Shoalhaven Natural Resource & Floodplain Management Committee

Meeting Date: Wednesday, 18 April, 2018
Location: Shoalhaven Entertainment Centre - Mezzanine Conference Room, Bridge Road, Nowra
Time: 4:00pm

Addendum Agenda

Reports

SN18.9 Technical peer review of the River Road Foreshore Shoalhaven Heads: Assessment of the Coastal Management Options Report by MHL.

HPERM Ref: D18/75302

Group:
Section: Environmental Services

Attachments: 1. MHL Technical Review

Purpose / Summary

To advise the Committee of the technical peer review by Edward Couriel from Manly Hydraulics Laboratory (MHL), of the River Road Foreshore Shoalhaven Heads: Assessment of the Coastal Management Options Report prepared by Water Research Laboratory (WRL) UNSW.

Recommendation:

That Council

1. Receive the Manly Hydraulics Laboratory technical review of the WRL River Road Coastal Option Report titled *MHL2595 – Review of River Road Foreshore, Shoalhaven Heads: Assessment of Coastal Management Options Report dated February 2018*, for information; and
2. Subject to availability of funding, incorporate the following technical information in the detailed design of any future coastal erosion remediation control structure at the River Road foreshore precinct:
    a. Coastal erosion remediation structure be designed for a more conservative large river entrance opening to reduce the risk of failure.
    b. A minimum design life of 25 years for coastal erosion remediation structure be adopted.

Options

1. As per the recommendation.

    Implications: Proceeding with the option endorsed by MHL's technical review, to undertake design incorporating the above technical information as per the MHL technical review recommendation. Designing the foreshore erosion remediation structures to a minimum design life of 25 years and for a large river entrance opening is likely to increase the cost of the structure. This will need to be costed as part of the detailed design process.

2. Recommend alternative options for the detailed design of the River Road coastal foreshore erosion remediation.

Implications: This would depend on the alternative option.

Background

The 2016 east coast low storm resulted in a moderate flood (Natural Disaster declared 2016) and a major coastal storm which impacted beaches and foreshores across the City.

This impact included coastal erosion of 1000 meters of riverbank on the Shoalhaven River at River Road, Shoalhaven Heads. In response to this erosion at River Road, Council engaged the University of NSW Water Research Laboratory (WRL) to undertake an assessment of the coastal management options to manage this erosion.

In August 2017, WRL produced the River Road Foreshore, Shoalhaven Heads: Assessment of Coastal Management Options, Technical Report, prepared by their team of experienced coastal and estuarine engineers.

The technical report divides the foreshore area up into six (6) prioritised zones based on coastal hazard and geo-technical risks impacting each zone. The study identified nine (9) management options:

1. Do nothing
2. Monitoring with no active management works
3. Monitoring in combination with management works
4. Relocating existing sand located within the beach area
5. Stabilisation of erosion scarps and revegetation
6. Protection structures (rock or geotextile revetment)
7. Repairs and improvements to stormwater outlets on the beach
8. Improvements to stormwater control across the beach
9. Nourishment of the beach

The report recommends which of the nine (9) foreshore management options are best suited to each foreshore management zone, as outlined in the figures below.

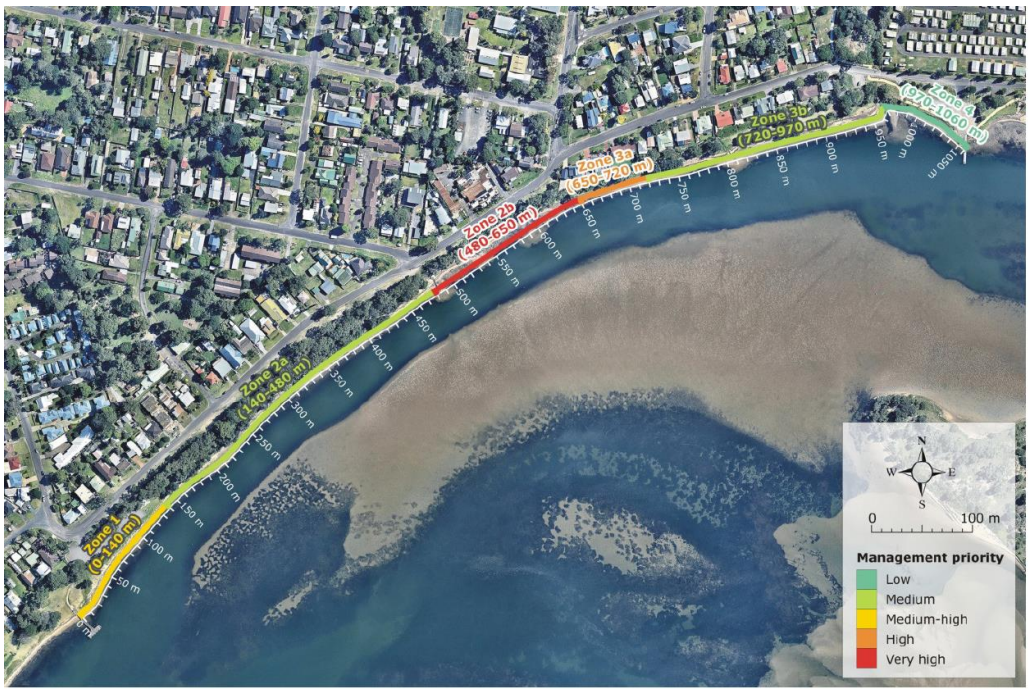

Figure 1: Qualitative Prioritisation of the Foreshore Management Zones

SN18.9

	Foreshore Management Zone					
Management Option	**Zone 1**	**Zone 2A**	**Zone 2B**	**Zone 3A**	**Zone 3B**	**Zone 4**
Do nothing	Not suitable	Not suitable	Not suitable	Not suitable	Not suitable	Not suitable
Monitor, without management works	Not suitable	Not suited	Not suitable	Not suitable	Some areas	May be suitable
Monitor, with management works	Suitable	Suitable	Not suitable	Not suitable	Suitable	Suitable
Beach scraping	Not required	Not required	With other management works	Not required	With other management works	With other management works
Stabilisation and revegetation of scarps	Suitable	Suitable	Not suitable	Not suitable	Suitable	Suitable
Protection revetment	May be option in future	May be option in future	Suitable	Suitable	Not required	Not required
Improvements to stormwater outlets	Not applicable	Not applicable	Suitable	Not applicable	Suitable	Suitable
Improvements to stormwater control across beach	Not applicable	Not applicable	Suitable	Not applicable	Suitable	Suitable
Nourishment of beach with sand from estuary	Suitable	Suitable	Suitable with additional protection [1]	Suitable with additional protection [1]	Suitable	Suitable

1. Based on an achievable/affordable modest extent of beach nourishment that could be applied in the short to medium term, as opposed to mass dredging of the estuary sand shoals and extensive nourishment of the whole foreshore profile.

Figure 2: Suitability of Management Options for the Foreshore Zones

SN18.3

Consultation on the WRL technical report has was undertaken with the Shoalhaven Heads Community Forum members, Shoalhaven Heads Estuary Taskforce and the Shoalhaven Heads community.

The community identified the need to address and manage the storm water impacts and maintain the visual amenity.

Stormwater management and discharge is Council's Asset and Works priority and a specialist stormwater design is needed with soft engineering options to be included. These conditions will provide erosion remediation of the whole frontage in one project, as requested by the community.

Upon the communities' request, Council sought a technical peer review of the WRL report and engaged Edward Couriel, Director, Manly Hydraulics Laboratory (MHL).

MHL are the technical arm of NSW Public Works Division. Edward Couriel is a qualified Coastal Engineer and has over 20 years' experience in coastal and estuarine engineering studies and is well placed to provide a pragmatic coastal engineering review of the WRL Technical Report. A copy of the MHL report is contained within Attachment 1.

The review recommends that a larger entrance scenario be adopted for the design of erosion control structures, as discussed in the WRL options report. The design modifications are expected to have a minor construction cost increase and an improved asset class and lifespan.

MHL also recommended that Council undertake a comparison of the life cycle cost and benefits of the WRL recommended 10-year design life of the erosion control structure compared with a longer serviceable life cycles of 25 and 50 years.

The peer review also highly recommended beach nourishment to some degree, as part of any longer-term foreshore management options adopted. As this may be warranted due to the potential benefits and cost savings of this management option, given the extensive environmental approvals associated with the sand nourishment options, the peer review recommended exploring sourcing sand behind the river entrance flood notch, where a "wet notch" was trialled in the 1990's.

It is recommended that this option be reviewed as part of the 2018 Lower Shoalhaven River Flood Risk Management Study and the associated review of the Shoalhaven River Entrance Management Plan.

If this is a viable option, it would provide, along with the maintenance of the dry flood notch, a moderate sand supply for repeat sand nourishment to the River Road foreshore areas and potentially extend the "life of the next entrance breakout".

Community Engagement

Extensive community consultation has already taken place in the development of the WRL foreshore management options report via the Shoalhaven Heads Estuary Taskforce and the Shoalhaven Heads Community Forum and at a community drop-in session at the Shoalhaven Heads community centre on Sunday 9 April 2017.

The community identified the need to address stormwater management and retain the visual and recreational amenity of the River Rd foreshore in any management options undertaken.

Members of the Shoalhaven Heads Estuary Taskforce requested Council obtain a technical peer review of the WRL report by another suitably qualified and experienced coastal engineer to assess if the recommended management options outlined in the WRL report are the best possible options. This technical review was completed as described above.

SN18.9

Financial Implications

In October 2017, Council, in consultation with the Shoalhaven Heads Community Forum, applied to the NSW Regional Growth – Environmental and Tourism – Restart NSW grant program for $1, 588,000 to undertake the coastal erosion management options recommended by WRL. Of this $1,588,000, Council would be contributing $550,000 for the storm water management works, rock protection and revegetation works. The cost of the peer review undertaken by MHL was $2,500.

The MHL peer review recommends designing the foreshore erosion remediation structures to a minimum design life of 25 years and for a large river entrance opening. This is likely to increase the cost of the structure, as larger sized rocks will be required. This will need to be costed as part of the detailed design process.

Manly Hydraulics Laboratory

110B King Street
Manly Vale NSW 2093
T 02 9949 0200 F 02 9948 6185 TTY 1300 301 181
ABN 81 913 830 179 www.mhl.nsw.gov.au

20th February 2018

Mr Ray Massie
Coast and Estuaries Officer
Shoalhaven City Council
Bridge Rd (PO Box 42)
Nowra NSW 2541
Ray.Massie@shoalhaven.nsw.gov.au

Dear Mr Massie,

MHL2595 – Review of *River Road Foreshore, Shoalhaven Heads: Assessment of Coastal Management Options* Report

NSW Governments' Manly Hydraulics Laboratory (MHL) is pleased to have undertaken this review of the *River Road Foreshore, Shoalhaven Heads: Assessment of Coastal Management Options* report (WRL 2016/21 Final Draft, August 2017). This letter report provides a summary of our review which was based on an appraisal of the appropriateness and feasibility of the coastal management options outlined within the WRL report.

1 Introduction

The WRL report presents the results of their assessment of conceptual coastal management options for the eroded foreshore along the River Road area of Shoalhaven Heads. The report includes a geotechnical engineering inspection and risk analysis undertaken by JK Geotechnics which is described in the report and reproduced in Appendix E.

The coastal management options developed within the report are based primarily on a 10 years design life, a small entrance opening condition at Shoalhaven Heads and a 20 years ARI design storm event. The condition of the entrance at Shoalhaven Heads is the overriding design parameter that results in the greatest degree of design sensitivity and is discussed further in the sections below.

The following sections provide a discussion on the results of our review, including the basis for our recommendations and conclusions.

2 Review of Coastal Management Options

The WRL report provides a detailed site decription outlining the characteristic of different areas along the foreshore. The foreshore is broken up into a number of distincitive zones (1 to 4) with zone 2 and zone 3 being further divided into two parts each (i.e. Zone 2a, Zone 2b, etc.).

2.1 Coastal Processes and Hazards Assessment

A description of the coastal processes affecting the area is provided in section 3 of the WRL report. The study focuses on the river entrance processes and stormwater drainage stating that these processes appear to have most influenced the observed erosion at the site. Based on the available record of entrance conditions, a 13% AEP is adopted for entrance opening conditions where a risk of further embankment erosion may occur. A brief description of the expected processes associated with stormwater discharge across the foreshore and its qualitative influence on potential sediment transport is also provided.

2.2 Geotechnical Hazards Assessment and Management Prioritisation

The geotechnical risk assessment undertaken by JK Geotechnics is outlined with the full report reproduced in Appendix E of the WRL report. Assessed Risk Levels (ARLs) are determined for 3 potential hazard pathways resulting in the following conclusions:

- Current levels of geotechnical risk are considered acceptable, with the exception of future erosion events causing ongoing landslip (hazard pathway 2) within Foreshore Zone 2B (between Renown Avenue and Mathews Street intersections with River Road).
- "……construction of foreshore erosion protection measures would reduce the risk to 'acceptable' levels".
- Council should monitor the foreshore slope in order to assess existing conditions and any indications of deterioration such as tension cracks along the crest area of the foreshore slope, further evidence of landslips, damage to timber steps, drainage culverts etc.:
    - on an annual basis;
    - after periods of prolonged or heavy rainfall;
    - during periods of predicted peak tidal levels and/or wave conditions.

Based on the above conclusions and a further qualitative assessment of exposure to coastal hazards and existing site conditions and characteristics, a prioritisation rating was assigned to each foreshore zone, as shown in **Figure 1** (Figure 5.1 in WRL report).

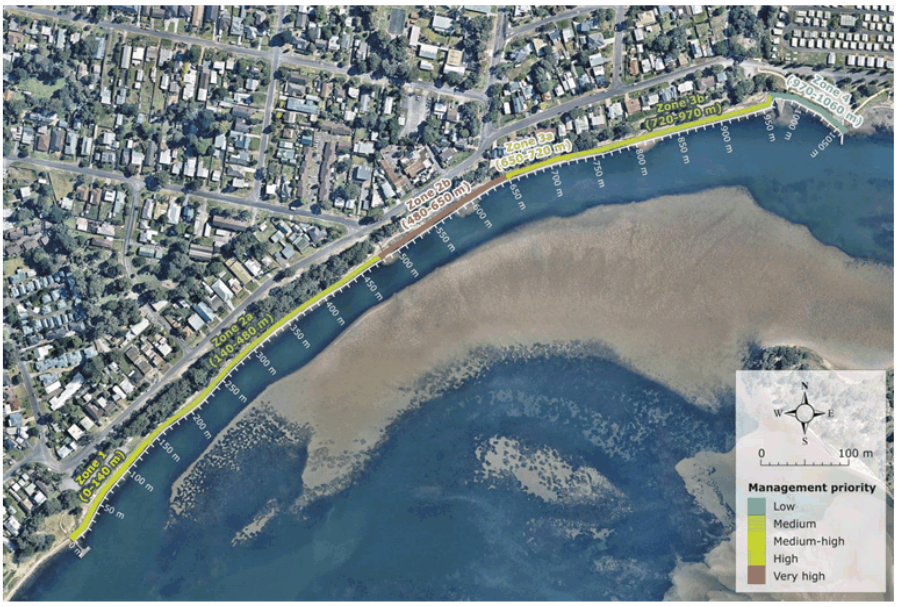

Figure 1 – Qualitative Prioritisation of Management Works (Figure 5.1, WRL 2017)

2.3 Foreshore Management Options

A range of management options are considered including "do nothing", soft options (e.g. monitoring and beach scraping), protection structures (either rock or geotextile bags) and beach nourishment. Options for improved stormwater control and management are also considered. The objective is emphasised as ***"addressing the immediate coastal hazards in the short term, while also not compromising the ability to implement a longer term management plan for this section of the estuary at a later date".*** This short term focus (as recognised by WRL) effectively rules out a number of potential alternative management otions (for example larger scale beach nourishment works) which would require additional investigations, funding and approvals. Table 6.1 of the report lists the assessed suitability of the options considered for each zone of the foreshore and Table 6.2 lists the recommended management options. The Recommended Foreshore Management Approach (Table 6.2) has been reproduced below.

Noteably, small scale nourishment of the foreshore is included as a suitable short term action for all areas (in conjunction with additional works such as a toe revetment for Zone 2B and Zone 3A), while larger scale nourishment of the entire foreshore profile is not considered as being "well suited to addressing the immediate engineering risks".

Table 6.2: Recommended Foreshore Management Approach

Foreshore Management Zone	Suggested Management Approach
Zone 1	Now: Re-profile erosion scarp, stabilise erosion surface, revegetate, consider improved public access. Short Term Future: Nourish beach ($13,000-$30,000).
Zone 2A	Now: Remove/cover tree stumps, revegetate, monitor tree safety. Short Term Future: Nourish beach ($32,000-$73,000), monitor beach width/volume, monitor embankment (if impacted by erosion).
Zone 2B	Now: Remove debris, improve stormwater outlets, protect embankment toe with rock ($280,000) or geotextile bag ($580,000) revetment (additional costs for optional crest boardwalk), train stormwater across beach, monitor embankment and crest area. Short Term Future: Nourish beach ($16,000-$37,000), monitor beach width/volume.
Zone 3A	Now: Remove debris, improve stormwater outlets, upgrade existing protection to embankment toe with rock ($115,000) or geotextile bag ($240,000) revetment (additional costs for optional crest boardwalk), train stormwater across beach, monitor embankment. Short Term Future: Nourish beach ($7,000-$15,000), monitor beach width/volume.
Zone 3B	Now: Re-profile erosion scarp, stabilise erosion surface, revegetate, consider improved access. Short Term Future: Nourish beach ($24,000-$54,000).
Zone 4	Short Term Future: stabilise erosion scarps, revegetate, nourish opportunistically ($8,000-$19,000).

MHL considered that the recommended foreshore management approach is appropriate and feasible given the focus on addressing the immediate coastal hazards in the short term. Larger scale nourishment of the foreshore would be expected to provide a greater degree of beach amenity improvement along with coastal protection/resilience benefits to the foreshore, however the relatively greater degree of certainty in coastal protection provided by the recommended revetment option allows Council to reduce their immediate risk of further embankment erosion with a low maintenance semi-permanent solution. Notwithstanding the above comments, outflanking of the proposed embankment berm remains a possibility, albeit with a low probability, should broader channel migration occur. Sand won from activities relating to maintenance of the entrance flood notch may be used for periodic beach nourishment and may form part of a longer term management solution. This could include management of the subaerial berm height and width, as well as excavation of a sediment sink in the shoals behind the flood notch that may contribute to longer entrance opening periods. Monitoring of the effectiveness and impacts of flood notch and shoal maintenance works should be carried out to inform future management operations.

2.4 Concept Designs of Foreshore Management Works

Section 7 of the report outlines the concept design of the proposed foreshore management works, comprising the embankment toe protection works, improvements to stormwater drainage across the beach and small scale beach nourishment works. The principal coastal

hazards affecting the site are reported to stem largely from the exposure of the foreshore to long period ocean swells during periods when the Shoalhaven River entrance is open. As such, the decision by WRL and Council to base the concept protection works design on only a small entrance opening (rather than a more conservative large opening) entails a reletively higher risk approach regarding the longevity of the proposed works. Furthermore, Appendix B Section 3.1 notes that a 10 years design life was adopted for the structure by Council and WRL. While many structures exceed their design life (due to a number of factors including conservative design assumptions, maintenance and sometimes luck), given the magnitude of the proposed works and associated costs, MHL would consider it appropriate to adopt a design life that results in a serviceable structure for a longer time period (for example 25 years). Due to the short design period adopted, no allowance for future sea level rise was included in the analysis. If a longer design life is considered, sea level rise should be incorporated into the design parameter determination. Prior to commencement of any work MHL recommends that council compare the life cycle costs and benefits of both the adopted 10 years design life structure and a structure designed with a longer serviceable life. WRL provides an indicative analysis of the sensitivity of the design conditions, noting that if the design event was changed from the 20 year ARI to the 100 year ARI, *"the wave and water level conditions at the proposed seawall along the inner foreshore are not expected to increase significantly"*. As such, MHL recommends that a cost benefit analysis of adopting an extended design life be considered.

2.4.1 Embankment Toe Protection Works

The hydraulic stability of rock armour and sand-filled geotextile containers on a 1V:1.5H slope is determined for each entrance condition (closed, small opening and large opening). WRL notes that the behaviour of geotextile containers subject to lateral velocities is unknown and hence their hydraulic stability under freshwater flood flow velocities was not assessed. On this basis MHL would not recommend using sand-filled geotextile containers for the proposed works in the absence of physical model testing that adequately demonstrates the stability of the containers under simulated flood flow conditions.

The stability of sandstone and basalt rock armour is analysed and presented in detail in Appendix B. Notably, the adopted rock masses for stability under wave attack were also assessed for stability under the 5% AEP flood flow velocity using the stone blanket stability design method, which demonstrated that the armour mass required to withstand wave attack was greater than that required for stability under flow velocities. The basalt and sandstone rock armour sizes recommended by WRL are reproduced in the table below.

Structure	Entrance	Material	Required Mass
Seawall	Closed or small opening	Basalt (2,650 kg/m^3)	M_{50} = 150 kg
		Sandstone (2,300 kg/m^3)	M_{50} = 250 kg
	Large opening	Basalt (2,650 kg/m^3)	M_{50} = 750 kg
		Sandstone (2,300 kg/m^3)	M_{50} = 1,300 kg

While the small entrance opening condition was adopted for the design, MHL would recommend utilising the armour sized for hydraulic stability under a large entrance opening condition. The existing erosion problem is understood to have stemmed for large swell penetration of an open entrance condition (June 2016) and hence it is rational to design the foreshore protection works for a known potential entrance condition that could occur throughout the design life of the structure. That is, unless the consequence of failure of a structure designed for only a small entrance opening are assessed to be acceptable.

Basalt is generally a preferable material for construction in the marine environment, hence the 750 kg (M_{50}) basalt armour stone would be the preferred construction material, followed by 1,300 kg (M_{50}) sandstone. If sandstone is adopted for the construction, rocks properties including the strength, Los Angeles abrasion and Sodium Sulphate soundness of the proposed rock source should be assessed for suitability for use in the a marine setting. Greater care during construction is also warranted if using sandstone to avoid potential degredation of rocks traversed by heavy machinery for example.

Wave overtopping was assessed using the methods given in the EurOtop (2016) Overtopping Manual to determine design crest elevation for 5% AEP wave conditions (table 7.3 as reproduced below).

Table 7.3: Comparison of Estimated Relative Runup Levels and Overtopping Rates for a range of Crest Levels for three Entrance Conditions (for 5% AEP event)

Parameter	Crest Level (m AHD)	Entrance Condition		
		Closed	Small Opening*	Large Opening*
2% Runup, $R_{u2\%}$ (m AHD)		2.7	4.6	6.7
Mean Wave Overtopping Rate for Crest Elevations (L/s/m)	2.5	0.3	140.1	430.5
	3.0	<0.1	43.8	221.0
	3.5	<0.1	10.3	96.7
	4.0	0.0	2.0	38.0
	4.5	0.0	0.3	13.7
	5.0	0.0	0.1	4.6

*EurOtop (2016) recommends that wave setup be excluded from the input water levels as its empirical equations are based on physical model test results which implicitly reproduced wave setup against the test structures. However, WRL has included wave setup in the input water levels for the small and large entrance opening conditions in the inner Shoalhaven Heads bay as this super-elevation is due to wave breaking outside the entrance rather than directly against the seawall.

WRL adopted an acceptable design overtopping rate of 5-10 L/s/m (tolerable for grass covered slopes, EurOtop, 2016) and an associated design crest height of 4.0 m AHD for the adopted small entrance opening condition. Council should be advised that in the event of a design storm event involving a large entrance opening, a significantly greater degree of wave opening would be expected (38 L/s/m from Table 7.3 above) which may lead to erosion of the embankment slope above and behind the proposed revetment. Detailed design should be undertaken to ensure that the proposed structure is designed to withstand potential erosion of material behind the structure to prevent undermining or slumping failure.

WRL quotes for NSW a *"scour level of approximately -1.0 m AHD is commonly adopted as an engineering rule of thumb for rigid coastal structures located at the back of the active (open coast) beach area."*. This is a commonly made misinterpretation of historical data which was based on scour measurements to around -1 ISLW (not AHD). The reference to Nielsen et al. 1992 actually states that *"The scour that may occur in front of reflective seawalls is likely to be greater than that on a natural beach and a level of -2.0 m AHD is often adopted for design"*. Notwithstanding the above, the adopted scour depth of -1.0 m AHD is considered to be appropriate given the relatively shelter location of the structure.

Additionally, Appendix B Section 7.2 acknowledges that the maximum depth of the entrance following the August 1974 flood has been reported as being between 10 m and 20 m. Should a major entrance scour event of this magnitude occur, the alignment of the channel and scoured entrance characteristics may lead to undermining of the toe of structure, although adopting a more conservative lower toe depth (of say -2.0 m AHD) is unlikely to provide much additional protection in an extreme scenario of this nature.

Indicative layouts for the proposed work are provided including potential access arrangements. MHL notes that end effects should be consider with the final design of the revetments being "turned back" at the ends to ensure that they are not potentially undermined by flanking erosion at the ends. The likely extent of additional erosion expected in the areas adjacent to the revetment should also be considered during detailed design as described by MHL (2016).

2.4.2 Stormwater Drainage Concept Improvements

The recommended improvements to the stormwater outlets at the foreshore as outlined in Section 7.4 are considered to be reasonable and would certainly improve local scour protection compared with the present situation. Managing stormwater flow across the beach via trial beach scraping maintenance works is recommended by MHL initially over the training of flows using geotextile bags due to the potential amenity benefits of beach scraping and the tendancy of geotextile bags placed across the foreshore to suffer damage and vandalism leaving a somewhat unsightly area that may lose effectiveness. Should beach scraping be demonstrated to be ineffective or financially burdensome, geotextile containers could be reconsidered at a later date.

2.4.3 Beach Nourishment Improvement Works

The recommendation to carry out beach nourishment in the short to medium term following construction of the embankment works would be highly beneficial to the amenity of the beach, in partially burying the embankment protection structure and in providing a sand buffer against future erosion events along the foreshore. While major nourishment was not considered as a stand-alone management option (due to cost, environmental approvals, timing, etc.), given the costs associated with revetment construction MHL still believes that major nourishment alone from the estuary shoals could be a viable solution to reduce the risk of further embankment erosion along the foreshore, albeit likely to require periodic top up following major events.

Nevertheless, the recommended minimum of 2-3 m of beach profile widening in front of the proposed embankment revetment (comprising 2,000-2,500 m^3) of sand is strongly supported following completion of the embankment protection works based on our review. Nourishment of the entire foreshore length (approximately 1,000 m) could be carried out providing a 5 m wider profile than that existing at the site for a cost of the order of $200,000. Council should note that this is approximately half the cost of the proposed embankment revetment works and would provide significant amenity benefits. Risks associated with large scale nourishment include the potential loss of this material from the foreshore during major flooding/storm events, which would necessitate further nourishment to reinstate a protective sand buffer if or when required. As noted in Section 2.3 of this report, maintenance works carried out for the entrance flood notch and in the shoals behind the flood notch may provide a source of sediment for nourishment works and aid in creating conditions for longer entrance opening periods if desired. These works may contribute to a longer term active management solution.

In all cases, some degree of beach nourishment is highly recommended to form part of the solution in managing the foreshore erosion problem.

3 Conclusions and Recommendations

WRL have undertaken a concept design and assessment of foreshore management options that utilises a well accepted methodology and included reasonable design assumptions. The resulting recommended management options are justifiable and would provide Council with a viable solution to their foreshore erosion management problems given the focus on addressing the immediate coastal hazards in the short term. While a small entrance opening was adopted as the basis for most of the concept design assessment, it would be prudent to utilise the large entrance opening scenario for the detailed design of any embankment protection works to provide a more resilient structure for what would likely be relatively little additional expense. The existing erosion problem is understood to have stemmed for large

swell penetration of an open entrance condition (June 2016) and hence it is rational to design the foreshore protection works for a known potential entrance condition that could occur throughout the design life of the structure. That is, unless the consequence of failure of a structure designed for only a small entrance opening are assessed to be acceptable.

Due to the short-term focus of the brief, MHL recommends that council compare the life cycle costs and benefits of the adopted 10 years design life of the structure proposed with a structure designed with a longer serviceable life. Beach nourishment of some degree is highly recommended as a part of any foreshore management solutions adopted and further consideration of major beach nourishment may be warranted given the potential benefits and cost savings of this management option.

I trust that this report is satisfactory to meet Shoalhave City Councils' requirements. Please contact me on (02) 9949 0224 or at Edward.Couriel@mhl.nsw.gov.au, or Stuart Young on (02) 4908 4986 or at Stuart.Young@mhl.nsw.gov.au should you wish to discuss any aspects further.

Yours sincerely

E D Couriel
Director, MHL
Manly Hydraulics Laboratory

NSW GOVERNMENT Manly Hydraulics Laboratory

110B King Street
MANLY VALE NSW 2093

Document Control

Issue/ Revision	Author	Reviewer	Approved for Issue	
			Name	Date
Draft	S Young	E Couriel	E Couriel	15/2/18
Final	S Young	E Couriel	E Couriel	21/2/18

Manly Hydraulics Laboratory is Quality System Certified to AS/NZS ISO 9001:2008.

SN18.10 Undertaking a Scientific Analysis of the Shoalhaven Dredging Program

HPERM Ref: D18/80719

Group: Planning Environment & Development Group
Section: Environmental Services

Purpose / Summary

To provide information on what scientific indicators could be used to undertake a scientific analysis/study of the 2016 Shoalhaven Citywide Dredging Program.

Recommendation

:

1. Receive the report for information; and
2. Include the development and implementation of a scientifically based environmental monitoring and evaluation program in the project brief and design of any future dredging projects and other large-scale Council projects. This will ensure that:
    - the implementation and success of projects can be monitored and evaluated;
    - reduce the risk of failure of environmental controls and mitigation measures and potential increased project costs;
    - ensure compliance with legislative obligations; and
    - learn valuable lessons for future projects to avoid and minimise potential environmental and community impacts and therefore save resources, time and money.

    The scale of an environmental monitoring and evaluation program would be dependent upon the scale of the proposed project and potential direct and indirect environmental impacts.

SN18.10

Options

1. As recommended.

    Implications: The development and implementation of a scientifically rigorous environmental monitoring and evaluation program for any future dredging projects will need to be included in the project brief to ensure resources and budget are allocated. The number of parameters included in and the size of the program would depend upon the scale of the proposed project, its location and potential environmental impacts.

2. Council propose alternative recommendation

    Implications: Would depend on the recommendation

Background

At the Committee meeting of 22 November 2017, the Committee resolved:

> *"That Council staff consider the Shoalhaven Natural Resources and Floodplain Management Committee's request to undertake a scientific analysis of the dredging and report back to the Committee on how staff can undertake this and how the University of Wollongong can be incorporated into this."*

In 2016, Council undertook the following dredging and creek/dune protection projects:

- Currambene Creek Navigation Channel (removal of a small quantity of rock only);
- Sussex Inlet Navigation Channel;
- Sussex Inlet Canals (Rivera Keys Estate);
- Lake Conjola Configuration Dredging; and
- Mollymook Beach Dune Protection (Blackwater Creek).

The Shoalhaven Dredging Project, Review of Environmental Factors (REF), prepared by Royal Haskoning DHV (2015), recommended the monitoring listed below. The main aim of the REF was to design the project to avoid direct environmental impacts. The purpose of the creek and dune protection works was to restore eroded dune and foreshore areas and protect assets.

Monitoring of dredged areas – Using hydrographic surveys to monitor the dredge area prior to and immediately following the dredging works to determine the dredge depth and width. The REF recommended that these hydrographic surveys be continued biannually for the first year and annually for the following four years to assess the changes in sediment composition and changes in the dredge channel morphology.

Monitoring of nourishment areas – Surveys of nourished areas at Lake Conjola, Sussex Inlet and Mollymook Beach to gain an understanding of the behaviour of the nourishment material. It was recommended that these nourishment areas should be surveyed annually for 3 years post nourishment.

The REF also recommended that photographic monitoring be undertaken of all nourishment areas.

This monitoring is being undertaken by Council. A copy of the REF can be viewed on Council's website.

https://shoalhaven.nsw.gov.au/LinkClick.aspx?fileticket=2SA6vO8kPYQ%3d&portalid=3

Scientific Indicators for Assessing Dredging Impacts

In order to undertake additional monitoring, quantitative data would need to have need been collected pre and post dredging works. This would provide the ability to analyse pre and post conditions to enable any meaningful analysis of changes in estuary health as a result of dredging.

The commonly used scientific indicators for analysing the health of intermittently closed and opened lakes and lagoons (ICOLLS) on the NSW Coast are tidal regimes, channel morphology, water quality, estuarine vegetation health, marine species numbers and habitat health and benthic macroinvertebrate population health.

It must be noted that there are many factors that influence or affect estuary health, including the indicators above. Careful selection of indicators is necessary to ensure that meaningful data is collected and that it is the actual impact of dredging that is being monitored rather than just general estuary health.

Below is a discussion of potential indicators that could be used to monitor estuary health as part of a dredging project.

Potential Indicators

Tidal Regime – Although the aim of dredging works is not to create or prolong the opening of the estuaries, data on the changes in the range of tidal variation in the estuaries yearly tidal planes, the average water levels and the tidal prisms could be used to analyse any tidal changes and water levels prior to and post dredging. Other variables that would affect this data, include the condition of the estuary entrance and or any artificial openings.

Is this data available? Water level and tidal data is available via the gauges located within Sussex Inlet and Lake Conjola.

Estuary channel morphology – Large scale dredging can change estuary channel morphology (depth & width) which may affect tidal velocities and in turn change the pattern and dimensions of shoaling and scouring in estuary entrances. Useful data collected on channel morphology can show specific areas where scouring or accretion has occurred pre and post dredging. The use of hydro-surveys is one method that can be used to assess channel morphology, as well as analysis of aerial photographic data and digital satellite.

Is this data available? Council undertook hydro-surveys of the actual dredge sites during dredging and after works were completed. Aerial photography is readily available and fairly easy to assess, however, the use of digital satellite data is not available and is relatively expensive.

Water quality – The collection of water quality data is one of the key indicators used to assess the health of estuaries.

Turbidity levels were monitored during the actual dredging works. Turbidity levels are a useful indicator to use to assess water quality effects of dredging due to the disturbance of sediments. Other water quality data that could be collected pre and post dredging works to assess likely impacts, include dissolved oxygen levels, nitrogen (TN), temperature, salinity and phosphorous (TP). Although in order to get any meaningful data that would show any impacts of dredging on water quality for pre and post dredging, the testing would need to be undertaken within close proximity to the dredging location. As turbidity levels remained within REF trigger levels no additional water quality monitoring was undertaken.

Is this data available? – As part of Council's water quality data monitoring program, samples are collected and analysed for Lake Conjola, Sussex Inlet and Currambene Creek. Water quality tests include temperature, dissolved oxygen, faecal coliforms (CFU/100ml), enterococci (cfu/100ml), phosphorus (mg/L) and total nitrogen (mg/L). This data is available for pre and post dredging, however the water quality test sites are located between 300 metres to 500 metres from the dredge sites and therefore an indicator of general estuary health not dredging. Results of Council's water quality monitoring program can be found on Council's AquaData website at https://www.shoalhaven.nsw.gov.au/Environment/Aqua-Data

Estuarine vegetation health – To assess the ecological impacts on estuarine vegetation from any dredging activities accurately, the vegetation communities need to be mapped and their condition assessed. The vegetation communities including seagrasses, saltmarsh, mangroves and swamp oak forest (casuarina) can be impacted by changes in water level, velocities and quality. Pre and post monitoring of the health and condition of these estuarine vegetation communities in locations that could be affected by a dredging project should be undertaken in order to quantify changes in vegetation health.

Is this data available? There is broad scale mapping available of vegetation types for each of the estuaries. As part of the Shoalhaven Dredging REF individual threatened species and threatened ecological communities were identified and assessed. The dredging works were designed to avoid direct impact on estuarine vegetation.

Marine species populations – Some marine fish species utilise estuaries for short periods of time, at a specific period of their life cycle whilst others spend longer periods of time within estuaries. It has been estimated that 60% by weight of the NSW commercial fish catch consisted of species that are dependent on estuaries at some stage of their life cycle (Edgar 2001).

The use of fish and prawn population health to estimate the health of estuaries is difficult and problematic. As different species benefit or increase in estuaries that are in a closed state whilst others may not be tolerant of a closed entrance conditions. Jones and West (2005) in their study of seagrass fish communities in six NSW South Coast ICOLL's, found that artificially opening the entrance of Lake Conjola to alleviate flooding resulted in the loss of large seagrass beds and subsequent decline in recruitment of economically important fish species to that area.

Their research indicated that artificial openings of lakes or carrying out entrance works, should be done with great caution as the impact of these activities on fish communities remains largely unpredictable (Jones & West 2005).

What data is available? – The NSW Department of Primary Industries - Fisheries may have data on fish populations.

Benthic macroinvertebrates populations – The abundance and diversity of macroinvertebrates is often used as an indicator to assess the condition and health of an estuary, river or stream.

In order to undertake any scientific analysis using this indicator, detailed sample surveys of population within the estuary at each dredging location and control sites would need to be collected pre and post dredging activities to be able to quantitatively assess potential impacts, if any on the population.

What data is available? – Nil

Conclusion

In conclusion, further scientific analysis of the 2016 dredging works, other than the monitoring that has already been carried out, is not feasible for the additional indicators discussed above, because baseline conditions were not collected before the commencement of the dredging. The aim of the dredging REF was to avoid direct impacts and included other mitigation measures.

There is reliable water quality data available to analyse the changes in estuary health pre and post dredging operations. However, this data is limited by the location of Council's existing water quality testing sites and would only provide information about general estuary health and not changes in estuary health as a result of dredging. Water quality monitoring, in accordance with NSW Environment Protection Authority (EPA) requirements, for turbidity was carried out during dredging operations. Turbidity remained within acceptable levels.

There is also reliable data available to assess tidal regimes. However, given the smaller scale of the dredging works, and the that fact that dredging had minimal influence on the estuary openings, this indicator is unlikely to identify changes to estuary health as a result of the dredging.

Future monitoring programs could be designed and implemented in collaboration with a research institution such as the University of Wollongong. To address the request by the Committee for "*scientific analysis of the dredging",* any future monitoring and evaluation program could consider the collection of pre and post dredging data using the following scientific indicators:

- Tidal regimes
- Channel morphology
- Water quality
- Estuarine vegetation distribution and health
- Marine species population health and benthic macroinvertebrate population health

Financial Implications

Any scientific analysis and collection of data for the purposes of assessing changes to the health of estuaries as a result of dredging activities will require additional resources and financial input. Therefore, a monitoring and evaluation program needs to be included as part of the overall project. There is opportunity to partner with research organisations and seek funding for monitoring.

Risk Implications

The risk implications for not undertaking any scientific analysis of the dredging programs/works nominated in this report are, at this time, minimal. Works have been completed and no direct adverse impacts detected nor any indication of adverse indirect impacts. It is relevant however, to consider additional environmental monitoring associated with future dredging operations, depending on the scale of the proposal, longevity and identified environmental concerns in the particular area.

SN18.11 Proposed Millards Creek and Currarong Creek Flood Study Projects

HPERM Ref: D18/68633

Group: Planning Environment & Development Group
Section: Environmental Services

Purpose / Summary

To inform the Committee and Council of the success in receiving grant funding from NSW Office of Environment and Heritage (OEH) for the Millards Creek Flood Study and Currarong Creek Flood Study.

Recommendation

The Committee recommends that Council:

1. Accept the OEH grant of $88,666 toward the cost of the flood study for Millards Creek;
2. Council allocate $44,333 from the 2017/18 Flood Programme budget (Job Number 15706) as Council's contribution to the Millards Creek Flood Study;
3. Accept the OEH grant of $77,000 toward the cost of the flood study for Currarong Creek; and
4. Council allocate $38,500 from the 2017/18 Flood Programme budget (Job Number 15706) as Council's contribution to the Currarong Creek Flood Study;

Options

1. As recommended

   Implications: Funding for the Millards Creek Flood Study of $88,666.67 and Currarong Creek Flood Study of $77,000.00 have been provided under the NSW State Government 'Floodplain Management Program' on a 2:1 basis. Council's contribution of $44,333 for Millards Creek and $38,500 for Currarong Creek comes from the existing Floodplain Program budget.

2. The Committee could choose to provide an alternative recommendation for future consideration by Council.

   Implications: Unknown

Background

Both projects are the first stage of the Floodplain Management process, where Council and the community are seeking to identify the flooding problem of Millards Creek and Currarong Creek, and its tributaries.

Preparation of the technical brief for the flood studies has commenced. The next step will be to seek quotations from suitably qualified consultants via a tender process.

Proposed Millards Creek Flood Study

Millards Creek is located within the Milton-Ulladulla urban area. The watercourse starts from Slaughterhouse Road Milton and discharges into Ulladulla Harbour. There is a history of overland flooding effecting residential properties within the Millards Creek catchment. A number of site specific studies exist, however, they do not capture the catchment holistically. The proposed flood study, will not only look at Millards Creek and its unnamed tributaries but will also consider overland flows. The information available about this catchment is minimal and thus the flood study would give Council better intelligence.

Proposed Currarong Creek Flood Study

Currarong Creek originates from the highlands of Beecroft Peninsula, flows through the Currarong Township and discharges to the Tasman Sea. Black Caves Creek joins Currarong Creek near the Currarong Road Bridge, and the combined flow discharges to the ocean.

Currarong is famous for its tourist attractions such as Abrahams Bosom Reserve and Point Perpendicular Lighthouse and lookout. No site-specific flood studies exist and the current information available about this catchment is minimal. The flood study would give Council better intelligence for both development controls and flood response.

Community Engagement

Advancing Council's long-term floodplain management program ensures that economic, social and environmental factors relating to the management of floodplains within the Shoalhaven are considered, documented and implemented in Council's planning programs and policies.

The community will be engaged throughout the duration of the project. Typically, a flood study project includes an initial mail-out and notifications via electronic media to inform residents and ratepayers within the flood study area. Community meetings and drop in sessions would typically be conducted throughout the project. In addition to this, the Shoalhaven Natural Resources and Floodplain Management Committee would be consulted throughout the duration of the project.

Financial Implications

Funding for the Millards Creek Flood Study of $88,666.67 and Currarong Creek Flood Study of $77,000.00 have been provided under the NSW State Government 'Floodplain Management Program' on a 2:1 basis. Council's contribution of $44,333 for Millards Creek and $38,500 for Currarong Creek comes from the existing Floodplain Program budget.

The project is for the provision of consultancy works and will not have any direct or immediate implications on Council's assets.

The tendering and studies will be undertaken by consultants who will be managed by the Natural Resources and Floodplain Unit of Council.

Risk Implications

No risk implications are applicable if Council undertakes both studies. Council will gain valuable information about the flood behaviour for both catchments, which will inform future land use planning and flood emergency management processes.

Council has a statutory responsibility for land use planning and management under the Environmental Planning and Assessment Act. If Council decides not to undertake these studies, the risk may be poor land use planning and emergency management for these areas. In addition, obligations under the Floodplain Development Manual (2005) will not be met.