14.3 metres). The shoal extends 100 metres into the shipping channel with a least depth of 13.4 metres.
The shipping channel is 550 metres wide at this position.

Patrick Ports Hastings is doing further investigations into the appearance of this shoal.

Deep draft vessels should exercise caution in this vicinity and keep to the western side of the shipping channel.

Chart affected: Aus 151

Further Notice: Further Notices will be issued.

If further information is required please contact the Harbour Master during business hours on (03) 59839406.

Dick Cox
Harbour Master
Port of Hastings

VICTORIAN NOTICE TO MARINERS

PORT OF HASTINGS

The following Notice to Mariners is published for general information.

STONY POINT, 5 February 1997

AUSTRALIA - VICTORIA

NO. 7/97 (T)

PORT OF HASTINGS

REDUCED DEPTH IN DREDGED CHANNEL

Date: 03.02.97

Reference Position: WGS 84 38°23.12S 145°14.78E No 19 Buoy
38°22.32S 145°14.58E No 21 Buoy

Details: Sand Waves have formed in the Dredged Channel between No's 19 & 21 Buoys, reducing the maintained depth to 14.2 metres.

Charts affected: AUS 151, AUS 156.

Further Notice : Further notice will be issued.

WILLIE SMITH
HARBOUR MASTER
PORT OF HASTINGS

VICTORIAN NOTICE TO MARINERS

TOLL
WesternPort

The following Notice to Mariners is published for general information.

STONY POINT, 19 December 2000

AUSTRALIA - VICTORIA
NO. 61/00(T)

PORT OF HASTINGS
REDUCED DEPTH IN CHANNEL

Date: 19 December 2000

Reference Position: WGS84 Lat 38°23.12S Long 145°14.78E No 19 Buoy
Lat 38°22.32S Long 145°14.58E No 2 Buoy

Details: A Sand Wave has peaked at 14.0m in the Channel between No 19 & 21 Buoys. Monitoring is continuing.

Charts Affected AUS151, AUS150

Further Notice: Further notice will be issued.

DICK COX
HARBOUR MASTER
PORT OF HASTINGS

GHD - Macknight

CONSULTING ENGINEERS
MARINE PROJECTS

TNT GEELONG PORT

TIDAL ANALYSIS AT STONY PT WESTERNPORT IN RELATION TO SAND WAVE REDUCTION IN CHANNEL DEPTH

SEPTEMBER 1997

PREPARED BY:

GHD-Macknight Pty Ltd
Suite 7, 11 Beach Street
Port Melbourne Vic 3207
Australia
A.C.N. 060 477 116

Ph: 3 9645 1633
Fax: 3 9645 1617

INTRODUCTION

In September 1997 GHD-Macknight were commissioned by TNT Geelong Port to carry out a tidal analysis of Stony Point, Western Port to determine the necessity of dredging sand waves between number 19 and 21 buoys. By controlling times of ship movements in the port the need for periodic dredging of sand waves may be avoided.

The port has a legislated navigation depth of -14.3 Chart Datum. The channel alignment and location has historically been selected to coincide with naturally deep water.

In the vicinity of channel marks 19 and 21 the seabed comprises deep sands which naturally form large sand waves under the action of strong tidal currents. In several locations the sand wave crests grow to a level of about -13.7m Chart Datum. Dredging using trailing suction dredges has been used in an attempt to control the level of the sand waves every few years. However information available suggests that this is ineffective and the sand waves quickly re-establish to their crest level of -13.7m within a matter of weeks. The dredging is a high cost item and strong environmental opposition to dredging and disposal of dredged spoil (even clean sands) make any dredging project slow and difficult to arrange.

The tidal range at Stony Point is about 2.5m. With the current level of shipping of less than 100 vessels per annum, the use of tidal height assistance to achieve the navigation depth of 14.3m was raised as a viable and practical option to dredging.

Under this scenario vessels requiring the full 14.3m of navigation depth would need to program their arrival at the 19 to 21 buoy location to have at least 0.6m of tide.

An analysis of tides at Stony Point was carried out to establish the feasibility of this proposal. Tides were predicted for the calendar year 1998 and levels were output at 10 minute intervals. Predications were supplied by the National Tidal Facility, The Flinders University of South Australia. An analysis of predicted tide levels was undertaken to provide the following information:-

- the number of occurrences during the entire year that the tides descended below 0.6m Chart Datum
- the total time when the tides fell below 0.6m
- percentage of time and tides fell below 0.6m
- delay time - the time it takes the tide to return to a level of 0.6m once it has fallen below this level
- a listing of the date and time of each period the tide falls below 0.6m

With this information the Port can determine whether careful management of traffic within the Port is preferable to periodic dredging of the site.

TIDAL PREDICTIONS

Tidal data supplied by the National Tidal Facility, (copyright reserved) was based on a harmonic analysis of 112 constituents at Stony Point. Each tidal constituent, obtained from observations, is defined by a separate component of the motion of the earth and moon about the sun and

contributes to a tidal fluctuation. The sum of all components produces the total tidal behaviour. Tides were generated at 10 minute intervals over a period of 1 year during 1998.

TIDAL ANALYSIS AND RESULTS

Based on the predicted 10 minute tide levels a small program was prepared to provide the required analysis of the 1988 tides at or less than 0.6m. The results are shown in Appendix 1.0. A summary of this data is shown in Table 1.0 and shows monthly, seasonal and yearly behaviour.

RESULTS

Table 1.0 gives an indication of the occurrence of tides below 0.6m Chart Datum, which equates to depths less than 14.3m for assumed sand waves at -13.7m. The total time over the entire year the tide was below this level was found to be 697 hours or nearly 8 percent of the year 1998. This was broken down into monthly and seasonal components. The lowest tides were found to occur in the summer months most significantly during January and February. During these two months both the number of occurrences and the mean delay time of the tide was at its peak. For February the percentage occurrence was at a high of 11.51 percent with 35 occurrences and a mean delay time of 2.21 hours. This is contrasted by the winter months specifically June and July where the percentage time occurrence reached a low of 5.23 percent with 20 occurrences and a mean delay time of 1.88 hours. A second lower peak appeared in September with the occurrence rising to 8.22 percent.

Figure 1 illustrates the percentage of time that the water depth in the vicinity of the sand waves in the channel between buoys 19 and 21 is greater than 14.3m. Figure 2 shows the same data as availability of depths as a percentage of time. For example the required depth of 14.3m is available for 92% of the time in 1998.

CONCLUSIONS

Overall the results indicate that if a navigation depth of 14.3m is required then vessels that might otherwise arrive at any time in the port would be delayed by about 2 hours if the tide was less than 0.6m.

With some minor foresight vessel departure and arrival times at the critical area in the vicinity of buoys 19 and 21 could be planned to coincide with a minimum predicted tide of 0.6m required to achieve a least depth of 14.3m over the sand waves which reach a level of -13.7m.

REMARKS

The analysis presented ignores tidal residuals which are a common event in most ports. In our experience tidal residuals to about 300mm generally occur at Stony Point as a result of water level fluctuations in Bass Strait which may result from local meteorological events or in some cases from events in the Southern Ocean.

Tidal residuals cannot generally be predicted and would affect the available navigation depth in the port in any case.

A number of the steel industry vessels using the shipping channel draw less than 10m, and hence the number of vessels requiring a navigation depth of 14.3m is far less than the 100 or so vessels using the channel.

	Mean Delay Time (hours)	Standard Deviation	Number of Occureneces	Total delay time (hours)	Percentage Time Tide >0.6m
January	2.30	0.58	37	85.17	88.55
February	2.21	0.53	35	77.33	88.49
March	2.11	0.77	32	67.5	90.93
April	2.21	0.87	23	50.83	92.94
May	2.22	0.60	20	44.33	94.04
June	1.88	0.56	20	37.67	94.77
July	1.84	0.53	22	40.83	94.51
August	1.66	0.65	35	58	92.2
September	1.79	0.79	33	59.17	91.78
October	2.04	0.81	28	56.83	92.36
November	2.30	0.87	22	50.5	92.99
December	2.10	0.90	33	69.17	90.7
Summer	2.21	0.68	105	231.67	89.27
Autumn	2.17	0.75	75	162.67	92.63
Winter	1.77	0.60	77	136.5	93.82
Spring	2.01	0.83	83	166.5	92.38
Yearly Total	2.05	0.74	340	697.33	7.96

Tide < 0.6m

Table 1.0 : Tide Occurrence Summary for 1998

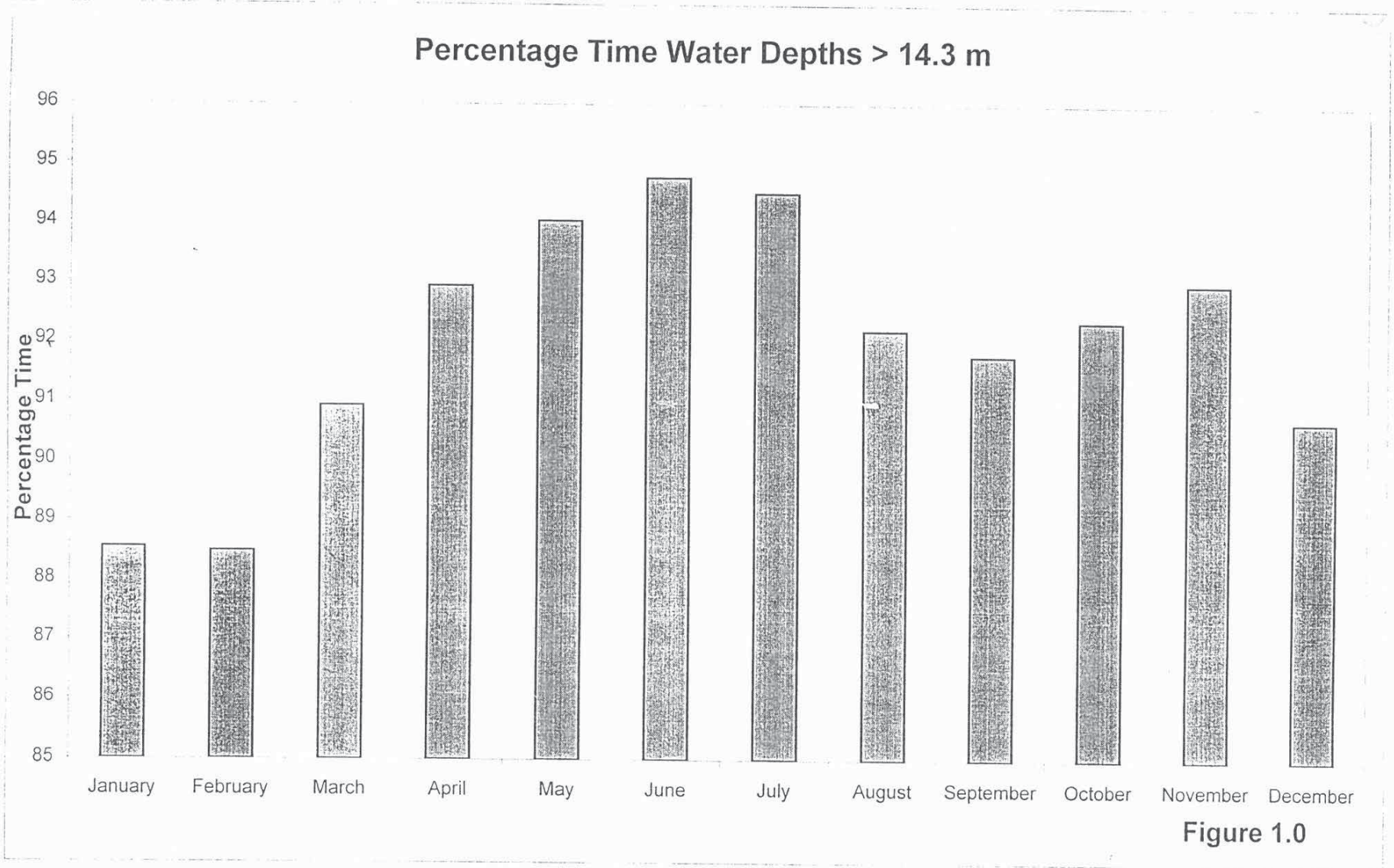

Percentage Time Water Depths > 14.3 m
Percentage Time
96
95
94
93
92
91
90
89
88
87
86
85
January
February
March
April
May
June
July
August
September
October
November
December

Figure 1.0

Variation of Water Depth with Time at Buoys 19/21 Based on Stony Point Tides for 1998

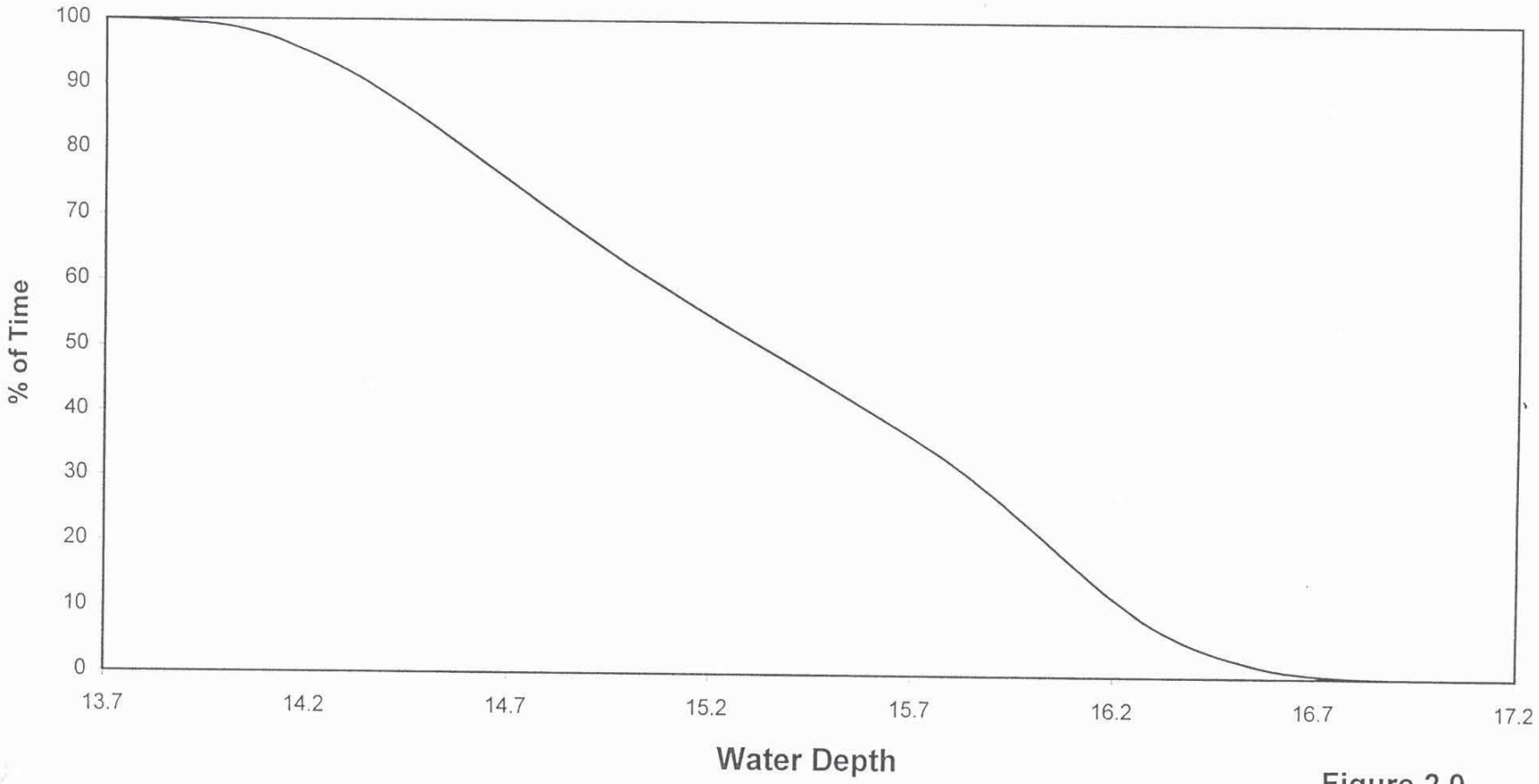


Figure 2.0

APPENDIX 1.0 STONY POINT TIDAL ANALYSIS FOR 1998

No	Day	Delay Time < 0.6	Delay Time > 0.6	Delay
1	1/01/98	18:50	21:50	3 hr 0 min
2	2/01/98	19:40	22:40	3 hr 0 min
3	3/01/98	20:30	23:30	3 hr 0 min
4	4/01/98	10:00	11:30	1 hr 30 min
5	4/01/98	21:30	0:10	2 hr 40 min
6	5/01/98	10:30	12:30	2 hr 0 min
7	5/01/98	22:30	0:40	2 hr 10 min
8	6/01/98	11:00	13:20	2 hr 20 min
9	6/01/98	23:40	1:00	1 hr 20 min
10	7/01/98	11:40	14:10	2 hr 30 min
11	8/01/98	12:30	15:00	2 hr 30 min
12	9/01/98	13:10	16:00	2 hr 50 min
13	10/01/98	14:10	17:00	2 hr 50 min
14	11/01/98	15:20	18:00	2 hr 40 min
15	12/01/98	16:20	19:10	2 hr 50 min
16	13/01/98	17:20	20:10	2 hr 50 min
17	14/01/98	18:20	21:10	2 hr 50 min
18	15/01/98	19:10	22:00	2 hr 50 min
19	16/01/98	20:00	22:40	2 hr 40 min
20	17/01/98	9:40	10:30	0 hr 50 min
21	17/01/98	20:50	23:10	2 hr 20 min
22	18/01/98	10:00	11:20	1 hr 20 min
23	18/01/98	21:40	23:40	2 hr 0 min
24	19/01/98	10:30	12:10	1 hr 40 min
25	19/01/98	22:40	23:50	1 hr 10 min
26	20/01/98	10:50	12:40	1 hr 50 min
27	21/01/98	11:20	13:20	2 hr 0 min
28	22/01/98	11:50	13:50	2 hr 0 min
29	23/01/98	12:20	14:30	2 hr 10 min
30	24/01/98	13:00	15:10	2 hr 10 min
31	25/01/98	13:50	15:50	2 hr 0 min
32	26/01/98	14:50	16:50	2 hr 0 min
33	27/01/98	15:50	18:00	2 hr 10 min
34	28/01/98	16:50	19:20	2 hr 30 min
35	29/01/98	17:40	20:30	2 hr 50 min
36	30/01/98	18:40	21:30	2 hr 50 min
37	31/01/98	19:30	22:30	3 hr 0 min
38	1/02/98	8:50	10:30	1 hr 40 min
39	1/02/98	20:30	23:20	2 hr 50 min
40	2/02/98	9:20	11:40	2 hr 20 min
41	2/02/98	21:20	0:00	2 hr 40 min
42	3/02/98	9:50	12:40	2 hr 50 min
43	3/02/98	22:30	0:30	2 hr 0 min
44	4/02/98	10:30	13:30	3 hr 0 min
45	4/02/98	23:40	1:00	1 hr 20 min
46	5/02/98	11:10	14:20	3 hr 10 min
47	6/02/98	12:00	15:00	3 hr 0 min
48	7/02/98	12:50	15:40	2 hr 50 min
49	8/02/98	13:50	16:30	2 hr 40 min
50	9/02/98	15:00	17:20	2 hr 20 min
51	10/02/98	16:20	18:20	2 hr 0 min
52	11/02/98	17:30	19:20	1 hr 50 min
53	12/02/98	18:30	20:30	2 hr 0 min

54	13/02/98	19:20	21:20	2	hr	0	min
55	14/02/98	20:00	22:00	2	hr	0	min
56	15/02/98	9:00	10:10	1	hr	10	min
57	15/02/98	20:50	22:40	1	hr	50	min
58	16/02/98	9:20	11:10	1	hr	50	min
59	16/02/98	21:40	23:00	1	hr	20	min
60	17/02/98	9:40	11:50	2	hr	10	min
61	17/02/98	22:20	23:20	1	hr	0	min
62	18/02/98	10:10	12:30	2	hr	20	min
63	19/02/98	10:30	13:00	2	hr	30	min
64	20/02/98	11:00	13:30	2	hr	30	min
65	21/02/98	11:30	14:10	2	hr	40	min
66	22/02/98	12:10	14:40	2	hr	30	min
67	23/02/98	13:00	15:20	2	hr	20	min
68	24/02/98	14:00	16:10	2	hr	10	min
69	25/02/98	15:10	17:10	2	hr	0	min
70	26/02/98	16:30	18:30	2	hr	0	min
71	27/02/98	17:40	19:50	2	hr	10	min
72	28/02/98	18:40	21:00	2	hr	20	min
73	1/03/98	7:40	9:20	1	hr	40	min
74	1/03/98	19:30	22:00	2	hr	30	min
75	2/03/98	8:10	10:40	2	hr	30	min
76	2/03/98	20:30	22:50	2	hr	20	min
77	3/03/98	8:40	11:40	3	hr	0	min
78	3/03/98	21:30	23:30	2	hr	0	min
79	4/03/98	9:20	12:30	3	hr	10	min
80	4/03/98	22:30	0:10	1	hr	40	min
81	5/03/98	10:00	13:20	3	hr	20	min
82	5/03/98	23:30	0:40	1	hr	10	min
83	6/03/98	10:50	14:00	3	hr	10	min
84	7/03/98	11:40	14:40	3	hr	0	min
85	8/03/98	12:30	15:10	2	hr	40	min
86	9/03/98	13:40	15:40	2	hr	0	min
87	10/03/98	15:20	16:00	0	hr	40	min
88	16/03/98	8:20	9:50	1	hr	30	min
89	17/03/98	8:40	10:40	2	hr	0	min
90	18/03/98	9:00	11:20	2	hr	20	min
91	19/03/98	9:30	12:00	2	hr	30	min
92	20/03/98	10:00	12:30	2	hr	30	min
93	21/03/98	10:30	13:00	2	hr	30	min
94	22/03/98	11:00	13:40	2	hr	40	min
95	23/03/98	11:40	14:10	2	hr	30	min
96	24/03/98	12:30	14:50	2	hr	20	min
97	25/03/98	13:40	15:30	1	hr	50	min
98	26/03/98	15:20	16:00	0	hr	40	min
99	29/03/98	6:30	7:30	1	hr	0	min
100	29/03/98	19:10	20:00	0	hr	50	min
101	30/03/98	6:50	9:10	2	hr	20	min
102	30/03/98	20:00	21:10	1	hr	10	min
103	31/03/98	7:30	10:20	2	hr	50	min
104	31/03/98	20:50	22:00	1	hr	10	min
105	1/04/98	8:10	11:20	3	hr	10	min
106	1/04/98	21:40	22:50	1	hr	10	min
107	2/04/98	8:50	12:10	3	hr	20	min
108	2/04/98	22:30	23:30	1	hr	0	min
109	3/04/98	9:40	13:00	3	hr	20	min
110	3/04/98	23:40	0:00	0	hr	20	min
111	4/04/98	10:30	13:30	3	hr	0	min

112	5/04/98	11:20	14:10	2	hr	50	min
113	6/04/98	12:20	14:30	2	hr	10	min
114	7/04/98	14:00	14:30	0	hr	30	min
115	14/04/98	7:40	9:10	1	hr	30	min
116	15/04/98	8:00	10:00	2	hr	0	min
117	16/04/98	8:20	10:40	2	hr	20	min
118	17/04/98	8:50	11:20	2	hr	30	min
119	18/04/98	9:30	12:00	2	hr	30	min
120	19/04/98	10:00	12:30	2	hr	30	min
121	20/04/98	10:40	13:00	2	hr	20	min
122	21/04/98	11:30	13:30	2	hr	0	min
123	22/04/98	12:30	14:00	1	hr	30	min
124	27/04/98	5:30	7:30	2	hr	0	min
125	28/04/98	6:10	8:50	2	hr	40	min
126	29/04/98	7:00	10:00	3	hr	0	min
127	30/04/98	7:40	10:50	3	hr	10	min
128	1/05/98	8:30	11:40	3	hr	10	min
129	2/05/98	9:20	12:20	3	hr	0	min
130	3/05/98	10:20	12:50	2	hr	30	min
131	4/05/98	11:20	13:20	2	hr	0	min
132	5/05/98	12:30	13:30	1	hr	0	min
133	13/05/98	7:00	8:20	1	hr	20	min
134	14/05/98	7:20	9:20	2	hr	0	min
135	15/05/98	7:50	10:00	2	hr	10	min
136	16/05/98	8:30	10:40	2	hr	10	min
137	17/05/98	9:10	11:20	2	hr	10	min
138	18/05/98	9:50	12:00	2	hr	10	min
139	19/05/98	10:40	12:30	1	hr	50	min
140	20/05/98	11:30	13:00	1	hr	30	min
141	25/05/98	4:10	5:30	1	hr	20	min
142	26/05/98	4:50	7:10	2	hr	20	min
143	27/05/98	5:40	8:20	2	hr	40	min
144	28/05/98	6:30	9:30	3	hr	0	min
145	29/05/98	7:30	10:20	2	hr	50	min
146	30/05/98	8:20	11:00	2	hr	40	min
147	31/05/98	9:10	11:40	2	hr	30	min
148	1/06/98	10:10	12:10	2	hr	0	min
149	2/06/98	11:20	12:30	1	hr	10	min
150	11/06/98	6:20	7:30	1	hr	10	min
151	12/06/98	6:50	8:40	1	hr	50	min
152	13/06/98	7:30	9:30	2	hr	0	min
153	14/06/98	8:00	10:20	2	hr	20	min
154	15/06/98	8:50	11:00	2	hr	10	min
155	16/06/98	9:40	11:40	2	hr	0	min
156	17/06/98	10:30	12:10	1	hr	40	min
157	18/06/98	11:50	12:30	0	hr	40	min
158	21/06/98	1:50	2:50	1	hr	0	min
159	22/06/98	2:30	4:00	1	hr	30	min
160	23/06/98	3:20	5:20	2	hr	0	min
161	24/06/98	4:20	6:40	2	hr	20	min
162	25/06/98	5:20	7:50	2	hr	30	min
163	26/06/98	6:20	9:00	2	hr	40	min
164	27/06/98	7:10	9:50	2	hr	40	min
165	28/06/98	8:10	10:30	2	hr	20	min
166	29/06/98	9:00	11:10	2	hr	10	min
167	30/06/98	10:00	11:30	1	hr	30	min
168	10/07/98	5:40	6:50	1	hr	10	min
169	11/07/98	6:10	8:10	2	hr	0	min

170	12/07/98	6:50	9:10	2	hr	20	min
171	13/07/98	7:40	10:00	2	hr	20	min
172	14/07/98	8:30	10:40	2	hr	10	min
173	15/07/98	9:20	11:20	2	hr	0	min
174	16/07/98	10:20	12:00	1	hr	40	min
175	16/07/98	23:10	0:30	1	hr	20	min
176	17/07/98	23:40	1:20	1	hr	40	min
177	19/07/98	0:20	2:10	1	hr	50	min
178	20/07/98	1:00	3:10	2	hr	10	min
179	21/07/98	1:50	4:00	2	hr	10	min
180	22/07/98	3:00	5:10	2	hr	10	min
181	23/07/98	4:00	6:20	2	hr	20	min
182	24/07/98	5:10	7:20	2	hr	10	min
183	25/07/98	6:10	8:30	2	hr	20	min
184	26/07/98	7:00	9:20	2	hr	20	min
185	27/07/98	8:00	10:00	2	hr	0	min
186	28/07/98	8:50	10:40	1	hr	50	min
187	29/07/98	9:50	11:00	1	hr	10	min
188	29/07/98	22:50	23:20	0	hr	30	min
189	30/07/98	23:10	0:00	0	hr	50	min
190	31/08/98	23:40	0:40	1	hr	0	min
191	2/08/98	0:10	1:20	1	hr	10	min
192	3/08/98	0:40	1:50	1	hr	10	min
193	4/08/98	1:20	2:20	1	hr	0	min
194	5/08/98	2:20	2:50	0	hr	30	min
195	7/08/98	4:20	4:40	0	hr	20	min
196	8/08/98	5:00	6:20	1	hr	20	min
197	9/08/98	5:40	7:40	2	hr	0	min
198	10/08/98	6:30	8:50	2	hr	20	min
199	11/08/98	7:20	9:40	2	hr	20	min
200	12/08/98	8:10	10:30	2	hr	20	min
201	12/08/98	21:10	22:50	1	hr	40	min
202	13/08/98	9:10	11:10	2	hr	0	min
203	13/08/98	21:40	23:50	2	hr	10	min
204	14/08/98	10:10	11:50	1	hr	40	min
205	14/08/98	22:20	0:50	2	hr	30	min
206	15/08/98	11:40	12:00	0	hr	20	min
207	15/08/98	23:00	1:30	2	hr	30	min
208	16/08/98	23:40	2:20	2	hr	40	min
209	18/08/98	0:30	3:00	2	hr	30	min
210	19/08/98	1:30	3:50	2	hr	20	min
211	20/08/98	2:40	4:40	2	hr	0	min
212	21/08/98	4:00	5:40	1	hr	40	min
213	22/08/98	5:10	6:40	1	hr	30	min
214	23/08/98	6:10	7:50	1	hr	40	min
215	24/08/98	7:00	8:50	1	hr	50	min
216	25/08/98	7:50	9:40	1	hr	50	min
217	25/08/98	21:00	21:30	0	hr	30	min
218	26/08/98	8:50	10:10	1	hr	20	min
219	26/08/98	21:10	22:30	1	hr	20	min
220	27/08/98	9:40	10:30	0	hr	50	min
221	27/08/98	21:40	23:20	1	hr	40	min
222	28/08/98	22:00	0:00	2	hr	0	min
223	29/08/98	22:30	0:30	2	hr	0	min
224	30/08/98	23:00	1:00	2	hr	0	min
225	31/ 9/1998	23:40	1:40	2	hr	0	min
226	2/09/98	0:20	2:10	1	hr	50	min
227	3/09/98	1:10	2:40	1	hr	30	min

228	4/09/98	2:10	3:20	1	hr	10	min
229	5/09/98	3:30	4:10	0	hr	40	min
230	6/09/98	4:30	5:30	1	hr	0	min
231	7/09/98	5:20	7:10	1	hr	50	min
232	8/09/98	6:20	8:20	2	hr	0	min
233	8/09/98	19:40	20:10	0	hr	30	min
234	9/09/98	7:10	9:20	2	hr	10	min
235	9/09/98	19:50	21:50	2	hr	0	min
236	10/09/98	8:10	10:10	2	hr	0	min
237	10/09/98	20:20	23:00	2	hr	40	min
238	11/09/98	9:10	10:50	1	hr	40	min
239	11/09/98	21:00	23:50	2	hr	50	min
240	12/09/98	10:10	11:30	1	hr	20	min
241	12/09/98	21:40	0:40	3	hr	0	min
242	13/09/98	11:20	11:50	0	hr	30	min
243	13/09/98	22:30	1:30	3	hr	0	min
244	14/09/98	23:20	2:10	2	hr	50	min
245	16/09/98	0:10	2:40	2	hr	30	min
246	17/09/98	1:20	3:20	2	hr	0	min
247	18/09/98	3:00	3:40	0	hr	40	min
248	22/09/98	19:40	20:30	0	hr	50	min
249	23/09/98	8:10	8:40	0	hr	30	min
250	23/09/98	19:50	21:30	1	hr	40	min
251	24/09/98	8:50	9:20	0	hr	30	min
252	24/09/98	20:20	22:20	2	hr	0	min
253	25/09/98	20:40	23:00	2	hr	20	min
254	26/09/98	21:10	23:40	2	hr	30	min
255	27/09/98	21:40	0:10	2	hr	30	min
256	28/09/98	22:20	0:40	2	hr	20	min
257	29/09/98	22:50	1:10	2	hr	20	min
258	30/10/98	23:40	1:40	2	hr	0	min
259	2/10/98	0:30	2:10	1	hr	40	min
260	3/10/98	1:40	2:40	1	hr	0	min
261	7/10/98	6:40	7:20	0	hr	40	min
262	7/10/98	18:20	20:40	2	hr	20	min
263	8/10/98	7:20	8:40	1	hr	20	min
264	8/10/98	18:50	21:50	3	hr	0	min
265	9/10/98	8:10	9:30	1	hr	20	min
266	9/10/98	19:40	22:50	3	hr	10	min
267	10/10/98	9:10	10:20	1	hr	10	min
268	10/10/98	20:20	23:40	3	hr	20	min
269	11/10/98	10:00	11:10	1	hr	10	min
270	11/10/98	21:10	0:20	3	hr	10	min
271	12/10/98	11:00	11:40	0	hr	40	min
272	12/10/98	22:00	1:10	3	hr	10	min
273	13/10/98	23:00	1:40	2	hr	40	min
274	15/10/98	0:00	2:10	2	hr	10	min
275	16/10/98	1:30	2:20	0	hr	50	min
276	21/10/98	18:40	20:10	1	hr	30	min
277	22/10/98	19:00	21:10	2	hr	10	min
278	23/10/98	19:30	21:50	2	hr	20	min
279	24/10/98	20:00	22:30	2	hr	30	min
280	25/10/98	20:30	23:10	2	hr	40	min
281	26/10/98	21:00	23:40	2	hr	40	min
282	27/10/98	21:40	0:10	2	hr	30	min
283	28/10/98	22:20	0:40	2	hr	20	min
284	29/10/98	23:10	1:10	2	hr	0	min
285	31/10/98	0:00	1:40	1	hr	40	min

286	4/11/98	16:50	19:00	2	hr	10	min
287	5/11/98	17:30	20:30	3	hr	0	min
288	6/11/98	18:20	21:30	3	hr	10	min
289	7/11/98	19:00	22:30	3	hr	30	min
290	8/11/98	19:50	23:20	3	hr	30	min
291	9/11/98	10:00	10:40	0	hr	40	min
292	9/11/98	20:50	0:00	3	hr	10	min
293	10/11/98	10:40	11:30	0	hr	50	min
294	10/11/98	21:40	0:40	3	hr	0	min
295	11/11/98	11:30	12:10	0	hr	40	min
296	11/11/98	22:40	1:10	2	hr	30	min
297	12/11/98	23:50	1:30	1	hr	40	min
298	19/11/98	17:50	19:30	1	hr	40	min
299	20/11/98	18:20	20:30	2	hr	10	min
300	21/11/98	18:50	21:20	2	hr	30	min
301	22/11/98	19:20	22:00	2	hr	40	min
302	23/11/98	20:00	22:40	2	hr	40	min
303	24/11/98	20:30	23:20	2	hr	50	min
304	25/11/98	21:10	23:50	2	hr	40	min
305	26/11/98	22:00	0:20	2	hr	20	min
306	27/11/98	22:50	0:50	2	hr	0	min
307	29/11/98	0:00	1:10	1	hr	10	min
308	1/12/98	14:20	15:40	1	hr	20	min
309	2/12/98	15:10	17:10	2	hr	0	min
310	3/12/98	16:00	18:50	2	hr	50	min
311	4/12/98	16:50	20:10	3	hr	20	min
312	5/12/98	17:50	21:10	3	hr	20	min
313	6/12/98	18:40	22:10	3	hr	30	min
314	7/12/98	19:30	23:00	3	hr	30	min
315	8/12/98	20:30	23:40	3	hr	10	min
316	9/12/98	10:20	11:20	1	hr	0	min
317	9/12/98	21:30	0:20	2	hr	50	min
318	10/12/98	10:50	12:20	1	hr	30	min
319	10/12/98	22:30	0:40	2	hr	10	min
320	11/12/98	11:40	13:00	1	hr	20	min
321	11/12/98	23:40	1:00	1	hr	20	min
322	12/12/98	12:20	13:30	1	hr	10	min
323	13/12/98	13:20	14:00	0	hr	40	min
324	17/12/98	16:50	17:10	0	hr	20	min
325	18/12/98	17:10	18:40	1	hr	30	min
326	19/12/98	17:40	19:50	2	hr	10	min
327	20/12/98	18:20	20:50	2	hr	30	min
328	21/12/98	18:50	21:30	2	hr	40	min
329	22/12/98	19:30	22:20	2	hr	50	min
330	23/12/98	20:10	23:00	2	hr	50	min
331	24/12/98	20:50	23:40	2	hr	50	min
332	25/12/98	21:40	0:10	2	hr	30	min
333	26/12/98	11:10	12:00	0	hr	50	min
334	26/12/98	22:40	0:40	2	hr	0	min
335	27/12/98	11:40	13:00	1	hr	20	min
336	28/12/98	0:00	0:50	0	hr	50	min
337	28/12/98	12:10	13:50	1	hr	40	min
338	29/12/98	12:40	14:50	2	hr	10	min
339	30/12/98	13:30	15:50	2	hr	20	min
340	31/12/98	14:20	17:10	2	hr	50	min

Marine Science & Ecology Pty. Ltd.

(Environmental Consultants)

35 TILBA STREET, ESSENDON, VICTORIA, 3040.
TELEPHONE: +61-3-9337 9465 FACSIMILE: +61-3-9337 0160 (A.C.N. 005 807 876)

26 November 1998

Toll Geelong Port
Mr Siri Gunawardana
Engineering Manager
65 Brougham Street
GEELONG VIC 3220

Dear Siri

Please find enclosed a draft report of the contamination assessment of marine sediments from the Steel Industry Wharves at Western Port.

The results show that with the exception of TBT, the geometric mean of all contaminants are below the low screening level and by this definition would classify the sediments as "clean". However, because the wharf concentrations are somewhat higher than concentrations in the spoil ground they may be classified as slightly contaminated (depending on how "background levels" are defined) and unconfined disposal of this sediment may not be permitted.

If land disposal is still an option, the results show that contamination status of the dredge spoil will not be an issue. If sea disposal is preferred, it is likely that elutriation testing of the sediment samples for copper, lead, zinc and tributyltin will be requested by the EPA *or* they may also argue that the wharf sediments are incompatible with sediments from the existing spoil ground and not consider sea disposal as an acceptable option unless an alternative spoil ground exists.

If elutriation testing is undertaken, results will need to be compared with EPA water quality standards for compliance. If concentrations comply with the EPA standards dredging may be approved. If concentrations exceed the EPA standards, further testing may be required at the discretion of the EPA.

Before finalising the report, I would like to clarify with Greg Parry the issue of defining background concentrations and whether a standard protocol exists for correcting differences in grain size between samples. This may involve some alterations to the report, however the conclusions are likely to remain unchanged.

Please call if you have any comments or questions about the report.

Yours sincerely

Harry Houridis

SAMPLING & ANALYSIS OF MARINE SEDIMENTS

STEEL INDUSTRY WHARVES

DRAFT

Prepared for

Toll Western Port

ASSESSMENT OF CHEMICAL AND PHYSICAL CHARACTERISTICS OF SEDIMENTS AT THE STEEL INDUSTRY WHARVES

INTRODUCTION

Toll Western Port plans to dredge approximately 5,000 m^3 of sediment from the berthing basins at the steel industry wharves located in the North Arm of Western Port. About 4,600m^3 would be removed from Berth No.2 (the conventional wharf) and about 500m^3 would be removed from Berth No.1 (the roll-on/roll-off wharf).

At the request of Toll Western Port, Marine Science & Ecology Pty Ltd undertook an assessment of the characteristics of the marine sediments at the steel industry wharves in accordance with the Draft Best Practice Environmental Management Guidelines for Dredging (EPA 1998).

The terms of reference of the survey undertaken by MSE were to:

- collect representative sediment samples from the steel industry wharves and have them analysed for a suite of chemical and physical parameters, and
- assess the suitability of the dredged sediments in terms of contamination status, for both land and sea disposal.

METHODS

FIELD

Field work was carried out by MSE on the 12th October 1998.

Sediment samples were collected at a total of nine sites, six around the wharf and three from a designated spoil ground, east of Middle Spit. All samples were collected from the seabed surface using pre-cleaned containers. Sediment samples were stored in a chilled esky and transferred to each laboratory under chain of custody protocols.

The position of each site was recorded using differential GPS. Table 1 summarises information on the location of each sample and water depth at the time of sampling. Site sampling locations are shown in Figure 1.

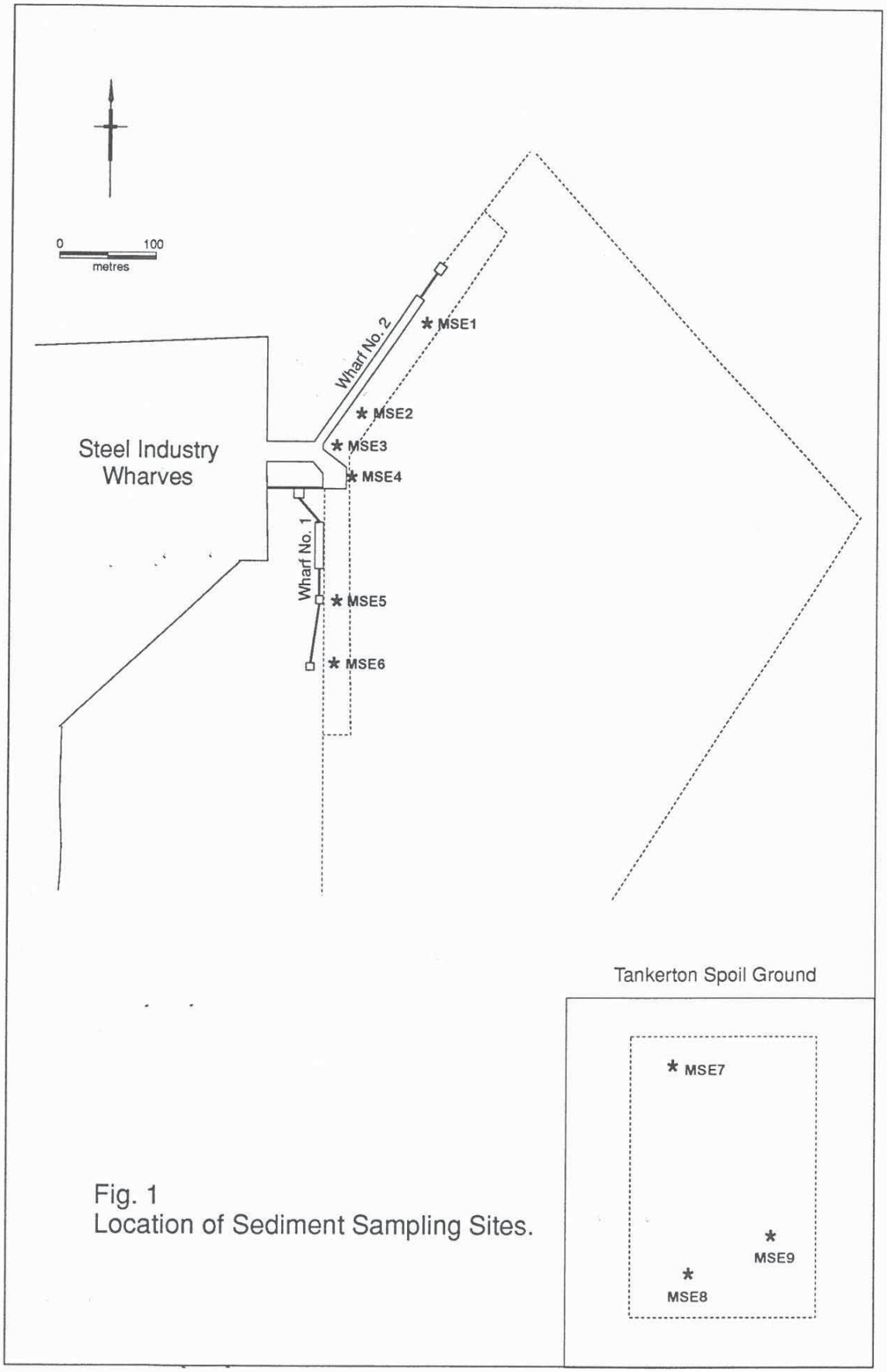


Fig. 1
Location of Sediment Sampling Sites.

TABLE 1. Summary of Sediment Sampling Locations

Location	Depth (m)	Time (EST)	Location		Substrate
			Easting	Northing	
MSE1	12.4	1133	55345082	5760335	surface layer of silty black mud
MSE2	11.8	1147	55345039	5760255	surface layer of silty black mud
MSE3	10.8	1158	55345008	5760218	40 cm layer of drift algae over mud
MSE4	12.6	1210	no satellite coverage		black silty mud
MSE5	12.5	1223	55344986	5760051	silty brown mud with layer of ?diatoms
MSE6	12.9	1236	55345015	5759978	silty brown mud
MSE7	10.6	1018	55347817	5752984	fine/medium sand
MSE8	12.9	1035	55347920	5752443	fine/medium sand
MSE9	13.6	1048	55348017	5752528	fine/medium sand

LABORATORY

All nine samples were analysed for total solids, density and particle size distribution. Six of the nine samples were also analysed for cadmium, copper, iron, mercury, lead, tributyltin, zinc, total petroleum hydrocarbons and total organic carbon. The choice of contaminants to be analysed were confirmed by the EPA prior to sampling.

Detection limits used for sediment testing are shown in Table 2.

TABLE 2. Analytical Detection Limits

Metal	Detection Limit (mg/kg)
Cd	0.1
Cu	0.5
Fe	50
Hg	0.01
Pb	1.0
Zn	0.5
TBT	0.0005
TPH	10
TOC	0.1%

The detection limits are taken from Table 5, Appendix 7.3 of the Technical Guidelines for Assessment of Chemical Contamination of Dredged Sediments (EPA 1998), except for TBT where the level of reporting is 0.0005 mg/kg rather than 0.0003 mg/kg.

Analytical testing was carried out by the following NATA registered laboratories.

- Australian Government Analytical Laboratories - tributyltin analysis
- WSL Consultants - all other analyses.

A full set of methods and results are given in Appendix 1.

RESULTS & DISCUSSION

PHYSICAL CHARACTERISTICS

In accordance with the draft dredging guidelines (EPA 1998) the physical characteristics of the sediment to be dredged and for the sediments on the spoil ground were measured. The results of these analyses are shown in Tables 3 and 4.

TABLE 3. Physical Properties of Dredge Spoil & Spoil Ground Sediments

SITE	TOTAL SOLIDS (%)	TOTAL ORGANIC CARBON (%)	DENSITY (G/ML)
MSE1	67	NTP	1.8
MSE2	60	3.1	1.6
MSE3	52	3.8	1.4
MSE4	66	NTP	1.9
MSE5	53	NTP	1.6
MSE6	59	2.4	1.7
MSE7	83	0.29	2.0
MSE8	82	0.29	2.2
MSE9	81	0.40	2.0

NTP = no test performed

TABLE 4. Sediment Particle Size Distribution of Dredge Spoil & Spoil Ground Sediments

	Particle Size Distribution in Micron Ranges (%v/v)					
	>2000 Gravel	500 - 2000 Coarse Sand	250 - 500 Medium Sand	63 - 250 Fine Sand	63 - 4 Silt	<4 Clay
MSE1	2.4	5.2	13.8	53.6	20.3	4.7
MSE2	4.5	8.3	9.4	43.0	27.8	7.0
MSE3	0.6	5.3	3.1	32.0	48.9	10.1
MSE4	9.0	25.9	4.6	30.3	24.8	5.4
MSE5	0.8	4.6	3.9	42.9	39.6	8.2
MSE6	0.5	12.2	14.6	44.9	22.4	5.4
MSE7	1.0	46.1	47.6	4.7	0.4	0.2
MSE8	0.3	30.8	63.0	5.9	0.0	0.0
MSE9	0.4	41.4	45.4	10.0	2.3	0.5

Wharf

Sediments at Berth No.2 generally consisted of a surface layer of black silty mud overlying a layer of sandy silt with shell. At Site MSE3, the sediment surface was overlain by a 40 cm thick layer of algal detritus. This site may be a "dead" area where drift accumulates. Sediments at this site were also much finer than at any other wharf site, being composed of almost 60% silt/clay. Other sites at the wharf were 25 - 48% silt/clay.

Spoil Ground

Sediments at the spoil ground consisted of medium to coarse sand. Very little silt or clay (0 - 2.8%) was present in these samples.

CHEMICAL CHARACTERISTICS

Contaminant Concentrations

Results are summarised in Table 5 and compared with previous results in Table 6. All results are expressed in mg/kg dry weight.

Full laboratory results are included in Appendix 1.

TABLE 5. Chemical Test Results for Sediment Samples (mg/kg, dry weight)

METALS	DETECTION LIMIT (mg/kg)	Steel Industry Wharves			Spoil Ground		
		MSE2	MSE3	MSE6	MSE7	MSE8	MSE9
Cd	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Cu	0.5	18	5.6	4.0	0.7	<0.5	<0.5
Fe	0.5	12000	12000	9600	6600	5600	7000
Pb	1	5.9	6.1	4.9	<1	<1	<1
Hg	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
TBT	0.0005	0.2	0.026	0.0034	<0.0005	<0.0005	<0.0005
Zn	0.5	50	43	38	4.7	4.6	5.0
TPH	10	<10	<10	<10	<10	<10	<10

Cadmium

Cadmium concentrations were less than the detection limit of 0.1 mg/kg across all sites.

Copper

Copper concentrations across the wharf sites ranged from 4 to 18 mg/kg. Concentrations at the spoil ground were generally below the detection limit of 0.5 mg/kg except at one site where 0.7 mg/kg was recorded. All values were below the minimum screening level of 34 mg/kg.

Statham (1977) estimated the maximum copper concentrations in Western Port to be about 4.5 mg/kg

which is also consistent with results from the three EPA monitoring stations in Western Port between 1989 and 1991.

Based on these levels, concentrations at Site MSE2 are elevated.

Lead

Lead concentrations across the wharf sites ranged from 4.9 to 6.1 mg/kg. Concentrations at the spoil ground were below the detection limit of 1 mg/kg. All values were below the minimum screening level of 47 mg/kg.

Mercury

Mercury concentrations were less than the detection limit of 0.01 mg/kg across all sites.

Zinc

Zinc concentrations across the wharf sites ranged from 38 to 50 mg/kg. Concentrations at the spoil ground ranged from 4.6 to 5 mg/kg. All concentrations were below the minimum screening level of 150 mg/kg.

TBT

TBT concentrations ranged from < 0.5 ng/g at the spoil ground to 200 ng/g at the wharf. The arithmetic mean concentration at the wharf was 76.5 ng/g as compared to a geometric mean of 26.5 ng/g. These values exceed the minimum screening level of 5g/g and the maximum screening level of 72 ng/g depending on which function is used.

The biological significance of elevated TBT levels in sediments is not well understood (Daly & Fabris 1993), however laboratory and field studies have shown that TBT contaminated sediments can affect growth in Pacific oyster (*Crassostrea gigas*) at levels of around 60 ng/g (USEPA 1988).

There are reports of variable effects in aquatic biota including lethality and changes in reproduction and growth. One commonly documented effect is imposex in gastropods, a condition in which females develop male sexual characteristics, causing sterility. This effect has been recorded in gastropods where TBT concentrations in water are as low as 1 ng Sn/L. Effects on biota other than molluscs is less well known.

Regulations introduced in June 1989 banned the use of organotin antifoulants on vessels 25 m or less in length and on piers, buoys and other submerged structures. Given the half life of TBT in sediments is between 4 months and 2 years, TBT will continue to be detected at wharves which accommodate large ships on a regular basis.

Comparisons with Background Levels

To compare results with background levels in Western Port the following documents were used for comparative purposes:

- Trace Metals in Western Port Sediments (Statham 1977)

- Marine Water Quality Monitoring 1989 - 1991 (EPA 1993)
- An Environmental Study of Tributyltins in Victorian Waters (Daly & Fabris 1993)

TABLE 6. Comparative Concentrations in Western Port Sediments. Units are mg/kg

METALS	Western Port Statham[1] (1977)	Western Port (1989-1991) Brown (1993), EPA (1993a,b)	Steel Industry Wharves MSE (1998)
Cd	<0.1 - 0.67	<0.1 - 1.8	<0.1 - <0.1
Cu	ntp	0.4 - 4.46	4 - 18
Pb	<0.5 - 13.3	0.0? - 19.3	4.9 - 6.1
Hg	ntp	0.01 - 0.49	<0.01 - <0.01
Zn	<0.7 - 34.9	1.83 - 13.94	38 - 50
TBT	ntp	<0.001 - 0.083[2]	<0.0034 - 0.200

[1] from Table 13 (Statham 1977)

[2] from Daly & Fabris (1993)

As noted in the recent Western Port Review (EPA 1996), the three EPA sites that are regularly monitored are under a high current regime and consist of predominantly sand. These may not accurately reflect general sediment concentrations in Western Port.

Overall, the study by Statham (1977) found that highest concentrations of trace metals occur in association with fine grain size/organic carbon rich sediments and were found around the Hastings Bight area.

Assessment Against Sediment Guidelines

The assessment of the contamination status of dredged sediments is made on the basis of whether the concentrations of contaminants comply with appropriate sediment guideline concentrations (EPA 1998). These guideline concentrations are given in Table 7.

TABLE 7. Sediment Quality Guidelines for Selected Metals (mg/kg, dry weight).

	Concentrations in Sediments (this study)				Screening Levels (EPA 1998)	
	Steel Industry Wharves		Spoil Ground		Minimum	Maximum
Analyte	Geo. Mean	Max	Geo. Mean	Max	Level	Level
Cd	<0.1	<0.1	<0.1	<0.1	1.2	9.6
Cu	7.4	18	0.6	0.7	34	270
Fe	11140	12000	6372	7000	not given	not given
Pb	5.6	6.1	<1	<1	47	218
Hg	<0.01	<0.01	<0.01	<0.01	0.15	0.71
Zn	43.4	50	4.8	5.0	150	410
TPH	<10	<10	<10	<10	not given	not given
TBT	0.026	0.200	<0.005	<0.005	0.005	0.072

Table 7 shows that only TBT concentrations exceeded the minimum screening level and as such may require additional elutriate testing for comparison with water quality standards.

Where the geometric means of all contaminants are below the minimum screening level *or* less than twice the background level, sediments are considered "clean" and suitable for disposal at sea (EPA 1988). The guidelines state that *"for sediments classified as clean, but where these guidelines would result in disposal of sediment with more than twice the background level, after correcting for any differences in grain size, consideration must be given to selection of the most appropriate site for spoil disposal"*.

Furthermore, *"where practical alternatives exist, unconfined disposal of this type of spoil will not be permitted. Where it is impractical to dispose of the spoil except on a spoil ground, preference will be given to disposal on nearby areas that are similarly contaminated or on spoil grounds already contaminated above background levels"*.

Disposal To Land

Onshore disposal is usually an option only where there is an area of land nearby which is suitable for dewatering and which has little value in its existing state (EPA 1998).

Where land disposal is the preferred option, the nature of the disposal material is assessed in accordance with the EPA's Classification of Wastes (EPA 1995). According to the concentrations listed below, the spoil would be classified as "fill material" as all contaminant levels are below those specified in the table below and the material consists of sand, clay and silt. The EPA has no restrictions on where such fill material may be disposed of although local authorities may have other requirements. The deposit of fill material must not result in any offsite impact on surface or groundwaters (EPA 1995).

Table 8. Maximum Concentrations Of Contaminants Allowed In Soil To Be Disposed Of As Fill Material.

Contaminant	Maximum Concentration Recorded (mg/kg dry weight)	Maximum Concentration Allowed (mg/kg dry weight)
Cd	<0.1	5
Cu	18	100
Hg	<0.01	2
Pb	6	300
Zn	50	500
Sn	0.2[1]	50
TPH (C6 -C9)	<10	100
TPH (>C9)	<10	1000

[1] measured as TBT

SUMMARY

According to draft dredging guidelines, sediments from the steel industry wharves can be categorised as clean in absolute terms but slightly contaminated relative to the spoil ground.

The sediments at the steel industry wharves contain levels of copper, lead, zinc and tributyltin that are higher than levels found in sediments from the existing spoil ground near Tankerton. While this is partly an artefact of the difference in sediment grain size, some of the contamination can be directly attributed to the shipping activities of the port. For example, the elevated levels of TBT, copper and zinc are not unexpected given that most of the ships visiting this port are larger than 25 metres in length and would undoubtedly be using a combination of TBT and metalliferous antifoulant paints.

CONCLUSIONS

The dredge spoil from the steel industry wharves would be suitable for land disposal subject to finding a site suitable for dewatering, which has little environmental value in its existing state.

Where practical alternatives exist, unconfined dumping of dredge spoil from the steel industry wharves into the existing spoil ground near Tankerton would not be recommended.

REFERENCES

Brown, R. (1993). Marine Water Quality Monitoring 1991 Yearly Report. Publication No. 386. Environment Protection Authority

Daly, H. & Fabris, G.F. (1993). An Environmental Study of Tributyltins in Victorian Waters. EPA SRS 90/020.

EPA (1993a). Marine Water Quality Monitoring 1990 Yearly Report. Publication No. 374. Environment Protection Authority

EPA (1993b). Marine Water Quality Monitoring 1989 Yearly Report. Publication No. 356. Environment Protection Authority

EPA (1995). Classification of Wastes. Publication No. 448. EPA Information Bulletin

EPA (1996). The Western Port Marine Environment. Publication No. 493. Environment Protection Authority

EPA (1998). Draft Best Practice Environmental Management Guidelines for Dredging. Draft Report, June 1998. Environment Protection Authority

Statham, P.J. (1977). Trace Metals in Western Port Sediments. Publication No.165. Marine Chemistry Unit. Ministry for Conservation.

USEPA (1988). Tributyltin Antifoulants; Notice of Intent to Cancel; Denial of Applications for Registration; Partial Conclusion of Special Review, US Environmental Protection Agency Federal Register, 53, October 4, 1988, 39022-39041.

FACSIMILE TRANSMISSION

LAWSON AND TRELOAR PTY LTD

Coastal, Ocean and Water Resources Consulting Engineers, A.C.N. 001 882 873

Ground Floor,
19 Business Park Drive
Notting Hill VIC 3168
Australia

Telephone: +61-3-9558 9955 Fax: +61-3-9558 9956 Email: vic@lat.com.au

TO: TOLL
ATTN: SIRI GUNAWARDANA
REF: JS217 / FM 7870
FAX NO: 5272 1560
FROM: DAVID PRENTIS
DATE: 30-6-00
No. of Pages: 6 (including this page)

Copy:
Attn: RICK
COPY FOR YOU

NOTE: This fax is [x] an original document and no further copy will be forwarded.
[ ] a preliminary copy of the original which will be forwarded by mail.

SIRI.

ATTACHED IS REVISED DOCUMENT ON BHP WHARF DREDGING. I FAXED IT BECAUSE THE DIAGRAMS ARE BIG FILES WHEN E-MAILED, I HOPE IT IS CLEAR ENOUGH.

I AM STILL TRYING TO CONTACT EPA ABOUT HOW TO PROCEED. THE RELEVANT PERSON IS DAVID MAY AND HE IS HARD TO CATCH.

Regards
David Prentis

DREDGING OF SHIP BERTH – BHP WHARF No. 2 – WESTERN PORT

1. NEED FOR DREDGING

Hydrographic survey (VCA Plan No 29453, surveyed April 1999) indicates that there has been shoaling in both BHP berth No 1 and No 2. The declared depths of these berths is 12.1 m and there are surveyed depths less than this at the southern end of Berth No 2 and also the southern end of Berth No 1. There is deepening of the northern end of berth No 1 and the pattern of depth changes is consistent with propeller wash from vessels, in particular vessels moored at the roll-on-roll-off berth at No 1.

There is a demonstrated need for maintenance dredging to re-establish the declared depths at these berths. The volume of material to be removed to bring the depth to 12.1 m is approximately 2,000 m^3 , and, to allow for over-dredging which is likely to occur in this sort of operation, it has been assumed that 5,000 m^3 of material will be removed. Note that these are the volumes of the solid material, and do not include bulking factors or allowances for water in slurries.

2. MATERIAL TO BE DREDGED

The sediments at the BHP berths have been sampled and analysed for contamination (Marine Science and Ecology Pty Ltd report "Sampling and Analysis of Marine Sediments, Steel Industry Wharves", March 1999). The summary from that report is as follows:

"*According to the draft dredging guidelines* [now known as the Guidelines for Best Practice Environmental Management of Dredging], *sediments from the steel industry wharves can be categorised as clean in absolute terms with the exception of tributyltin which exceeded the minimum screening level.*

The sediments at the steel industry wharves contain levels of copper, lead, zinc and tributyltin that are more than twice as high as levels found in sediments from the existing spoil ground near Tankerton. While this is partly an artefact of the difference in sediment grain size, some of the contamination can be directly attributed to the shipping activities of the port."

The report noted that the material to be dredged is finer in grain size than the existing Tankerton spoil ground and that there was a higher level of contaminants in the material than at the existing spoil ground. The material is suitable for disposal on land where it would be classified as "fill material", being composed of sand, clay and silt.

3. METHOD OF DREDGING

Given the nature and location of the material to be removed, the most efficient method of dredging is to use a cutter-suction dredge, provided that a suitable disposal site can be identified. Other alternatives include a grab or a trailing suction hopper dredge (TSHD), however there are difficulties with these alternatives. A grab is relatively slow and liable to release material into the water column. There is not a suitable TSHD readily available, and this method requires a suitable location for the disposal of the material at sea to be found.

The preferred option is therefore to use a cutter-suction dredge and to pump the dredged material to a disposal site on land.

The alternative methods of disposal of the dredged material have potentially serious environmental impacts. If the material were to be dumped at sea, most likely on an existing declared spoil ground north of Tankerton, it is unlikely to remain in place due to the very fine nature of the majority of the material. It would be dispersed by the tidal currents and would not remain within the spoil ground. This would apply to any dumping from a barge or TSHD.

The advantage of a cutter-suction dredge with disposal on land is that there is minimal risk of environmental damage. The dredge itself will cause very little turbidity if properly operated and by disposing of the dredged material on land, the water to be discharged can be filtered either through filters or through a series of settling ponds. The disposed material is contained and its known.

4. LOCATION FOR ONSHORE DISPOSAL OF DREDGED MATERIAL.

To be suitable for disposal of dredged material, a potential site must be within reasonable distance of the dredge site to enable pumping. There must be sufficient area to contain, not only the dredged material, but also the water which is used to transport the material. The water will be discharged to the sea only after the dredged material has settled out and hence there is a need for bunds and a sufficient area to retain the water until settling has taken place. This can be managed through a series of staged settling ponds if necessary.

There is an area of Crown Land to the south of the dredge site which is appropriate for the spoil disposal. The area is shown on the accompanying map and is a section of reclaimed land adjacent to the Esso Long Island Point Fractionation Plant. In the south of this reclaimed area there is a depression which at present contains storm water and some scrubby vegetation. This area is less than I km from the location of the dredging and hence well within the practical limits of pumping. The location is shown, along with the berths to be dredged, in figure 1.

The detailed levels of this land is shown in figure 2 taken from a survey plan by P.G.Speedie and Associates Pty Ltd. There is a depression with a level generally below 2.0 m AHD surrounded by bund or wall with a crest level above 4.5 m AHD. Volume calculations indicate that the following volumes are contained below the given level surfaces which are indicated by the contours in figure 2.

Level (metres AHD)	Volume available below the given level (cubic metres)
2.00	2,484
2.25	8,604
2.50	15,991
2.75	24,152
3.00	33,075
3.25	43,052
3.50	54,884
3.75	68,653
4.00	82,911

These figures demonstrate that there is ample capacity to receive the material to be dredged. If it is assumed that the suspension delivered by the dredge is composed of 80% water, the total volume of material plus water is 25,000 m^3. It can be seen from the above figures that there is ample capacity to contain this entire volume at a level very close to 2.75 m AHD. This area can be identified on the survey plan and is essentially the main basin area.

It would thus be practical to place all of the dredged material in the proposed disposal site and allow the suspended material to settle before draining off the water. Alternatively, there is also ample room to create a series of settling ponds and to discharge the water more rapidly using sequential settling. If desired, the water could be discharged through a filter consisting of rows of geo-fabric socks of more than 1 m in diameter filled with graded rock and sand in sequence.

5. SUMMARY

It has been found that

1. There is a need for maintenance dredging at the BHP No 1 and No 2 Berths
2. The material to be dredged is suitable for use as land fill
3. There is a site suitable for receiving the dredged material on Crown land approximately 1 km to the south of the dredging location.
4. The proposed site has ample capacity to receive the dredged material plus the transporting water.
5. There is sufficient room at the proposed disposal site to allow settlement of the dredged material or filtering prior to discharge of the transporting water back to the sea.
6. The use of a cutter-suction dredge with disposal of the dredged material on land is the preferred option from an environmental point of view with minimal risk to the environment.

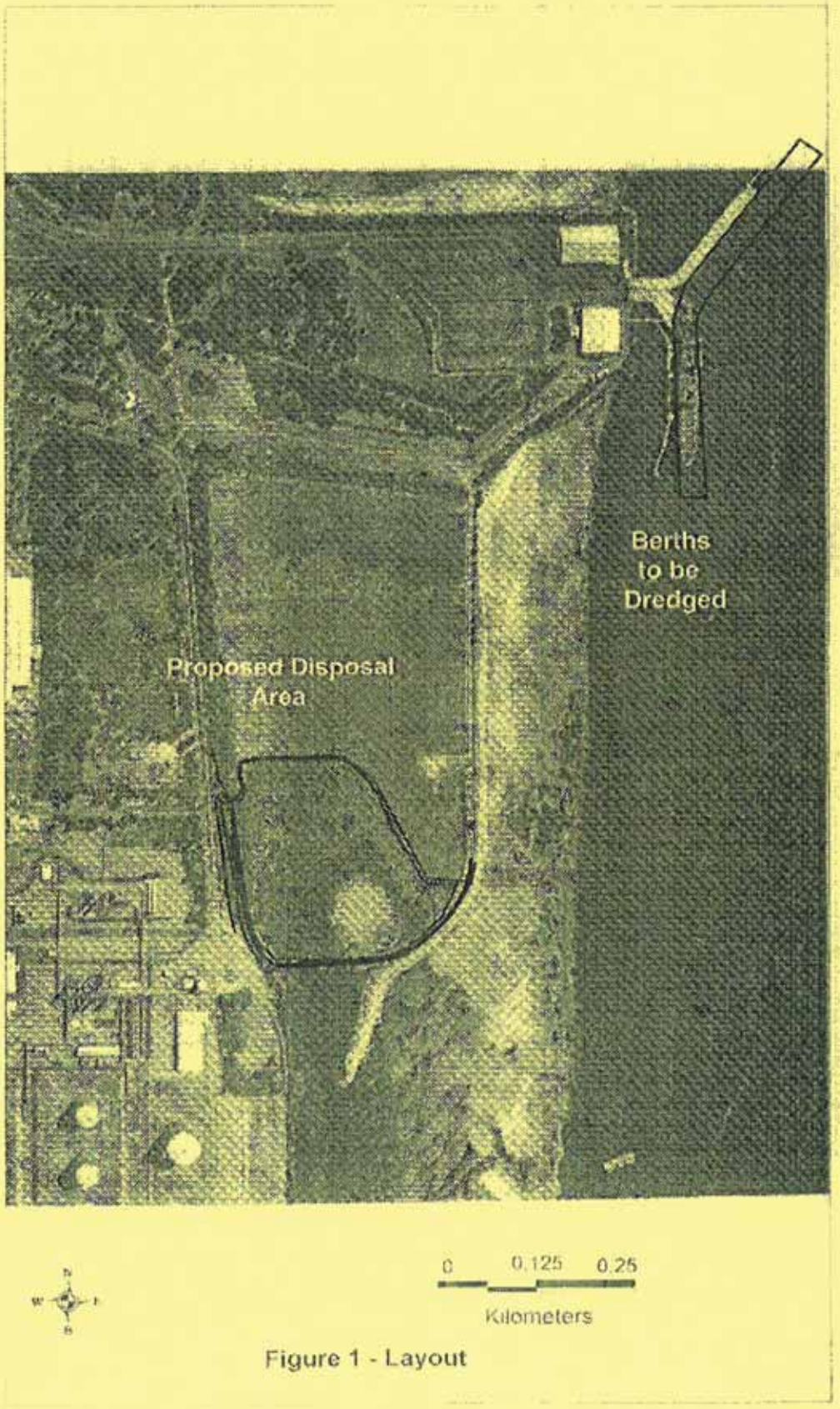


Figure 1 - Layout

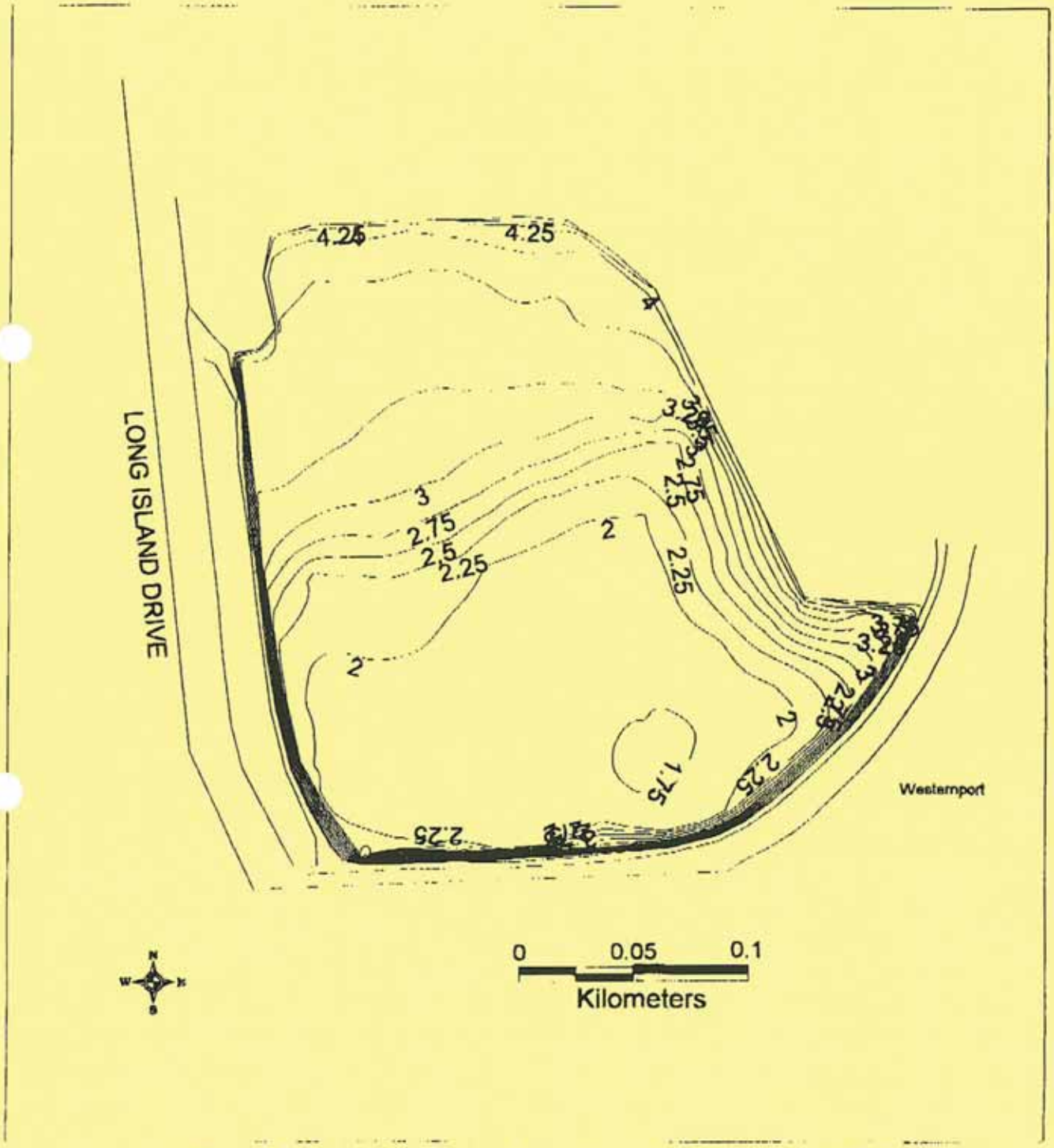


Figure 2 - Survey of proposed disposal site (Contours in m AHD)

Dredging of Ship Berth - BHP Wharf No. 2 - Westernport
Toll Westernport
J5217

27-2701

TOLL WESTERNPORT

From: Peter Hinksman <phinksman@vicchannels.vic.gov.au>
To: 'Rob.Webber@epa.vic.gov.au'
Cc: Dick Cox (E-mail) <tollwesternport@bigpond.com>
Subject: RE: Stony Point Dredging
Date: Friday, January 29, 1999 2:41 PM

Good afternoon Rob

Thank you for your email and facsimiles.

The Stony Point Jetty has been an on going issue for discussion for several months and the decision taken late last year was arrived at after much thought and consideration. There should be no change to the proposed disposal site.

The VCA would be unwilling to agree to the dumping of spoil in port waters. Item 8 of Mr Cuming's letter suggest placing the spoil "in the tidal flow of the channel". The tides are extremely strong in Western Port and any spoil dumped in such a manner would disperse but to where?

The disposal to sea would require:
* A much greater in depth analysis of the spoil to that previously done for land disposal
* A study to find a suitable disposal location within the bay that offers stability
* A study that looks at the environmental impacts of using a stable site -assuming an appropriate one found.

The above is going to take a considerable time and money. Further it delays the dredging the lack of which will no doubt start to impact on public amenity.

I may be contact on 9612 3541 should you wish to discuss the above further.

Regards

Peter Hinksman

> -----Original Message-----
> From: Rob.Webber@epa.vic.gov.au [SMTP:Rob.Webber@epa.vic.gov.au]
> Sent: Thursday, January 28, 1999 1:30 PM
> To: phinksman@vicchannels.vic.gov.au
> Subject: Stony Point Dredging
>
> Peter,
>
> Further to our discussion earlier today I am faxing the
> correspondence from Brian Cumming and others regarding the proposed
> spoil
> disposal site. I would appreciate your views on the potential
> disposal of
> the spoil arising from the Stony Point dredging proposal to the bay to
> enable me to provide a response to NRE.
>
> Thanks again for your assistance
>
> Rob.
>

Crib Point & Stony Point Public Parks & Foreshore Reserve Committee of Management Inc.

Secretary: C. Witton
Mobile 0418 348959

P.O. Box 224 Crib Point 3919
PH: 0359 838111

327 Stony Point Rd.,
Crib Point 3919

15TH April 2000

18 APR 2000
WesternPort

Mr D Cox
Harbour Master
Toll Westernport
Stony Point Road
STONY POINT. VIC 3919

Dear Sir

For some time this Committee has been negotiating with NRE and EPA for approval under the Dredging Protocol to dredge Stony Point access channel. this approval has now been received and work is to commence after Easter., approximately 15th May 2000.

In 1998 when we wrote to you regarding the dredging, a copy of that letter is enclosed.together with your response.

This letter is to seek confirmation that the requirements as set out in your letter still apply..

If there are to be any changes please advise me as soon as possible so I may advise the contractors.

Yours faithfully,

Cecelia Witton
Secretary.

0418 870 676

TOLL
WesternPort

A Division of
TOLL Transport Pty Ltd
A.C.N. 006 604 191
Stony Point Road, Crib Point 39
P.O. Box 102 Hastings Vic. 391
Telephone 03 - 5983 9406
Facsimile 03 - 5983 6043

144

File No. 27-2701

C. Witton

Crib Point Foreshore Committee
P.O. Box 224
Crib Point 3919

16 December 1998

Thankyou for your letter regarding the proposed dredging of the Stony Point boat ramp channel, in which you stated the necessity to install temporary crossovers for access to Toll's premises.
With respect to these crossovers, Toll would require three in the following locations;
1) Directly at the entrance to the jetty approach.
2) At the entrance to the side gate on the western boundary of the depot.
3) At the rear tug lead light pole (300 m towards Crib Point from the Depot).

All three crossovers would need to be construct to cater for heavy vehicles such as cranes and articulated trucks which are engaged in our day to day business.
The crossing at the jetty approach would also need to cater for lighter vehicles and therefore some consideration should be give to the lower ground clearance of these vehicles.

We also suggest that appropriate warning signs be erected informing those motorist who are either entering or leave the jetty that a crossing is in place and that care should be taken.

We further suggest that a possible alternative pipe route to eliminate the two crossings adjacent to the depot is to run the dredge pipes under the jetty and along the eastern and northern boundary fences.

Yours sincerely

Rick Purton
Works Engineer

Crib Point & Stony Point Public Parks & Foreshore Reserve Committee of Management Inc.

Secretary: C. Witton
Mobile 0418 348 959

P.O. Box 224 Crib Point 3919
PH: 0359 838111

327 Stony Point Rd.,
Crib Point 3919

6th December 1998

129

Mr D Cox
Harbour Master
Toll Westernport
Stony Point Road
STONY POINT 3919

Dear Dick,

I am writing to advise that we have finally engaged a contractor to dredge the access channel from the boat ramp.

Brenton Abbott of Dredgecorp Pty Ltd will carry out the works which are due to start on 29th December 1998.

It is planned to pump the spoil directly to the sight selected by Dr Greg Parry of EPA which is approximately 900 metres up the road, by running the pipes along side the roadway.

As the pipe is being laid on shore it is intended to place a crossovers to cover the pipe where traffic will cross.

Could you please advise me if you have any objections to this, or special requirements regarding the construction of the crossovers.

Yours faithfully,

Cecelia Witton
Secretary.

City and Bays Region
Level 8
Siddeley House
PO Box 281
World Trade Centre Victoria 3005 Australia
Telephone 61 3 9928 3900
Facsimile 61 3 9928 3929
DX 1119W Port Melbourne
Website www.parkweb.vic.gov.au

6 June 2000

Mr Cox
Toll Westernport
PO Box 102
HASTINGS
VIC 3915

Dear Mr Cox

I wish to inform of Parks Victoria's intention to carry out maintenance dredging in the vicinity of the Tankerton Jetty, French Island. As the recreational managers for Westernport, Parks Victoria is responsible for the maintenance of navigable waters.

The access channel and area around the low level landings was last dredged in 1994 with the construction of the new jetty facility. The current dredging in the vicinity of the jetty is to enable safe access to the low landings for recreational vessels. The material to be dredged is predominantly sandy sediment with deposition onto the beach area between the rock groyne and the pier abutment. The dredged material will initially be dark in colour and may have a strong sulphurous odour. After a few days exposed to air and light, the sediment will change to the colour of sand and loose it's odour.

Dredging plant and equipment is to be established on site mid June with the works programmed for completion in approximately two weeks, weather permitting. Mariners are advised to exercise caution and proceed at a speed commensurate with safe navigation when in the vicinity of the dredge. Dredging will only be carried out during daylight hours and floating plant will be appropriately marked.

It is expected there will be some localised turbidity as return waters carry some of the finer material back into the water. However, given the short duration of the works impacts should be minimal. A suitable turbidity monitoring program will be undertaken in liaison with the EPA.

Should you require further advice on this matter please contact Peter Teesdale, Ranger in Charge, San Remo Office on 5678 5247.

Yours sincerely

Sonja Bertotto
Regional Project Manager
City and Bays

Tankerton stakeholder letter3

LAWSON AND TRELOAR PTY LTD

Coastal, Ocean and Water Resources Consulting Engineers

Directors
N.V. Lawson BE(Hons), MEngSc, FIEAust, CPEng
P.D. Treloar BE(Hons), ME, PhD, FIEAust, CPEng, MASCE
N.I. Collins BE(Civil), MEngSc, MIEAust, CPEng, RPEQ
R.A. Rice BE(Hons), BSc, MEngSc, MIEAust, CPEng

19 Business Park Drive
Notting Hill VIC 3168
Australia
Phone: +61-3-9558 9955
Fax: +61-3-9558 9956
Email: vic@lat.com.au

Rick Purton
Note contents - Pls. make arrangements to call for tenders.
Sim

Siri Gunawardana
Toll Westernport
c/o Toll Geelong Port
PO Box 344
Geelong VIC 3220

Our Ref: J5217/LM1788

Dear Siri,

Re: Dredging of BHP Wharf No 2, Hastings

In the recent consent to the dredging of the ship berth BHP Wharf No 2 at Hastings from the Department of Natural Resources and Environment dated 19 April, 2001, reference was made to the Commonwealth legislation *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

Under the EPBC Act, there are guidelines as to whether a project needs to be referred to Environment Australia. There are two sections which appear relevant to the above project:-

Exceptions (Page 2 of Guidelines)
The EPBC Act provides that approval is not required for an action that is a lawful continuation of a use of land, sea or seabed that was occurring immediately before the commencement of the Act. (This exemption does not apply to an enlargement, intensification or expansion of an existing use)

The proposed dredging is a continuation of existing use and therefore would be exempted.

Marine Activities (Appendix to Guidelines, page 11)
Dredging to maintain existing navigational channels would not normally be expected to have a significant impact on the environment where the activity is undertaken as part of normal operations and the disposal of spoil does not have a significant impact.

The question to be considered here is whether the disposal of spoil may have a significant impact. The proposal has been approved by the Victorian Department of Natural Resources and Environment following advice from the Victorian Environment Protection Authority. A copy of the letter is attached. Thus, provided the operations are undertaken in accordance with the consent conditions, there will be no significant impact and hence the project is exempted.

I believe that the above is sufficient to meet the requirements of the EPBC Act and the project may proceed.

Yours sincerely,
LAWSON AND TRELOAR PTY LTD

David Provis.

David Provis.
Principal Oceanographer
Manager, Melbourne

Encl.

ACN 054 385 081

MELBOURNE OFFICE
20 Sixth Ave, Chelsea Heights, 3196
Mobile 0417 100 624, Phone (03) 9772 4727
Email: malcolmv@ocean.com.au

PORTLAND OFFICE
14 Townsend St, Portland, 3305
Phone 0355 236 392, Fax 0355 217 255
Email: frankzeigler@profdivers.com.au

Inspection of Seabed & Sediment Sampling Steel Industries Berth, Westernport Bay 12th of February 2002

Attn:
Rick Purton
Toll Westernport
Crib Point
Victoria 3919

This is to certify that under the direction of Rick Purton of Toll Westernport, Professional Diving Services attended the Steel Industries Berth on Friday the 12th of February 2002. This work was done for the express purpose of conducting an underwater seabed survey and collecting sediment samples.

Professional Divers forwards this report without favour or prejudice. This report presents a true and accurate representation of the findings. There were no reports of accident or injury during the works and all Victorian Work Cover Authority, AS 2299 and PDI Safety requirements have been complied with.

Malcolm Venturoni
Melbourne Operations Manager
Professional Divers International

Introduction

Professional Diving Services conducted the seabed survey and sediment sampling at the Steel Industries Berth, Westernport Bay at the request of Toll Westernport. The survey included a visual inspection of the seabed, depth recording, probing of the silt to gauge depth of deposit and to take two core samples and two scoop samples. The findings of the survey are presented below in the report.

Methodology

As per instructions from Toll Westernport divers surveyed the seabed at the No 2 products loading wharf and at the Ro Ro berth under the loading ramp and out from the No. 1 fender wharf. Divers took scoop samples at the northern and southern end of each berth and took a core sample at the southern end of the Products Berth and at the Northern end of the Ro Ro Berth adjacent to the fender wharf. The seabed was probed at intervals along and out from each berth, this was done to gauge the depth and density of the silt cover. Divers also noted the degree of slope in the seabed behind the face of the berth and back up under the piles.

Work performed/Major Findings

Products Berth:
Divers found that the entire seabed at the Products Berth had a light silt cover over a hard clay bottom. The silt was mainly built up at the southern end of the wharf and also under the berth. The angle of the slope of the seabed from the face of the berth back under the wharf varied from 30 – 45 degrees. The average depth of silt at the northern end of the berth before striking a hard bottom was 1.0m where as the southern end of the berth the average depth of silt over the hard bottom was 2.0m+. Divers also recorded striking obstructions while probing along the face of the berth and believe the obstructions to be either small rocks or debris. Under the berth the depth of silt was on average greater than 2.0m. A core sample was taken at the southern end of the Products Berth and consisted of light silt with much decomposing organic matter. Scoop samples were also taken at the berth at the northern and southern end, these also consisted of light silt.

Ro Ro Berth:
Divers found that the seabed at the Ro Ro berth also consisted of a light silty cover over a hard clay bottom. The depth of silt along this berth was however not as severe as with the Products Berth. The main area surveyed was out from the No. 1 Fender Wharf where the depth of silt over the hard clay bottom varied between 1 – 2 metres. The greatest area of silting at this berth is under the loading ramp structure where the depth of water is 6.0 metres. The angle of the slope of the seabed from the face of the berth back under the wharf was on average approximately 25 degrees. The southern end of the Ro Ro berth was also heavily silted out from the dolphins with the depth of silt in this area being greater than 2.0 metres. A core sample was taken at the northern end of the Ro Ro Berth and consisted of light silt. Scoop samples were also taken at the berth at the northern and southern end, these also consisted of light silt.

Conclusion

The built up of silt at the Steel Industries Berths at Westernport generally concentrates around the southern end of each berth and around the Ro Ro Berth loading ramp. The depth of silt in these built up areas is greater than 2.0 metres and given the angle of the seabed back up under the wharf that once the berth has been dredged the remaining silt under the wharf will most likely slump creating silt problems out from the berth once again.

Photographic results & tables

The following photographs and tables are clear evidence of the work conducted and assist in understanding the findings of this report.

Depth of silt over bottom Products Berth

	-5 metres	-2 metres	Berth face	+ 5 metres	+10 metres
Sth end of berth 0m	2.0m+	2.0m+	2.0m+	2.0m+	2.0m+
+ 20 metres	2.0m+	2.0m+	2.0m+	2.0m+	2.0m+
+ 40 metres	2.0m+	2.0m+	2.0m+	2.0m+	1.8m
+ 60 metres	2.0m+	2.0m	1.2m	1.5m	1.5m
+ 80 metres	2.0m+	1.4m	1.2m	1.2m	1.2m
+ 100 metres	2.0m+	1.5m	1.5m	1.5m	1.2m
+ 120 metres	1.5m	1.5m	1.2m	1.2m	1.0m
+ 140 metres	2.0m+	1.5m	1.0m	1.1m	1.1m
+ 160 metres	2.0m+	1.5m	1.0m	0.8m	0.6m

Depth of silt over bottom out from No. 1 Fender Wharf, Ro Ro Berth

	-5 metres	-2 metres	Berth face	+ 5 metres	+10 metres
Nth end of berth	2.0m+	2.0m+	2.0m	1.5m	1.4m
+ 20 metres south	2.0m+	2.0m+	2.0m+	1.4m	1.0m
+ 40 metres south	2.0m+	2.0m+	2.0m	1.2m	1.0m
+ 60 metres south	2.0m+	2.0m+	1.2m	1.0m	0.8m

APPENDIX C
Information Provided by Parks Victoria

Local Port of Western Port Dredging:

The following is a list of areas where Parks Victoria currently completes maintenance dredging in Western Port under a service agreement with Birdon P/L in order to provide safer navigable access:

Site	Land Status	Site Priority	Site Details / Purpose	Frequency (years)	Total Annual Volume (m3)	Maintained dredge design depth (m) CD
San Remo Jetty	PV CoM	B	Access to landings - recreational and commercial vessels	3 years	5,000	-1.2m to -1.8m in defined dredge design areas
Tankerton Channel and Jetty	PV CoM	B	Channel and access to low landings – recreational and public transport ferry service	3-5 years	2,000	-2.0m

The following locations have demand for dredging to maintain a navigable access however are outside Parks Victoria's managed area of responsibility, as private / local government / Committee of Management facilities:

Site	Land Status	Site Details / Purpose	Frequency (years)	Total Annual Volume (m3)
Tooradin	Tooradin Boat Ramp	To provide access to the private boat ramp	3-4 years	1,000
Yaringa Boat Harbour	Yaringa Boat Harbour	To provide access to the private harbour facility	10 years	5,000
Newhaven Marina and boat ramp	Newhaven Yacht Club	Safe access for recreational users of the boat ramp	Unsure	Unsure
Hastings Boat Ramp and Hastings Yacht Club Boat Ramp	Mornington Peninsula Shire Council	Safe access for recreational users of the boat ramp	Annual	500
Stony Point Boat Ramp	Crib Point Stony Point Foreshore Committee of Management	Safe access for recreational users of the boat ramp	1-2 years	1,000

Extract 1999 GHD Dredging Study - Western Port sites.

Stony Point

Melway Reference Map 195 F5

Physical Values

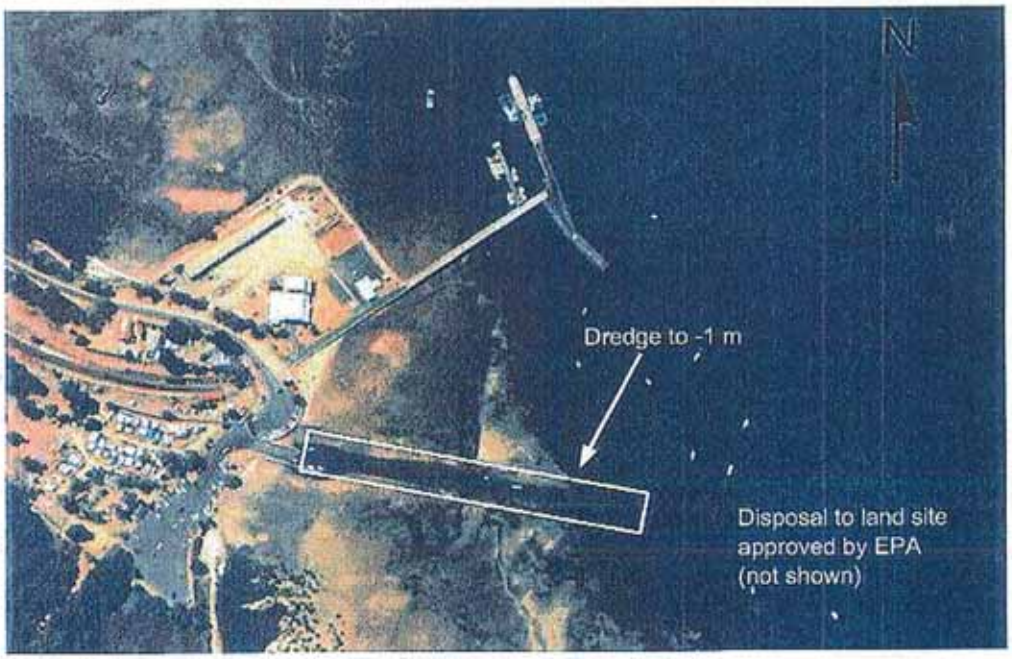
Depth at LW (m)	0.5
Tide Range (m)	2.3
Current (knots)	> 1.0
Wave Exposure (m)	0.25-0.50

Coastal Features

Sediment Transportation Rate	Low
Net Transportation Direction	North
Sediment Type	Sand
Seabed Variation	Silting

Dredging Parameters

Quantity (m^3)	500	*Sensitivity of Area to dredging*	Low
Frequency (years)	1-2 years	*Likely Contamination*	Low
Optimum Time to Dredge	September	*Dredging Plant*	Excavator or Drag lin
Disposal Area	Offsite to land		



References

1 *Western Port Bay Environmental Study 1973-1974*

2 *Plan No 3215, PMA, Westernport - Stony Point Boat Ramp, 1987*

3

4

5

24.0 Stony Point Boat Ramp - Westernport

Stony Point boat ramp is subject to gradual siltation which is removed every few years. Suitable plant includes a drag line or excavator since the quantity is of the order of several hundred cubic metres. Material has previously been disposed of to nearby land, but this has now reached the point where disposal to land elsewhere is required by EPA. The material is uncontaminated.

The channel should be dredged to at least 0.6m.

24.1 Constraints

The Convenor of the Dredge Protocol Committee has indicated that dredged spoil should be disposed offsite to land.

24.2 Options

There are no options to this, as the adjacent land areas have been filled and further disposal threatens mangroves and other fragile environments.

24.3 Issues

There are no known issues to this small scale work.

24.4 Conclusions

As the quantities are relatively small (<<1000 m^3) excavation and disposal by trucking to acceptable EPA site(s) is required in future.

24.5 Summary

Volume	<1,000 m^3
Cost	$10,000
Frequency	Every few years, say 1-2 years
Timing	September (prior to peak use)

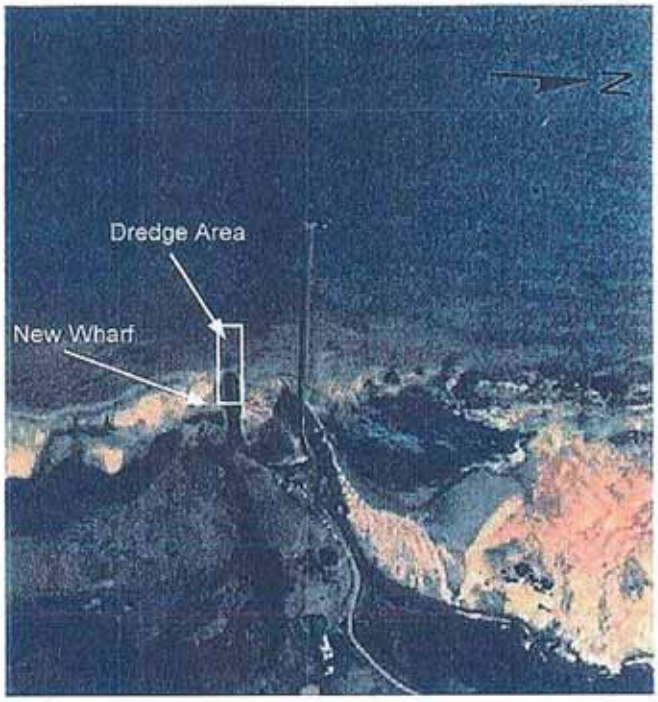
Tankerton Wharf Entrance

Melways Reference Page 17

Physical Values		**Coastal Features**	
Depth at LW (m)	2.0-3.0	*Sediment Transportation Rate*	Low
Tide Range (m)	2.3	*Net Transportation Direction*	South
Current (knots)	< 2.0	*Sediment Type*	Sand
Wave Exposure (m)	0.25-0.50	*Seabed Variation*	Silting

Dredging Parameters

Quantity (m^3)	<10,000	*Sensitivity of Area to dredging*	Medium
Frequency (years)	3-5 years	*Likely Contamination*	Low
Optimum Time to Dredge	Winter	*Dredging Plant*	Cutter/Suction or Grab
Disposal Area	Middle Bank Spoil Ground		



References

1 *Western Port Bay Environmental Study 1973-1974*

2 *Plan No 4215, PMA, Westernport - Tankerton, Approaches to Tankerton Jetty, 1994*

3 *PMA, Westernport Region, Contract for Dredging of Channel to Tankerton Jetty, 1993*

4 *Aerial Photo, Qasco photo151, May 1994*

5 *Plan No 4464, PMA, Westernport - North Arm Tankerton Post Dredge Survey*

18.0 Tankerton Channel

The Tankerton channel was dredged to provide access to the new Tankerton wharf which was constructed in the early 1990's.

In the North Arm of Western Port at Tankerton, sediment transport occurs as a result of the strong tidal current, swell wave action and local wind wave action.

The tide in Western Port is semi-diurnal with a range of about 3.0 m at Stony Point. This relatively large range in combination with a average tidal duration of the ebb or flood of about 6.2 hours gives rise to horizontal currents of about 1m/s (1.9 knots) at springs in the deeper channels and slightly lower currents in the shallower areas. Tidal currents alone are capable of initiating motion and transporting the mainly sandy sediments offshore, and the silty to clayey sediments nearshore.

Tankerton is about the limit of the ocean swell penetration into the Bay from the Western Entrance. Oscillatory currents resulting from the swell assist in stirring up sediments which are then transported by tidal currents. Similarly, local wind waves may also assist in transporting sediments, especially inshore in shallower waters, where the oscillatory currents are more pronounced.

Overall, the seabed in the North Arm is quite mobile, and in the predominantly sandy areas, large sand waves have formed. Inshore where sediments may vary and the sand cover is less, sand waves are much less likely, but sediment transport may still occur.

The Tankerton channel was dredged across the line of the current, which has been studied in detail and exhibits a flood dominant behaviour along the eastern side of the North Arm. Thus sedimentation of the channel is to be expected, and must be controlled by regular dredging if boating access is to be guaranteed to the wharf.

18.1 Constraints

There are no physical constraints to the dredging of the channel. However there is often strong local opposition to large scale dredging and disposal in Western Port.

18.2 Options

Siltation of the channel can be expected in terms of slumping of the batters, particularly the southern side of the channel, and siltation near the wharf. Comparison of recent surveys by Parks Victoria indicates that the outer channel has remained clear, and most deposition occurs at the inshore end of the channel.

As the channel is relatively short, it is not well suited to a trailing suction hopper dredge. Similarly, this type of plant cannot dredge in the tight confines around the Wharf.

A cutter suction dredge is best suited to the actual dredging phase of the works, but is more prone to interruptions by weather.

Disposal of the material may well be strongly influenced by the requirements of the EPA. Ideally the trailing suction hopper dredge offers the best option as it can dump the material directly over the ports declared spoil ground, which is just north of Tankerton and East of Middle Spit.

The cutter suction dredge by comparison would need to either pump the material to deeper water as the pumping distance is not sufficient to pump to the spoil ground, or load the material into barges for transport to the spoil ground. The latter will result in some turbidity from the overflow water.

18.3 Issues

The cutter suction dredge is the best plant to achieve the desired dredging in the conditions at the site. Accordingly, the issues that arise from this proposed methodology are discussed below.

The preferred and most efficient methodology is to pump the material to deeper water north of the Tankerton channel. This methodology is likely to be opposed by the environmental lobby, and if history is any guide, considerable environmental studies and monitoring will need to be undertaken to establish at least the following:

- there are no unique species at the proposed dump site
- the dumping will not cause undue damage to any species
- the material dumped will not be dispersed about the bay
- turbidity levels will not cause damage to Western Port
- mangroves and seagrass beds will not be damaged

If this methodology is not acceptable, then the material will need to be transferred to barges and dumped over the declared borrow site. A similar, although probably lower key environmental study/ assessment will probably be required at the spoil ground.

The transfer of material from the dredge to the barges will result in overflow water to the bay which will create turbid plumes. The impact of the plumes may need to be determined.

Overall dredging in Western Port has been strongly opposed by the environmental groups, and any works have been subject to intense scrutiny. Appropriate lead time for monitoring and background studies, as well as budget should be allowed for this work.

18.4 Conclusions

The Tankerton approach channel should be dredged with a cutter suction or grab dredge. The spoil disposal site is subject to EPA review and will depend on the degree of contamination, volume involved, plant available at the time, and cost.

18.5 Summary

Volume	<10,000 m^3
Cost	<$100,000
Frequency	3 to 5 years
Timing	April to September

Site 14 : Rutherford Inlet

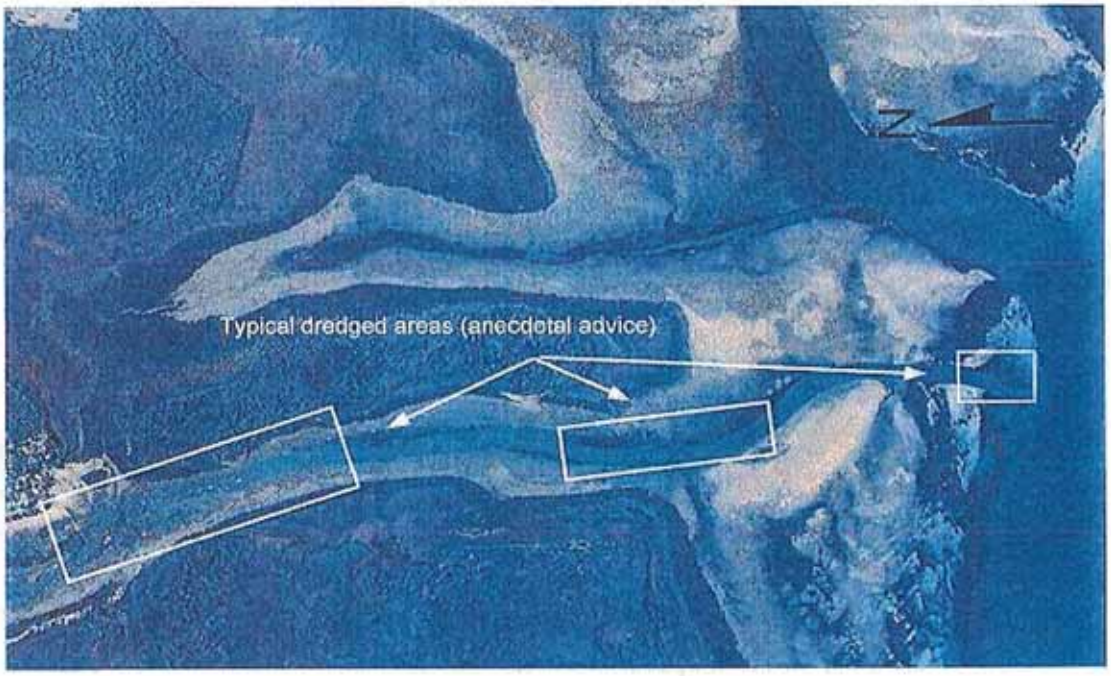
Channel

Melway Reference Map 142 E12

Physical Values		**Coastal Features**	
Depth at LW (m)	<2.7	*Sediment Transportation Rate*	Low
Tide Range (m)	2.3	*Net Transportation Direction*	South
Current (knots)	1.0	*Sediment Type*	Silty Sand
Wave Exposure (m)	<0.25	*Seabed Variation*	Minor Siltation

Dredging Parameters

Quantity (m^3)	1,000	*Sensitivity of Area to dredging*	Medium
Frequency (years)	Every ten years	*Likely Contamination*	Low
Optimum Time to Dredge	All year	*Dredging Plant*	Cutter/Suction
Disposal Area	Onshore		



References

1 *Western Port Bay Environmental Study 1973-1974*
2 *Warneet Forshore Committee*
3 *Aerial Photo, Qasco photo 176, May 1994*
4 *Plan No WP 409 2919, PMA, Westernport - Rutherford Inlet, 1984*
5

Rutherford Inlet

The natural inlet leads to the Warneet Channel and small boat facilities. The inlet is of stable form and depth and is quite adequate for the class of vessels typically transiting to Warneet. We understand that the entrance was dredged in the late 1980's to remove a local shoal, and since then has remained navigable.

Site 19 : Tankerton Wharf Entrance

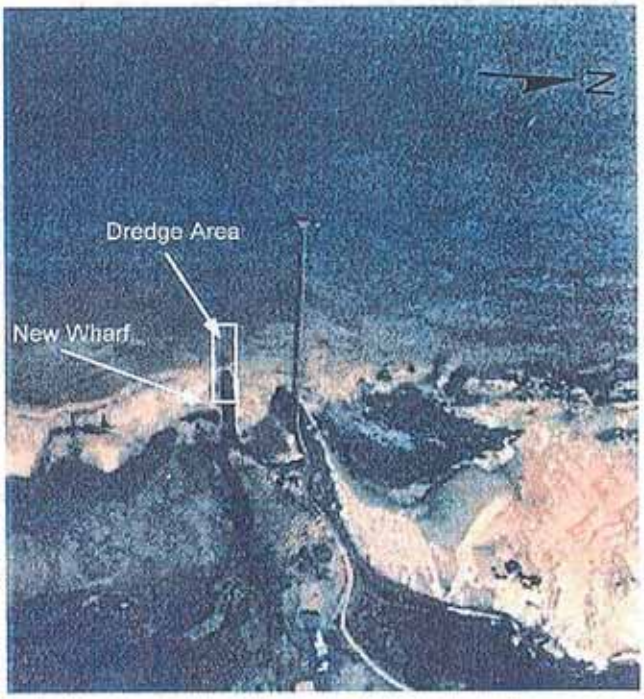
Channel

Melways Reference Page 17

Physical Values		Coastal Features	
Depth at LW (m)	2.0-3.0	*Sediment Transportation Rate*	Low
Tide Range (m)	2.3	*Net Transportation Direction*	South
Current (knots)	< 2.0	*Sediment Type*	Sand
Wave Exposure (m)	0.25-0.50	*Seabed Variation*	Silting

Dredging Parameters

Quantity (m^3)	<10,000	*Sensitivity of Area to dredging*	Medium
Frequency (years)	3-5 years	*Likely Contamination*	Low
Optimum Time to Dredge	Winter	*Dredging Plant*	Cutter/Suction or Grab
Disposal Area	Middle Bank Spoil Ground		



References

1. *Western Port Bay Environmental Study 1973-1974*
2. *Plan No 4215, PMA, Westernport - Tankerton, Approaches to Tankerton Jetty, 1994*
3. *PMA, Westernport Region, Contract for Dredging of Channel to Tankerton Jetty, 1993*
4. *Aerial Photo, Qasco photo151, May 1994*
5. *Plan No 4464, PMA, Westernport - North Arm Tankerton Post Dredge Survey*

Tankerton Wharf Entrance

The channel to the new wharf at Tankerton was created by dredging and will require ongoing regular maintenance dredging. Spoil has been disposed off at the nearby declared spoil ground at Middle Spit. Any dredging work in Western Port has been subject to intense scrutiny and generally opposed by various groups and therefore any works should be planned, substantiated and orchestrated carefully with suitable monitoring.

Likely reasons for infill of the channel are the remnant swell and local wind wave activity stirring up sediments and the strong tidal currents across the line of the channel which will transport any material.

Comparison of surveys by Parks Victoria has shown that the outer channel has remained relatively free of siltation and only the inner channel near the wharf shows some siltation.

Site 20 : Tooradin

Channel

Melways Reference Map 143 K10

Physical Values		Coastal Features	
Depth at LW (m)	> 0.2	*Sediment Transportation Rate*	Low
Tide Range (m)	3.0	*Net Transportation Direction*	South
Current (knots)	1.0	*Sediment Type*	Sand
Wave Exposure (m)	< 0.25	*Seabed Variation*	Minor Siltation

Dredging Parameters

Quantity (m^3)	1,000	*Sensitivity of Area to dredging*	Medium
Frequency (years)	Every 20 years	*Likely Contamination*	Low
Optimum Time to Dredge	All year	*Dredging Plant*	Cutter/Suction
Disposal Area	Onshore		

References

1 *Western Port Bay Environmental Study 1973-1974*

2 *Aerial Photo, Qasco photo177, May 1994 Tooradin Foreshore Committee*

3 *Plan No WP 361 2715, PMA, Westernport - Tooradin, 1982*

4 *Plan No 2756 7, PMA, Westernport - Tooradin, Sawtells Inlet, 1983*

5 *Plan No 4595, PMA, Westernport - Tooradin Channel North, Approach to Tooradin, 1995*

Tooradin Channel

The channel comprises a relatively deep and wide outer channel, and a narrow and shallow inner channel leading to the boat ramp, jetty and mooring areas. Only the inner channel required dredging, with infill being most likely caused by slumping of the bank from boat wakes and propeller wash. We understand that the channel was dredged about 30 years ago and since then some shoals have formed, but the channel is still navigable.

Disposal of spoil is likely to be accompanied by turbidity and should consider the impact on mangroves and marine life.

We understand that no records were kept of the previous dredging, but it was anecdotally at corners and at the jetty. Accordingly the inner channel should be monitored by discussion with the local committee of management to ascertain dredging requirements.

Site 63 : Stony Point

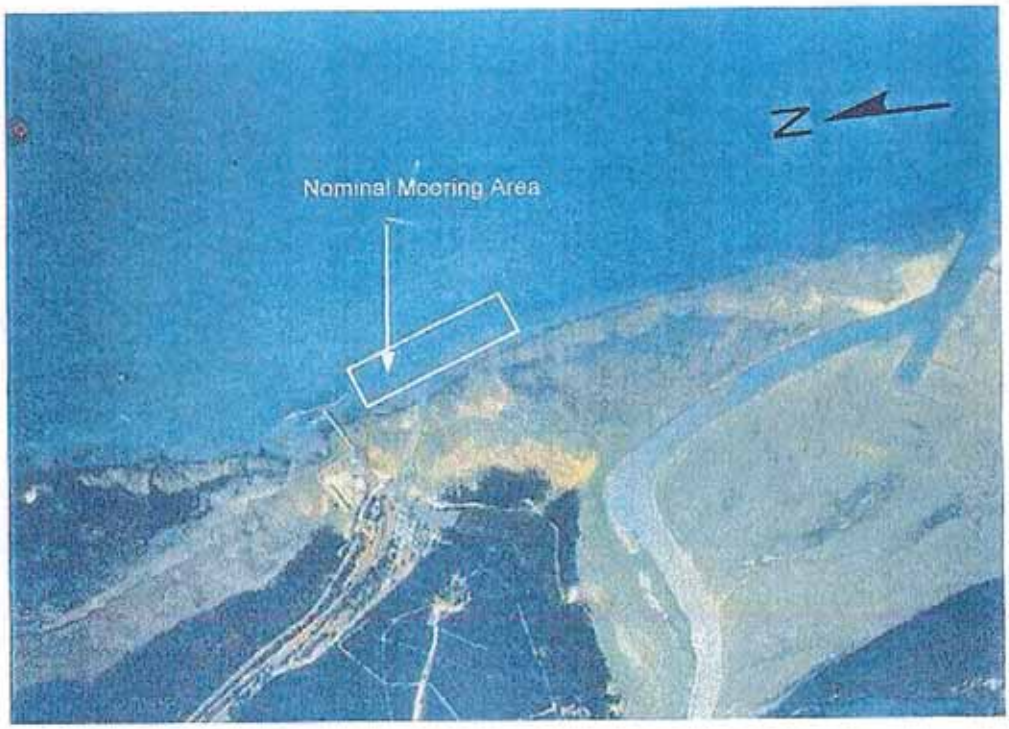
Mooring

Melway Reference Map 195 F5

Physical Values		Coastal Features	
Depth at LW (m)	3.0-6.5	*Sediment Transportation Rate*	Low
Tide Range (m)	2.3	*Net Transportation Direction*	North East
Current (knots)	> 1.0	*Sediment Type*	Sand
Wave Exposure (m)	0.25-0.50	*Seabed Variation*	No Change

Dredging Parameters

Quantity (m^3)	Not dredged	*Sensitivity of Area to dredging*	Low
Frequency (years)	N/A	*Likely Contamination*	Low
Optimum Time to Dredge	All year	*Dredging Plant*	N/A
Disposal Area	N/A		



The mooring area is deep and has stable depths.

References

1 *Western Port Bay Environmental Study 1973-1974*

2 *Plan No 3370, PMA, Westernport - Stony Point, Vicinity of Stony Point Jetty, 1988*

3 *Plan No 2729, PMA, Westernport - Stony Point, Soundings in Vicinity of the Pier, 1982*

4 *Aerial Photo, Qasco photo 1584, January 1998*

5

Site 66 : Warneet A (Rutherford Inlet)

Mooring

Melways Reference Map 142 D12

Physical Values		Coastal Features	
Depth at LW (m)	3.0	*Sediment Transportation Rate*	Low
Tide Range (m)	2.3	*Net Transportation Direction*	South
Current (knots)	< 1.0	*Sediment Type*	Sand
Wave Exposure (m)	< 0.25	*Seabed Variation*	Silting

Dredging Parameters

Quantity (m^3)	Not dredged	*Sensitivity of Area to dredging*	Low
Frequency (years)	N/A	*Likely Contamination*	Low
Optimum Time to Dredge	All year	*Dredging Plant*	N/A
Disposal Area	N/A		

Most mooring areas at Warneet are, and always have been shallow and inaccessible at low water. The area varies in depth with distance from the channel, but is satisfactory for existing vessels and depths are stable.

References

1 *Western Port Bay Environmental Study 1973-1974*
2 *Warneet Foreshore Committee*
3 *Aerial Photo, Qasco photo176, May 1994*
4 *Plan No WP 409 2919, PMA, Westernport - Rutherford Inlet, 1984*
5

Site 67 : Warneet B (Rutherford Inlet)

Mooring

Melways Reference Map 142 D12

Physical Values

Depth at LW (m)	0.5
Tide Range (m)	2.3
Current (knots)	<1.0
Wave Exposure (m)	< 0.25

Coastal Features

Sediment Transportation Rate	Low
Net Transportation Direction	South
Sediment Type	Sand
Seabed Variation	Silting

Dredging Parameters

Quantity (m^3)	Not dredged	*Sensitivity of Area to dredging*	Low
Frequency (years)	N/A	*Likely Contamination*	Low
Optimum Time to Dredge	All year	*Dredging Plant*	N/A
Disposal Area	N/A		

Most mooring areas at Warneet are, and always have been shallow and inaccessible at low water. The area varies in depth with distance from the channel, but is satisfactory for existing vessels and depths are stable.

References

1. *Western Port Bay Environmental Study 1973-1974*
2. *Warneet Foreshore Committee*
3. *Aerial Photo, Qasco photo176, May 1994*
4. *Plan No WP 409 2919, PMA, Westernport - Rutherford Inlet, 1984*
5.

Site 68 : Warneet C (Rutherford Inlet)

Mooring

Melways Reference Map 142 E11

Physical Values

Depth at LW (m)	1.0
Tide Range (m)	2.3
Current (knots)	< 1.0
Wave Exposure (m)	< 0.25

Coastal Features

Sediment Transportation Rate	Low
Net Transportation Direction	South West
Sediment Type	Sand
Seabed Variation	Silting

Dredging Parameters

Quantity(m^3)	Not dredged	*Sensitivity of Area to dredging*	Low
Frequency (years)	N/A	*Likely Contamination*	Low
Optimum Time to Dredge	All year	*Dredging Plant*	N/A
Disposal Area	N/A		

Most mooring areas at Warneet are, and always have been shallow and inaccessible at low water. The area varies in depth with distance from the channel, but is satisfactory for existing vessels and depths are stable.

References

1. *Western Port Bay Environmental Study 1973-1974*
2. *Warneet Foreshore Committee*
3. *Aerial Photo, Qasco photo176, May 1994*
4. *Plan No WP 409 2919, PMA, Westernport - Rutherford Inlet, 1984*
5.

Site 69 : Warneet D (Rutherford Inlet)

Mooring

Melways Reference Map 142 F10

Physical Values

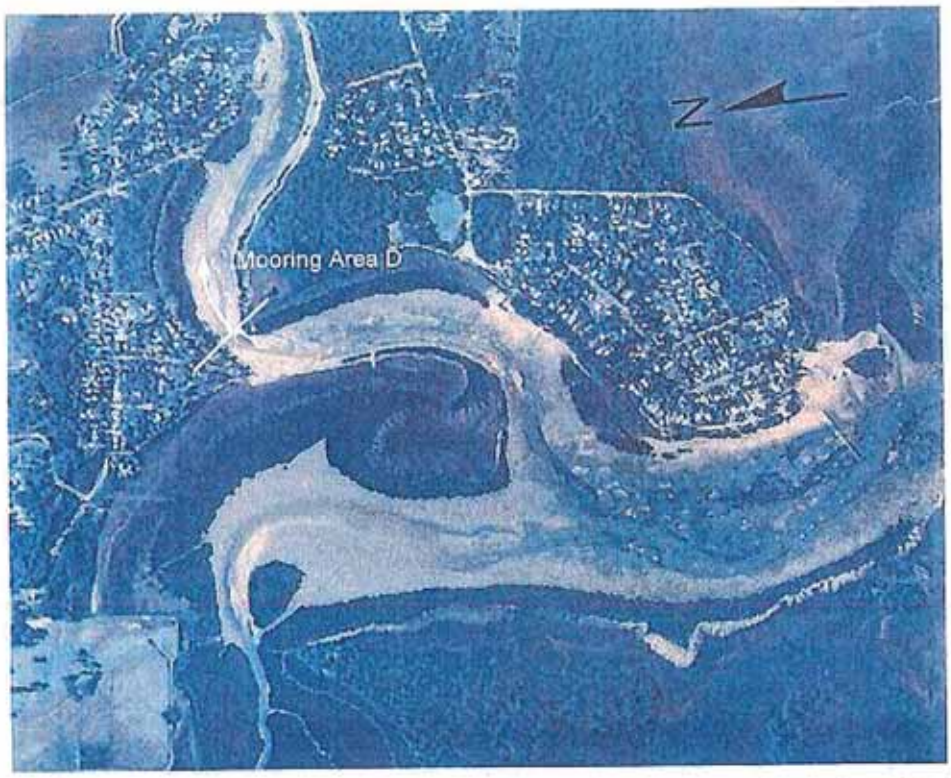
Depth at LW (m)	1.5
Tide Range (m)	2.3
Current (knots)	< 1.0
Wave Exposure (m)	< 0.25

Coastal Features

Sediment Transportation Rate	Low
Net Transportation Direction	West
Sediment Type	Sand
Seabed Variation	Silting

Dredging Parameters

Quantity (m^3)	Not dredged	*Sensitivity of Area to dredging*	Low
Frequency (years)	N/A	*Likely Contamination*	Low
Optimum Time to Dredge	All year	*Dredging Plant*	N/A
Disposal Area	N/A		



The area is shallow but adequate for the small vessels using this area. From anecdotal advice, the area is gradually shoaling and a few moorings have had to be relocated.

References

1 *Western Port Bay Environmental Study 1973-1974*

2 *Warneet Foreshore Committee*

3 *Aerial Photo. Qasco photo176, May 1994*

4 *Plan No WP 409 2919, PMA, Westernport - Rutherford Inlet, 1984*

5

Site 25 : Cowes

Pier/Jetty

Melway Reference Map 531 K1

Physical Values		Coastal Features	
Depth at LW (m)	5.0	*Sediment Transportation Rate*	Low
Tide Range (m)	2.3	*Net Transportation Direction*	East
Current (knots)	1.0-1.5	*Sediment Type*	Sand
Wave Exposure (m)	< 0.25	*Seabed Variation*	No Change

Dredging Parameters

Quantity (m^3)	Not dredged	*Sensitivity of Area to dredging*	Low
Frequency (years)	N/A	*Likely Contamination*	Low
Optimum Time to Dredge	All year	*Dredging Plant*	N/A
Disposal Area	N/A		

The jetty provides adequate water for the ferries and recreational vessels using the pier and there is no evidence of siltation. The strong tidal currents, local wind waves and swell tend to cause minor shoreline variations, but overall the pier depths are more than adequate.

References

1 *Western Port Bay Environmental Study 1973-1974*

2 *Plan No 3440, PMA, Westernport - Vicinity of Cowes Jetty, 1988*

3

4

5

Site 27 : Flinders

Pier/Jetty

Melway Reference Map 262 B9

Physical Values		Coastal Features	
Depth at LW (m)	1.5-2.5	*Sediment Transportation Rate*	Low
Tide Range (m)	2.3	*Net Transportation Direction*	North East
Current (knots)	0.5-1.0	*Sediment Type*	Sand
Wave Exposure (m)	> 0.75	*Seabed Variation*	No Change

Dredging Parameters

Quantity (m^3)	Not dredged	*Sensitivity of Area to dredging*	Low
Frequency (years)	N/A	*Likely Contamination*	Low
Optimum Time to Dredge	All year	*Dredging Plant*	N/A
Disposal Area	N/A		

Flinders Pier is partially in the lee of West Head. The pier provides adequate but shallow water depths at the lower landings for a range of recreational and commercial activities. The seabed level is stable and unchanged over time.
The breakwater shown in the photograph has been demolished at the time of writing.

References

1 *Western Port Bay Environmental Study 1973-1974*
2 *Plan No 2457, PMA, Westernport - Flinders, Soundings in Vicinity of Jetty, 1979*
3 *Plan No 3430, PMA, Westernport - Flinders, Vicinity of Jetty, 1988*
4 *Aerial Photo, Qasco photo 1693, January 1998*
5

Site 29 : Hastings

Melway Reference Map 154 K11

Pier/Jetty

Physical Values		Coastal Features	
Depth at LW (m)	2.0	Sediment Transportation Rate	Low
Tide Range (m)	2.3	Net Transportation Direction	Nil
Current (knots)	< 1.0	Sediment Type	Clayey Sand
Wave Exposure (m)	< 0.25	Seabed Variation	No Change

Dredging Parameters

Quantity (m^3)	< 500	Sensitivity of Area to dredging	Low
Frequency (years)	Infrequent	Likely Contamination	Low
Optimum Time to Dredge	All year	Dredging Plant	Cutter/Suction
Disposal Area	Onshore		

Hastings pier is subject to the general slow siltation within Hastings Bight. Generally though, depths are adequate and any seabed changes are slow and incremental. Parks Victoria were not able to provide information regarding the dredging history of the site but, based on staff experience, we intuitively believe that the area has been exposed to some minor dredging work.

Dredging frequency and the next dredging will to some degree be dependent on vessel activities and demand and hence is indeterminate at this time.

References

1 *Western Port Bay Environmental Study 1973-1974*

2 *Aerial Photo, Quasco photo162, May 1994*

3 *Plan No 3421, PMA, Westernport - Hastings, Vicinity of Jetty, 1988*

4 *Plan No 3763, PMA, Westernport - Hastings, 1991*

5

Site 32 : Newhaven

Pier/Jetty

Melway Reference Map 534 H6

Physical Values

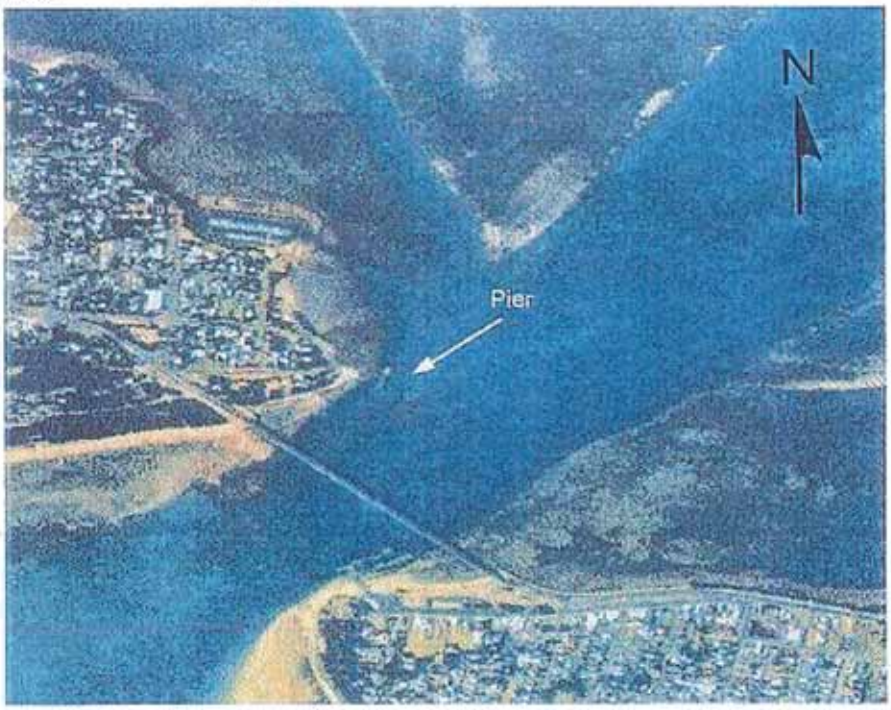
Depth at LW (m)	3.0-4.5
Tide Range (m)	2.3
Current (knots)	> 2.0
Wave Exposure (m)	< 0.25

Coastal Features

Sediment Transportation Rate	Low-Medium
Net Transportation Direction	North
Sediment Type	Sand
Seabed Variation	Minor Siltation

Dredging Parameters

Quantity (m^3)	Not dredged	*Sensitivity of Area to dredging*	Low
Frequency (years)	N/A	*Likely Contamination*	Low
Optimum Time to Dredge	All year	*Dredging Plant*	N/A
Disposal Area	N/A		



The pier lies in a low wave energy environment just inland of the western entrance. Currents are strong and combined with the low to medium sediment transport on this part of the coast, depths are adequate and stable.

References

1 *Western Port Bay Environmental Study 1973-1974*

2 *Plan No 3713, PMA, Westernport - Newhaven, 1991*

3 *Plan No 3443, PMA, Westernport - Vicinity of Newhaven Jetty, 1988*

4 *Plan No WP 294 2035, PMA, Westernport Eastern Entrance - San Remo - Newhaven, 1978*

5 *Aerial Photo, Qasco photo 1747, January 1998*

Site 36 : Rhyll

Pier/Jetty

Melway Reference Map 534 K11

Physical Values

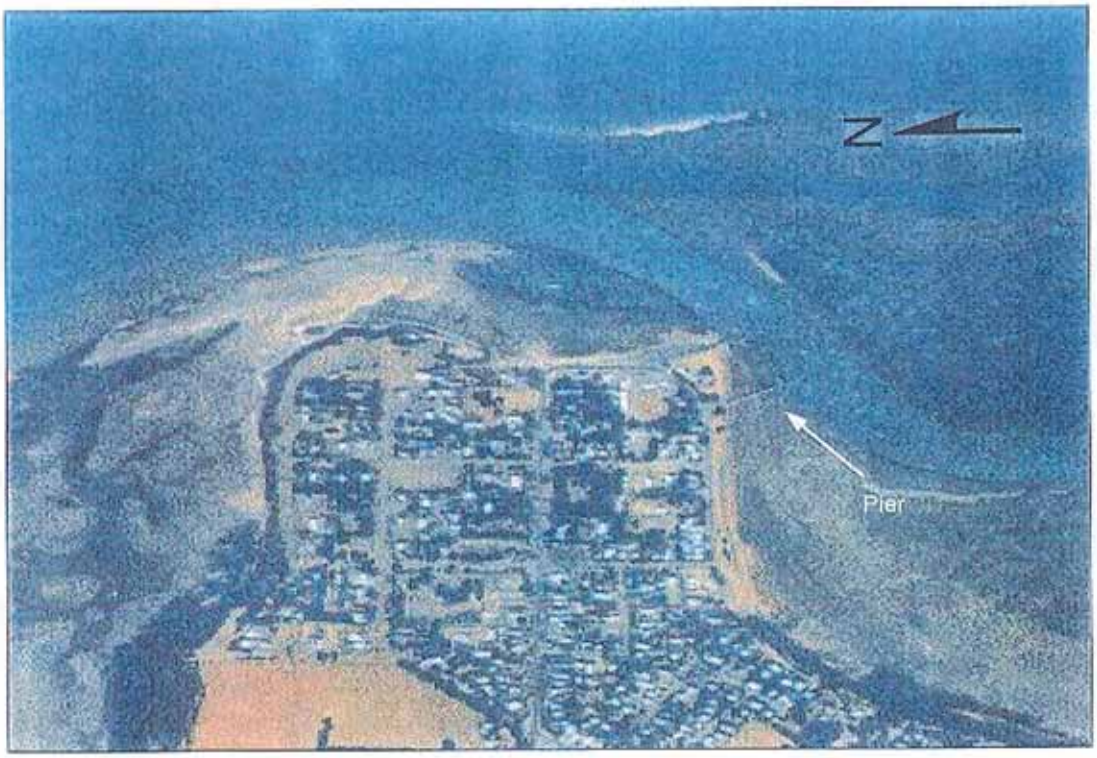
Depth at LW (m)	5.0
Tide Range (m)	2.3
Current (knots)	1.0
Wave Exposure (m)	< 0.25

Coastal Features

Sediment Transportation Rate	Low
Net Transportation Direction	South West
Sediment Type	Clayey Sand
Seabed Variation	No Change

Dredging Parameters

Quantity (m^3)	Not dredged	*Sensitivity of Area to dredging*	Low
Frequency (years)	N/A	*Likely Contamination*	Low
Optimum Time to Dredge	All year	*Dredging Plant*	N/A
Disposal Area	N/A		



The Rhyll pier provides adequate and stable water depths for the existing small vessels using the facilities in this area.

References

1. *Western Port Bay Environmental Study 1973-1974*
2. *Plan No 3712, PMA, Westernport - Ryll, 1991*
3. *Plan No 3451, PMA, Westernport, Phillip Island - Approaches to Ryll Jetty, 1988*
4. *Aerial Photo, Qasco photo 1722, January 1998*
5.

Site 39 : San Remo

Melway Reference Map 534 H7

Pier/Jetty

Physical Values

Depth at LW (m)	< 8.0
Tide Range (m)	2.3
Current (knots)	> 1.0
Wave Exposure (m)	Low

Coastal Features

Sediment Transportation Rate	High
Net Transportation Direction	North East
Sediment Type	Sand
Seabed Variation	Minor Siltation

Dredging Parameters

Quantity (m^3)	7000	*Sensitivity of Area to dredging*	Low
Frequency (years)	3 Years	*Likely Contamination*	Low
Optimum Time to Dredge	All year	*Dredging Plant*	Cutter/Suction
Disposal Area	Onshore, South to beach		

References

1 *Western Port Bay Environmental Study 1973-1974*

2 *Plan No WP 294 2035, PMA, Westernport Eastern Entrance - San Remo - Newhaven, 1978*

3

4

5

Site 42 : Tooradin

Melway Reference Map 144 A3

Pier/Jetty

Physical Values

Depth at LW (m)	0.2
Tide Range (m)	2.3
Current (knots)	< 1.0
Wave Exposure (m)	< 0.25

Coastal Features

Sediment Transportation Rate	Low
Net Transportation Direction	South West
Sediment Type	Sand
Seabed Variation	Silting

Dredging Parameters

Quantity (m^3)	1,000	*Sensitivity of Area to dredging*	Low
Frequency (years)	Every 20 years	*Likely Contamination*	Low
Optimum Time to Dredge	All year	*Dredging Plant*	Cutter/Suction
Disposal Area	Onshore		

The Tooradin pier caters for a range of small vessels and provides adequate water for most existing needs. Conditions are quiet at the pier and sedimentation is slow and incremental. Based on anecdotal information, the area is said to have shoaled since the jetty was rebuilt in the early 1980's.

We understand that the area currently needs dredging. Accordingly, sampling and testing for contaminants will be required and a disposal area agreed with EPA.

References

1 *Western Port Bay Environmental Study 1973-1974*

2 *Aerial Photo, Qasco photo 177, May 1994*

3 *Plan No WP 361 2715, PMA, Westernport - Tooradin, 1982*

4 *Tooradin Foreshore Committee*

5 *Plan No 4594, PMA, Westernport - Tooradin Channel North, Approach to Tooradin, 1995*

Site 43 : Warneet North

Pier/Jetty

Melway Reference Map 142 E11

Physical Values

Depth at LW (m)	-1.0
Tide Range (m)	2.3
Current (knots)	< 1.0
Wave Exposure (m)	< 0.25

Coastal Features

Sediment Transportation Rate	Low
Net Transportation Direction	South West
Sediment Type	Sand
Seabed Variation	Silting

Dredging Parameters

Quantity (m^3)	Not dredged	*Sensitivity of Area to dredging*	Low
Frequency (years)	N/A	*Likely Contamination*	Low
Optimum Time to Dredge	All year	*Dredging Plant*	N/A
Disposal Area	N/A		

The small timber jetty caters for small craft and provides adequate water depths. Based on anecdotal information the area is presumed to have stable depths.

References

1 *Western Port Bay Environmental Study 1973-1974*

2 *Aerial Photo, Qasco photo 1788, January 1998*

3 *Plan No WP 409/2919, PMA, Westernport - Rutherford Inlet, 1984*

4

5

Site 44 : Warneet South

Pier/Jetty

Melway Reference Map 142 E12

Physical Values

Depth at LW (m)	1.0
Tide Range (m)	2.3
Current (knots)	< 1.0
Wave Exposure (m)	< 0.25

Coastal Features

Sediment Transportation Rate	Low
Net Transportation Direction	South East
Sediment Type	Sand
Seabed Variation	Silting

Dredging Parameters

Quantity (m^3)	200	*Sensitivity of Area to dredging*	Low
Frequency (years)	Annual	*Likely Contamination*	Low
Optimum Time to Dredge	All year	*Dredging Plant*	Cutter/Suction
Disposal Area	Onshore		

The reinforced concrete jetty caters for a range of craft and provides adequate water depths. Based on anecdotal information the area is presumed to have stable depths.
The nominal dredged areas shown are based on anecdotal information. Spoil area(s) will be subject to contaminant testing and EPA review.

References

1 *Western Port Bay Environmental Study 1973-1974*
2 *Aerial Photo, Qasco photo 1788, January 1998*
3 *Plan No WP 409/2919, PMA, Westernport - Rutherford Inlet, 1984*
4
5

Site 91 : Tooradin

Boat Ramp

Melway Reference Map 144 A4

Physical Values		Coastal Features	
Depth at LW (m)	0.3	*Sediment Transportation Rate*	Low
Tide Range (m)	2.3	*Net Transportation Direction*	West
Current (knots)	< 1.0	*Sediment Type*	Sand/Silt
Wave Exposure (m)	< 0.25	*Seabed Variation*	Silting

Dredging Parameters

Quantity (m^3)	200	*Sensitivity of Area to dredging*	Low
Frequency (years)	Annual	*Likely Contamination*	Low
Optimum Time to Dredge	All year	*Dredging Plant*	Excavation or Drag lin
Disposal Area	Onshore		

The ramp and approach channel to the main channel was dredged in the early 1990's and material pumped ashore. Since then we understand that annual clearing with a long reach back hoe is required for the vicinity of the ramp, but this quickly silts again within 6 months. The information was gained anecdotally and there are no records of dredge sites and disposal areas.

References

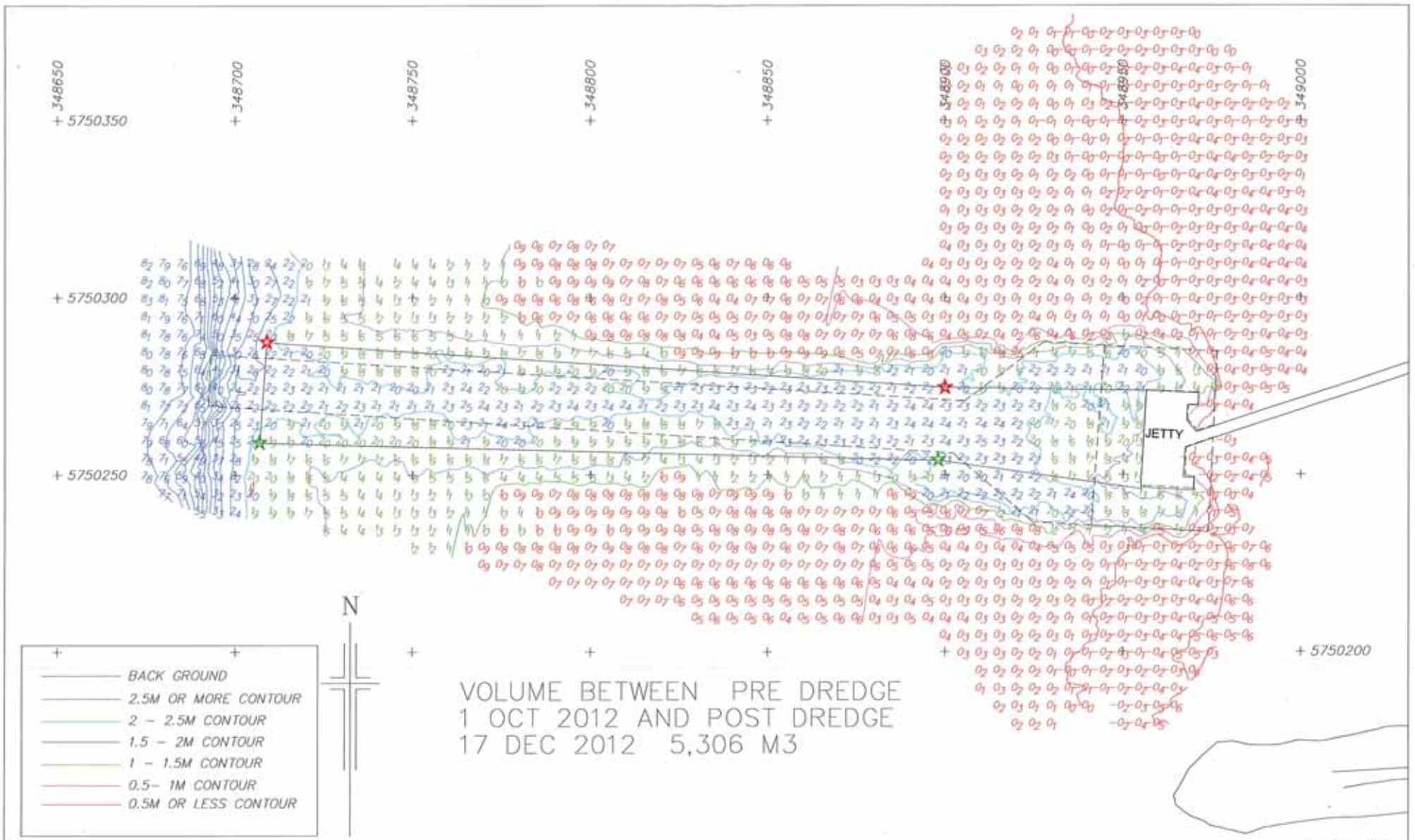
1 *Western Port Bay Environmental Study 1973-1974*

2 *Aerial Photo, Qasco photo 177, May 1994*

3 *Plan No WP 361-2715, PMA, Westernport - Tooradin, 1982*

4 *Tooradin Foreshore Committee*

5 *Plan No 4594, PMA, Westernport - Tooradin Channel North, Approach to Tooradin, 1995*



ORIGINAL SHEET SIZE A3

Surveyed and Prepared By

Redmapping

Hydrographic Surveys
Feature Surveys
Beach Profiles
Amphibious Service

P.O Box 521, Bacchus Marsh
www.redmapping.com.au
Mobile 0409 432 241

0 20 40 60 80 100 m

SCALE 1:1000

COORDINATES: MGA	SURVEY: PB	17 DEC 2012
HEIGHT DATUM: CHART	CALC.: PB	17 DEC 2012
CAD REF.: TANK11	DRAWN: PB	18 DEC 2012
FLD/LVL BOOK:	CHECKED:	

NOTES:

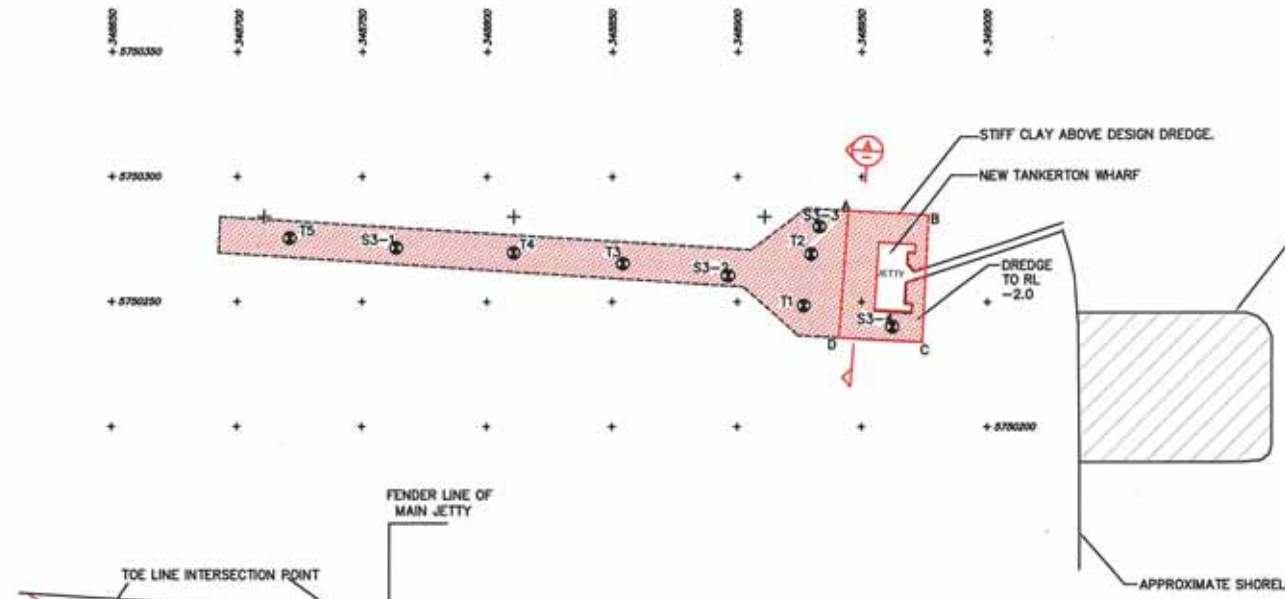
COORDINATES BASED ON MAP GRID AUSTRALIA
HEIGHT DATUM BASED ON
WESTERN PORT CHART DATUM 1.69 M BELOW AHD
CONTOURS INTERVALS 0.5M
LOW FREQUANCY TRANSDUCER AT 30 KHZ
REV 2 TOTAL AREA VOLUME ADDED

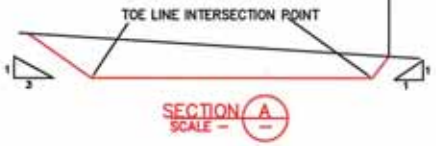
TANKERTON JETTY
POST DREDGE
HYDROGRAPHIC SURVEY

DRAWING No. TANK 11

SHEET 1 OF 1

REVISION 01





SECTION A
SCALE –

SAMPLE DATA

NO.	CORE LENGTH (m)	DETAILS	DATE
T1	0.6	SAND / SILT – CLAY AT 0.6	
T2	0.8	SAND / SILT – CLAY AT 0.8	
T3	1.0	SILT – CLAY AT 1.0	24/8/99
T4	1.0	SILT	
T5	0.8	SILT	
S3-1	NO DETAILS	SILT – FINE/MEDIUM SAND	
S3-2	NO DETAILS	SILT – FINE/MEDIUM SAND	23/05/2006
S3-3	NO DETAILS	SILT – FINE/MEDIUM SAND	
S3-4	NO DETAILS	SILT – FINE/MEDIUM SAND	

NO CONTAMINATION

SCHEDULE OF CO-ORDINATES

POINT	EASTING	NORTHING	LEVEL(m)(CD)	DESCRIPTION
A	348944.76	5750286.38	-2.0	TOE LINE INTERSECTION POINT
B	348976.47	5750284.70	-2.0	TOE LINE INTERSECTION POINT
C	348974.04	5750233.81	-2.0	TOE LINE INTERSECTION POINT
D	348941.10	5750235.66	-2.0	TOE LINE INTERSECTION POINT

REFER TO SURVEY TANK03-2007 FOR HYDRO SURVEY

LEGEND:

DREDGE AREA

SPOIL DISPOSAL AREA

NOTE:

WARNING

SERVICES SHOWN ON THIS DRAWING ARE APPROXIMATE ONLY. THE EXACT LOCATION IS TO BE CONFIRMED ON SITE BY CONTRACTOR PRIOR TO COMMENCEMENT OF WORKS.

PRELIMINARY

A ISSUED FOR APPROVAL

PARKS VICTORIA
DREDGING SERVICES AGREEMENT
DREDGING PLAN
TANKERTON WHARF

31-24053-K006 A

ORIGINAL SHEET SIZE A1

NOTES:
COORDINATES BASED ON MGA94, ZONE 55
HEIGHT DATUM BASED ON CHART DATUM
CONTOUR INTERVAL: 0.5m

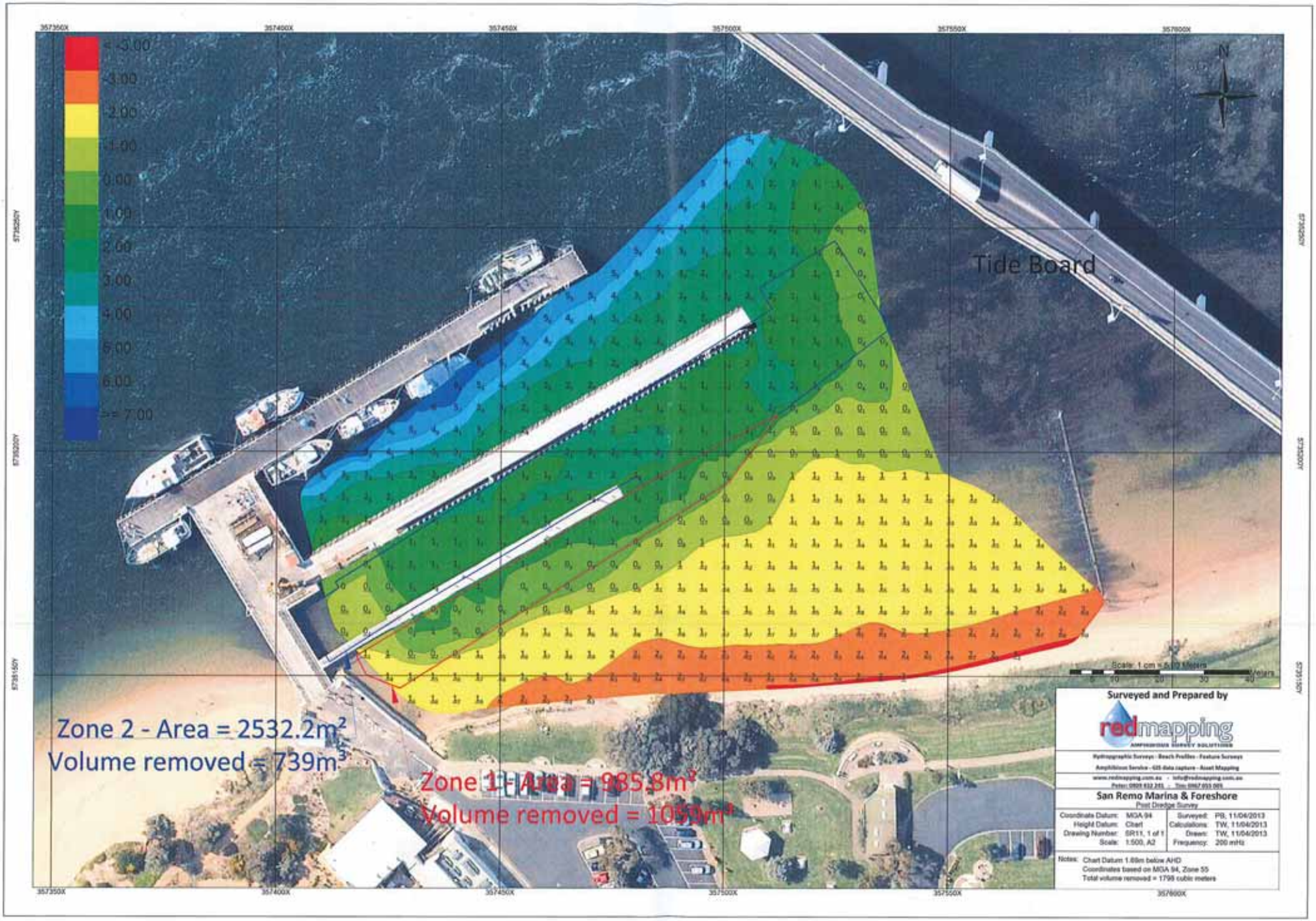
0 20 40 60 80 100 m
SCALE 1:1000

COORDINATES: MGA	SURVEY:
HEIGHT DATUM: CHART DATUM	CALC.: PB 18 DEC 2013
CAD REF.:	DRAWN: PB 18 DEC 2013
FLD/LVL BOOK:	CHECKED:

Surveyed and Prepared By
Redmapping
Hydrographic Surveys
Feature Surveys
Beach Profiles
Amphibious Service
P.O Box 521, Bacchus Marsh
www.redmapping.com.au
Hooks 0409 432 241

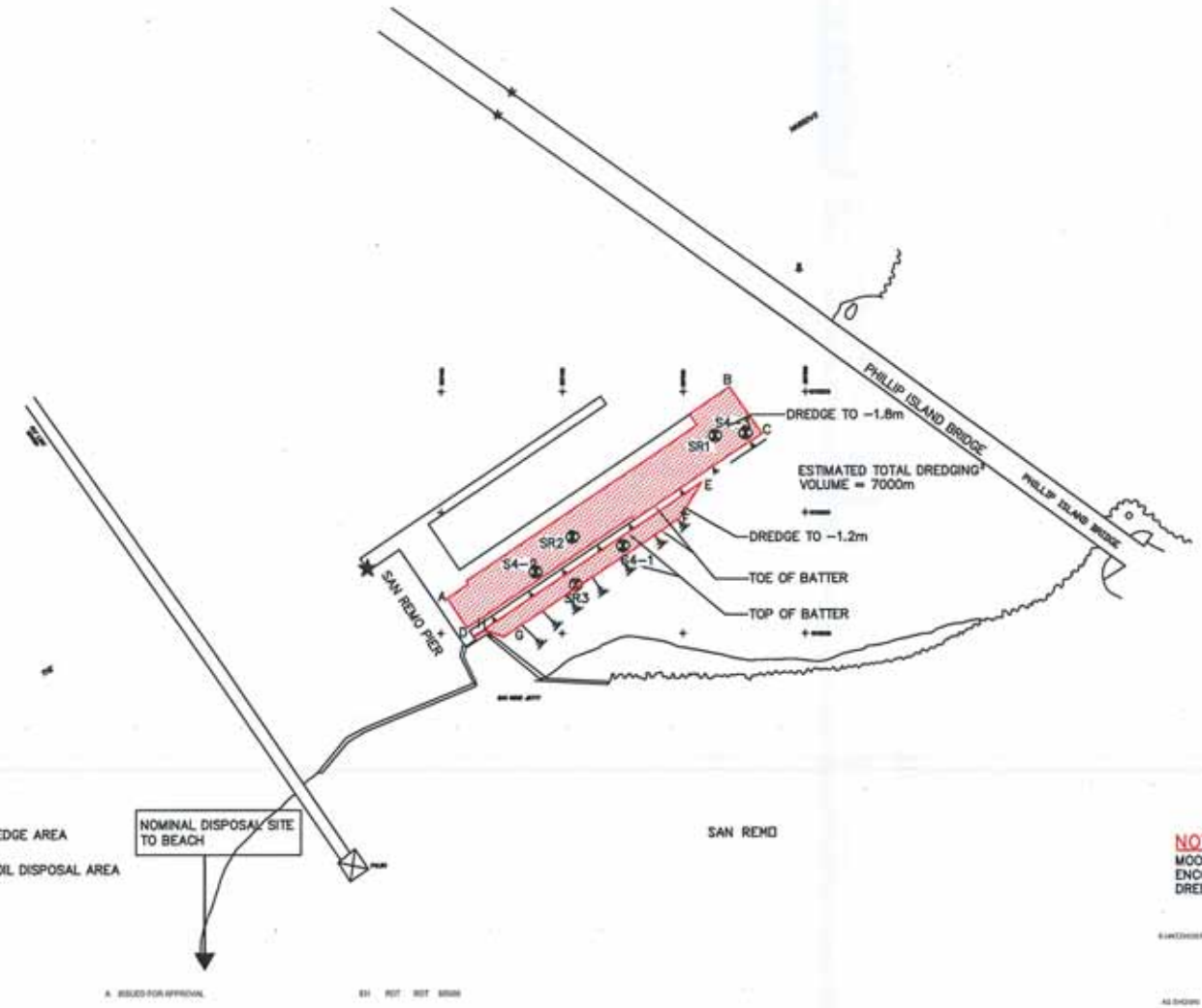
TANKERTON
MGA 94 UPDATE

DRAWING No. PV 6
SHEET 1 OF 1
REVISION 0


357350X
357400X
357450X
357500X
357550X
357600X
< -3.00
-3.00
-2.00
-1.00
0.00
1.00
2.00
3.00
4.00
5.00
6.00
>= 7.00
N
Tide Board
Zone 2 - Area = 2532.2m²
Volume removed = 739m³
Zone 1 - Area = 985.8m²
Volume removed = 1059m³
Surveyed and Prepared by
redmapping
Hydrographic Surveys - Beach Profiles - Feature Surveys
Amphibious Service - GIS data capture - Asset Mapping
San Remo Marina & Foreshore
Post Dredge Survey
Coordinate Datum: MGA 94
Height Datum: Chart
Drawing Number: SR11_1 of 1
Scale: 1:500, A2
Surveyed: PB, 11/04/2013
Calculations: TW, 11/04/2013
Drawn: TW, 11/04/2013
Frequency: 200 mHz
Notes: Chart Datum 1.88m below AHD
Coordinates based on MGA 94, Zone 55
Total volume removed = 1798 cubic meters

SCHEDULE OF CO–ORDINATES

POINT	EASTING	NORTHING	LEVEL(m)(CD)	DESCRIPTION
A	357402.84	5735164.55	–1.8	
B	357519.19	5735251.87	–1.8	
C	357532.17	5735232.46	–1.8	
D	357411.07	5735152.37	–1.8	
E	357507.59	5735212.37	–1.2	
F	357498.77	5735197.70	–1.2	
G	357425.98	5735148.65	–1.2	
H	357417.95	5735151.52	–1.2	



SAMPLE DATA

NO.	CORE LENGTH (m)	DETAILS	DATE
SR1	0.80	SAND, WHITE ROCK AT 0.8m	12/10/98
SR2	0.20	SAND / MUD, CLAY AT 0.20m	
SR2	1.80	SAND	
S4–1	NO DETAILS	FINE / MEDIUM SAND	23/05/2006
S4–2	NO DETAILS	FINE / MEDIUM SAND	
S4–3	NO DETAILS	FINE / MEDIUM SAND, SILT	

NO CONTAMINATION

LEGEND:

- DREDGE AREA
- SPOIL DISPOSAL AREA

NOTE:
MOORING CHAIN ETC ENCOUNTERED DURING LAST DREDGE MOSTLY REMOVED.

WARNING
SERVICES SHOWN ON THIS DRAWING ARE APPROXIMATE ONLY. THE EXACT LOCATION IS TO BE CONFIRMED ON SITE BY CONTRACTOR PRIOR TO COMMENCEMENT OF WORKS.

PRELIMINARY

A ISSUED FOR APPROVAL

PARKS VICTORIA
DREDGING SERVICES AGREEMENT
DREDGING PLAN
SAN REMO PIER
31-24053-K007 A

ORIGINAL SHEET SIZE A1

NOTES:
COORDINATES BASED ON MGA94, ZONE 55
HEIGHT DATUM BASED ON CHART DATUM
CONTOUR INTERVAL: 0.5m

SCALE 1:1000

COORDINATES: MGA 94	SURVEY:
HEIGHT DATUM: CHART DATUM	CALC.: PB 18 DEC 2013
CAD REF.:	DRAWN: PB 18 DEC 2013
FILE/DIL BOOK:	CHECKED:

Surveyed and Prepared By
Redmapping
Hydrographic Surveys
Feature Surveys
Beach Profiles
Amphibious Service
P.O Box 521, Bacchus Marsh
www.redmapping.com.au
Mobile 0409 432 241

SAN REMO
MGA 94 UPDATE

DRAWING No. PV 7
SHEET 1 OF 1
REVISION 0