

NAVIGATION DREDGING – IMPROVING OUTCOMES THROUGH PARTNERSHIPS AND BENEFICIAL USE OF DREDGED MATERIALS.

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ABSTRACT: The Land and Property Management Authority (LPMA) is the lead agency for the coordination of navigation dredging in NSW waterways and works in partnership with the private sector, local and State government and community to achieve balanced social, environmental and economic outcomes.

Entrances to the State's coastal harbours, estuaries and lakes are highly prone to shoaling from marine sand. Shoaling can seriously affect navigation and cause other detrimental impacts which can disadvantage regional coastal communities that rely on maritime-related enterprises, tourism and recreation.

Since announcing its dredging strategy in 2007, LPMA has been fostering partnerships for dredging in regional coastal waterways through the Minor Ports, River Entrances and Waterways Programs. Under these programs, dredging projects compete for the limited funds available from NSW Treasury on a state-wide basis.

Over the last couple of years there has been a shift in how dredge material is valued. Campaigns to improve navigation at Coffs Harbour, Terranora Inlet and Port Macquarie have used dredge material to good effect for improved environmental and social outcomes.

More recently, dredging campaigns in Swansea Channel and the Myall River have combined commercial use of dredged material with contributions from State and local government to help offset the cost of dredging. This collaborative approach has enabled a greater volume of material to be dredged and has provided sand for foreshore renourishment works and for other local projects.

In this paper we demonstrate how these recent partnerships have the potential to achieve better environmental, social and economic outcomes than the more traditional approach (i.e. fully funded by government with the main focus on achieving improved navigation).

Introduction

In mid 2003, the Department of Lands [now Land and Property Management Authority] was given responsibility for a portfolio of maritime assets which effectively include all of the state's major maritime assets outside the major ports of Sydney, Botany Bay, Newcastle and Port Kembla. The portfolio includes breakwaters, jetties, wharves, training walls and general harbour assets with an estimated replacement value of AUD \$1.5 billion. The portfolio also includes programs to enhance the safety of navigation through maintenance dredging of entrance channels and ports.

Traditionally, the approach taken by the Authority and its predecessors has been to prioritise dredge campaigns according to importance and value for money to ensure that limited funding is used to maximise returns on a state-wide basis. This system is still utilised today. However, other initiatives have recently been incorporated to enhance value for money. These include endeavours to share in the cost of dredging with other agencies, local government and industry. The triple bottom line outcomes from recent projects at Swansea Channel and Myall River have been very encouraging and these are discussed in this paper.

Note: unless stated otherwise, any reference to the term “dredging” in this paper relates to “maintenance dredging” and not capital dredging or dredging for other purposes such as removal of contaminated materials or in reclamation works.

Background

Safe navigation of key coastal rivers and harbours is vital for NSW's regional economy. Funding to help maintain safe navigation is currently provided through the NSW Government's Minor Ports, River Entrances and Waterways Programs.

At present, there are two LPMA sponsored programs that facilitate dredging of state waterways. Dredging of major boating channels and regional harbours that support significant infrastructure and commerce are usually funded at 100% of the cost through the government's Minor Ports and River Entrances Program. The Authority also seeks applications from local government under its Waterways Program which involves direct management of the dredging project by the relevant local council and contributions of up to 50% of the total estimated cost being made from the Waterways Program. Both programs have a limited budget and projects are therefore approved according to merit on a state-wide basis.

Allocation of Funding for Dredging in NSW waters

In February 2007, a strategy was implemented to assess priorities for dredging key river and port entrances throughout NSW to ensure that limited resources were appropriately allocated. In more recent times, LPMA has been striving to achieve multiple bottom line outcomes and to seek additional social, environmental and economic enhancements from its dredging projects.

The cost of undertaking a dredging project can vary enormously according to material composition, the presence of contaminants, site conditions, scale of the project, disposal options and market forces/timing. Accordingly, historical costs or rates are not always an accurate guide to predicting the cost of a dredging project.

In addition, there are substantial fixed costs associated with dredging projects. The component cost of mobilising and demobilising a dredge can sometimes exceed the component cost of dredging, particularly on small projects. Once established, a decision to vary the contract volume within certain limits can be made based on the attractiveness of the tendered dredge rate.

Typical dredge projects undertaken by LPMA would fall into broad categories as per **Table 1** below.

Table 1: Estimated Cost of Dredging

Category	Quantity	Indicative Cost
Major Dredging	60,000 cubic metres	\$600,000 - \$800,000
Medium Dredging	30,000 cubic metres	\$400,000 - \$500,000
Minor Dredging	20,000 cubic metres	\$300,000 - \$400,000

Recent Approach to Dredging Works

In recent years, there has been a greater recognition of the value of dredged materials. Campaigns at Coffs Harbour, Terranora Inlet (Tweed Heads) and Port

Macquarie have all used dredged materials to good effect to enhance social and economic outcomes.

At Coffs Harbour (2009) 37,000 m³ of sand dredged from the outer harbour was pumped 1.8 kilometres to renourish a depleted Park Beach, situated north of Coffs Creek entrance. The beach had suffered considerable loss of sand from the storms in May 2009. In this instance, the additional sand pumping costs were offset by the enhancement of a popular beach for the community.

At Terranora Inlet (2008) approximately 18,000 m³ of marine sand was dredged from the navigation channel and placed on the adjacent foreshore which was suffering from bank erosion.

At Port Macquarie (2007) 17,000 m³ of sand was pumped about 1.5 kms to the nearby Town Beach where Port Macquarie, Hastings Council used its resources to rebuild the dunal system in order to protect valuable community land behind the coastline.

The foreshore renourishment works completed at Coffs Harbour, Terranora Inlet and Port Macquarie in recent years became possible at least in part because of the need to maintain adequate water depths in nearby navigable waters. In the traditional model of dredging for minimum cost, these external benefits may not have been realised.

Partnership and Beneficial Use Model.

Today, LPMA actively promotes a more holistic approach towards its dredging programs and is actively seeking to engage with local government, other state government entities, industry and boating groups to achieve a broader base of benefits from its dredging efforts.

The benefits of maintaining coastal waterways extend far beyond simply providing a service to a select number of boat owners. Improved navigation is important to many local and regional industries that rely on access to waterways for trade and commerce. These industries, including commercial fishing, recreation and tourism, are important drivers for commerce in the state's regional coastal centres. Accordingly, the involvement of local Government, and other state Government entities has the potential to add considerable value to LPMA's program, through both financial and work-in-kind contributions.

In recent maintenance dredging projects conducted at Swansea Channel and Myall River collaboration with various levels of government and industry has enabled a significantly greater volume of material to be dredged and has provided additional funding from the sale of sand to effect other foreshore renourishment works which otherwise may not have been afforded under conventional funding models. This new approach involves:

1. Avoiding transport and disposal costs associated with dredging,
2. Capture and sale of dredged materials for lawful use in other local projects,
3. Reinvesting income from the sale of sand into the dredging project, and
4. Seeking other project partners/sponsors.

The new model also benefits external projects by providing alternative sources of construction fill materials and potentially reducing the cost of such projects. The

model is consistent with core sustainability objectives of resource and energy conservation and waste minimisation. However, it should be recognised that the model for beneficial use of dredged materials is not a solution for all dredging projects undertaken by LPMA. In order to benefit from this approach, the nature of the materials and their proximity to a suitable market(s) is fundamental.

Figures 1A, 1B and 1C illustrate the compounding benefits of avoided handling costs, revenue from sand sales and co-contributions from project sponsors. The figures adopted are characteristic of the recent experience with the Swansea Channel project and should not be considered as typical for all projects undertaken by LPMA.

MODEL A – Disposal / Beach Re-nourishment

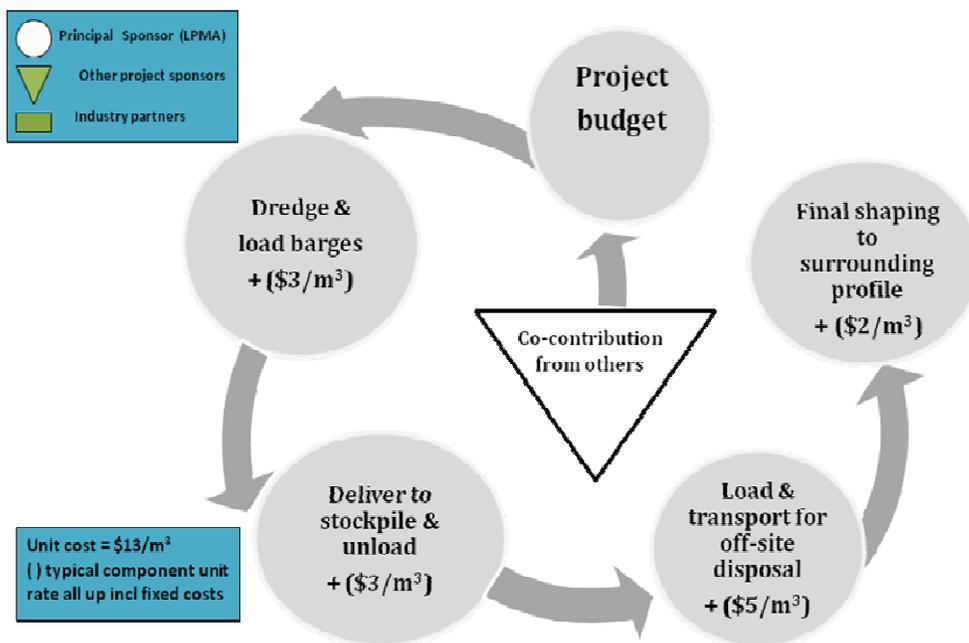


Figure 1A – Schematic Process for Disposal / Beach Re-nourishment (Model A)

MODEL B – Beneficial Use

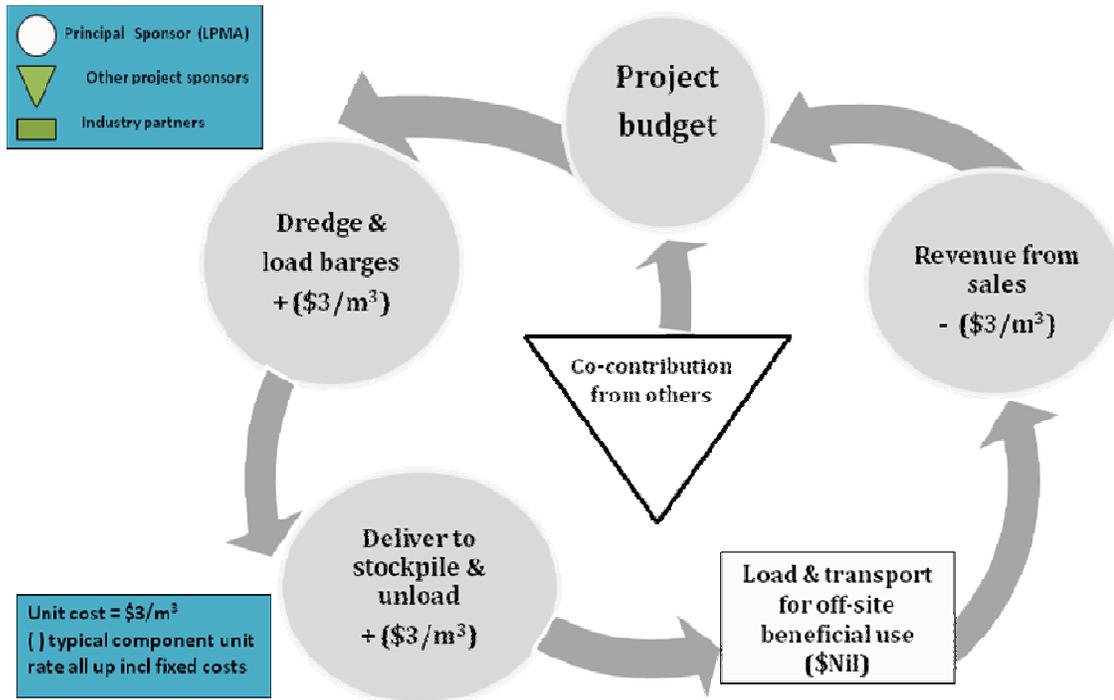


Figure 1B – Schematic Process for Beneficial Reuse (Model B)

Project budget **\$300,000**
Co-contributions **\$150,000**

		Budget \$	Unit cost (\$ / m3)	Volume (m3)
i)	Model A	300,000	13	23,000
ii)	Model A with co-contributions	450,000	13	35,000
iii)	Model B	300,000	3	100,000
iv)	Model B with co-contributions	450,000	3	150,000

Figure 1C – Schematic Process for Beneficial Reuse

The Swansea Channel Project, Marks Point, Lake Macquarie

LPMA recently completed a dredging campaign at Swansea Channel near Marks Point, Lake Macquarie. Lake Macquarie is Australia's largest saltwater coastal lake covering 110 square kilometres and Swansea Channel is the lake's only link to the Tasman Sea. The work comprised the removal of marine sands in the section of channel between the southern entrance into Swan Bay and the "Drop-over" into Lake Macquarie (Refer to **Figure 2**). This section of the estuary is most prone to siltation and is referred herein as the "site".

The site has been subject to dredging for more than 50 years, primarily to improve navigation of recreational vessels but also to deliver heavy equipment to nearby power stations. The principal issue throughout this period has been affordability and justification of the cost.

The previous major dredging campaign at the site was undertaken during 2006 by the Lake Macquarie Project Management Committee (involving state and local government funding). This work involved the removal of 50,000 cubic metres of sands, placement of sand-filled geofabric tubes, rock protection and reclamation works to narrow the southern entrance into Swan Bay at a cost of \$1.4 million.

In 2003 some 120,000 cubic metres of sand was dredged from the main channel to improve the infamous "Dog Leg" and dredged material was deposited into deep holes within Swan Bay. These holes are understood to have been caused by over-dredging from a commercial sand operation in Swan Bay.

During the period between 1998 and 2001 a further 50,000 cubic metres of material was dredged from the channel. Most of this material was pumped to Blacksmith's Beach up to 3km to the east of the site.



Figure 2 – Aerial Photo of Site January 2009, Courtesy Marmong Point Marina

Expression of Interest (EOI) and Tender Processes

LPMA recognised a need to undertake dredging works to improve navigation at two locations within the site following routine hydrographic surveys conducted by NSW Maritime during 2008 and early 2009

Based on previous campaigns it was recognised that the materials to be dredged would be clean marine sands, suitable for use in civil and building construction projects. It was also recognised that the cost to remove the sand and place on Blacksmith Beach would be significant. These factors led the LPMA to seek an EOI from;

- a) proponents to dredge specified areas of the channel under a licence agreement with LPMA (including exchange of material rights from LPMA to the proponent), or;
- b) parties interested in acquiring clean marine sands from the dredging project (undertaken by or on behalf of LPMA).

In early June 2009, LPMA allocated \$300,000 to undertake essential dredging in accordance with option b) and in early July 2009 tenders were sought from dredging and marine contractors.

The tender document incorporated several unique features to ensure optimisation of the limited funds allocated and added flexibility to change course during the work should external factors change. These included:

1. Flexible provisions to enable the successful contractor to use and sell dredge materials at their will and risk with the aim of reducing tendered rates for the work;
2. Specification of several alternative disposal options to suit both hydraulic and mechanical dredging equipment and to encourage innovation and interest in tendering for the work;
3. Generous limits of accuracy for tendered quantities in the event of additional funding or revenue becoming available during the work.
4. Separation of dredging rate from the transport and disposal rate, where offsite disposal was directed by the Principal's Representative.

Synchronising Dredging and Export Activities

Dredging was undertaken by a local marine contractor commencing with a barge-mounted 20 tonne excavator and two 75 tonne hopper barges working in tandem to deliver dredged materials to the stockpile site at the Naru Point foreshore, up to 1.5km from the dredge site. A 20 tonne excavator was based at the Naru Point stockpile site to unload barges and form a stockpile. This method typically achieved around 450 to 500 cubic metres of sand per day averaged over the period of the dredging campaign (i.e. 7 months).

In parallel with the dredging contract, LPMA engaged with respondents to the EOI process for purchase of dredged sands for their own use under a standard agreement. This agreement required the purchaser to verify the suitability of the material for reuse as required by relevant legislation. Under the agreement, the purchaser was also responsible for site safety, temporary access provisions such as

road grading and barricades, providing a loader and operator, control of public access and environmental controls such as managing dust, vibration and noise.

Working space at the Naru Point stockpile site was limited to 3,000 square metres. Accordingly, a practical limit of approximately 12,000 cubic metres of sand could be temporarily stored at the site. Contingencies were put in place to stockpile at other (non-recoverable) locations in the event that sufficient purchasers could not be found. However, these alternative disposal sites were not required over the project term.

With the limited area available for handling and stockpiling materials, synchronising contract works with the off-site transport of dewatered materials was at times difficult and required active management by LPMA and co-operation by the contractor's involved. Situations arose during the work where the dredging contractor could not keep up with demand and also times where demand was not apparent resulting in congestion at the stockpile site resulting in double-handling of stockpiled materials. **Figure 3** shows a photograph of the stockpile site in February 2010 following a two-month downtime period of off-site transport activities.

In order to reduce the cost of the loader and operator, desired export rates from the site needed to be in the order of 1,000 cubic metres per day or more, about twice the dredge rate. In order to achieve this up to 12 truck and dog trailers were used to remove the sands to various local construction projects located up to 35 km from the site.



Figure 3 – Naru Point Stockpile Site

Due to the limited stockpile area, and optimal rates of transporting sand being twice the dredge rate, export of sand from the site was undertaken intermittently. A typical export cycle would commence with the stockpile approaching full capacity and would continue for two to three weeks. One load out hardstand was established at each end of the stockpile to facilitate a continuous dredging operation.

Co-operative Arrangements with Other Authorities and Cost Sharing

Soon after the project commenced, boating lobby groups and LPMA engaged with other sponsors to attract an additional \$160,000 towards the cost of the project through partners, NSW Maritime and Lake Macquarie City Council. These funds

were considered paramount for achieving an effective dredge volume required to prolong the effectiveness of the project and hence to deliver a successful outcome.

Project Outcomes

The project outcomes included:

- More efficient use of project funds
- Extending the LPMA budget-limited contract volume (approx. 23,000 m³) to 67,885 m³ thereby prolonging the effectiveness of the campaign,
- Residual funds were used to repair and improve local government road infrastructure,
- Providing a free source of sand to local government for use in a nearby beach re-nourishment project located approximately 10 km from the stockpile site,
- Providing an alternative fill source for use in other local projects

Dredging of the Myall River near the entrance to Port Stephens

The lower estuary of the Myall River provides an important link for both recreational and commercial vessels between Tea Gardens/Hawks Nest and Nelson Bay/Port Stephens. In the lower estuary the designated navigation channel (locally known as the Corrie Channel) is marked by the NSW Maritime Authority and has been dredged several times since 1960 in order to maintain safe navigability.

The waterway is located within the Great Lakes Local Government Area and the Port Stephens – Great Lakes Marine Park. Corrie Channel is heavily used by a full range of recreational boating and commercial vessels as it provides the only all weather safe passage to and from Tea Gardens/Myall Lakes.

Management of the waterway is shared between State and local government including LPMA, Marine Parks Authority, NSW Maritime Authority, Department of Environment, Climate Change and Water, Industry & Investment NSW and Great Lakes Council. The Port Stephens and Myall Lakes Estuary Management Plan (Umwelt, 2000) nominated responsibility for dredging Corrie Channel with Great Lakes Council (with assistance from relevant State agencies). The Estuary Management Plan suggested an indicative cost for dredging in the order of \$800,000 and recommended the commercial use of the dredged sand be investigated to offset the cost of the work.

In 2009 the development of a sand shoal within Corrie Channel reached an extent that access for all but the smallest of recreational boats was restricted at low tide. Shoaling was particularly an issue for the Tea Gardens to Nelson Bay public ferry service and larger vessels.

In response, Great Lakes Council successfully applied for funding under the NSW Government's Waterways Program for dredging of the waterway. Under the Waterways Program, which is administered by the LPMA, funding is available to local government on a dollar for dollar basis for dredging projects that would make significant improvement to the navigability of their waterways, with a focus on recreational boating needs.



Figure 4: Lower Myall River (Corrie Channel)

The proposed dredging project developed by Council involved the removal of 12,000m³ of marine sand from Corrie Channel at an estimated cost of \$370,000 inclusive of all investigation and design, environmental assessment and approvals, on-ground works, rehabilitation, supervision and project management. Under the Waterways Program, Council is responsible for all components of the project with technical assistance available from relevant State agencies.

Approved Dredging Project

Dredging in Corrie Channel commenced in late June 2010 in accordance with planning approval under State Environmental Planning Policy (Infrastructure) 2007, Review of Environmental Factors (REF) under Part V of the Environmental Planning & Assessment Act, 1979 and the concurrence/approval of relevant State Agencies.

The approved project involved the removal of 29,000m³ of marine sand from Corrie Channel and placement on 4 separate sites. These sites included 2 private land holdings (each with a current development approval for land filling), a Council reserve and renourishment of Jimmy's Beach at Hawks Nest. Negotiations with the private land holders yielded payments for the material (9,500m³ and 13,000m³ respectively) which was reinvested into the project.

It should be noted the bed of the Myall River is Crown land and the commercial sale of the dredged material by Council required special approval from the LPMA. In this instance, approval was granted on the basis that income from the sale of the dredged material was reinvested in the project.

Dredging of Corrie Channel and placement of the dredged material was completed by the end of September 2010. The project, which involved pumping the material up to 3 km from the dredge site, was completed for a net cost of \$295,000. Savings to

the project from the involvement of the private sector (savings that were reinvested into the project) are valued at over \$250,000.

In addition to the cost savings and the prime objective of the project, valuable social and environmental outcomes were also achieved including restoration of a public coastal reserve and renourishment of Jimmy's Beach.

Conclusion

The collaborative approach taken by LPMA in recent maintenance dredging projects conducted at Swansea Channel and Myall River has enabled a greater volume of material to be dredged and has provided additional funding from sand sales to effect other foreshore renourishment works which would not have been undertaken by conventional funding models. The new model also benefits external projects by providing alternative sources of construction fill materials and it is consistent with core sustainability objectives of resource conservation, waste minimisation and energy conservation. However, it should be recognised that the model for beneficial use of dredged materials is not a solution for all dredging projects undertaken by LPMA.

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