Shire of Northam
Heritage, Commerce and Lifestyle

SHIRE OF NORTHAM

NOTICE OF A
SPECIAL COUNCIL MEETING
COMMENCING AT
5:30 PM
WEDNESDAY
29 JUNE 2016

Councillors:

Please be advised that the next Special Council Meeting will be held 29 June 2016.

JASON WHITEAKER
CHIEF EXECUTIVE OFFICER
24 June 2016

SHIRE OF NORTHAM

AGENDA

SPECIAL COUNCIL MEETING TO BE HELD ON 29 JUNE 2016

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AGENDA

SPECIAL COUNCIL MEETING TO BE HELD ON 29 JUNE 2016

Notice and Agenda of the Special Meeting of Council to be held in the Council Chambers on WEDNESDAY, 29 June 2016 at 5:30 pm.

DISCLAIMER

No responsibility whatsoever is implied or accepted by the Shire of Northam for any act, omission or statement or intimation occurring during Council/Committee meetings or during formal/informal conversations with staff. The Shire of Northam disclaims any liability for any loss whatsoever and howsoever caused arising out of reliance by any person or legal entity on any such act, omission or statement or intimation occurring during Council/Committee meetings or discussions. Any person or legal entity who acts or fails to act in reliance upon any statement does so at that person's or legal entity's own risk.

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SHIRE OF NORTHAM

AGENDA

SPECIAL COUNCIL MEETING TO BE HELD ON 29 JUNE 2016

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1. OPENING AND WELCOME

2. DECLARATION OF INTEREST

Item Name	Item No.	Name	Type of Interest	Nature of Interest

3. ATTENDANCE

COUNCIL

Councillors	S B Pollard
	T M Little
	D G Beresford
	J E Williams
	J Proud
	R W Tinetti
	C L Davidson
	U Rumjantsev
	C R Antonio
	D A Hughes
Chief Executive Officer	J B Whiteaker
Executive Manager Engineering Services	C D Kleynhans
Executive Manager Development Services	C B Hunt
Executive Manager Community Services	R Rayson
Executive Manager Corporate Services	C Young
Executive Assistant – CEO	A C Maxwell

GALLERY

4. APOLOGIES

5. LEAVE OF ABSENCE PREVIOUSLY APPROVED

Cr D A Hughes has been granted leave of absence from Friday, 1 July 2016 to Sunday, 31 July 2016 inclusive.

6. APPLICATIONS FOR LEAVE OF ABSENCE

Nil.

7. RESPONSE TO PREVIOUS PUBLIC QUESTIONS TAKEN ON NOTICE

Nil.

8. PUBLIC QUESTION TIME

Nil.

9. PUBLIC STATEMENT TIME

Nil.

10. PETITIONS/DEPUTATIONS/PRESENTATIONS

Nil.

11. CONFIRMATION OF MINUTES OF PREVIOUS MEETINGS

11.1 RECEIPT OF MINUTES OF THE REGIONAL CENTRES IMPLEMENTATION COMMITTEE

RECOMMENDATION

That Council receives the minutes of the Regional Centres Implementation Committee Meeting held 13 June 2016.

11.2 ADOPTION OF THE RECOMMENDATIONS OF THE REGIONAL CENTRES IMPLEMENTATION COMMITTEE

RECOMMENDATION

That Council;

1. **Not take any further action with regard to the proposed dredging at this time due to the significant costs involved without grant funding being in place**
2. **Prepare a business case for funding from the State/Federal Government for funding to assist with the dredging of the Avon River between the weir and the current Avon Bridge;**
3. **Undertake investigations and actions with regard to the securing of a suitable site for sediment disposal for any proposed future dredging activities;**
4. **Continues to make an annual allocation to the Dredging Reserve Fund;**
5. **Undertake detailed planning to improve the environmental and aesthetic amenity of the Avon River; and**
6. **Accepts the update as provided noting that business case funding allocated in the 2016/17 budget is be progressed for the following;**
    1. **Planning for social housing areas redevelopment.**
    2. **Recreation Centre Stage 2; and**
    3. **CBA/D Development.**

Shire of Northam
Heritage, Commerce and Lifestyle

SHIRE OF NORTHAM

MINUTES

REGIONAL CENTRES IMPLEMENTATION COMMITTEE MEETING

HELD

MONDAY

13 JUNE 2016

SHIRE OF NORTHAM
MINUTES
REGIONAL CENTRES IMPLEMENTATION COMMITTEE MEETING HELD ON 13 JUNE 2016

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MINUTES
REGIONAL CENTRES IMPLEMENTATION COMMITTEE MEETING HELD ON 13 JUNE 2016

Minutes of the Regional Centres Implementation Committee meeting held in the Council Chambers on MONDAY, 13 June 2016 at 1.00pm.

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SHIRE OF NORTHAM
MINUTES
REGIONAL CENTRES IMPLEMENTATION COMMITTEE MEETING HELD ON 13 JUNE 2016

1. OPENING AND WELCOME

The Presiding Member, Cr S B Pollard declared the meeting open at 1.01pm.

2. DECLARATION OF INTEREST

Parts of Division 6 Subdivision 1 of the Local Government Act 1995 requires Council members and employees to disclose any direct or indirect financial interest or general interest in any matter listed in this agenda.

The Act also requires the nature of the interest to be disclosed in writing before the meeting or immediately before the matter being discussed.

NB A Council member who makes a disclosure must not preside or participate in, or be present during, any discussion or decision making procedure relating to the disclosed matter unless the procedures set out in Sections 5.68 or 5.69 of the Act have been complied with.

3. ATTENDANCE

President	S Pollard
Councillors	D Hughes
	D Beresford
	J Williams
Northam Chamber of Commerce	A Marshall
Avon Community Development Foundation	P Tomlinson
Community Representative	C McConnell

EX-OFFICIO MEMBERS

Shire of Northam	
Executive Manager Development Services	C Hunt
Chief Executive Officer	J Whiteaker
Executive Assistant – CEO	A Maxwell

4. APOLOGIES

EX-OFFICIO MEMBERS

Mia Davies MLA Office	
RDA Wheatbelt	J Grist
Community Representative	R Bristow-Stagg

SHIRE OF NORTHAM
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REGIONAL CENTRES IMPLEMENTATION COMMITTEE MEETING HELD ON 13 JUNE 2016

5. CONFIRMATION OF MINUTES OF PREVIOUS MEETINGS

RECOMMENDATION / COMMITTEE DECISION

Minute No: RCI.17

Moved: Cr Hughes
Seconded: Cr Williams

That the minutes of the Regionals Centres Implementation Committee Meeting held on 3 September 2015 be confirmed as a true and correct record of that meeting.

CARRIED 6/0

5.1 Update on progress of Outstanding Committee Decisions

5.1.1 That Council accepts the update on the progress against the Growth Plan performance indicators as provided and request the Chief Executive Officer to investigate the cost of 'custom modelling' as outlined in the growth plan performance indicators.

The following advice was received from Technical Director - Economics

RPS Australia Asia Pacific;

Custom modelling of sub-sections of the economy to understand changes in Gross Regional Product can be undertaken however this modelling for areas with fewer than 50,000 residents is reliant on employment data which is only current to the 2011 Census of Population and Housing. Modellers such as ourselves and REMPLAN would have to make some assumptions regarding the change in the workforce since this period which would limit the accuracy of the outputs.

Therefore, given the 2016 Census is due to be held later this year, I recommend that the modelling be undertaken from mid-2017 when updated and accurate information is available

As a consequence no further action will be taken until late 2017.

5.2 Invite the Aboriginal Elders to participate in the Regional Centres Implementation Committee

This is proving to be challenging given the range of 'elders' within the community. The Aboriginal community are being widely consulted through the Aboriginal & Environmental Interpretive Centre which it is hoped will result in a more aligned Aboriginal Community, which may then assist in identifying an appropriate representative. Matter is therefore in hold.

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6. AGENDA ITEMS

Ms C McConnell entered the Council Chambers at 1.03pm.

6.1 MANAGEMENT OPTIONS FOR NORTHAM TOWN POOL (AVON RIVER)

Name of Applicant:	Internal Report
File Ref:	7.2.3.1
Officer:	Chadd Hunt/Jason Whiteaker
Officer Interest:	N/A
Policy:	Local Government Act 1995
Voting:	Simple Majority

PURPOSE

For the Committee to review the most appropriate methodology for the future management and ongoing maintenance of the Northam Town Pool section of the Avon River.

BACKGROUND

The Committee recommended to Council the following at its meeting held on 3rd September 2015 –

That Council request the Chief Executive Officer to;

1. *Call for tenders to undertake sediment removal from the Avon River between the Avon Bridge and Avon Weir;*
2. *Structure the tender so as not to preclude any of the dredging options including (dredging of current channel, dredging of entire water body, dredging of two channels, dredging of pool area downstream of Peel Street Bridge);*
3. *Structure the tender to allow it to go over multiple years if required;*
4. *Undertake community consultation in accordance with the provided communication strategy in order to formulate a view on what the community would like its river to be in coming years;*
5. *Explore the opportunity to utilise nitrate to assist in controlling smell which emanates from the Avon River from time to time; and*
6. *Be in a position to report back to the Committee the outcomes of the above no later than November 2015.*

Council resolved at its meeting held on 16 September 2015 also endorsed the above recommendations.

Since the above resolution Council staff have undertaken further investigation with respect to the dredging options and engaged the services of a company specialising in dredging

advice and tendering. The reason for the additional work was to ascertain the likely costs associated with each of the above options for the tender as well as the logistics involved in the storage and disposal of the extracted sediment. This information was required in order for the Committee and Council to make a fully informed decision. Following the submission of the preliminary report the consultants were further engaged to provide additional information on an alternate site for sediment disposal and storage. A copy of the final report is attached to this agenda.

In addition advice was sought from both Matt Giraudo (Consulting Hydrologist) and Department of Water on the reports submitted. A copy of these reports are also attached to the Agenda.

Community consultation was also undertaken with regard to the Avon River and Town Pool with the results of which are attached to this report.

STATUTORY REQUIREMENTS

The Shire of Northam has a funding agreement in place with the Department of Regional Development requiring the Council to finalise this project to the detailed design stage.

The statutory framework associated with the Town Pool is complex and involves Rights in Water Irrigation Act 1914, Statewide Policy No 5 – Environmental Water Provisions Policy for Western Australia, Environmental Protection Act and Aboriginal Heritage Act 1972.

It is understood that because the Town Pool is an "artificial" waterbody responsibility for remedial actions (such as dredging) has historically been the responsibility of the local authority, notwithstanding that approvals from other government agencies are required to undertake those works.

CONFORMITY WITH THE COMMUNITY STRATEGIC PLAN

OBJECTIVE N2: Enhance the health and integrity of the natural environment

STRATEGY N2.1: Identify vulnerable environments or areas in need of protection
STRATEGY N2.2: Protect the integrity of the ecosystems of our rivers and waterways
STRATEGY N2.3: Employ risk management strategies and measures to protect natural assets from natural disasters, including fire and flood.

BUDGET IMPLICATIONS

The Funding agreement with the Department of Regional Development and Lands indicates a total remaining budget of approximately $161,000 for this component of the project associated with the Avon River improvements.

Council allocated a figure of $273,600 listed in the 2015/16 Budget for dredging with a figure of $223,600 being offset by a transfer from Reserve. This leaves a remaining residual amount of $67,000 within that reserve.

Depending on the option proposed to be undertaken the cost of the dredging can range from $600,000 to $1,500,000.

OFFICER'S COMMENT

A concern that has been raised by the Department of Water is with regard to the proposed dredging of the western channel as follows –

> *In dredging the western channel, there may be a risk to the integrity of the islands. i.e. increasing the risk of them being subject to erosion. I believe there is already some erosion of some islands occurring, hence the rocks deposited around the edges by Peter Wheatherly in recent years. Although Matt Giraudo's Dec 2013 paper on sediment analysis looked at bathymetry and sediment makeup, depths and deposition rates, it didn't include proper hydrodynamic modelling to show what effect the proposed channel dredging would have on deposition/scour areas. Looking at Fig. 22 in that document, the downstream-most island on the western side looks like it could be impacted by a channel excavated between it and the bank. It may be prudent to have proper hydrodynamic and sediment deposition/scouring numeric modelling done if the western channel is to be dredged.*

It is also staff's contention that at some stage dredging will need to be undertaken in the Town Pool and that it is not reasonable for the State Government to expect that the total cost is met by Local Government. As mentioned within the previous reports the Avon River and the town pool is a highly altered and complex system. What is also clear is that there is no single solution to the issues associated with the river system and particularly the town pool. The most recent correspondence from Matt Giraudo confirms this fact –

The cause of poor water quality is important in understanding the likely success or otherwise of potential intervention strategies, including dredging. The following issues are critical in understanding the management intervention strategies:

- *Most of the sediment deposition into the Northam Town Pool is associated sediment flow within the river itself, and therefore does not come from the Town of Northam.*
- *The key driver impacting water quality is not nutrient input from the town but organic matter contained within sediments.*
- *Phosphorus contained within the sediment appears largely inactive – in that it is likely to be bound to the sediment and not readily bioavailable.*
- *The primary source of N is from agricultural land.*

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In staff's opinion a primary question for the Committee and Council is if the current expenditure highlighted within the attached report will provide the Community with value for the investment required. There is some concern that the cost of expenditure will not match the communities' expectations for the appearance and use of the Town Pool. The recent comments from Matt Giraudo are relevant with respect to the potential benefits of dredging –
Given these management drivers it follows, that:

- *Investment in nutrient reduction activities in the Town of Northam is unlikely to result in a significant improvement in water quality in the Town Pool.*
- *Water quality improvement within the Town of Northam should concentrate on reducing organic matter reaching the Town Pool to reduce BOD particularly during summer storm events.*
- *Partial excavation of sediment from the Town Pool will in itself probably have a limited impact on overall water quality of the Town Pool. This is because there will likely be sufficient organic matter remaining in sediments after excavation to drive anoxic conditions during summer months, particularly during years of limited summer flow in the river.*

Dredging (particularly the western channel) will however have an aesthetic improvement to the river in that the additional water in the river for longer periods and hence the exposed banks will not be as prevalent. This is also dependent on a number of other factors including summer rainfall events, climatic condition and seasonal variations.

If dredging is to be undertaken a major concern and cost is with respect to the storage, ongoing treatment and disposal of the sediment once extracted. The original scoping study looked at areas under the direct control of Council however it is apparent that the sites selected were not suitable and significant restrictions on the amount of dredge material that could be stored and treated. There was also significant costs in building the storage structure due to the fact that all materials had to be brought into the site. The revised report looked at alternatives that provided both a greater area and reduced construction costs. Given the above comments on the fact that at some stage dredging will need to occur it is recommended by staff that access to the identified land be secured on a long term basis (either purchased or leased). Further details will be provided verbally at the meeting.

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RECOMMENDATION

That it be recommended to Council that it ;

1. **Not take any further action with regard to the proposed dredging at this time due to the significant costs involved without grant funding being in place**
2. **Prepare a business case for funding from the State/Federal Government for funding to assist with the dredging of the Avon River between the weir and the current Avon Bridge;**
3. **Undertake investigations and actions with regard to the securing of a suitable site for sediment disposal for any proposed future dredging activities.**
4. **Continues to make an annual allocation to the Dredging Reserve Fund.**

COMMITTEE DECISION

Minute No: RCI.18

Moved: Paul Tomlinson
Seconded: Cr Des Hughes

That it be recommended to Council that it;

1. **Not take any further action with regard to the proposed dredging at this time due to the significant costs involved without grant funding being in place**
2. **Prepare a business case for funding from the State/Federal Government for funding to assist with the dredging of the Avon River between the weir and the current Avon Bridge;**
3. **Undertake investigations and actions with regard to the securing of a suitable site for sediment disposal for any proposed future dredging activities.**
4. **Continues to make an annual allocation to the Dredging Reserve Fund.**
5. **Undertake detailed planning to improve the environmental and aesthetic amenity of the Avon River**

CARRIED 7/0

COMMITTEE DISCUSSION

- In relation to funding sources, it was raised that Council must have a clear course of action and proposed solution.
- It was suggested that monitoring post dredging be utilised to monitor the water quality and other associated outcomes.

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ATTACHMENT 1 – COMMUNITY FEEDBACK

Shire of Northam
Heritage, Commerce and Lifestyle

AVON RIVER REVITALISATION

The aim of the Avon River Revitalisation community consultations is to define some of the issues that the local community feel are important to them concerning the Avon River between the Avon Bridge and the Avon weir, and identify potential strategies to improve the health, appearance and use of the river.

81 people completed the feedback forms.

Is the Avon River important to our community? Why?
100% of the people who completed a survey indicated that the river is important to the community. Reasons:

- It is the only piece of remnant vegetation left in the Shire.
- It is a meeting point. (x2)
- It is a place of relaxation.
- It is a major feature of the town, both for locals and to attract visitors.
- It is a big tourist attraction. (x6)
- It is home to a lot of wildlife.
- It should be important to more people but it isn't.
- It is the focal point of the community and encourages people to visit (e.g. Avon Descent).
- It is the origin of the Swan River.
- It provides habitat and last refuge for native species that have had their habitat destroyed elsewhere.
- Our kids share the river and the stories of the river and it is important to our culture.
- It is a natural resource for the town. (x5)
- It is the main thoroughfare to Northam.
- The town was built around the river and as such it forms a focal point. (x2)
- The river is the heart of our town.
- It is a quiet place to meet, BBQ, exercise, play and just enjoy living in the country.
- The river is important to our environmental tourism, quality of life and the overall wellbeing of our town.
- It is central and an easily accessible area of beauty which provides light recreation and leisure for a wide range of users.
- It is a vital part of the Avon Valley history and an integral part of our history.
- It should be retained and revitalised for the sake of future generations.
- Aesthetically and ecologically it is important and the community should be able to use it more.
- It allows people to interact with wildlife. It gives travellers a reason to stop in our town to have the experience.
- Great for photography.
- It is a focal point for the town. (x5)

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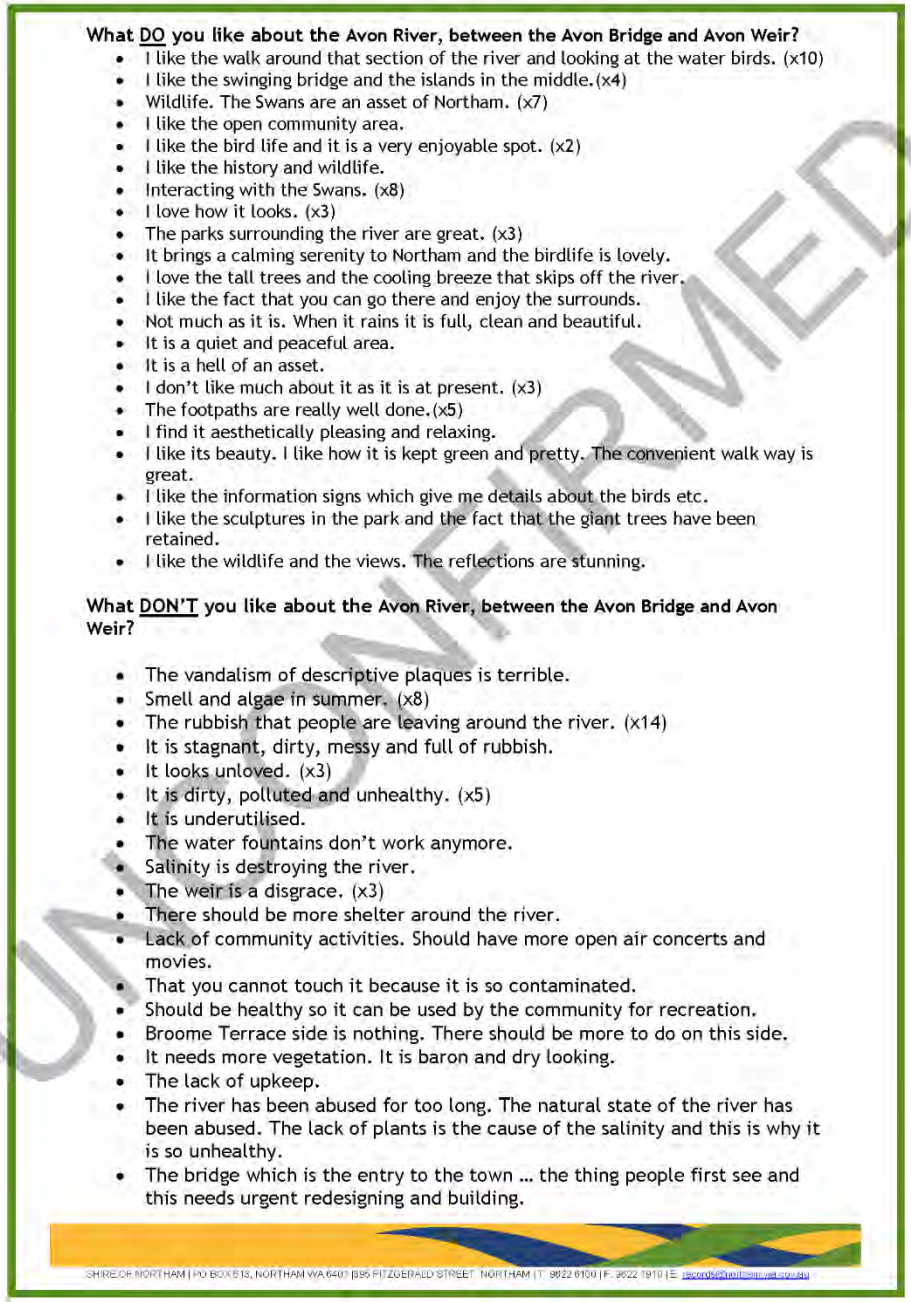

What DO you like about the Avon River, between the Avon Bridge and Avon Weir?

- I like the walk around that section of the river and looking at the water birds. (x10)
- I like the swinging bridge and the islands in the middle.(x4)
- Wildlife. The Swans are an asset of Northam. (x7)
- I like the open community area.
- I like the bird life and it is a very enjoyable spot. (x2)
- I like the history and wildlife.
- Interacting with the Swans. (x8)
- I love how it looks. (x3)
- The parks surrounding the river are great. (x3)
- It brings a calming serenity to Northam and the birdlife is lovely.
- I love the tall trees and the cooling breeze that skips off the river.
- I like the fact that you can go there and enjoy the surrounds.
- Not much as it is. When it rains it is full, clean and beautiful.
- It is a quiet and peaceful area.
- It is a hell of an asset.
- I don't like much about it as it is at present. (x3)
- The footpaths are really well done.(x5)
- I find it aesthetically pleasing and relaxing.
- I like its beauty. I like how it is kept green and pretty. The convenient walk way is great.
- I like the information signs which give me details about the birds etc.
- I like the sculptures in the park and the fact that the giant trees have been retained.
- I like the wildlife and the views. The reflections are stunning.

What DON'T you like about the Avon River, between the Avon Bridge and Avon Weir?

- The vandalism of descriptive plaques is terrible.
- Smell and algae in summer. (x8)
- The rubbish that people are leaving around the river. (x14)
- It is stagnant, dirty, messy and full of rubbish.
- It looks unloved. (x3)
- It is dirty, polluted and unhealthy. (x5)
- It is underutilised.
- The water fountains don't work anymore.
- Salinity is destroying the river.
- The weir is a disgrace. (x3)
- There should be more shelter around the river.
- Lack of community activities. Should have more open air concerts and movies.
- That you cannot touch it because it is so contaminated.
- Should be healthy so it can be used by the community for recreation.
- Broome Terrace side is nothing. There should be more to do on this side.
- It needs more vegetation. It is baron and dry looking.
- The lack of upkeep.
- The river has been abused for too long. The natural state of the river has been abused. The lack of plants is the cause of the salinity and this is why it is so unhealthy.
- The bridge which is the entry to the town ... the thing people first see and this needs urgent redesigning and building.

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- The river is not deep enough. Not at any time of the year.
- I don't like the security of the area near the river.
- Minson Avenue with the back of the shops facing the river is a complete eyesore. Something needs to be done to hide this because it takes away from the whole area.
- Crossing the Peel Street Bridge can be very dangerous.
- The old swan enclosure area does not meet the beauty of the rest of the river. It has potential to join seamlessly with the rest of the area.
- Apart from the footpath there is nothing else to draw people to the area.
- When dry it is depressing. It needs aeration.
- We need to do a litter pick up. (x9)
- Don't like the presence of sea gulls. They have to go. They are robbing the native bird life of valuable food. (x3)
- Domestic ducks should not be on our river. They should be in a backyard or relocated through the RSPCA.
- Lack of footpaths and crossovers.

What would make the Avon River more enjoyable and appealing to you and your family?

- More careful policing of the area and cleaning up of the park and the river regularly.
- Regular cleaning out of rubbish. (x6)
- Pump in more water over summer. (x8)
- Walk trails, York to Toodyay.
- Fish in the river and it we made the river usable.
- A cleaner river with more shops near it (coffee vans, hire bikes, hire canoes, etc.). (x2)
- Remove the levy banks and find a better way to draw people to the river.
- Bring back the natural look.
- Improve how it looks.
- BBQ areas, small shop to buy coffee and cake with alfresco set up, paddle boats (let the people aerate the river).
- Ensure there are no mosquitoes
- More shaded picnic areas, water you can touch that is not polluted and kayaks.
- We want to be able to swim in the river again. (x4)
- More vegetation! It used to be so green and beautiful.
- Make it healthy.
- Clean it! Do the work now and enjoy it forever.
- Install a large properly designed fountain to circulate the water. Solar powered. With under water lights!
- Make it deeper, cleaner and make it a permanent pool.
- Better lighting and more picnic tables. (x2)
- Aerate it. (x3)
- Outdoor exercise equipment along the river would be great. (x6)
- Revegetation on the banks would beautify and attract more birds.
- More river focused activities and not just the once per year Avon Descent.
- Canoes and paddle boat hire. (x5)
- Walk an underwater tunnel.
- Water from underground bores to replenish the water levels during summer.
- Get rid of the sea gulls.
- Signage encouraging water activities.
- Improved footpaths (in bits).
- Less litter and more bins.

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What do you believe are the main threats to the health of the Avon River?

This was a very close rank. They are ranked 1 to 4 with 1 being perceived as the most important threat.

Types of Threats	Importance
Changes to the natural water flows - unnaturally high or low flows caused by drought or human intervention such as weirs.	3
Loss of plant life - removing plants from a riverbank makes it more likely to erode, reduces habitats for other wildlife, affects the river's natural temperature and reduces the soil's ability to filter polluted water entering the rivers.	2
Climate change - predictions suggest there will be longer intervals between rainfall but more intense storms, altering a river's natural state and creating poor living conditions for wildlife.	4
Pollutants and litter - these can cause poor water quality which threatens wildlife and affects everyone's enjoyment of the river.	1
Other threats: • Weeds and excessive grating • Hydrology • Humans • Doing nothing • Deep agricultural drains • Domestic ducks and sea gulls	

How do you currently use the river and its surroundings and how would you like to use it in the future?

- Walking around the river/exercise. (x14)
- Feed the ducks. (x5)
- Only to attend the markets.
- I don't use it as it is. I would like to see it cleaned.
- Circuit racing for the power dingy racing team who compete in the Avon Descent. We would like to practice locally and want permission to do circuits in this area.
- Kayak and BBQ with family.
- Would like to see water sports.
- Concerts in the park are awesome. (x2)
- The park is family friendly. Would love to see a skate park right there at Bernard Park to involve the teenagers within the community.
- I don't use it but would like to see it opened up to non-powered boats.
- For picnics and have canoed in there. Seems to be a rare sight for the community to see a canoe in the river and people enjoy seeing this.
- Virtual audio tours of the healthy river in the Visitor Centre would be good too.
- Accessing the waterpark and playground. (x5)
- Would like to use it more for recreation (kayak, canoe and paddle boats). (x9)
- For BBQs and picnics. (x6)

What can the Shire of Northam do to improve the health of the Avon River, between the Avon Bridge and Avon Weir?

<u>Litter and Debris</u>

- Clean up the rubbish regularly (x18)
- Create a volunteer group within the community so people can care for the river.
- Remove the debris from the river banks.
- Remove the shopping trolleys.

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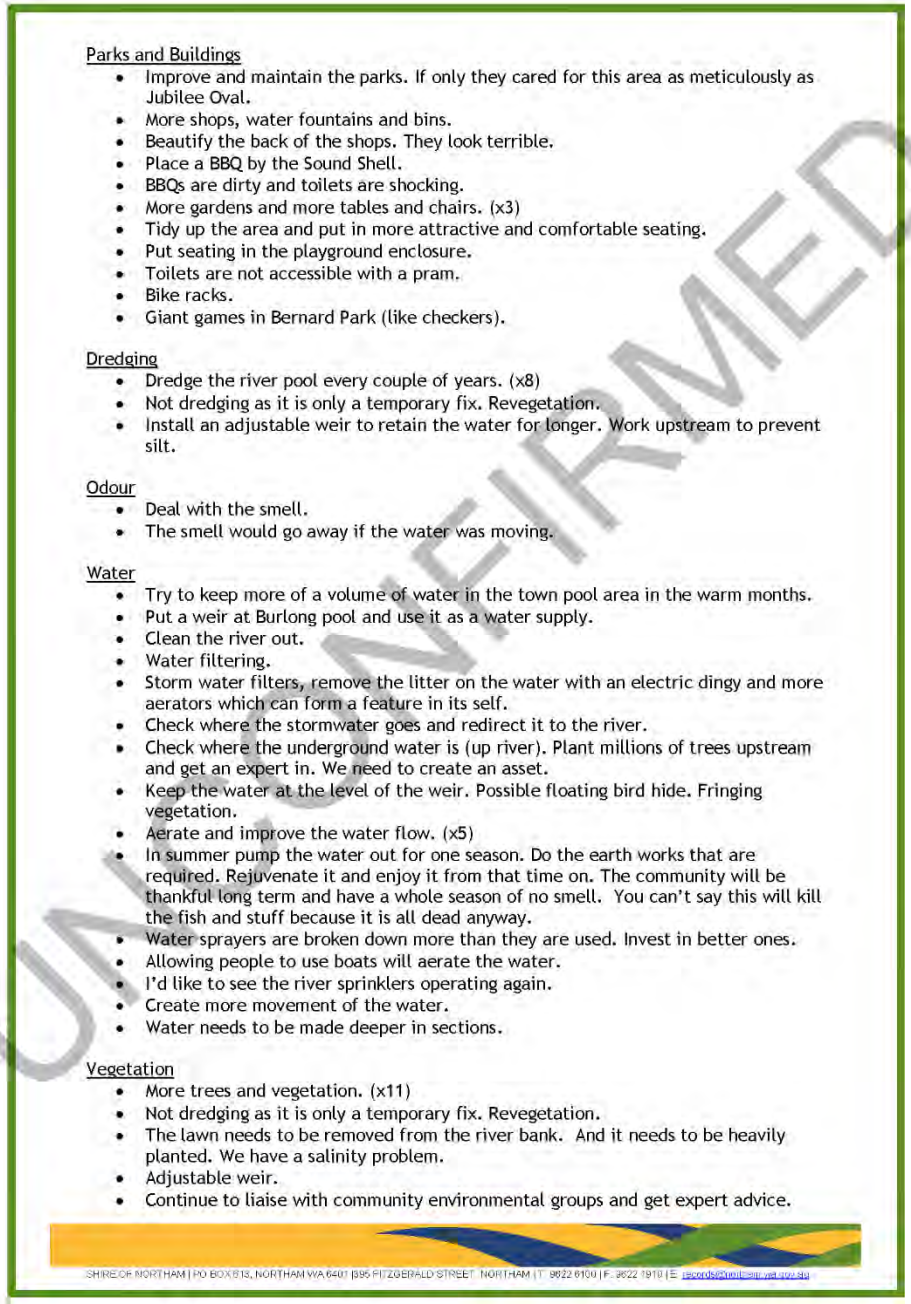
MINUTES
REGIONAL CENTRES IMPLEMENTATION COMMITTEE MEETING HELD ON 13 JUNE 2016



Parks and Buildings

- Improve and maintain the parks. If only they cared for this area as meticulously as Jubilee Oval.
- More shops, water fountains and bins.
- Beautify the back of the shops. They look terrible.
- Place a BBQ by the Sound Shell.
- BBQs are dirty and toilets are shocking.
- More gardens and more tables and chairs. (x3)
- Tidy up the area and put in more attractive and comfortable seating.
- Put seating in the playground enclosure.
- Toilets are not accessible with a pram.
- Bike racks.
- Giant games in Bernard Park (like checkers).

Dredging

- Dredge the river pool every couple of years. (x8)
- Not dredging as it is only a temporary fix. Revegetation.
- Install an adjustable weir to retain the water for longer. Work upstream to prevent silt.

Odour

- Deal with the smell.
- The smell would go away if the water was moving.

Water

- Try to keep more of a volume of water in the town pool area in the warm months.
- Put a weir at Burlong pool and use it as a water supply.
- Clean the river out.
- Water filtering.
- Storm water filters, remove the litter on the water with an electric dingy and more aerators which can form a feature in its self.
- Check where the stormwater goes and redirect it to the river.
- Check where the underground water is (up river). Plant millions of trees upstream and get an expert in. We need to create an asset.
- Keep the water at the level of the weir. Possible floating bird hide. Fringing vegetation.
- Aerate and improve the water flow. (x5)
- In summer pump the water out for one season. Do the earth works that are required. Rejuvenate it and enjoy it from that time on. The community will be thankful long term and have a whole season of no smell. You can't say this will kill the fish and stuff because it is all dead anyway.
- Water sprayers are broken down more than they are used. Invest in better ones.
- Allowing people to use boats will aerate the water.
- I'd like to see the river sprinklers operating again.
- Create more movement of the water.
- Water needs to be made deeper in sections.

Vegetation

- More trees and vegetation. (x11)
- Not dredging as it is only a temporary fix. Revegetation.
- The lawn needs to be removed from the river bank. And it needs to be heavily planted. We have a salinity problem.
- Adjustable weir.
- Continue to liaise with community environmental groups and get expert advice.

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- The rivers edge needs attention. Dead tree removals and suitable plant replacements.
- I would like to see less concrete and more trees. Leaves are not mess, they are compost. Stop blowing them away and burning them. Let them decompose into food for our sick environment.

Do you have any additional comments that will assist the Shire of Northam to improve the health and look of the Avon River, between the Avon Bridge and Avon Weir?

- The river and surrounds could be much more of a tourism feature for the town.
- Renew the information boards about the history and wildlife.
- It is good to see the Shire doing something about the river.
- Excessive grading of Tankard Street makes the river unhealthy.
- The river needs more plant life. More shelter. Fish.
- Watch what water is going into the river. Look to river specialists about what is best to do. River flow is important to the health of the river. Remove the weir???
- Get rid of the small and improve the look of the river. Improve the health of the water.
- It is a beautiful view from the main street where the Avon Mall is. Leave the Fitzgerald site as public open space.
- Clean the paths and widen the bridge.
- Stop releasing balloons at public events unless they are biodegradable. They get mistaken for food and kill our wildlife.
- I would love to be involved as a local contractor. I am experienced in this field - Geoff Hicks PO Box 457, York.
- Education! Have a public forum "Back from the Brink" and make the community a part of the solution.
- It is urgent.
- The new works on the footpath of the Avon Bridge is disgusting. What an unsafe eyesore. 90% of people come to Northam via this bridge.
- We should promote the river and the surrounding areas. So much area is wasted. New shops in the town should be encouraged to front the river and enhance the streetscape.
- Do not repeat previous decisions to install sprinklers on the river. This does not work. It is more about education.
- Create a group and coordinate it so we can all work together to make the river better.
- Would like to see a better enclosure for the Swans.
- Make a picnic area on the flour mill side of the bridges.
- Shire needs to inflict harsher litter fines. Signage so people know how to report people littering.
- Need to improve the condition of the islands and riverbanks urgently.

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ATTACHMENT 2 – SCHOOL STUDENT FEEDBACK

Shire of Northam
Heritage, Commerce and Lifestyle

AVON RIVER REVITALISATION

The aim of the Avon River Revitalisation community consultations is to define some of the issues that the local community feel are important to them concerning the Avon River between the Avon Bridge and the Avon weir, and identify potential strategies to improve the health, appearance and use of the river.

Avonvale Primary School - Year 4 and 5 (completed October 2015) 36 kids
West Northam Primary School - Year 5 and 6 (completed October 2015) 27 kids
Clontarf - Year 7, 8 and 9 (completed October 2015) 24 kids
St Josephs School - Year 3 and 7, Davinchi Club (High School)
Northam Primary - Year 2 and 4

I really like having the river in Northam because …

- It tells us stories that are indigenous. (Picture of Aboriginal spirits around the river)
- It has white swans and long necked turtles. (x6)
- It tells our stories.
- I love the colours it brings through our town.
- I love the animals it brings.
- I like the wildlife. (x13)
- We are the only place with long neck turtles.
- I love the Avon Descent. (x8)
- I love the swinging bridge.
- It is so beautiful to look at. (x4)
- I love to see the ducks and swans and turtles.
- The wildlife is so interesting and gives people something else to do.
- I love to watch the Avon Descent.
- It makes me feel calm and nice.
- It is a great river and if it was clean we could use it.
- It is an attraction and brings people to the town.
- Makes the town look non-dry.
- The view is alright.
- You can swim in it for free.
- There are ducks and you can feed them. (x2)
- I like the river because of the park and trees.
- It is very beautiful and great for picnics and feeding the ducks. (x2)
- Because it encourages wildlife to live here too.
- It is a nice view.
- Wildlife. (x3)
- It is nice having living creatures in our town.
- My ancestors fished here and swam in the Avon River and this makes it special. I like to feed the ducks and watch the Avon Descent. It is wonderful having the river in Northam.
- The ducks are nice and you can feed them but you get chased by the swans.

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- I love going to our river to be by nature.
- It is a good place for you to walk along.
- You can feed the ducks and when it is hot the water evaporates and it flows with the wind to give you a cool breeze.
- It is a lovely habitat for swans and other creatures.
- It is something nice to see.
- We have lots of good events by the river and I go there to feed the ducks.
- I like the river because it pretty much runs through the middle of the town and it looks nice.
- I really like having the river in Northam because sometimes I like going to the riverside to feed the ducks and swans. (x3)
- It is beautiful in the sunset and it reminds me of my ancestors.
- I love to see the wildlife.
- The water is cool and natural.
- It is a wonderful place to go with your family and we admire the ducks and just walk around it. The two parks are great and it is such a nice place to have family time.
- It is an amazing view and it is useful (swimming and games).
- It makes the town look relaxing and good for people to gather there. The Avon descent is great too.
- It is refreshing, it stands out and it is beautiful.
- The river has been the highlight of Northam for many years.
- The river has been around for a long time in Northam.
- Families can enjoy the river and all that it offers.
- Elders used to swim in it and younger aboriginals can pass it on to their younger family members.
- It is very important to our community because of the Balladong Aboriginal people and the swans are a part of our community.
- Because it is a heritage site it is important to our community and our culture.
- It provides an important centre piece to our town.
- It is important to indigenous people like we used to be able to swim in it and meet near it for corroboree.
- It is a part of our community.
- It represents our town.
- It holds a connection to the Balladong people.
- It is the biggest tourist attraction in town which brings people from all over.
- It is a tourist attraction.
- It is a great place to run around the bridges and brings more fun to the community.
- It is important to indigenous people.
- It was a meeting place for years.
- It is culturally important to the Balladong people. (x4)
- It is a place for wildlife to drink.
- It is bad long.
- It is a nice centrepiece to the town and the start of the Avon descent is great.
- There is a little pool where people can swim sometimes.
- When it flows it is clean and we love to swim in it.
- I love the big pool in there. This part can be an entertaining area.
- The water pool is great. When the pool is closes me and my mates swim in it.
- You can do activities in it and other stuff like environmental stuff.
- That my ancestors used to swim in there.
- It is nice having water all year round.
- It is a nice big open pool for the aboriginal people and we love swimming in it.

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- I don't really like it.
- It is a good sight to see.
- Walking across the bridge.
- It is nice during winter.
- It reminds me of the Balladong people who was here before us.
- I like the free WiFi at the river and the water park.
- The water playground in the park is great because we want to get wet and have fun.
- The wildlife.
- I like it because of the Swans.
- It is good to look at and also to see the ducks.
- I like to walk around the bridges and swim at the weir.
- I use the river to exercise. We walk around it. (x2)
- I like the free WiFi. (x2)

I think we could use the river for …

- BBQ, picnic and a fire to sit around.
- Art, nature watching, sharing stories, canoeing and swimming.
- Art.
- Canoeing (x2)
- Boating, canoeing and swimming. (x5)
- A wildlife park. (x3)
- An inland beach, with white sand and no big edges. (x5)
- Rowing
- Stand up paddle boarding.
- A pool for swimming all year with rope swings and a water slide. Also a gondola would be a great attraction.
- Swimming. (x13)
- Fishing, for tours and swimming.
- Growing the swan population. (x4)
- A marine park.
- Different activities during the year.
- Shows.
- A place for fish to stay alive.
- Fish and fishing.
- Swimming. (x18)
- Would be good to do swimming lessons in the river and water fights.
- Kayaking and canoeing. (x3)
- Avon Descent (x2)
- Fishing (x2)
- I am now big enough to swim in there but the water is dirty.
- For breeding some fish and other animals. (x2)
- Swimming, fishing and using it as an attractive tour stop.
- Doing more things like swimming and fishing. (x3)
- A variety of different races, swimming and kayaking. (x2)
- Have $10 canoe rides. It would bring more people in the community there.
- A picnic area and a rope swing into the water.
- If the river was flowing all year round we could swim in it.
- Beautified river banks.
- A new footbridge and extend the walking tracks upstream.

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- We want to be able to swim in it more. (x11)
- Swimming. We need a big water slide.
- We need a big water park and packs of slides.
- Kayak hire and some telescopes to watch the wildlife.
- Our families like to swim in the water holes. Make a few bigger water holes.
- Make a designated swimming area.

I don't like the river when …

- People litter. (x5)
- It is dry. The duck poo, the smell and the rubbish make it look and feel dirty.
- People hurt the animals. (x2)
- They kill the ducks with their rubbish. (x2)
- People hurt the animals and steel the eggs.
- It is dirty and stinky. (x15)
- It is dirty and disgusting.
- I fall in or when it smells.
- All of the time it is dirty and it smells and some of the ducks are evil.
- It stinks, the water is green and it is too dry most of the time.
- People be mean to the ducks.
- It is summer because it always dries up and smells in summer. (x2)
- I always like it.
- It is not nice when it smells.
- It is dirty and smells. (x7)
- It stinks only when it is low or empty.
- It has moss and algae.
- When visitors come past the Avon River it is a shame to Northam.
- It is so dirty and uncared for that you can't use it for anything.
- I don't like the river when it is dirty as it is not safe to go swimming in there. (x3)
- It kills the wildlife in it when it is dirty.
- When it is polluted and there is no fish and other animals because the river I so dirty that fish can't even live there.
- When the swans are not there.
- When it is dried up it is terrible.
- It is all polluted and smelly.
- Litter (x2)
- It is raining because it rises and it could flood.
- People litter because they are destroying the environment around the river.
- It is not deep enough.
- When the river stops flowing it smells (x5).
- Not being able to swim in it in summer.
- The bird poo around the edges, the bad smell and people chuck rubbish in there.
- The environment is bad and things are dying in the river.
- The water is stagnant and stinks over summer.
- I wish it was always clean.
- It gets pretty bad in the summer.
- The river is dirty with heaps of rubbish in it.
- The smell and the rubbish. (x5)

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- I don't like the trolleys in the river. (x3)
- It is dirty and unhealthy.
- It should be clean so the animals have a better chance of living.
- I don't like the little islands in the river and when it dries up it stinks.
- People chuck trolleys and glass in the river.
- The poop in there.
- The poo is bad. Clean out the poo. (x6)

I think we could make the river healthier by ...

- Helping the animals and cleaning the river.
- Pick up the rubbish. Respect the animals and put more signs up so people know to do this.
- Pick up the rubbish. (x7)
- Not littering. (x3)
- Clean it up. (x15)
- Keep watch of what is under the bridges.
- Let people use it for swimming and canoeing because this will aerate the water.
- Place a net under the bridges from one side to the other to catch the rubbish and drain the water. The net needs to be cleaned out regularly but. This will also keep the swans in.
- Clean out the dirty water and put some fresh water in there.
- Use a net under the bridges.
- Clean it ... this is pretty self-explanatory! (year 5)
- Suck all of the watch out and put some cement in the bottom and then put fresh water in it.
- Filter the water. (x2)
- Put some fish in the river to clean it up.
- Pump some extra fresh water into it.
- Put fences along the footpath. (x2)
- Not running out sewer pipes into the river.
- Clean it, educate people, get people together and get cleaning as a community.
- Put clean dirt around it.
- Remove the trolleys and rubbish from the river.
- Clean it up. (x10)
- Sort the pollution out.
- Not rubbishing the view.
- More plants, more care.
- Try putting more trees in and use a few cleaning machines before it gets so bad.
- Make sure there is no animal poo in there as it turns bad.
- Plant more plants and trees and clean out the litter. (x2)
- Can we please have a day when we all clean up together?
- Growing more trees by the river and try to get more animals living there.
- The river would be healthier if we planted along the river banks.
- Send the schools to the river like every second or third week and make us clean it.
- Plant. More. Trees.
- Stop the birds from poohing in it.
- Flowing water to wash the smell out. (x6)
- More water!
- Get rid of the domestic ducks and geese and leave the white swans in there. All of the domestic birds are adding to the problems.
- Make it clean.
- Take away all of the non-native animals.
- Improve the flow.

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- Clean it up (x6)
- Purify our local waste water and inject it back into the river.
- There were never domestic ducks and geese when the river was healthy. Get rid of them.
- Drag the shopping trolleys and bikes out of the river. This will make it safer for everyone.
- Make it deeper in the middle.
- Recirculate the water and pump it from the weir back up stream.
- Make an artificial beach.

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ATTACHMENT 3 – DREDGING NOTES

NOTES – DREDGING OF THE NORTHAM TOWN POOL

Shire of Northam

Abstract
Advice – dredging of the Northam Town Pool.

Prepared by Matt Giraudo
Feb 2016

SHIRE OF NORTHAM
MINUTES
REGIONAL CENTRES IMPLEMENTATION COMMITTEE MEETING HELD ON 13 JUNE 2016

1 Background

A number of studies (including the BMT scoping document) have concluded that poor water quality in the Northam Town Pool is caused by eutrophic pool sediments. They conclude that eutrophic sediments cause in high concentrations of phosphorous in the water column which in turn leads to excessive algal growth and ultimately anoxic conditions in the river pool.

Documented evidence suggests that anoxic conditions occur in the Northam Town Pool in the absence of eutrophic conditions and associated algal blooms (Giraudo 2013a). Dissolved oxygen levels in the town pool decline rapidly after the cease-to-flow caused predominately by organic carbon contained in sediments. The anoxic conditions in the pool are the cause of the poor water quality and offensive smell experienced during summers, particularly during extended periods of little or no flow in the river.

Anoxic conditions are exacerbated by local stormwater inflow in summer which increases the biological oxygen demand (BOD) in the town pool, triggering a rapid reduction in dissolved oxygen (DO) within the water column.

Release of phosphorus from sediments appears to be muted due to slow accumulation rates of phosphorous and high concentrations of Al and Fe within sediments. As a result, phosphorous appears largely bound to the sediment and is not released during anoxic conditions.

The cause of poor water quality is important in understanding the likely success or otherwise of potential intervention strategies, including dredging. The following issues are critical in understanding the management intervention strategies:

- Most of the sediment deposition into the Northam Town Pool is associated sediment flow within the river itself, and therefore does not come from the Town of Northam.
- The key driver impacting water quality is not nutrient input from the town but organic matter contained within sediments.
- Phosphorus contained within the sediment appears largely inactive – in that it is likely to be bound to the sediment and not readily bioavailable.
- The primary source of N is from agricultural land.

Given these management drivers it follows, that:

- Investment in nutrient reduction activities in the Town of Northam is unlikely to result in a significant improvement in water quality in the Town Pool.
- Water quality improvement within the Town of Northam should concentrate on reducing organic matter reaching the Town Pool to reduce BOD particularly during summer storm events.
- Partial excavation of sediment from the Town Pool will in itself probably have a limited impact on overall water quality of the Town Pool. This is because there will likely be sufficient organic matter remaining in sediments after excavation to drive anoxic conditions during summer months, particularly during years of limited summer flow in the river.

Annual accumulation of sediments in the Northam Town Pool is estimated at between 2,300 – 3,000 m^3/yr (Giraudo 2013b). If no dredging is undertaken, then the Town Pool will eventually completely fill with sediment.

Natural scouring of the Northam Town Pool currently appears to occur only during flows exceeding 100 m^3/s (Giraudo 2014), which occurs infrequently. Since 2000 flows have exceeded the threshold of 100 m^3/s on just two (2) occasions.

Increased frequency of the scouring of the town pool could be enhanced by the construction of a variable crest weir (Giraudo 2014). In the absence of a change to the weir, regular dredging of the Town Pool will be required to keep it free of sediment.

2 Pre-feasibility

Most of the analysis required for prefeasibility for dredging of the pool has already been undertaken, including:

- Estimation of the volume of sediment and rate of accumulation (Giraudo 2013a).
- General composition of the sediment (WRC 1996, Giraudo 2013 a & b).
- Type of dredge required – small cutter section dredge – similar to that used in 2000.

The key outstanding issues that need to be explored are associated with treatment and disposal of the sediment. Facts informing treatment and disposal of sediment include:

- Rate of accumulation of sediment: 2,500 - 3,000 m^3/yr – dredging will likely be an important medium – long term management strategy for managing sediment in the pool.
- Limited capacity of the netball courts to contain sediment (~5,500 m^3). It is assumed that the disused tennis courts are unsuitable as a long term treatment area for various reasons, including proximity to residential areas.
- Sediments are relatively benign, however will require treatment with lime for acidity (approximately 50 kg lime /m^3 sediment).
- Significantly dredging will be required to change the environment / character of the Town Pool. Excavation of the western channel will require removal of 30,000 m^3.
- Sediment composition is unlikely to be suitable for land fill or have any other commercial value, so an alternative cost-efficient disposal mechanism is required.

The key decision-critical factor impacting the feasibility of the dredging of the Town Pool is the treatment and disposal of the sediment, and in particular the limited size of the treatment site.

Excavation of the western channel will require multiple dredging operations. Maintenance dredging to account for the estimated 2,300 - 3,000 m^3/yr of sediment accumulating in the pool would also require regular dredging, assuming a treatment area storage capacity of 5,500 m^3 (disused netball courts).

In terms of pre-feasibility, it is recommended that further assessment of the identified treatment sites be undertaken, including:

- Site survey.
- Geotech assessment and drilling.
- Consideration of the land surrounding / adjacent to the disused netball courts.

The prefeasibility assessment should also consider if dredged material can be effectively used to construct the bund wall, potentially with the addition of a fixing material such as 'claycrete'.

Assuming a bund wall 2m high and 2:1 side slopes as indicated in the BMT report and a 5 -6 m top width surrounding the 380m perimeter of the disused netball courts, it is estimated that the bund wall will be approximately 5,500 – 6,000 m^3.

3 Approvals

Given the relatively benign nature of the dredged material and assuming the development of an effective environmental management plan (EMP), it is considered that a pre-referral to the OEPA is unlikely to be necessary. However, it is recognised that the previous referral in 1996 did result in an "Informal Review and Public Advice". Further advice from DER is recommended in the first instance.

The nature of the approval process is ultimately determined but the nature of environmental risk associated with the project and the potential for environmental harm. In this instance, preliminary sediment analysis has concluded that there is limited contamination of the sediments.

The sediment contained within the Northam Town Pool is essentially the same as the other 300,000 m^3 of sediment that traverses the Northam Weir each year. No significant quantities of heavy metals, hydrocarbons or pesticides have been identified in the sediments. Phosphorous contained within the sediment appears largely bound to the sediment itself and is unlikely to be bio-active.

The key issue surrounding the environmental risks will be the frequency and timing of the dredging of the sediment, which in large part will be dictated by the nature and size of the treatment site (refer Section 5).

4 Sediment Sampling and Analysis

Preliminary chemical analysis of sediments was undertaken in 2013 (3 samples) in addition to nine (9) samples taken in 1996. Of the 12 samples tested only 2 provided any indication of contamination with pesticides and heavy metals, and these were in very low concentrations.

Additional sample analysis will be required to support the development of the environmental management plan and to inform the treatment and disposal of dredged material. However, available data indicates that the dredged material is largely benign, and reflective of the underlying sediment present in river flow. The reason for this is that the vast majority of the sediment accumulating in the river pool is deposited sediment flow from upstream river flow.

The primary risk associated with excavation of sediment is the development of acid forming compounds due to drying and subsequent oxidation of dredged sediments. Previous analysis has indicated that sediments will need to be treated with 50 kg/m^3 of lime to neutralise dredged sediments. Further sampling at 50 m intervals is recommended to better assess the rate at which lime will need to be added to excavated sediment, as outlined in the BMT report.

Further analysis of pesticides and heavy metals is recommended however at a lower frequency than that identified in the BMT report, due to the high cost of analysis a low probability of encountering contaminants.

There is no evidence of hydrocarbons being present in the town pool, or in samples collected from the Swan Enclosure. Samples collected in 2014 indicate moderate levels of Pyrene, a simple hydrocarbon, which occur as a result of contamination and/or as a result of natural processes. If it is associated with anthropogenic contamination, then Pyrene typically occurs in association with other hydrocarbons. In the case of the Northam Town Pool, the lack of associated hydrocarbons suggests

that the presence of Pyrene is as a result of natural processes. Limited further testing for hydrocarbons is recommended.

The BMT report suggests testing for the presence of tributyltin. This compound is associated with antifouling paint and although a common contaminant in mariners and harbours is extremely unlikely to present in the Northam Town Pool.

Analysis of samples for TOC, nutrients metals, bulk density and cation exchange is recommended as presented in the BMT report.

5 Environmental Impact Assessment

There are two key environmental impacts that will need to be managed as a result of dredging:

- Management of acid forming component of dredged sediment material.
- Management of the sediment plume during dredging.

Acidic sediments can be neutralised through the application of lime, most effectively undertaken at the time of dredging in the treatment area prior to removal of dried sediment from the treatment area.

Management of the impact of the plume created as a result of dredging will require further consideration. The sediment plume will contain nutrients, and in particular N and P, although most of the P will be bound to the sediment and is unlikely to be bioactive. The dredging plume will also contain a portion of organic carbon and will potentially add to downstream turbidity.

The timing, period and frequency of dredging will be important factors influencing downstream environmental impacts. If dredging is undertaken during the winter flow period, then there is likely to be an associated spike in nutrient concentration downstream, however nutrients are likely to be sediment bound and present a relatively minor environmental hazard. Organic carbon contained with the dredging plume may lead to anoxic conditions, however the risk of this occurring during the winter flow period is relatively minor due to the high underlying oxygen content of river flow during the winter flow period.

If dredging is undertaken during summer, then the impact on the Northam Town Pool itself is likely to be high, principally due to the release of organic carbon into the water column leading to the anoxic conditions within the pool.

The social impacts of undertaking the dredging during summer would also be likely to be significant. Dredging in summer will result in significant odour issues due to extended anoxic conditions in addition to potential exposure of sediments as a result of reduced water level in the Town Pool itself.

Given the limited capacity of the treatment area, it is considered that dredging will need to be undertaken at regular intervals, and for relatively short periods of time. This will further impact the potential risk of environmental harm, but will allow effective monitoring of the downstream impacts can be undertaken and alternative management responses to be implemented.

It is likely that the impact of the dredging plume will be significantly influenced by the flow conditions during the period of dredging. As a result a relatively high degree of flexibility will be required to minimise downstream impacts.

Development of the environmental management plan (EMP) will be best undertaken using an adaptive management approach. The EMP will need to identify the environmental risk, and effective strategies for downstream monitoring and decision trees and thresholds for assessing impacts.

6 Dredging Strategy

The dredging strategy used will ultimately be driven by two key drivers. The limitations associated with the treatment area and the potential downstream environmental impacts associated with the dredging plume.

It is assumed that dredging will need to be undertaken during the flow period, due to the high environmental and social impacts stemming from the alternative summer dredging program. It is likely that dredging will need to be undertaken during a relatively narrow window of suitable flow conditions in the river.

The limited capacity of the treatment area, need for ongoing dredging, uncertainty regarding disposal of sediment and adaptive approach to manage downstream environmental impacts, are all factors that call for a high degree of flexibility in dredging operation.

Maintaining flexibility in operation will be the key factor influencing the underlying feasibility of the project. In identifying potential management responses, one of the options that the Shire of Northam may consider is the purchase of a small cutter dredge and manage the operation of the dredging itself.

7 References

BMT Consultants 2015. Shire of Northam Avon River Dredging Scoping Study. Prepared for the Shire of Northam. December 2015.

Giraudo (2013a) Northam Town Pool – Water Quality Assessment and recommendations for Management. Prepared by Matt Giraudo for the Shire of Northam, Perth, Western Australia, October 2013

Giraudo M (2013b), Northam Town Pool – Sediment Analysis. Shire of Northam, Northam Western Australia, December 2013

Giraudo M (2014), Northam Town Pool – Water Quality Assessment and Recommendations. Shire of Northam.

WRC (1996) Northam Town Pool – Samples. Prepared by Water and Rivers Commission internal memorandum, Perth, Western Australia, July 1996.

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ATTACHMENT 4 – DRAFT AVON RIVER DREDGING SCOPING STUDY

Alysha Maxwell

From: IMMS Brendan <Brendan.Imms@water.wa.gov.au>
Sent: Thursday, 25 February 2016 4:47 PM
To: Chadd Hunt
Subject: I56929 - RE: Avon River Dredging Report
Attachments: 2015 - (Draft) Avon River Dredging - Scoping Document - with comments.pdf

Hi Chadd,

In general the document appears sound in its coverage of options, technical aspects, required approvals and other considerations. I have attached the draft with my comments in it. Below are some more general comments:

Time of year for dredging.
Dredging during winter flow would have the benefit of dilution/flushing of returned water from DMCP or geotube, (otherwise if it is high in nutrients there may be a bloom in downstream pool). You would need to take into account Avon Descent though. Dredging outside of flow, on the other hand, would mean any sediment stirred up would be able to resettle on the pool bottom quicker, thereby minimising its time in the water column and having a more localised impact. Performing the dredging just prior to anticipated commencement of flow (i.e. late Autumn) would probably be the ideal time.

In dredging the western channel, there may be a risk to the integrity of the islands. i.e. increasing the risk of them being subject to erosion. I believe there is already some erosion of some islands occurring, hence the rocks deposited around the edges by Peter Wheatherly in recent years. Although Matt Giraudo's Dec 2013 paper on sediment analysis looked at bathymetry and sediment makeup, depths and deposition rates, it didn't include proper hydrodynamic modelling to show what effect the proposed channel dredging would have on deposition/scour areas. Looking at Fig. 22 in that document, the downstream-most island on the western side looks like it could be impacted by a channel excavated between it and the bank. It may be prudent to have proper hydrodynamic and sediment deposition/scouring numeric modelling done if the western channel is to be dredged.

In terms of approvals required from this department, a licence under the *Waterways Conservation Act* will be needed, as the document correctly states. The need for a Bed and Banks permit, which are issued under the *Rights in Water and Irrigation Act* is generally negated by having the former licence, as is the case at Burlong Pool.

Let me know if you have any further queries.

Regards,

Brendan Imms
Natural Resource Management Officer
Department of Water - Swan Avon Region
7 Ellam St Victoria Park WA 6100
Phone: 08 62508053
Email: brendan.imms@water.wa.gov.au

Government of **Western Australia**
Department of **Water**

From: Chadd Hunt [mailto:emds@northam.wa.gov.au]
Sent: Friday, 5 February 2016 10:36 AM

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To: IMMS Brendan
Subject: Avon River Dredging Report

Hi Brendan

Trust things are going well in 2016 for you! Just thought I would touch base with you regarding the Avon River project which is progressing, albeit quite slowly at the moment. At this point in time we have engaged BMT JFA Consultants to provide some preliminary advice on the options for dredging the pool, including indicative costings. It would be appreciated if you could provide some advice with regard to the "technical" aspects of the BMT report with regard to the methodology and approvals process. I have attached a copy of the draft report and would appreciate any feedback that you can give so that I can get the report finalised and presented to Council.

Again I would appreciate your advice on this matter and if you have any queries please do not hesitate to contact me to discuss.

Regards,

Chadd Hunt
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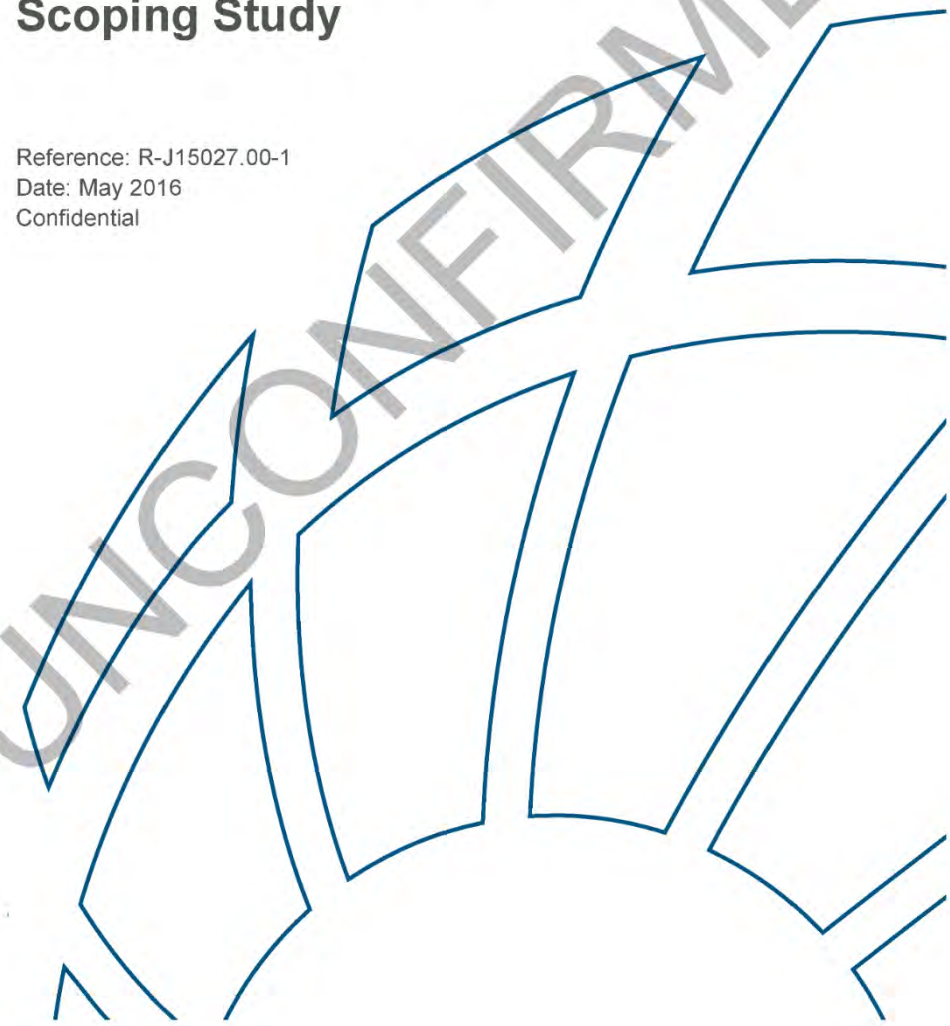
BMT JFA Consultants
"Where will our knowledge take you?"

AVON RIVER DREDGING
Scoping Study

Reference: R-J15027.00-1
Date: May 2016
Confidential



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SHIRE OF NORTHAM

AVON RIVER DREDGING

SCOPING STUDY

Prepared for

Shire of Northam
heritage, commerce and lifestyle

BMT JFA Consultants
By

Rev	Issue	Prepared by	Submitted to	Date	Copies
A	Draft – Internal Review	H Sunarko	T Green	2/12/15	1 elec.
B	Draft for Client Review	H Sunarko	C Hunt	4/12/15	1 elec.
C	Draft – Internal Review	C Webb	H Sunarko	04/05/16	1 elec.
D	Draft for Client Review	C Webb/H Sunarko	C Hunt	06/05/16	1 elec.

Document Information	
Client:	Shire of Northam
Project	Avon River Dredging
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Author	H Sunarko
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Current Revision	Rev D

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EXECUTIVE SUMMARY

The Northam Town Pool (hereafter referred to as 'the Pool') is located in the centre of the town of Northam. The Pool is one the town's major attractions providing a valuable recreational resource. However, the Pool suffers from poor environmental and aesthetic conditions due to multiple factors.

Recent studies commissioned by the Shire of Northam (here after referred to as 'the Shire') had identified a number of possible management actions that can be taken to improve the Pool amenity. One of the management options is to dredge the sediment accumulated in the Pool. The removal of accumulated sediment will help in improving the condition of the Pool by extraction of the organic-rich sediment, which causes depletion of Dissolved Oxygen and providing higher concentrated flow, which may to result in a reduced rate of future sedimentation, as sediment is kept in suspension.

To enable dredging works to be performed in the Pool, approvals are required to be obtained by the Shire from the relevant regulatory authorities such as Environmental Protection Agency (EPA), Department of Environment Regulation (DER) and others. This approval process will include the required sediment sampling and analysis to understand the physical and chemical characteristics of the dredged material.

In this initial scoping study, the following contributing elements have been assessed to determine the best path forward:

- Dredging volume (based on three options, which include: eastern channel (5,500m^3), western channel (30,000m^3) and combination of the two (35,500m^3))
- Capacity of the placement site options (particularly the storage capacity in the disused netball court at various bund heights, and its comparison with the Gun Club site).

Based on this assessment, it has been found that the Netball site limits the dredging scope due to the small area available. Upon re-visiting the site to inspect the suitability of the Gun Club site for dredged material placement, the Dredged Material Containment Pond (DMCP) option was re-assessed and given the larger area, and the availability of insitu fill material for the construction of the pond, the Gun Club site offers a more practical and economical material placement solution. The estimated project cost for dredging of 35,500m^3 of sediment and placing them in the Gun Club site is $1.5 million, which equates to $42/m^3.

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1 INTRODUCTION

The Avon Catchment is a large catchment, which covers more than 120,000km^2. Following major flooding from a cyclonic front in early 1955 many towns along the Avon River suffered severe flooding. This led to the adoption of the River Training Scheme (RTS), which aimed to alleviate the perceived flood risk by straightening the river, removing vegetation and braided channels, and deepening the channel. The RTS program continued until the early 1970s and has changed the morphology of the river system.

The town of Northam is located 96km north-east from Perth with an estimated population of about 11,730 (ABS, 2014). The Pool is located in the centre of the town of Northam. The Pool is one the town's major attraction providing a valuable recreational resource. However, the Pool is experiencing poor environmental and aesthetic conditions due to multiple factors, such as:

- Accretion of sediment in the Pool caused by the reduction in the frequency of large flows (flow exceeding 100m3/s), which is required to move the unconsolidated sediment (Giraudo, 2014)
- Poor water quality caused by high concentration of nutrients and organic matter contained within the sediments, which leads to high density of phytoplankton and causes Dissolved Oxygen depletion (anoxic condition) in the Pool (Giraudo, 2013a).

Recent studies commissioned by the Shire have identified a number of possible management actions that can be taken to improve the Pool amenity, one of the management options is to dredge the sediment accumulated in the Pool. The removal of accumulated sediment will help in improving the condition of the Pool by:

- Extraction of the organic-rich sediment, which causes depletion of Dissolved Oxygen
- Providing higher concentrated flow, which is likely to result in a reduced rate of future sedimentation as sediment is kept in suspension.

Following a Council meeting in September 2015, the Council resolved to request the CEO to:

- Call for tenders to undertake sediment removal from the Pool
- Structure the tender so as not to preclude any of the dredging options, including dredging of current channel, dredging of entire water body, dredging of two channels, dredging of the Pool area downstream of Peel Street Bridge
- Structure the tender to allow it to go over multiple years if required.

To meet the Council's request, it is proposed for the work to be undertaken in a staged approach via the completion of an initial scoping and methodology development study. This scoping study aims to understand the dredging scope, material placement and management options and to understand the regulatory requirements for the project. This study aims to allow the Shire to make an informed decision with a better understanding of the project requirements, schedule, costs and risks.

This report has been prepared jointly by BMT JFA and BMT Oceanica. The report structured as follows:

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- Chapter 2 – Scope of Works – Provides a description of the project aims and scope of works to be addressed by the BMT Team in this report
- Chapter 3 – Site Visits – Provides a brief commentary on the dredging and dredged material placement options
- Chapter 4 – Data Review – Review of available and provided information
- Chapter 5 – Preliminary Options Assessment – Provides options assessment in terms of dredging scope, dredged material placement site selection and management methods
- Chapter 6 – Relevant Approvals and Legislation – Provides information regarding relevant approvals and legislation
- Chapter 7 – Sampling and Reporting Requirements – Provides information regarding the requirements to characterise the dredged material
- Chapter 8 – Project Delivery Program – Provides indicative project delivery program
- Chapter 9 – Project Cost Estimate – Provides indicative project cost estimates
- Chapter 10 – Project Risks and Opportunities – Provides high level near term risks and opportunities
- Chapter 11 – Recommendations – Provides recommendations for the next step of the project
- Chapter 12 – References.

2 PROJECT AIMS

2.1 Aims

The aims of the scoping study are as follows:

- To assess the available historical information
- To assess the dredging and dredged material management options
- To assess the approval requirements including environmental site investigation requirements
- To identify and assess the project schedule, costs and risks
- To provide a recommendation to the Shire.

2.2 Scope of Work

The works included under the Scoping Phase are as follows:

- Site visit to assess dredging and dredged material placement site, meet the Shire of Northam Project Team and collect or view any additional data pertaining to the Pool and/or historic dredging activities (e.g. the dredging in 2000)
- Review data for suitability for approvals and/or further design works and advise if further data is required
- Provide advice on the preferred design (widths and depths) for the various dredging/excavation options based on the previously achieved levels in the RTS and works performed by Giraudo (2014)
- Review dredged material placement options and assess approvals processes, programs and budget costs
- Preliminary stakeholder and regulatory consultation regarding the proposed dredging to determine the relevant environmental approvals required
- A preliminary assessment of the pre-, during, and post- campaign monitoring requirements for inclusion in the contractor Project Execution Plan (PEP)
- Prepare a single scoping and recommendation report for the Shire to consider prior to proceeding to the next phase
- Follow up site visit to assess additional dredged material placement options
- Revise scoping and recommendation report to account for additional dredged material placement options.

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3 SITE VISITS

The project kick off meeting and site visit were held on 5th November 2015 and were attended by representatives from BMT JFA and the Shire. An additional site visit occurred on 22nd April 2016 to inspect the Gun Club land. The site visits and kick off meeting provided an opportunity for the project team to meet and discuss the project's goals and objectives. In the kick of meeting, additional data was also provided by the Shire. A list of the additional data is provided in Appendix A.

The following sites were inspected during both site visits:

- Avon river from swing bridge
- Northam Weir
- Disused netball courts
- Disused tennis courts
- Gun Club available land

Photos taken during the visits are shown in Figure 3-1 to Figure 3-14.

Figure 3-1: Aerator Near Newcastle Bridge

Figure 3-2: Avon River from Broome Tce

Figure 3-3: Dredging Equipment Launching Pad

Figure 3-4: Northam Weir

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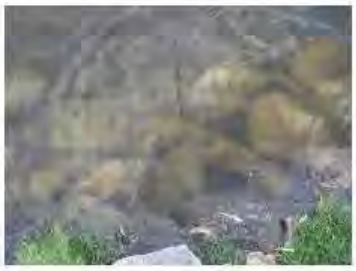

Figure 3-5: Avon River Water Visibility

Figure 3-6: Disused Netball Court

Figure 3-7: Fence Opening at the Netball Court

Figure 3-8: Existing Drainage Adjacent to the Netball Court

Figure 3-9: Pedestrian Pathway Over the Drainage

Figure 3-10: Disused Tennis Court

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Figure 3-11 Gun Club Land

Figure 3-12 Avon River (downstream of weir)

Figure 3-13 Fence line between Gun Club and Avon River (downstream of weir)

Figure 3-14 Public walkway between Gun Club land and weir.

4 REVIEW OF EXISTING INFORMATION

4.1 Environmental Condition in the Northam Town Pool

The Pool, amongst several other Avon River pools, provides important breeding and refuge areas for waterbirds and water related fauna. However, the number of pools remaining as viable refuge sites has been reduced due to sedimentation.

The seagrass *Ruppia* sp. is estimated to cover ~75% of the Pool bed due to tolerance of the brackish nature of the Pool water. These plants are an important nutrient sink in the Pool, provide stability to the Pool floor and are an important food source for waterbirds that reside in the vicinity of the Pool (WC 1995).

High concentrations of nutrients and organic matter within the sediments have led to correspondingly high nutrient concentrations in the water column within the Pool, leading to a high density of phytoplankton (WC 1995; Davies et al. 1996; cited in DoW 2007). A large percentage of the phytoplankton is blue-green algae and as a result, algal blooms commonly occur in summer due to poor flushing rates. This leads to reduced dissolved oxygen concentrations due to the increase in benthic oxygen consumption (WC 1995, DoW 2007, Giraudo 2013a).

The high biomass of the Pool bed has resulted in a high organic content of the surface sediments which has led to the production and release of hydrogen sulfide gas. Acid sulfate soils (ASS) have also previously been identified within the Pool sediments (Giraudo 2013a).

4.2 Previous Sediment Sampling and Analysis

Sediments were sampled at nine sites along the length of the Pool in 1995 (WC 1995). Total phosphorus and total nitrogen concentrations in the sediments were found to be low to moderate; however, under specific conditions these sediment nutrients can be released into the water column and contribute to algal blooms (WC 1995). Pesticides and heavy metals were measured in two of the nine samples and were found to be present in low concentrations. Particle size distribution (PSD) was analysed in samples below the swing bridge. Sampling indicated that the sediments were a combination of silts and sands with the surface-most horizon comprising dark homogenous ooze with a high organic content (WC 1995).

Sediments within the Pool were sampled again in 1996 (GA 1996; WRC 1996). Nine samples were collected from the Pool and analysed for settling times, sand to fines ratios and PSD. Based on the PSD test, the samples were found to be predominantly clay and silt with up to 45% clay and 27% silt, with some sand present (GA 1996). Upon further observation, it was noted that a large proportion of the sand sized material broke down into fine clay when manually handled, suggesting that the proportion of sand was much lower than measured (WRC 1996).

Further sediment sampling and analysis in the Pool was completed in 2013 (Giraudo 2013a). Samples were collected at two sites along the proposed western dredge channel and one site along the proposed eastern dredge channel. Low to moderate concentrations of nutrients were found in the sediments. High sediment concentrations of iron and aluminium were observed. Analyses for ASS found all samples to have positive net acidity (see Section 7).

4.3 Previous Dredging

The Pool was previously dredged in 1914, 1952/53, 1954/56, 1974 and 2000. The dredging campaign in 2000 removed 50,000 m^3 of sediment from the Pool to deepen and improve the health and aesthetics of the Pool. Sediment was removed from the eastern channel between the Avon Bridge and the Peel Street Bridge and from the entire channel width between the Peel Street Bridge and the weir. The sediment was disposed to an offsite stockpile at the Gun Club site ~500m north of the dredging site (DoW 2007). The final volumes dredged during the other campaigns are unknown.

4.4 Previous Approvals

In 1996, the removal of accumulated sediment from the Pool was referred to the Western Australian (WA) Environmental Protection Authority (EPA) under Part IV of the *Environmental Protection Act 1986* (EP Act) and the EPA set the Level of Assessment for the proposal as "Informal Review with Public Advice".

4.5 Management Measures Identified

The following management options have been identified in the "Water Quality Assessment and Recommendations for Management" Report, (Giraudo, 2013a):

Table 4-1: Potential Management Options

Option No.	Name	Description	Remarks
1.	Increased Water Level	Adding water into the Pool to provide dilution is unlikely to yield any significant environmental benefits, because the concentration of nutrients in the water column is not the key factor causing the rapid reduction in the Dissolved Oxygen within the water column	Not a recommended option
2.	Phosphorus Binding	Phosphorus is the limiting factor influencing biological production, but most of the Phosphorus contained within the sediment is bound and therefore inactive. Adding phosphorus binding agent is unlikely to yield significant benefits	Not a recommended option
3.	Artificial Oxygenation.	Oxygenation of benthic layers will alleviate hypoxic and anoxic conditions within the Pool. However, oxygen needs to be delivered to benthic layers over a large area of the Pool after the cease-to-flow period to be successful. Oxygenation of the shallow, warm waters that occur in the Pool during summer and autumn presents a significant challenge. Costs and technical difficulties make this option largely impractical in this instance.	Not a recommended option

Option No.	Name	Description	Remarks
4	Harvesting of Aquatic Weed	Physical removal of aquatic weed and/or filamentous algae can reduce the rate of accumulation of organic matter within the Pool sediments, but it won't reduce the organic matter already present within the sediment. Harvesting of aquatic weeds and filamentous algae will not stop the production of the offensive smelling hydrogen sulphide because the organic rich sediment is the primary cause of the oxygen depletion within the water column and the production sulphur dioxide.	Not a recommended option
5	Aerobic digestion of organic sediment	Aerobic decomposition of organic matter within sediments using commercial products utilising large populations of bacteria and peroxide compounds to aerate benthic water will potentially remove the source of the problem – organic matter contained within sediments. This is a relatively new technology and products currently available have not been tested in this environment, with examples typically restricted to wastewater treatment and commercial applications with small volumes of sediment with higher concentration of organic matter. A trial in the Swan Enclosure, located adjacent to the Pool, is recommended to better assess the potential application within the Pool.	Recommended by Giraudo, but is not part of this Scope of Work
6	Dredging	Dredging of sediment will in part provide a short to medium term solution by removal of the organic rich sediment and to provide higher concentrator flow to mobilise the sediments There are multiple options for dredging scopes, which are discussed in a later section in this report	Recommended option and part of this Scope of Work
7	Variable Crest Weir	Further accumulation of organic-rich sediments in the Pool will occur unless there is a change to the existing hydraulic conditions of the Pool. Scouring of the Pool does occur, but only during large flows events (>100 m 3 /s). Hydrologic analysis of the Avon River indicates that the observed reduction in the frequency of scouring flows over the last 3 decades is likely to continue into the future. Hydraulic modelling indicates that the construction of a variable crest weir will assist in controlling future accumulation of sediment in the Pool by reducing the threshold of flow required to result in scouring of sediments to 20 – 30 m 3 /s.	Recommended option but is not part of this Scope of Work

4.5.1 Geotechnical Characteristic of Dredged Material

Sediment sampling was undertaken within the Pool in April 1996 prior to the previous dredging campaign in 2000. According to Giraudo (2013) a relatively high proportion of fine sand was present within the Pool.

Results from the sampling undertaken in 1996 have been summarised and assessed in Table 4-2 below. The percentage of fines ranges between 21% and 50% with an average of

30%. The percentage of coarse material ranges between 50% and 79%, with an average of 70%.

Table 4-2: Sampling Results Within the Pool Previously Undertaken By Golders and Associates (1996)

Sample #	% Clay (< 0.002mm)	Silt % (< 0.006mm)	Sand + Gravel (>0.006 mm)
1.	45.00%	5.00%	50.00%
2.	19.00%	12.00%	69.00%
3.	21.00%	27.00%	52.00%
4.	19.00%	12.00%	69.00%
5.	11.00%	10.00%	79.00%
6.	17.00%	7.00%	76.00%
7.	17.00%	7.00%	76.00%
8.	14.00%	14.00%	72.00%
9.	9.00%	12.00%	79.00%
Average	**19.11%**	**11.78%**	**69.11%**

4.5.2 Dredged Material – Anticipated Bulking Factor

In order to sufficiently design the Dredged Material Containment Pond (DMCP) facility to meet the requirement of the potential dredge volumes, the representative particle size distribution (PSD) described in Table 4-2 was analysed with other key geotechnical properties in order to best estimate the likely bulking factors and material volumes entering the DMCP (for details of these conditions refer Appendix B). The PSD results were grouped to incorporate fine materials (clays and silts) and coarse (sands and gravels). The anticipated bulking factor of dredged material is provided in Table 4-3.

Table 4-3 Estimated Bulking Factor and Volumes of Discharged Dredge Materials

Material	Fines (< 0.75mm)	Coarse (>0.75mm)	Overall
Bulking Factor	2.2	1.1	1.42-1.44

5 PRELIMINARY OPTIONS ASSESSMENT

This options assessment consists of the following considerations:

- Dredging volume
- Dredged material placement site selection
- Dredged material management options.

5.1 Dredging Scope Options

There are four dredging scope options considered in this initial study, these options are outlined in Table 5-1. The dredging volumes provided below are taken from the Sediment Analysis report by Giraudo (2013b), which are based on 2011 bathymetric survey by RM Surveys.

Table 5-1: Dredging Scope Options

Option No.	Option Name	Estimated Dredging Volume (m^3)	Estimated Bulked Volume (m^3)	Description
1.	Dredging of Existing (Eastern) Channel Only	5,500	7,900	This option consists of dredging the existing eastern channel, which is typically 0.2 – 0.6m in depth
2.	Dredging of Western Channel Only	30,000	42,700	This option would reinstate a second channel to complement the previously dredged (eastern) channel. The estimated quantity required would be approximately 30,000m^3 in order to remove all overlying sediment from the existing bed level (approximately 1.0-1.5m in depth)
3.	Dredging of Western and Eastern Channels	35,500	50,500	This option consists of the combination of western and eastern channel dredging. The total volume of the works is approximately 35,500m^3
4.	Dredging of Entire Water Body Dredging	120,000	170,800	This option consists of the removal of all sediment loads in the entire area of the Pool including the proposed western and eastern channels. The total volume of the works is in the order of 120,000m^3. This option is NOT recommended due to the following factors: • Significant cost • Large size of material placement area required • Inconsistent with natural morphology within the area and unsustainable in the long term

In this study Options 1, 2, and 3 have been selected for further assessment.

5.2 Dredging Equipment

It is envisaged that dredging work will be undertaken by a small cutter suction dredger (CSD), which is similar to the 2000 dredging campaign. The CSD is stationary dredger which is equipped with a cutter head and dredge pump. The soil is mobilised by the mechanical rotation of the cutter head, then transported hydraulically by the flow of the dredge pump. During its operation, a CSD moves around a spud pole by pulling and slacking on the two fore sideline wires. A picture showing a small CSD is provided below.

Figure 5-1: Example of a Small CSD

Hydraulically transported dredged material typically consists of a solid/water mixture with 10% – 20% solid and 80% – 90% water. By matching the delivery rate to the size of the dredged material containment pond and installing suitable tail water outlet, a large proportion of the water can be drained from the placed material.

5.3 Dredged Material Management Options

There are a number of engineering techniques that can be used to drain the water out of the dredged material. These options are as follows:

5.3.1 Dredged Material Containment Pond

A dredged material containment pond (DMCP) is a facility, which is designed to receive, settle and store dredged material. A figure showing a typical DMCP design is provided in Figure 5-2. The DMCP typically configured to the needs of the Avon River Dredging would consist of the following key components:

- Dredged material inlet
- Primary Pond, which is allow for settlement of coarser material
- If required, a Secondary Pond, which will allow for further settlement of fine material
- Tail water outlet structure (e.g. weir-box)
- Spillway directing the latent water back into the Avon River.

Figure 5-2: Dredged Material Containment Pond

5.3.2 Geotextile Tube

Where site area constraints exist it may be possible to utilise geotextile tubes and reduce the area required to separate the water from the fines. A geotextile tube (hereafter referred to as "geotube") is a tube-like container made out of woven polypropylene filaments. The filaments are woven into a pre-engineered pattern such that the water can escape from containment while the sediment being kept within. Figure 5-3 shows a geotube being used for dewatering of dredged material.

Figure 5-3: Dewatering of a Geotube

The dredged slurry is pumped directly from the dredger to the infill port of the geotube. During the filling, pressures start to build up inside the geotube, where it forces the water to escape from the pores between the woven fabrics. When water is drained and the height of the geotube reduces, then a second cycle of filling can begin. The process is repeated until the maximum capacity of the geotube is reached and the geotube is full of sediments. Settlement of suspended particles inside the geotube typically requires the application of a

chemical (flocculation) agent, which neutralises the particle surface charges, allowing the particles to settle faster. The selection and application of the flocculation agent has to be done with care to ensure that it will not adversely affect the ecology. When full, the geotube can either be cut open to air dry the sediments or be transported away as a unit for disposal.

5.4 Dredged Material Management and Placement Site Selection

The potential dredged material placement sites identified during the site visits are outlined in Table 5-2 below. Drawing # 1254_00_001_01A depicts each of these material placement sites and is provided in Appendix F.

Table 5-2: Dredged Material Placement Site

Option No.	Option Name	Description	Remarks
1	Disused Netball Court	The disused netball court is approximately 8,000m^2 in size. The required pipeline work ranges from 350m to 1350m. It is located in a relatively isolated area away from the neighbourhood. A photo of the disused netball court is provided in Figure 3-8	• 8,000m^2 footprint of land available • 350-1350m of pipe work required • No risk of material returning to the Pool • Relatively isolated
2	Disused Tennis Court	The disused tennis court is approximately 7,000m^2 in size. The required pipeline work ranges from 400m to 1400m. It is located adjacent to residential properties. A photo of the disused tennis court is provided in Figure 3-10	• 7000m^2 footprint of land available • 400-1400m of pipe work required • Risk of material returning to the Pool • Very close to residential area
3	Gun Club Land	The vacant land is approximately 61,000m^2 in size. The required pipeline work ranges from 350m to 1350m This land was used for material placement in the previous dredging campaign. Photos of the land available are provided in Figure 3-11 and Figure 3-13	• 61,000m^2 footprint of land available (30,000m^2 expected for DMCP use) • 350m-1350m of pipe work required • No risk of material returning to pool • Relatively isolated

5.4.1 Disused Netball Court

Pictures showing the disused netball court are provided in Figure 3-6. The court is rectangular in shaped (approximately 80m x 100m) with an area of approximately 8,000m^2.

5.4.1.1 DMCP Option

It is anticipated that material will be borrowed from an external site in order to build the external and internal DMCP bunds. Given the limited footprint available to build the reclamation at this site, the allowable bund height will drive the amount of insitu dredged material that can be suitably placed at the netball court site.

In order to estimate the required DMCP sizing required, containment bund height must incorporate sediment settling (ponding) and freeboard in addition to the height required for solids retention. In this preliminary calculation, the bund design has been based on the following parameters:

- Bund crest width of 1m
- Side slope ratio of 1 Vertical: 2 Horizontal
- Typical reclamation allowances of 0.5m ponding and 0.3m for freeboard.

This design may change and may be subject to environmental specifications on discharged water quality at the DMCP outlet and may require sediment settling testing and DMCP detailed design studies. The relationship between bund height's effect on available reclamation capacity and volume required for bund construction is detailed Appendix C and is illustrated in Figure 5-4.

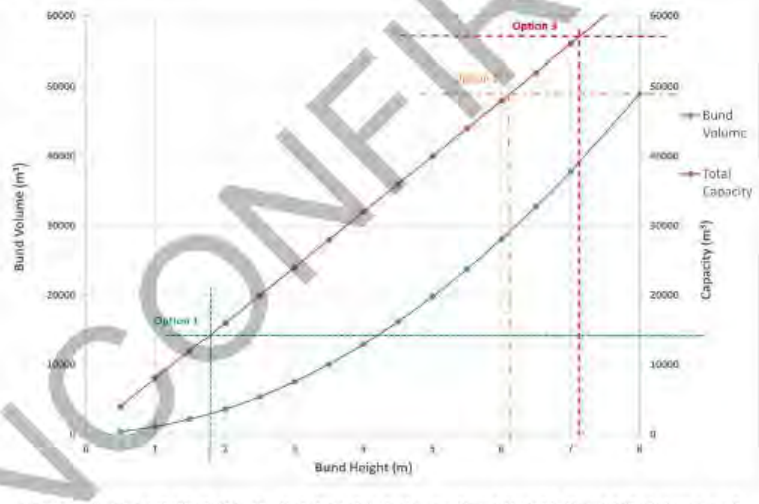

Figure 5-4: Disused Netball Court – Relationship between Bund Height, Bund Fill Volume and Storage Capacity

Based on the three options considered in this study, the bund height requirements and fill volume required to construct the DMCP bund at the Netball Courts are provided in Table 5-3.

Table 5-3: Preliminary DCMP Sizing and Bund Height and Volume Required for Placement at Netball Court Site

Option No.	Insitu Dredged Volume	Bulk Dredged Volume	Bund Height (m) (excl. freeboard and ponding)	Bund Height (m) (incl. freeboard and ponding)	Bund Volume (m^3)	Total DCMP Capacity (m^3)
1.	5,500	7,900	1.79	2.6	2,950	14,300
2.	30,000	42,700	6.14	6.9	29,350	49,100
3.	35,500	50,500	7.12	7.9	39,060	56,900

As can be seen in the table above, in order to provide sufficient capacity for options 2 and 3 in a single campaign a significant bund height and volume is required. This is considered to be impractical and cost prohibitive to construct and thus staging or use of geotubes should be considered.

5.4.1.2 Geotube Option

The disused netball court can accommodate a certain number of geotubes at the same time. Table 5-4 and Table 5-5 below show the calculation to determine the most suitable geotube size for the disused netball court and the quantity of geotube required for the three dredging options. Based on this calculation, the 27m (circumference) geotube provides the maximum storage capacity within the constraint of the site.

Table 5-4: Geotube Option Assessment

Geotube Size [1]	Width required [2]	Storage Capacity per lineal metre (m^3/lm)	Max. Number of Tube in Row	Linear Length of Tube	Storage Capacity[3]
13.5	16.5	8.2	5	70	2,870
18	21	13.4	4	70	3,752
27	30	21.7	3	70	4,557
36	39	31.5	2	70	4,410

Note:

[1] size in metre of geotube circumference

[2] width including 3m space allowance between tubes for safe access

[3] storage capacity within the constraint of the site

Table 5-5: Indicative Geotube Quantity Required

Option No.	Dredging Volume (m^3)	Estimated Bulk Volume (m^3)	Length of Tube Required (m) *
1.	5,500	7,810	~360
2.	30,000	42,600	~1964
3.	35,500	50,410	~2324

Note: *27m circumference with 21.7m^3/linear metre capacity

5.4.2 Disused Tennis Court

As outlined in Table 5.2, the disused tennis court is located upstream from the Pool. This site has not been further assessed and is not the preferred side due to the following reasons:

- Located adjacent to residential area
- Smaller footprint than the netball courts (already shown to be constrained), which means a larger fill volume and bund height are required to store the dredged material.

A photo showing the disused tennis court is provided in Figure 3-10.

5.4.3 Gun Club Land

Pictures showing the Gun Club land are shown in Figure 3-11 and Figure 3-13. The land is approximately 61,000m^2 in area however it is envisaged that 30,000m^2 will be directly utilised for the purpose of the DMCP. This will allow for a significant buffer around the perimeter of the proposed DMCP. Approximately 20,000 m^2 of this land was used in the previous dredging campaign undertaken in 2000.

5.4.3.1 DMCP Option

It is anticipated that material will be borrowed onsite from existing insitu material in order to build the external and internal DMCP bunds.

In order to estimate the required DMCP sizing required, containment bund height must incorporate sediment settling (ponding) and freeboard in addition to the height required for solids retention. In this preliminary calculation, the bund design has been based on the following parameters:

- Bund crest width of 1m
- Side slope ratio of 1 Vertical: 2 Horizontal
- Allowances of 0.3m ponding (reduced from previous option due to large area) and 0.3m for freeboard.

This design may change and be subject to environmental specifications on discharged water quality at the DMCP outlet. This will warrant in-situ sediment settling testing and DMCP detailed design studies. The relationship between bund height's effect on available reclamation capacity and volume required for bund construction is detailed Appendix C and is illustrated in Figure 5-5.

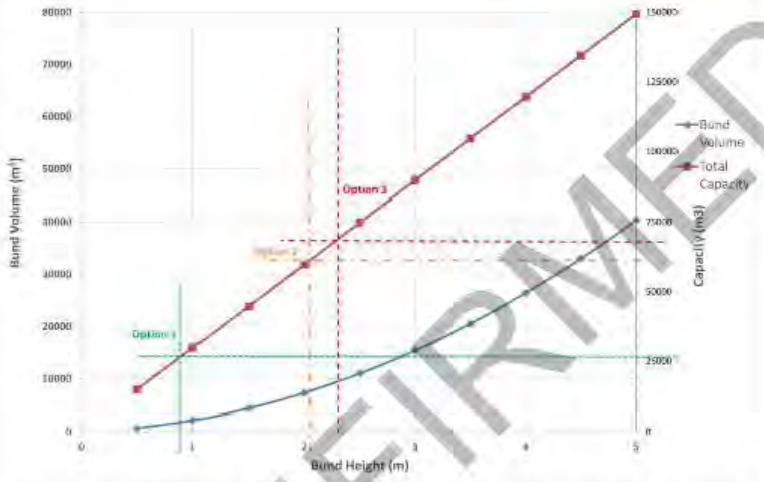

Figure 5-5: Gun Club Land – Relationship between Bund Height, Bund Fill Volume and Storage Capacity

Based on the three options considered in this study, the bund height requirements and fill volume required to construct the DMCP on the Gun Club land are provided in Table 5-6.

Table 5-6: Preliminary DCMP Sizing and Bund Height and Volume Required for Placement at Gun Club Site

Option No.	Insitu Dredged Volume	Bulk Dredged Volume	Bund Height (m) (excl. freeboard and ponding)	Bund Height (m) (incl. freeboard and ponding)	Bund Volume (m^3)	Total DCMP Capacity (m^3)
1.	5,500	7,900	0.26	0.86	1,720	25,700
2.	30,000	42,700	1.42	2.02	7,480	60,400
3.	35,500	50,500	1.683	2.28	9,300	68,100

As shown in the table above, the extra footprint of land available at the Gun Club provides significant opportunity when compared to the smaller placement site alternatives. The extra land minimises the required bund height and volume and allows the ability to dredge a larger quantity of material in a given campaign.

During this preliminary design assessment, the footprint of land to be used for the construction of the DMCP on the Gun Club Land has remained constant throughout all of the 3 dredging scenarios (30,000m^2). It is expected that if a smaller dredging campaign is undertaken a footprint smaller than 30,000m^2 would be utilised and dredging costs per m^3 may be reduced.

5.4.4 Decommissioning of Dredged Material Placement Site

The options associated with the decommissioning of the dredged material placement site will be dependent upon the Shire's plan for the future use of the site. Dredged material can either be left onsite or if appropriate, be transported to other location for beneficial reuse.

For the purpose of this scoping study and cost estimation, the following assumptions have been made:

- If placed in the disused netball court site, dredged material will be transported to nearby landfill. The cost estimate provided in Section 9 includes haulage costs, but excludes landfill charges.
- If placed in the Gun Club site, dredged material will be spread across the site to an acceptable profile.

5.5 Option Assessment Conclusion

Based on this assessment, the dredging project scope is limited by the size of the material placement site chosen, particularly in relation to the following:

- Acceptable cost per cubic metre of dredged material considering the cost associated with the placement solution
- Maximum bund height acceptable by the Shire, key stakeholders and community
- Risk associated with construction of higher/larger bunds.

The considerably larger footprint of land available at the Gun Club site, and the ability to source bund material onsite reduces the risk associated with DMCP construction and offers a more adaptable solution to varying dredge volumes.

Based on these factors the Gun Club site offers significant advantages over the other sites.

6 RELEVANT APPROVALS AND LEGISLATION

The proposed dredging campaign falls under several Acts due to the nature and location of the works and the nature of the sediment to be dredged. The relevant Acts which will require consideration are listed and summarised below, together with the relevant regulatory authorities requiring consultation.

6.1 Relevant Legislation

- *Aboriginal Heritage Act 1972* (WA)
- *Environmental Protection Act 1986* (WA)
- *Contaminated Sites Act 2003* (WA)
- *Waterway Conservation Act 1976* (WA)
- *Swan and Canning Rivers Management Act 2006* (WA)

6.1.1 Aboriginal Heritage Act 1972 (WA)

The WA Department for Aboriginal Affairs (DAA) maintain a register of over 22,000 Aboriginal Heritage sites (which can include artefacts, engravings, paintings, mythological or ceremonial places) which have been defined under the *Aboriginal Heritage Act 1972* (AH Act). The AH Act applies to any registered Aboriginal site. The Pool lies within a registered Aboriginal site (DAA 2015), and as such, liaison with the DAA is required (Section 6.2.1).

6.1.2 Environmental Protection Act 1986 (WA)

The Environmental Protection Act (EP Act) is the key legislation governing environmental protection and management in WA, including assessment of the impacts of any proposed new works. The EP Act (mainly Part IV), together with its subsidiary Environmental Impact Assessment Administrative Procedures 2012 (EPA 2012), specifies the objectives and requisite procedures for an environmental impact assessment (EIA) of proposed works that must be complied with by all stakeholders including the proponent, the EPA and any other relevant party.

Under Section 38(1) of the EP Act (Part IV), where a proposed project development is likely to have a significant effect on the environment, the proponent must refer the proposal to the EPA for a decision on whether it requires a formal environmental impact assessment, and if so, at what level of assessment. When referring a project, it is necessary to submit a referral pro-forma (obtained from www.epa.wa.gov.au). The referral form outlines the project details and likely environmental impacts, management and consultation commitments. Typically the referral form is appended and references a detailed EIA document.

6.1.3 Containment Sites Act 2003 (WA)

The disposal of dredged material to land has the potential to create a contaminated site, dependent on the nature of the material to be dredged. The identification, management and remediation of contaminated sites are covered by the WA *Contaminated Sites Act 2003* (CS Act). The Contaminated Sites Guidelines (DER 2014) provide guidance on the assessment

and management of contaminated sites under the CS Act, and are discussed in further detail in Section 7.1.1.

6.1.4 Waterways Conservation Act 1976 (WA)

Dredging projects occurring within the WA Department of Water's (DoW) jurisdiction (Waterway Management Areas) require a Licence to Dredge under the *Waterways Conservation Act 1976* (WC Act). The WC Act applies to the waters and associated land within five declared management areas:

- Albany waterways and catchment (Princess Royal Harbour, Oyster Harbour, King George Sound and associated rivers)
- Wilson Inlet and associated rivers
- Leschenault Estuary and associated rivers
- Peel-Harvey Estuarine System including Serpentine, Murray and Harvey Rivers
- Avon River inner catchment.

As the Pool falls within the Avon River inner catchment, dredging will require the necessary approvals as defined under the WC Act (Section 6.2.4).

6.1.5 Swan and Canning Rivers Management Act 2006 (WA)

The Pool falls within the Swan-Avon Catchment Boundary, and as such is subject to the *Swan and Canning Rivers Management Act 2006* (SCR Act). The objectives of the SCR Act are principally aimed at the restoration and protection of development control areas and the Riverpark, and to provide for the management of activities that affect the ecological and community benefits and amenity of the development control area and the Riverpark. The Pool does not lie within the boundaries of the development control area, however it does fall within the boundaries for the Riverpark. As such, activities at the Pool, such as dredging, will need to be completed in accordance with the SCR Act.

6.2 Regulatory Consultation

Due to the number of Acts applying to the proposed dredging campaign, consultation with a number of regulatory authorities will be required to:

- Determine the most appropriate sampling and analysis program and monitoring and management program
- Apply for the relevant approvals
- If necessary, report the results of sampling and any monitoring during works.

The below sections describe the relevant regulatory authorities that will require consultation prior to dredging.

6.2.1 Department of Aboriginal Affairs

The DAA's role under the AH Act is to protect and manage places of significance listed on the Register of Aboriginal sites. Approval from the DAA may need to be sought under the AH Act for dredging of the Pool due to its location within a registered Aboriginal site (DAA 2015). Applications are reviewed by the Aboriginal Cultural Material Committee before being

referred to the Minister for Indigenous Affairs for determination. It is recommended that a heritage consultant is contracted for approvals from the DAA. The costs associated with this have not been included in Section 9.

6.2.2 Environmental Protection Agency

Although referral to the EPA for dredging within the Pool has been completed previously (Section 4.3), it is suggested that a pre-referral meeting with the EPA is held again to determine whether a formal referral and/or assessment is required. This is due to the length of time that has passed and the subsequent results of sediment sampling obtained since the EPA's previous decision not to formally assess the project. It is suggested that the pre-referral meeting involves the Shire, the EPA and BMT Oceanica. The meeting will be an opportunity to provide the EPA with as much information as possible to allow them to make an informed decision on whether the project requires referral. The meeting would need to occur prior to the commencement of any dredging and preferably before sampling and analysis to ensure the EPA are satisfied with the sampling and analysis program proposed.

6.2.3 Department of Environment Regulation

Due to the presence of ASS and elevated levels of aluminium and iron within the area to be dredged (Section 4.4, Giraudo 2013a), dredging and disposal of the sediments should be managed under the CS Act. This will require further sampling to sufficiently characterise the sediments within the Pool. If it is determined that the sediments within the Pool are contaminated (as defined in the CS Act), the disposal of sediments may result in the creation of a contaminated site at the disposal site. The Department of Environmental Regulation (DER) is the relevant regulatory authority for contaminated sites and ASS. Extensive liaison with the DER will be required to ensure that sediments are sufficiently sampled and managed and the impacts of dredging are monitored appropriately. Preliminary consultation with the DER has also indicated that due to the location of the Pool and the area through which the Avon River has passed prior to the Pool, assessment for the presence of asbestos may be required.

6.2.4 Department of Water

Disturbing or interfering with the bed or banks of a watercourse has the potential to alter its flow regime, cause erosion and adversely impact reliant vegetation, fauna or other uses. Under the WC Act, a permit to authorise interference or obstruction of the bed and banks of a watercourse will be required. These permits are obtained from the DoW, and are free of charge.

Additionally, a licence to carry out dredging or reclamation on waterways will also be required under the WC Act. This licence is required for dredging or reclamation within the waters and waterways of a declared management area, within which the Pool is located.

6.2.5 Department of Parks and Wildlife and Swan River Trust

Previously, the Swan River Trust (SRT) was a statutory authority defined by the SCR Act. In July 2015, the SRT was merged with the Department of Parks and Wildlife (DPaW). The statutory functions of the SCR Act are now divided between the SRT and DPaW. Principally, approvals are required from DPaW if works are occurring within a development control area (DCA), or if works are likely to impact DCAs. As the Pool is not located within a DCA, and

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liaison with DPaW has indicated that they do not anticipate that the proposed dredging will impact a DCA, no approvals are required from DPaW. However, DPaW have requested that they be included during stakeholder consultation.

7 SAMPLING AND REPORTING REQUIREMENTS

To sufficiently characterise the material, further sediment sampling will be required. This will allow for the determination of current contaminant levels within the sediment, and will also determine the location of ASS and inform the treatment options required for the disposal of ASS (e.g. liming). Prior to sediment sampling and analysis, liaison will be required with regulators to ensure sampling is completed with due regard to relevant guidelines. Results gained through sediment analysis will act to inform environmental impact assessments and management plans (Section 7.2).

7.1 Sediment Sampling and Analysis

7.1.1 Relevant Guidelines

The following guidelines will inform the sampling program design, and provide guideline values against which contaminant levels in the sediments can be compared:

- National Assessment Guidelines for Dredging (NAGD; CA 2009)
- Contaminated Sites Guidelines (DER 2014)
- Acid Sulfate Soils Guideline Series (DEC 2013)
- Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC & ARMCANZ 2000)
- Guidelines for the Assessment Remediation and Management of Asbestos-Contaminated Sites in WA.

The below sections provide further detail on each of the guidelines.

National Assessment Guidelines for Dredging

The National Assessment Guidelines for Dredging (NAGD; CA 2009) provide a framework for the review and assessment of ocean disposal of dredged material. Although ocean disposal is not proposed for the Pool dredging, the guidelines can provide a useful reference for the assessment and management of dredging operations. The guidelines include information on:

- Assessing sediment quality
- Assessing dredging and disposal sites
- Determining management and monitoring requirements.

Contaminated Sites Guidelines

The Contaminated Sites Guidelines (DER 2014) provide guidance on the assessment and management of contaminated sites under the CS Act. While land disposal of dredged material is not dealt with specifically in the guidelines, the dredging would still fall under the CS Act and potential human and environmental impacts must be subject to a risk assessment.

Assessment involves a preliminary disposal site investigation and the comparison of dredge sediment contamination levels against the National Environment Protection (Assessment of Site Contamination) Measure guidelines (NEPC 2013; as referenced in the Contaminated

Sites Guidelines, DER 2014) to assess the ecological and human health risks associated with the material once it has been disposed to land.

Acid Sulfate Soils Guideline Series

Acid sulfate soils have previously been identified in the Pool (Giraudo 2013a). The disturbance of ASS can decrease pH levels and cause mobilisation of metals into the water column. The Acid Sulfate Soils Guidelines Series (DEC 2013) contains guidance on how to identify ASS risk areas and the subsequent assessment methods, including sampling and reporting for material intended for land reclamation purposes. These guidelines complement the Contaminated Sites Management Series (DEP 2001) and outline a risk assessment approach for ASS under the CS Act.

Australian and New Zealand Guidelines for Fresh and Marine Water Quality

Interim Sediment Quality Guidelines

The disturbance of material during dredging has the potential to release contaminants within the sediments into the water column and impact aquatic organisms in the Avon River. Therefore it is appropriate to assess the sediments against the ANZECC & ARMCANZ (2000) interim sediment quality guidelines to determine the environmental impact of the proposed dredging.

Water Quality Guidelines

Dredging causes the release of sediment pore water into the water column and return water from the disposal site is proposed to be returned to the Avon River. The impact of these discharges may be reviewed by comparing the water quality parameters (of elutriate sample concentrations of the proposed material prior to dredging and/or of the tail water concentrations during dredging) with the ANZECC & ARMCANZ (2000) trigger values for physical and chemical stressors and toxicants.

Guidelines for the Assessment, Remediation and Management of Asbestos-Contaminated Sites in WA

The Guidelines for the Assessment, Remediation and Management of Asbestos-Contaminated Sites in WA recommends the completion of a preliminary site investigation (DoH 2009). It is recommended that a terrestrial environmental consultant with experience in asbestos sampling and analysis is utilised for this task.

7.1.2 Sampling and Analysis Plan

The recommended sediment sampling program should be outlined in a sediment sampling and analysis plan (SAP). The SAP should be designed in accordance with the Acid Sulfate Soils Guidelines (DEC 2013) and the Contaminated Sites Guidelines (DER 2014) with guidance from the NAGD (CA 2009), providing a risk-based approach to the sampling and analysis protocol. The SAP should contain information on:

- Previous and forecasted dredging and disposal
- Review of potential contaminants of concern
- Sediment sampling locations and depths
- Fieldwork operations including equipment and personnel
- Field procedures for sediment sample collection, processing, transport and storage

- Sediment data analysis, assessment and management.

It is recommended that relevant regulatory authorities are consulted during the preparation of the SAP to ensure that the proposed sampling and analysis satisfies their requirements. The number of sampling locations will be based on the proposed dredge footprint and dredging volumes using guidance from the Contaminated Sites Guidelines (DER 2014), the Acid Sulfate Soils Guidelines (DEC 2013) and the NAGD (CA 2009).

Based on the site history and the previous sediment sampling and analysis results, it is recommended that the proposed dredge material be analysed for the following analytes:

- Total organic carbon
- Total and elutriate nutrients
- Total and elutriate metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel, zinc, aluminium and iron)[1]
- PSD
- Acid sulfate soils
- Bulk density
- Hydrocarbons
- Total and elutriate tributyltin[1]
- Pesticides[2]
- Asbestos
- pH
- Cation exchange capacity

The above list of analytes will be rationalised during preparation of the SAP.

In line with the Acid Sulfate Soils Guidelines (DEC 2013), and due to the linear nature of the proposed dredge footprint, sampling for ASS may involve sampling every 50m in each channel to characterise the presence and location of ASS within the Pool. As the channels are ~1km long, this equates to 20 sites per channel, which could result in up to 40 samples collected for ASS analysis. Sufficient analysis for ASS is required to allow accurate estimation of the liming required to neutralise the acid during the disposal of dredge material. Further liaison with the DER during the preparation of the SAP may indicate that a smaller number of sampling sites are required, however this should be determined following confirmation of the final scope.

For the remaining analytes, it is expected that a minimum of 10 sites will require sampling and analysis. The number of sites requiring analysis may increase, and will be finalised following confirmation of the scope and further liaison with regulatory authorities.

[1] *Note that elutriate analysis may only require if the total contaminant concentration exceeds the guidelines values (to be determined through further regulator consultation)*

[2] *Analysis for pesticides that have been phased out from agricultural practices (DSEWPaC 2011) is not required if there is existing data demonstrating the absence of these contaminants in the dredging area since May 2004 (the date Australia ratified the Stockholm Convention on Persistent Organic Pollutants)*

Soil sampling in the vicinity of the disposal site is also required for the determination of ambient background contamination concentrations. This allows the calculation of specific guidelines values in accordance with the Contaminated Sites Guidelines (DER 2014) and also provides information on any contamination already present at the disposal site prior to the disposal of dredged material. It is anticipated that a maximum of 10 sites are required to sufficiently characterise the sediments at the disposal site, however this should be determined following confirmation of the final scope and further liaison with the DER.

7.2 Post-Sampling Documentation and Management

Following receipt of the laboratory results, a Dredging Environmental Impact Assessment (DEIA) document will be required to identify key environmental and socio-economic issues that may arise from the proposed campaign (Section 7.2.1).

Based on the outcomes outlined within the DEIA, a Dredging Environmental Management Plan (DEMP) should then be prepared to ensure proper environmental management of the proposed campaign by explicitly defining the methods, actions and roles of the Proponent and contractor (Section 7.2.2).

Due to the presence of ASS at the site, an Acid Sulfate Soil Management Plan (ASSMP) will be required (Section 7.2.3). The ASSMP outlines management actions required to ensure minimal impacts to the environment from the disturbance of ASS, and will require submission to the DER for review. The ASSMP may be integrated with, or form a component of, the DEMP.

Following completion of the dredging campaign, results of the during- and post- campaign ASS monitoring should be documented for future reference (Section 7.2.4).

Further details on each of these reports are included in the sections below.

7.2.1 Dredging Environmental Impact Assessment

A DEIA will be required to identify the environmental and social issues relating to the proposed dredging. The DEIA should include the results of the sediment sampling and analysis. The potential environmental and social impacts associated with the proposed dredging and disposal activities should also be outlined with recommendations for appropriate monitoring and management measures. Potential environmental and social issues are detailed in Table 7-1, although it should be noted that these will be refined during preparation of the DEIA.

Table 7-1: Key Environmental and Social Issues and Potential Impacts

Issue	Potential Impacts
Environmental	
Turbidity and sedimentation	• Light limitation to benthic flora • Smothering of benthic habitat • Abrasion of marine organisms
Direct damage to benthic habitats	• Impact to fauna that feed on seagrass • Reduction in water quality
Anoxia	• Deteriorating water quality • Impact to aquatic organisms
Nutrient release from sediment	• Nuisance algae growth
Mobilisation of contaminants	• Deteriorating water quality • Contamination of aquatic organisms
Release of hydrogen sulfide gas	• Deterioration of air quality
Acid sulfate soils	• Acidification of waters • Deoxygenation of the water column • Release of heavy metals
Sediment removal/alteration of local topography	• Change in river hydrodynamics
Hydrocarbon spill	• Contamination of aquatic organisms
Noise	• Disturbance of aquatic/terrestrial fauna • Impact on waterbirds
Vegetation disturbance	• Destruction of habitat • Reduction of environmental value' • Impact on waterbirds
Vessel movement	• Collision with fauna • Impact on waterbirds
Social	
Turbid plume	• Reduced aesthetics and recreational values
Unsightly disposal site	• Reduced aesthetics
Exposure to contaminants in dredge material	• Reduced health of local community
Public safety/Restricted public access to dredge and/or disposal sites	• Restricted commercial and/or recreational values
Release of H2.S gas	• Reduced aesthetics and health of local community
Noise	• Reduced aesthetics and health of local community
Dust	• Reduced aesthetics and health of local community

Issue	Potential Impacts
Aboriginal heritage	• Reduced historic values
Navigation hazards	• Reduced recreation values

7.2.2 Dredging Environmental Management Plan

A DEMP detailing the required monitoring and management actions should be prepared prior to the proposed dredging. The DEMP should contain all Proponent and Contractor environmental monitoring and management commitments. This is completed to minimise the environmental impact of the dredging and disposal. Based on the existing information it is anticipated that the main issues requiring monitoring and management will be the generation of ASS and the deterioration of water quality resulting from the disturbance of sediments and release of nutrients. Required monitoring may include:

- Turbidity monitoring
  - Daily plume sketches[3]
  - Daily site photographs
  - Aerial photography (at least once during the dredging campaign)
- Water quality monitoring
  - Up to daily pH, dissolved oxygen monitoring of water in the dredge plume and at the disposal site
  - Weekly nutrients and heavy metals analysis of water in the dredge plume and at the disposal site
  - Post-dredging water and/or sediment monitoring
- Sediment quality monitoring at the disposal site (post-dredging sampling may be required as well as during-dredging sampling)
- Seagrass monitoring

Required management actions may include:

- Turbidity management
- Water quality management
  - Treatment of acidic supernatant water with lime
  - Timing dredging works to coincide with favourable seasonal conditions
- Dust management
- Hydrocarbon spills management
- Odour management
- Noise management

[3] *A plume sketch is a sketch of the physical extent of the visible plume overlaid onto a map.*

- Waste management
- Public health and safety management
- Emergency procedures

These requirements are subject to revision based on the findings of the DEIA and advice/requirements of the relevant regulatory authorities. The DEMP may require submission to the regulatory authorities prior to the commencement of works.

7.2.3 Acid Sulfate Soils Management Plan

Due to the presence of ASS, the preparation of an Acid Sulfate Soil Management Plan (ASSMP) will be required in accordance the guidelines detailed in "Treatment and management of soils and water in acid soils landscapes" (DEC 2011). The monitoring and management actions in the ASSMP may be integrated with the DEMP and will include dredge spoil and supernatant water quality monitoring for pH and heavy metals, and the treatment of the dredge spoil and tail water with alkaline material (including materials, volumes, methods and timeframes) to minimise the risk of releasing acidic water into the terrestrial and aquatic environment. The ASSMP must be submitted to the DER for approval prior to the commencement of works.

7.2.4 Project Close-Out Report

During and after the proposed dredging, it is recommended that the environmental monitoring data is compiled and analysed, and included in an environmental management section of a project close-out report. Monitoring results may be required to be submitted to the regulatory authorities. Additionally, preparation and submission of an ASSMP closeout report will be required by the DER following completion of the proposed dredging.

8 PROJECT DELIVERY PROGRAM

The table below details the approximate timings for the completion of near term tasks outlined in this scoping document. Note that these timings will be subject to change depending on the requirements of the relevant regulatory authorities.

Gantt charts showing the indicative project schedules for the three dredging options (all disposing to the Gun Club) are provided in Appendix D.

Table 8-1: Approximate timings for completion of all tasks associated with proposed dredging

Task	Approximate Time Frame (Weeks)
Pre-Feasibility Study and Conceptual Design	4-8
Regulator consultation	2–8
Referrals and approvals[1]	>8
Preparation of Sampling and Analysis Plan	3–4
Implementation of Sampling programme	1–2
Laboratory analysis	3–5
Detailed Feasibility Study and Design	4-8
Preparation of Dredging Environmental Impact Assessment	3–4
Preparation of Dredging Environmental Management Plan and Acid Sulfate Soil Management Plan	4–5
Procurement Services (Tender and Contract documentation preparation, tender period, evaluation and award)	10

Note:

1. The length of time required to complete referrals and approvals is heavily dependent on the outcome of further regulator consultation
2. Some tasks listed above may be completed concurrently, reducing the overall length of time required to complete all tasks

9 PROJECT COST ESTIMATE

9.1 Pre-Construction Works Cost Estimate

The approximate costs for the completion of the near-term tasks outlined in this scoping document are detailed in Table 9-1. Please note these cost estimates may be subject to change as they are based on current rates and laboratory costs. The costs are also based on the currently proposed scope.

Table 9-1: Approximate Costs for the Completion of the Tasks Outlined in this Scoping Document

Item	Approximate cost ($000)					
	Eastern channel		Western channel		Both channels	
	Lower	Upper	Lower	Upper	Lower	Upper
Pre-Feasibility Study						
Conceptual Design (incl. drafting)	8	10	8	10	8	10
Project Staging and Planning	5	8	5	8	5	8
Project Cost Estimate and Financial Analysis (Net Present Cost)	5	8	5	8	5	8
Project Risk Management (risk identification and mitigation)	1	2	1	2	1	2
Approvals						
Liaison with OEPA including pre-referral meeting	3	5	3	5	3	5
Preparation of referral document to OEPA[1]	3	5	3	5	3	5
Liaison with DER	1	2	1	2	1	2
Liaison with DoW and application for Licence to Dredge and/or Permit to interfere with bed and banks	1	2	1	2	1	2
Sediment Sampling and Analysis						
Preparation of SAP	10	15	10	15	10	15
Sampling program	40	45	40	45	60	65
Laboratory analysis	10	15	20	25	25	30
Environmental Impact Assessment						
Preparation of DEIA	15	20	15	20	15	20
Detailed Feasibility Study and Design						
Detailed Design Development	8	10	8	10	8	10

Item	Approximate cost ($000)					
	Eastern channel		Western channel		Both channels	
	Lower	Upper	Lower	Upper	Lower	Upper
Detailed Project Staging and Planning	4	6	4	6	4	6
Project Cost Estimate and Financial Analysis (Net Present Cost)	2	4	2	4	2	4
Project Construction Risk Management (risk identification and mitigation)	1	2	1	2	1	2
Environmental Monitoring and Management						
Preparation of DEMP[2]	7	10	7	10	7	10
Preparation and submission of ASSMP[2]	10	15	10	15	10	15
Preparation of close-out report	5	10	5	10	5	10
Procurement Services and Management						
Preparation of RFT and Contract Documentation	8	10	8	10	8	10
Tender Support, Evaluation and Award	4	5	4	5	4	5
Total	**146**	**199**	**156**	**209**	**181**	**234**

Note:

1. Dependent on outcome of pre-referral document to OEPA
2. Note that costs associated with the implementation of the DEMP and ASSMP have not been included due to their reliance on the outcomes of sediment sampling and further regulator liaison

9.2 Indicative Project Cost Estimates

9.2.1 Netball Court

Details of the overall project cost estimates including the constructions costs involving the DMCP option and the Geotube option at the Netball court sites are provided in Appendix E and are summarised in Table 9-2 and Table 9-3.

Table 9-2: Summary of Indicative Project Cost Estimates – DMCP Option – Netball Courts

Option No.	Dredged Volume (m3)	Approximate cost ($000)						Overall cost per m^3 dredged ($)
		Planning Phase	DMCP Construction Costs	Dredging and Dredged Material Management	Decommissioning	Total Cost (excl. contingency and GST)	Total Cost plus: 30% contingency and GST	
1	5,500	$199	$184	$165	$62	$610	$872	158
2	30,000	$209	$1,481	$595	$289	$2,574	$3,681	123
3	35,500	$234	$1,950	$698	$340	$3,222	$4,608	130

Table 9-3: Summary of Indicative Project Cost Estimates – Geotube Option – Netballs Courts

Option No.	Dredged Volume (m3)	Approximate cost ($000)						Overall cost per m^3 dredged ($)
		Planning Phase	Geotube Cost	Dredging and Dredged Material Management	Decommissioning	Total Cost (excl. contingency and GST)	Total Cost plus: 30% contingency and GST	
1	5,500	$199	$269	$165	$62	$695	$993	$181
2	30,000	$209	$894	$595	$289	$1,987	$2,842	$95
3	35,500	$234	$1,035	$698	$340	$2,306	$3,298	$93

9.2.2 Gun Club

Details of the overall project cost estimates including the constructions costs involving the DMCP option at the Gun Club site are provided in Appendix E and are summarised in Table 9-4.

Table 9-4: Summary of Indicative Project Cost Estimates – DMCP Option – Gun Club

Option No.	Dredged Volume	Approximate cost ($000)						Overall cost per m3 dredged
		Planning Phase	DMCP Construction Costs	Dredging and Dredged Material Management	Decommissioning	Total Cost (excl. cotingency and GST)	Total Cost plus: 30% contingency and GST	
1	5,500	$199	$17	$165	$19	$400	$573	$104
2	30,000	$209	$71	$595	$31	$907	$1,297	$43
3	35,500	$234	$85	$698	$36	$1,053	$1,506	$42

9.3 Value for Money

One of the means to measure value for money is to compare the estimated capital costs against time benefit in relation to the rates of siltation in the Pool. In other words, the capital spent on dredging works will buy time, and as siltation continues, the sediment load inside the Pool will eventually return to the pre-dredging volume.

Based on the rate of siltation of 2,300 – 3,000 m^3/year, as estimated by Giraudo (2014), the capital cost per year of benefit for the three dredging options at the Netball courts and Gun Club sites are provided in Table 9-5 and Table 9-6 and are shown in Figure 9-1 and Figure 9-2.

Table 9-5: Value for Money Assessment – Netball Court

Option No.	Dredged Volume	Time Benefit		CAPEX/Time Benefit ($/year)	
		Low - 2,300 m^3/yr infill rate	Upper - 3,000m^3/yr infill rate	Lower Estimate	Upper Estimate
1	5,500	2.39	1.83	$364,547.24	$475,496.40
2	30,000	13.04	10.00	$282,217.47	$368,109.74
3	35,500	15.43	11.83	$298,532.78	$389,390.58

Table 9-6 Value for Money Assessment – Gun Club

Option No.	Dredged Volume	Time Benefit		CAPEX/Time Benefit ($/year)	
		Low - 2,300 m^3/yr infill rate	Upper - 3,000m^3/yr infill rate	Lower Estimate	Upper Estimate
1	5,500	2.39	1.83	$239,420.32	$312,287
2	30,000	13.04	10.00	$99,444.08	$129,709
3	35,500	15.43	11.83	$97,551.23	$127,240

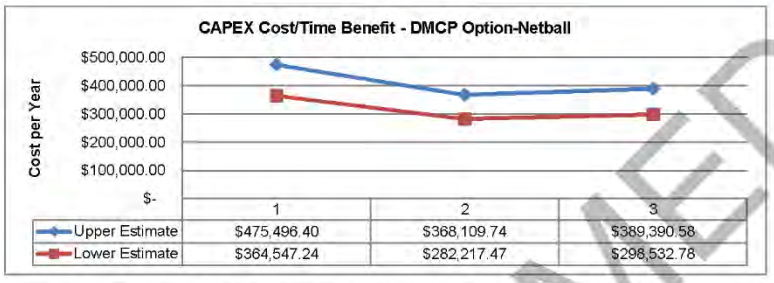

Figure 9-1: Preliminary Value for Money Assessment – Netball Courts

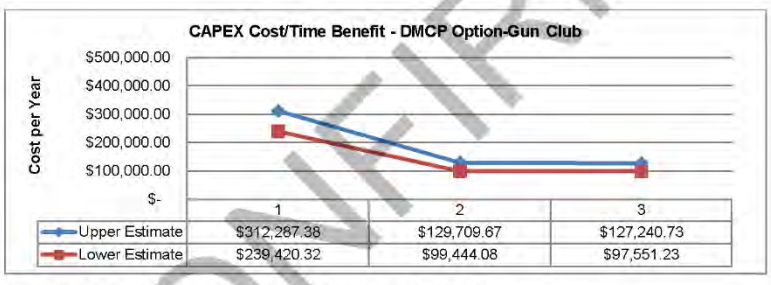

Figure 9-2 Preliminary Value for Money Assessment – Gun Club

9.4 Project Cost Estimate Observations

Based on the results outlined above, the most beneficial option based on CAPEX Cost/ Time Benefit analysis is to use the Gun Club land for the larger quantity of material (option 3).

10 PROJECT RISKS AND OPPORTUNITIES

There are a number of engineering and environmental risks and opportunities associated with the proposed dredging and placement site due to the location of the works. These risks and opportunities are outlined in Table 10-1.

Table 10-1: Project Risks ad Opportunities

Risks	Opportunities
Engineering & Technical	
• Suitability of insitu fill material for bund construction • Bund Stability and DCMP design for maximum settling of suspended sediment	• Value engineering of bund construction which including geotechnical assessment and design • Establishment of long-term maintenance dredging strategy
Environmental	
• Impact to surrounding environment due to release or disturbance of ASS and other contaminants • Higher regulator consultation hours than anticipated due to complexity of project • High level of monitoring and/or management due to regulator liaison • Longer approvals and referral process due to approvals being considered necessary for completion	• Approval could be sought for multiple dredging projects to complete the dredging in a staged process or to allow for more regular maintenance dredging campaigns. However, the project would have to be taken to the EPA with that approach, and it may potentially (although not necessarily) require further management as a result of the surrounding environment being impacted on multiple occasions

11 RECOMMENDATIONS

Based on this initial scoping study, it is recommended that the following to be considered by the Shire:

- Undertake a Feasibility Engineering Study (FES) to develop a DMCP design and to further assess the project cost. This FES study would typically include the following:
  - Assessment of insitu material properties for bund construction
  - DMCP design, which may include topographic survey of Gun Club site to determine cut/fill quantities available
  - Identification and management of project risks.
- Commence the approval process, which consists of the following:
  - Liaison with relevant regulatory agencies (OEPA, DER and DoW) and initiate a pre-referral meeting
  - Preparation of referral document
  - Prepare an application for Licence to Dredge and/or permit to interfere with bed and banks
- Commence Sediment Sampling and Analysis to better understand the physical and chemical characteristic of the dredging material
  - Preparation of Sediment Analysis Plan (SAP)
  - Undertake Sampling Program
  - Perform laboratory analysis on samples collected.
- Conduct hydrographic survey of Town Pool (to confirm campaign programme and volumes)

12 REFERENCES

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SHIRE OF NORTHAM
MINUTES
REGIONAL CENTRES IMPLEMENTATION COMMITTEE MEETING HELD ON 13 JUNE 2016

APPENDIX A:
DOCUMENT LIST

SHIRE OF NORTHAM
MINUTES
REGIONAL CENTRES IMPLEMENTATION COMMITTEE MEETING HELD ON 13 JUNE 2016

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Item No.	Report No.	Report Title	Rev	Date	Author	Category
1		Hydraulic Assessment Northam Weir		Feb-14	Matt Grando	1
2		Northam Town Pool - Water Quality Assessment and Recommendations for Management		Oct-13	Matt Grando	1
3		Northam Town Pool - Sediment Analysis		Dec-13	Matt Grando	1
4		The Avon: A Back to Front River			M. Reuell et al	2
5	WRM 11	Avon River Management Programme		Aug-99		2
6	RRP 2	River Recovery Plan - Section 6 — Northam		May-99	Water and Rivers Commission and Avon River Management Authority	2
7	WRM 47	Assessment of the status of river pools in the Avon catchment		Dec-07	Rebekah Eastzig	2
8	Ref. 103638	Dept. Environmental Protection Proposal Validation Letter		Dec-96	KJ Taylor	2
9	Contract No. 5699	Dredging of Northam Town Pool Tender Document for Lump Sum Contract		1-Dec-99	Town of Northam	2
10	9864/1/29	Laboratory Testing - Northam Town Pool		9-Apr-99	Fred Davenport - Golder Associates	2
11	File 1281	Memorandum - Northam Town Pool - Samples		9-Jul-99	Ira Leader	2
12	Ref 5121	Northam Town Pool Dredging - Survey		11-Mar-97	Bill Till - Water and Rivers Commission	2
13	12/532	Small and Northam Town Pool Sediment Management Plan		14-Dec-11	Kelsey Hunt/Chadd Hunt Correspondence and Report by Avon River Management Authority Dated July 1995	2
14		Policy SRT/D/E1			Swan River Trust	2
15		Minutes - Meeting of Avon River Advisory Committee		17-May-96		3
16		Schedule 10 - Community Amenities - Budget for the Year Ended 30 June 01		30-Jun-01		3
17		Schedule 10 - Community Amenities - Budget for the Year Ended 30 June 02		30-Jun-02		3
18		Avon River Newspaper Articles		20-Mar-91	Avon Valley Advocate	3
19	23971	Minutes - Ordinary Meeting of the Council		13-Oct-99		3
20	23881	Minutes - Ordinary Meeting of the Council		25-Aug-99		3
21		Ordinary Council Meeting - Minutes		19-Nov-08		3
22	24371	Minutes of Ordinary Council Meeting		22-Mar-01		3
23		Photos				3
24	Ref. 2-6A	Submission for Funding Letter		26-Apr-96	D Barnett - Town of Northam	3
25		Dredging of Town Pool Awarded			Town of Northam	3

SHIRE OF NORTHAM
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APPENDIX B:
BULKING CALCULATION

SHIRE OF NORTHAM
MINUTES
REGIONAL CENTRES IMPLEMENTATION COMMITTEE MEETING HELD ON 13 JUNE 2016

BMT JFA Consultants

Avon Reclamation Netball Site Capacity Calculation

SEDIMENT PROPERTIES	Unit	Option 1	Option 2	Option 3	Reference
Water Density	(t/m^3)	1	1	1	*Assumed value - fresh water*
Sediment Particle Density	(t/m^3)	2.65	2.65	2.65	*Assumed value*
Moisture Content	(%)	36.5%	36.5%	36.5%	*Manually entered to achieve Dry Dens. of ~1.350kg/m3 (determined from Van Rijn 1993)*
Degree of Saturation	(%)	100%	100%	100%	*Assumed saturated conditions*
Specific Gravity	-	2.65	2.65	2.65	
Void Ratio e	-	0.97	0.97	0.97	
Porosity n		0.49	0.49	0.49	
Insitu Dry Density	(t/m^3)	1.35	1.35	1.35	*1,350kg/m3 adopted based on Van Rijn 1993 - eqns. 3.2.4*
Insitu Bulk Density	(t/m^3)	1.84	1.84	1.84	
PSD CHARACTERISTICS					
Percentage of Fines (<75μm)	%	35.0%	35.0%	35.0%	*Weighted average across 9 insitu samples (Winkler 1998)*
Percentage Clays (<2μm)	%	20.0%	20.0%	20.0%	*Weighted average across 9 insitu samples (Winkler 1998)*
Estimated percentage of 'trapped' fines (as percent of fines)	%	20%	20%	20%	*Assumed to account for flocculation*
Effective Fines Percentage (percent of total mass)	%	28%	28%	28%	
Effective Coarse Percentage (coarse + trapped fines)	%	72%	72%	72%	
DREDGING INPUTS		Small CSD	Small CSD	Small CSD	
Total Dredging Volume (All areas)	(insitu m^3)	5,500	30,000	35,500	*Dredging volume as per sinsoil, Dec 2013*
Estimated Avg. Production Rate	(insitu m^3/hr)	100	100	100	*Estimated production rate for Small CSD*
Avg. Slurry Solids Volume Concentration	(%)	15.0%	15.0%	15.0%	*Typical of small CSD's*
Inferred Average Dredging Efficiency	(%)	65%	65%	65%	*Typical contractor downtime/efficiency located on similar jobs*
Working hours per day	(hrs)	12	12	12	*Typical contractor hours*
INFLOW CHARACTERISTICS					
Hourly Dry Mass Flowrate (Avg. Prod. Rate)	(t/hr)	135	135	135	
Avg. Dry Mass Flowrate	(kg/s)	37	37	37	
Avg. Bulk Flowrate (*per second*)	(m^3/s)	0.09	0.09	0.09	
Avg. Bulk Flowrate (*per hour*)	(m^3/hr)	340	340	340	
Avg. Water Flowrate	(m^3/s)	0.08	0.08	0.08	
Avg. Solids Concentration	(kg/m^3)	398	398	398	
Inflow Fines concentration	(kg/m^3)	111.3	111.3	111.3	
Inferred Average Daily Dredging Rate	(insitu m^3/day)	780	780	780	
Inferred Average Weekly Dredging Rate	(insitu m^3/wk)	5,460	5,460	5,460	
Avg. Daily Dry Mass Flowrate	(t/day)	1,050	1,050	1,050	
Inferred Average Daily Dry Mass Flowrate	(kg/s)	12	12	12	
Avg. Bulk Flowrate (*per hour*)	(m^3/hr)	110	110	110	
STORAGE REQUIREMENTS					
Avg. placed concentration of fines C_d	(kg/m^3)	600	600	600	*Adopted value based on Van Rijn 1993 Table 11.4 (500-600kg/m3)*
Coarse material bulking factor	-	1.1	1.1	1.1	*Assumed for sands/gravels*
Avg. placed Void Ratio e_d		3.42	3.42	3.42	
Finial placed volume of fines V_f	m^3	3,460	18,860	22,320	
Inferred fines bulking factor	-	2.2	2.2	2.2	
Required storage volume *V (solids)*	m^3	7,900	42,700	50,500	
Inferred total bulking factor		1.44	1.42	1.42	
Recommended Freeboard + Ponding Depth	m	0.80	0.80	0.80	*preliminary height allowance based on previous experience & design (0.5m ponding + 0.3m freeboard)*
Total Reclamation Capacity	m^3	14,300	49,100	56,900	*Based on 0.8 ha footprint*

Key:
- Input value
- Calculated value

SHIRE OF NORTHAM
MINUTES
REGIONAL CENTRES IMPLEMENTATION COMMITTEE MEETING HELD ON 13 JUNE 2016

BMT JFA Consultants

Avon Reclamation Gun Club Site Capacity Calculation

SEDIMENT PROPERTIES	Unit	Option 1	Option 2	Option 3	Reference
Water Density	(t/m^3)	1	1	1	*Assumed value - fresh water*
Sediment Particle Density	(t/m^3)	2.65	2.65	2.65	*Assumed value*
Moisture Content	(%)	36.5%	36.5%	36.5%	*Manually entered to achieve Dry Dens. of ~1,350kg/m3 (determined from Van Rijn 1993)*
Degree of Saturation	(%)	100%	100%	100%	*Assumed saturated conditions*
Specific Gravity	-	2.65	2.65	2.65	
Void Ratio e	-	0.97	0.97	0.97	
Porosity n	-	0.49	0.49	0.49	
Insitu Dry Density	(t/m^3)	1.35	1.35	1.35	*1,350kg/m3 adopted based on Van Rijn 1993 - eqns. 3.2.4*
Insitu Bulk Density	(t/m^3)	1.84	1.84	1.84	
PSD CHARACTERISTICS					
Percentage of Fines (<75μm)	%	35.0%	35.0%	35.0%	*Weighted average across 9 insitu samples (Golder) 1996*
Percentage Clays (<2μm)	%	20.0%	20.0%	20.0%	*Weighted average across 9 insitu samples (Golder) 1996*
Estimated percentage of 'trapped' fines (as percent of fines)	%	20%	20%	20%	*Assumed to account for flocculation*
Effective Fines Percentage (percent of total mass)	%	28%	28%	28%	
Effective Coarse Percentage (coarse + trapped fines)	%	72%	72%	72%	
DREDGING INPUTS		Small CSD	Small CSD	Small CSD	
Total Dredging Volume (All areas)	(insitu m^3)	5,500	30,000	35,500	*Dredging volume as per Gippel, Dec 2013*
Estimated Avg. Production Rate	(insitu m^3/hr)	100	100	100	*Estimated production rate for Small CSD*
Avg. Slurry Solids Volume Concentration	(%)	15.0%	15.0%	15.0%	*Typical of small CSD's*
Inferred Average Dredging Efficiency	(%)	65%	65%	65%	*Typical contractor downtime/Allowance incurred on similar jobs*
Working hours per day	(hrs)	12	12	12	*Typical contractor hours*
INFLOW CHARACTERISTICS					
Hourly Dry Mass Flowrate (Avg. Prod. Rate)	(t/hr)	135	135	135	
Avg. Dry Mass Flowrate	(kg/s)	37	37	37	
Avg. Bulk Flowrate (*per second*)	(m^3/s)	0.09	0.09	0.09	
Avg. Bulk Flowrate (*per hour*)	(m^3/hr)	340	340	340	
Avg. Water Flowrate	(m^3/s)	0.08	0.08	0.08	
Avg. Solids Concentration	(kg/m^3)	398	398	398	
Inflow Fines concentration	(kg/m^3)	111.3	111.3	111.3	
Inferred Average Daily Dredging Rate	(insitu m^3/day)	700	700	700	
Inferred Average Weekly Dredging Rate	(insitu m^3/wk)	5,460	5,460	5,460	
Avg. Daily Dry Mass Flowrate	(t/day)	1,050	1,050	1,050	
Inferred Average Daily Dry Mass Flowrate	(kg/s)	12	12	12	
Avg. Bulk Flowrate (*per hour*)	(m^3/hr)	110	110	110	
STORAGE REQUIREMENTS					
Avg. placed concentration of fines C_{fp}	(kg/m^3)	600	600	600	*Adopted value based on Van Rijn 1993 Table 11.4 (500-600kg/m3)*
Coarse material bulking factor	-	1.1	1.1	1.1	*Assumed for sands/gravels*
Avg. placed Void Ratio e_p		3.42	3.42	3.42	
Final placed volume of fines V_f	m^3	3,460	18,860	22,320	
Inferred fines bulking factor	-	2.2	2.2	2.2	
Required storage volume V (solids)	m^3	7,700	42,700	50,500	
Inferred total bulking factor		1.44	1.42	1.42	
Recommended Freeboard + Ponding Depth	m	0.60	0.60	0.60	*preliminary height allowance based on previous experience & design (0.3m ponding + 0.3m freeboard)*
Total Reclamation Capacity	m^3	25,900	60,700	68,500	*Based on 3 ha footprint*

Key:
- Input value
- Calculated value

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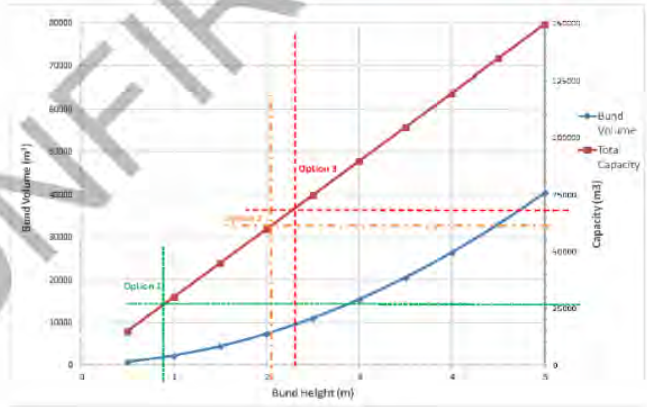
APPENDIX C:
DMCP PRELIMINARY CAPACITY CHECK

BMT JFA Consultants

Title: Gun Club - DMCP Preliminary Sizing - Assessment of Bund Height, Bund Fill Volume and Storage Capacity

h(bund)	Bund Volume	Total Pond Capcity (approximate)
0.5	734	14945
1	2202	29890
1.5	4404	44835
2	7340	59780
2.5	11010	74725
3	15414	89670
3.5	20552	104615
4	26424	119560
4.5	33030	134505
5	40370	149450
5.5	48444	164395
6	57252	179340
6.5	66794	194285
7	77070	209230
8	99824	239120
10	154140	298900

Assumptions	
Parameter	**Value**
Bund crest width (m)	1
Batter slopes (1 in X)	3
Pond Length	245
Pond Width	122



SHIRE OF NORTHAM
MINUTES
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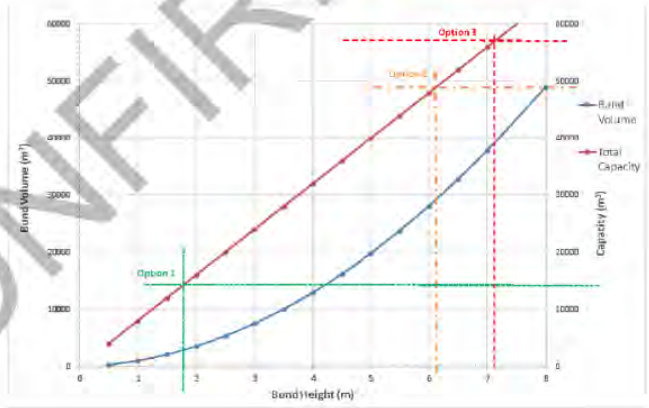
BMT JFA Consultants

Title: Disused Netball Court - DMCP Preliminary Sizing - Assessment of Bund Height, Bund Fill Volume and Storage Capacity

h(bund)	Bund Volume	Total Pond Capcity (approximate)
0.5	360	4000
1	1080	8000
1.5	2160	12000
2	3600	16000
2.5	5400	20000
3	7560	24000
3.5	10080	28000
4	12960	32000
4.5	16200	36000
5	19800	40000
5.5	23760	44000
6	28080	48000
6.5	32760	52000
7	37800	56000
8	48960	64000
10	75600	80000

Assumptions	
Parameter	Value
Bund crest width (m)	1
Batter slopes (1 in X)	2
Pond Length	80
Pond Width	100



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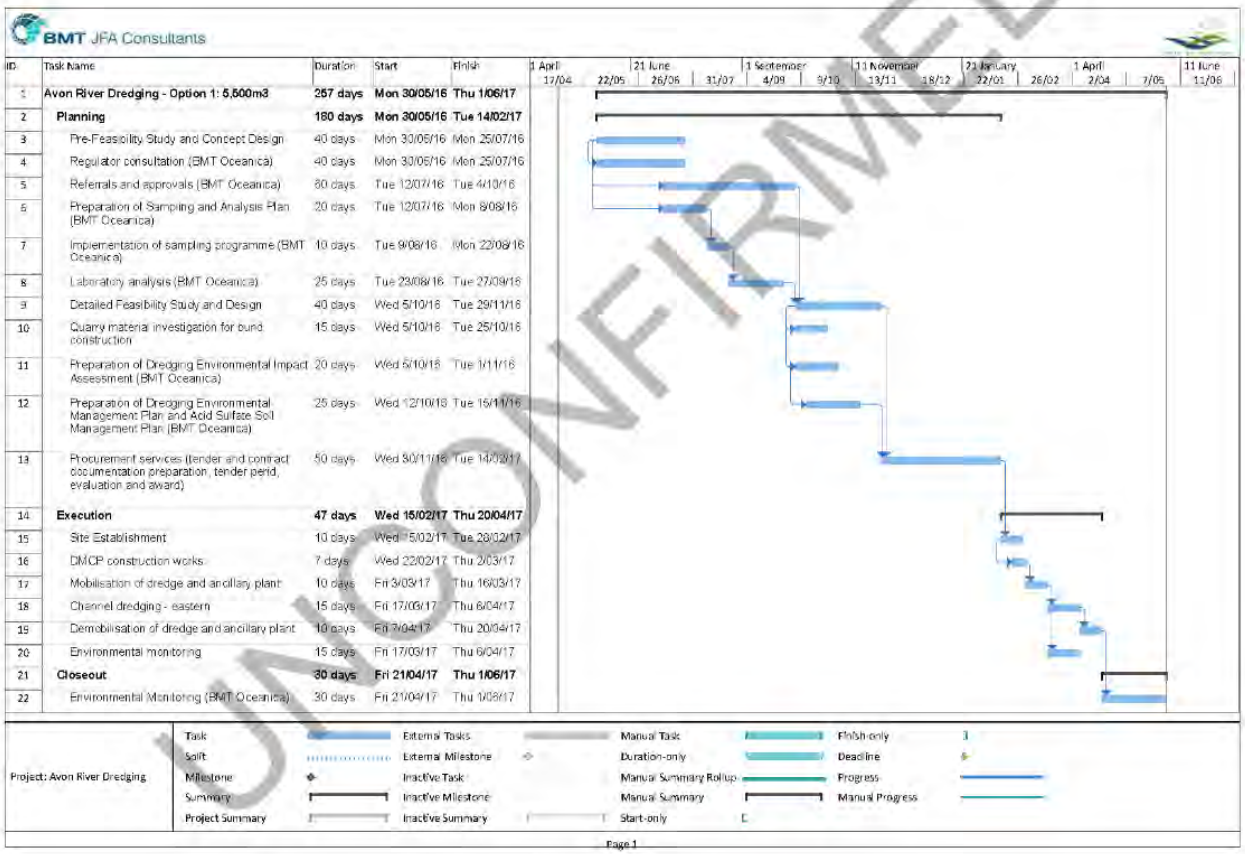
APPENDIX D:
INDICATIVE PROGRAM

BMT JFA Consultants

ID	Task Name	Duration	Start	Finish
1	**Avon River Dredging - Option 1: 5,500m3**	**257 days**	**Mon 30/05/16**	**Thu 1/06/17**
2	**Planning**	**180 days**	**Mon 30/05/16**	**Tue 14/02/17**
3	Pre-Feasibility Study and Concept Design	40 days	Mon 30/05/16	Mon 25/07/16
4	Regulator consultation (BMT Oceanica)	40 days	Mon 30/05/16	Mon 25/07/16
5	Referrals and approvals (BMT Oceanica)	60 days	Tue 12/07/16	Tue 4/10/16
6	Preparation of Sampling and Analysis Plan (BMT Oceanica)	20 days	Tue 12/07/16	Mon 8/08/16
7	Implementation of sampling programme (BMT Oceanica)	10 days	Tue 9/08/16	Mon 22/08/16
8	Laboratory analysis (BMT Oceanica)	25 days	Tue 23/08/16	Tue 27/09/16
9	Detailed Feasibility Study and Design	40 days	Wed 5/10/16	Tue 29/11/16
10	Quarry material investigation for bund construction	15 days	Wed 5/10/16	Tue 25/10/16
11	Preparation of Dredging Environmental Impact Assessment (BMT Oceanica)	20 days	Wed 5/10/16	Tue 1/11/16
12	Preparation of Dredging Environmental Management Plan and Acid Sulfate Soil Management Plan (BMT Oceanica)	25 days	Wed 12/10/16	Tue 15/11/16
13	Procurement services (tender and contract documentation preparation, tender perid, evaluation and award)	50 days	Wed 30/11/16	Tue 14/02/17
14	**Execution**	**47 days**	**Wed 15/02/17**	**Thu 20/04/17**
15	Site Establishment	10 days	Wed 15/02/17	Tue 28/02/17
16	DMCP construction works	7 days	Wed 22/02/17	Thu 2/03/17
17	Mobilisation of dredge and ancillary plant	10 days	Fri 3/03/17	Thu 16/03/17
18	Channel dredging - eastern	15 days	Fri 17/03/17	Thu 6/04/17
19	Demobilisation of dredge and ancillary plant	10 days	Fri 7/04/17	Thu 20/04/17
20	Environmental monitoring	15 days	Fri 17/03/17	Thu 6/04/17
21	**Closeout**	**30 days**	**Fri 21/04/17**	**Thu 1/06/17**
22	Environmental Monitoring (BMT Oceanica)	30 days	Fri 21/04/17	Thu 1/06/17



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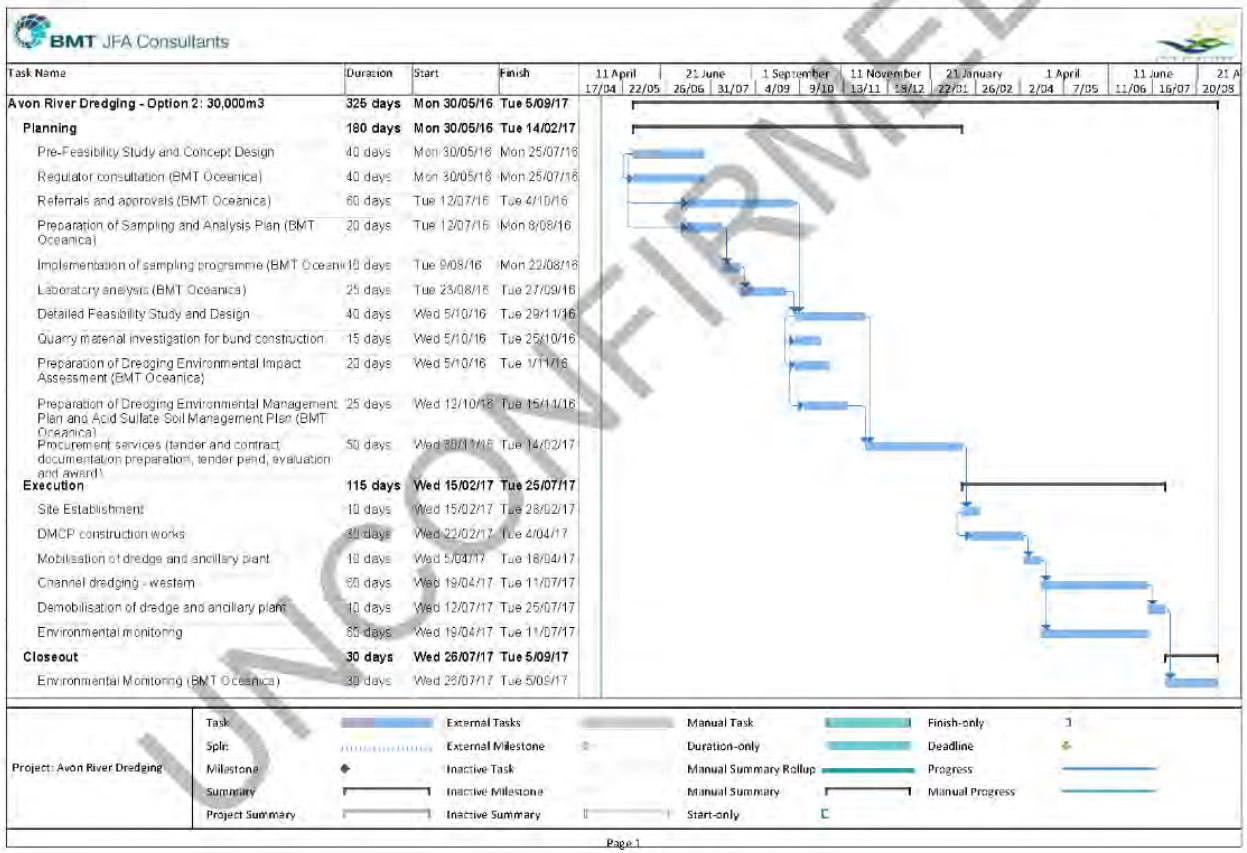

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APPENDIX E:
PROJECT COST ESTIMATE

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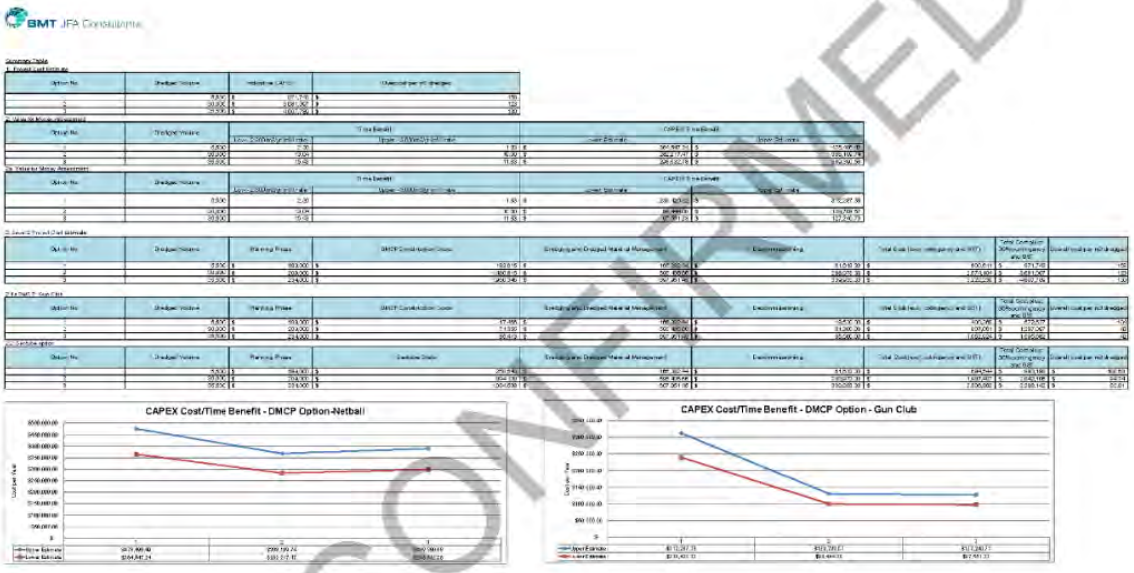

BMT JFA Consultants

Title Option 1 - Indicative Cost Estimate - [illegible]

Item	Phase	Task	Quantity	Unit	Rate	Total	Comments
1	Planning						
		Pre-Feasibility Study	1	Item	$ 36,000.00	$ 36,000	Indicative estimated
		Approvals	1	Item	$ 14,000.00	$ 14,000	Indicative upper estimate provided by BMT Oceanica
		Environmental Site Investigation	1	Item	$ 75,000.00	$ 75,000	Indicative upper estimate provided by BMT Oceanica
		Environmental Impact Assessment	1	Item	$ 20,000.00	$ 20,000	Indicative upper estimate provided by BMT Oceanica
		Detailed Feasibility Study and Design	1	Item	$ 22,000.00	$ 22,000	Indicative estimate
		Preparation of DEMP and ASSMP	1	Item	$ 25,000.00	$ 25,000	Indicative upper estimate provided by BMT Oceanica
		Procurement Services	1	Item	$ 15,000.00	$ 15,000	Indicative estimate
2	Excavation/Construction						
		Site Establishment	1	Item	$ [illegible]	$ [illegible]	Approximate insurance & contractor admin costs
		Mobilisation of civil works plant and equipment	1	Item	$ 1,085	$ [illegible]	1 x Excavator ($150ph) and 1 x D6 dozer ($205ph) 3 hr travel allowance
		DWCP Construction - Sand supply and Delivery	2950	Rates (m3)	$ [illegible]	$ [illegible]	Fill sand supply and delivered - $[illegible]/m3 2950m3 / 20m3 (vol per semi) = 148 semi trucks 10 trucks per day = 15 days
		DWCP Construction - Earthworks	20	Day	$ [illegible]	$ [illegible]	Wet hire 1 x [illegible] Excavator ($150 ph) and 1 x D6 dozer ($205 ph) incl. fuel - 12 hour day
		Mobilisation of Dredge and Associated plant	1	Item	$ 30,000	$ 30,000	Based on similar dredging project
		Channel Dredging - Eastern	7	Days	$ 7,000.00	$ [illegible]	12 hr day operation with 65% equipment utilisation, ~$7000/day
		Dredged Material Management	7	Day	$ [illegible]	$ [illegible]	Wet Hire 1 x 30T Excavator ($150 ph) and 1 x D6 dozer ($205 ph) incl. fuel - 12 hour day
		Demobilisation of civil works equipment and associated plant	1	Item	$ 1,065	$ [illegible]	1 x Excavator ($150ph) and 1 x D6 dozer ($205ph) 3 hr travel allowance
		Demobilisation of dredge and associated plant	1	Item	$ 25,000	$ 25,000	Based on similar dredging project
		ASS Management	5500	Rates (m3)	$ 3	$ 16,500	Assumed rate - to be further assessed following consultation with regulators and completion of Sampling Analysis Plan
		Construction Management Services	18	Hour	$ 190	$ 3,420	Based on 3 visits (start, during and completion), 6 hr per visit
3	Close-Out/Decommissioning						
		Environmental Monitoring and reporting	1	Provisional Sum	$10,000.00	$ 10,000	Assumed rate - to be further assessed following consultation with regulators and completion of Sampling Analysis Plan
		Rehabilitation	1	Provisional Sum	$[illegible]	$ [illegible]	From Haulage cost component of Decommissioning
					Subtotal	$609,611	
					Contingency (30%)	$182,883	
					GST	$79,249	
					Total	$871,743	

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Title Option 1a - Indicative Cost Estimate - Dam Club

Item	Phase	Task	Quantity	Unit	Rate		Total		Comments
1	Planning								
		Pre-Feasibility Study	1	Item	$	28,000.00	$	28,000	Indicative estimates
		Approvals	1	Item	$	14,000.00	$	14,000	Indicative upper estimate provided by BMT Oceanica
		Environmental Site Investigation	1	Item	$	75,000.00	$	75,000	Indicative upper estimate provided by BMT Oceanica
		Environmental Impact Assessment	1	Item	$	20,000.00	$	20,000	Indicative upper estimate provided by BMT Oceanica
		Detailed Feasibility Study and Design	1	Item	$	22,000.00	$	22,000	Indicative estimate
		Preparation of DEMP and ASSMP	1	Item	$	25,000.00	$	25,000	Indicative upper estimate provided by BMT Oceanica
		Procurement Services	1	Item	$	15,000.00	$	15,000	Indicative estimate
2	Execution/Construction								
		Site Establishment	1	Item	$	10,000	$	10,000	Approximate insurance & contractor set [illegible]
		Mobilisation of civil works plant and equipment	1	Item	$	1,085	$	1,085	1 x Excavator ($150ph) and 1 x D6 dozer ($205ph), 3 hr travel allowance
		DMCP Construction - Sand Supply and Delivery	0	Rates (m3)	$	0	$	-	Fill sand supply and delivered - [illegible] 2960m3 / 20m3 (cubic per semi) = 148 semi trucks [illegible] trucks per day = 15 days
		DMCP Construction - Earthworks	[illegible]	Day	$	4,260	$	18,400	Wet Hire 1 x 30T Excavator ($150 ph) and 1 x D6 dozer ($205 ph) incl. fuel - 12 hour day
		Mobilisation of Dredge and Associated plant	1	Item	$	30,000	$	30,000	Based on similar dredging project
		Channel Dredging - Eastern	7	Days	$	7,020.00	$	49,359	12 hr day operation with 55% equipment utilisation, ~$7020/day
		Dredged Material Management	7	Day	$	4,260	$	30,[illegible]	Wet Hire 1 x 20T Excavator ($150 ph) and 1 x D6 dozer ($205 ph) incl. fuel - 12 hour day
		Demobilisation of civil works equipment and associated plant	1	Item	$	1,085	$	1,085	1 x Excavator ($150ph) and 1 x D6 dozer ($205ph), 3 hr travel allowance
		Demobilisation of dredge and associated plant	1	Item	$	25,000	$	25,000	Based on similar dredging project
		ASS Management	5500	Rates (m3)	$	3	$	16,500	Assumed rate - to be further assessed following consultation with regulators and completion of Sampling Analysis Plan
		Construction Management Services	18	Hour	$	90	$	3,420	Based on 3 visits (start, during and completion), 6 hr per visit
3	Close Out/Decommissioning								
		Environmental Monitoring and reporting	1	Provisional Sum		10,000.00	$	10,000	Assumed rate - to be further assessed following consultation with regulators and completion of Sampling Analysis Plan
		Rehabilitation	1	Provisional Sum		[illegible]	$	[illegible]	[illegible] component of Decommissioning
					Subtotal			$400,368	
					Contingency (30%)			$120,111	
					GST			$52,048	
					Total			$572,527	

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Title: Option 2 - Indicative Cost Estimate - Northam

Item	Phase	Task	Quantity	Unit	Rate	Total	Comments
1	Planning						
		Pre-Feasibility Study	1	Item	$ 28,000.00	$ 28,000	Indicative estimate
		Approvals	1	Item	$ 14,000.00	$ 14,000	Indicative upper estimate provided by BMT Oceanica
		Environmental Site Investigation	1	Item	$ 85,000.00	$ 85,000	Indicative upper estimate provided by BMT Oceanica
		Environmental Impact Assessment	1	Item	$ 20,000.00	$ 20,000	Indicative upper estimate provided by BMT Oceanica
		Detailed Feasibility Study and Design	1	Item	$ 22,000.00	$ 22,000	Indicative estimate
		Preparation of DEMP and ASSMP	1	Item	$ 25,000.00	$ 25,000	Indicative upper estimate provided by BMT Oceanica
		Procurement Services	1	Item	$ 15,000.00	$ 15,000	Indicative estimate
2	Execution/Construction						
		Site Establishment	1	Item	$ 10,000.00	$ 10,000	Approximate insurance & contractor admin costs
		Mobilisation of civil works plant and equipment	1	Item	$ 1,065.00	$ 1,065	1 x Excavator ($300 ph) and 1 x D6 dozer ($250 ph), 3 hour travel
		DMCP Construction - Sand Supply and Delivery	29350	Rates (m3)	$ 33.00	$ 968,550	Fill sand supply and delivered - $33/m3 29350m3 / 25m3 (vol per semi) = ~468 semi trucks 12 trucks per day = ~[illegible] days
		DMCP Construction - Earthworks	120	day	$ 4,260.00	$ 511,200	Wet Hire 1 x 30T Excavator ($150 ph) and 1 x D6 dozer ($205 ph) incl. fuel - 12 hour day
		Mobilisation of Dredge and Associated plant	1	Item	$ 30,000.00	$ 30,000	Based on similar dredging project
		Channel Dredging - Western	38	Day	$ 7,000.00	$ 269,231	12 hr day operation with 85% equipment utilisation, ~$7000/day
		Dredged Material Management	28	Day	$ 4,260.00	$ 163,846.15	Wet Hire 1 x 20T Excavator ($300 ph) and 1 x D8 dozer ($250 ph), 12 hour day
		Demobilisation of civil works equipment and associated plant	1	Item	$ 1,065.00	$ 1,065	1 x Excavator ($300 ph) and 1 x D6 dozer ($250 ph), 8 hour travel
		Demobilisation of dredge and associated plant	1	Item	$ 25,000.00	$ 25,000	Based on similar dredging project
		ASS Management	30000	Rates (m3)	$ 3.00	$ 90,000	Assumed rate - to be further assessed following consultation with regulators and completion of Sampling Analysis Plan
		Construction Management Services	33	Hour	$ 195.00	$ 6,283.74	1 visit per week, 6 hr per visit
3	Close Out/Decommissioning						
		Environmental Monitoring and reporting	1	Provisional Sum	$ 10,000.00	$ 10,000	Assumed rate - to be further assessed following consultation with regulators and completion of Sampling Analysis Plan
		Rehabilitation	1	Provisional Sum	$ 278,973.33	$ 278,973	From Haulage cost component of Decommissioning
					Subtotal	$2,574,194	
					Contingency (30%)	$772,258	
					GST	$334,645	
					Total	$3,681,097	

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Title: Option 2a - Indicative Cost Estimate - Gun Club

Item	Phase	Task	Quantity	Unit	Rate	Total	Comments
1	Planning						
		Pre-Feasibility Study	1	Item	$ 28,000.00	$ 28,000	Indicative estimated
		Approvals	1	Item	$ 14,000.00	$ 14,000	Indicative upper estimate provided by BMT Oceanica
		Environmental Site Investigation	1	Item	$ 85,000.00	$ 85,000	Indicative upper estimate provided by BMT Oceanica
		Environmental Impact Assessment	1	Item	$ 20,000.00	$ 20,000	Indicative upper estimate provided by BMT Oceanica
		Detailed Feasibility Study and Design	1	Item	$ 22,000.00	$ 22,000	Indicative estimate
		Preparation of DEMP and ASSMP	1	Item	$ 25,000.00	$ 25,000	Indicative upper estimate provided by BMT Oceanica
		Procurement Services	1	Item	$ 15,000.00	$ 15,000	Indicative estimate
2	Execution/Construction						
		Site Establishment	1	Item	$ 10,000.00	$ 10,000	Approximate insurance & contractor admin costs
		Mobilisation of civil works plant and equipment	1	Item	$ 1,065.00	$ 1,065	1 x Excavator ($300 ph) and 1 x D6 dozer ($250 ph), 8 hour travel
		DMCP Construction - Sand Supply and Delivery	0	Rates (m3)	$ 33.00	$ -	Fill sand supply and delivered - $33/m3 2955m3 / 20m3 (vol per semi) = 1468 semi trucks 12 trucks per day = ~120 days
		DMCP Construction - Earthworks	30	day	$ 4,200.00	$ 70,290	Wet Hire 1 x 20T Excavator ($150 ph) and 1 x D6 dozer ($205 ph) incl. fuel - 12 hour day
		Mobilisation of Dredge and Associated plant	1	Item	$ 30,000.00	$ 30,000	Based on similar dredging project
		Channel Dredging - Western	38	Day	$ 7,000.00	$ 269,291	12 hr day operation with 95% equipment utilisation, ~$7000/day
		Dredged Material Management	36	Day	$ 4,260.00	$ 16[illegible]46.15	Wet Hire 1 x 20T Excavator ($300 ph) and 1 x D6 dozer ($250 ph), 12 hour day
		Demobilisation of civil works equipment and associated plant	1	Item	$ 1,065.00	$ 1,065	1 x Excavator ($300 ph) and 1 x D6 dozer ($250 ph), 8 hour travel
		Demobilisation of dredge and associated plant	1	Item	$ 25,000.00	$ 25,000	Based on similar dredging project
		ASS Management	30000	Rates (m3)	$ 3.00	$ 90,000	Assumed rate - to be further assessed following consultation with regulators and completion of Sampling Analysis Plan
		Construction Management Services	23	Hour	$ 190.00	$ 6,263.74	1 visit per week, 5 hr per visit
3	Close Out/Decommissioning						
		Environmental Monitoring and reporting	1	Provisional Sum	$ 40,000.00	$ 40,000	Assumed rate - to be further assessed following consultation with regulators and completion of Sampling Analysis Plan
		Rehabilitation	1	Provisional Sum	$ 21,300.00	$ 21,300	From Recontiling component of Decommissioning
					Subtotal	**$907,061**	
					Contingency (30%)	**$273,118**	
					GST	**$117,918**	
					Total	**$1,297,097**	

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Title: Option 2 - Indicative Cost Estimate - Netted

Item	Phase	Task	Quantity	Unit	Rate	Total	Comments External
1	Planning						
		Pre-Feasibility Study	1	Item	$28,000.00	$ 28,000	Indicative estimated
		Approvals	1	Item	$14,000.00	$ 14,000	Indicative upper estimate provided by BMT Oceanica
		Environmental Site Investigation	1	Item	$110,000.00	$ 110,000	Indicative upper estimate provided by BMT Oceanica
		Environmental Impact Assessment	1	Item	$20,000.00	$ 20,000	Indicative upper estimate provided by BMT Oceanica
		Detailed Feasibility Study and Design	1	Item	$22,000.00	$ 22,000	Indicative estimate
		Preparation of DEMP and ASSMP	1	Item	$25,000.00	$ 25,000	Indicative upper estimate provided by BMT Oceanica
		Procurement Services	1	Item	$ 15,000.00	$ 15,000	Indicative estimate
2	Execution/Construction						
		Site Establishment	1	Item	$ 10,000	$ 10,000	Approximate insurance & contractor admin costs
		Mobilisation of civil works plant and equipment	1	Item	$ 1,085	$ 1,085	1 x Excavator ($300 ph) and 1 x D6 dozer ($250 ph), 8 hour travel
		DMCP Construction - Sand Supply and Delivery	39060	Rates (m3)	$ 33	$ 1,28[illegible]	Pit sand supply and delivered - $33/m3 29280m3/15m3 (incl part [illegible]) = 1952 semi trucks 12 trucks per day = ~155 days
		DMCP Construction - Earthworks	155	Day	$ 4,260	$ 660,300	Wet Hire 1 x 20T Excavator ($150 ph) and 1 x D6 dozer ($205 ph) incl. fuel - 12 hour day
		Mobilisation of Dredge and Associated plant	1	Item	$ 35,500	$ 35,500	Based on similar dredging project
		Channel Dredging - Eastern and Western Channel	45	Rates (m3)	$ 7,000.00	$ 318,5[illegible]	12 hr/day operation with 65% equipment utilisation, ~$7000/day
		Dredged Material Management	46	Day	$ 4,260	$ 195,884.51	Wet Hire 1 x 20T Excavator ($300 ph) and 1 x D6 dozer ($250 ph) 12 hour day
		Demobilisation of civil works equipment and associated plant	1	Item	$ 1,085	$ 1,085	1 x Excavator ($300 ph) and 1 x D6 dozer ($250 ph), 8 hour travel
		Demobilisation of dredge and associated plant	1	Item	$ 25,000	$ 25,000	Based on similar dredging project
		ASS Management	35500	Rates (m3)	$ 3	$ 106,500	Assumed rate - to be further assessed following consultation with regulators and completion of Sampling Analysis Plan
		Construction Management Services	39	Hour	$ 190	$ 7,410	1 visit per week, 3 hr per visit
3	Close Out/Decommissioning						
		Environmental Monitoring and reporting	1	Provisional Sum	$10,000.00	$ 10,000	Assumed rate - to be further assessed following consultation with regulators and completion of Sampling Analysis Plan
		Rehabilitation	1	Provisional Sum	$329,933.33	$ 329,933	From Haulage cost component of Decommissioning
					Subtotal	$3,222,230	
					Contingency (30%)	$966,669	
					GST	$418,890	
					Total	$4,607,789	

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BMT JFA Consultants

Title: Option 2a - Indicative Cost Estimate - Gun Club

Item	Phase	Task	Quantity	Unit	Rate	Total	Comments External
1	Planning						
		Pre-Feasibility Study	1	Item	$26,000.00	$ 26,000	Indicative estimated
		Approvals	1	Item	$14,000.00	$ 14,000	Indicative upper estimate provided by BMT Oceanica
		Environmental Site Investigation	1	Item	$110,000.00	$ 110,000	Indicative upper estimate provided by BMT Oceanica
		Environmental Impact Assessment	1	Item	$20,000.00	$ 20,000	Indicative upper estimate provided by BMT Oceanica
		Detailed Feasibility Study and Design	1	Item	$22,000.00	$ 22,000	Indicative estimate
		Preparation of DEMP and ASSMP	1	Item	$25,000.00	$ 25,000	Indicative upper estimate provided by BMT Oceanica
		Procurement Services	1	Item	$ 15,000.00	$ 15,000	Indicative estimate
2	Execution/Construction						
		Site Establishment	1	Item	$ 10,000	$ 10,000	Approximate insurance & contractor admin costs
		Mobilisation of civil works plant and equipment	1	Item	$ 1,065	$ 1,065	1 x Excavator ($300 ph) and 1 x D6 dozer ($250 ph), 8 hour travel
		DMCP Construction - Sand Supply and Delivery	3	Rates (m3)	$ 33	$ [illegible]	Fill sand supply and delivered : $33/m3 29050m3/... (incl path ...) = 1952 semi trucks 12 trucks per day = ~155 days
		DMCP Construction - Earthworks	38	Day	$ 4,250	$ 89,348	Wet Hire 1 x 20T Excavator ($190 ph) and 1 x D6 dozer ($235 ph) incl. fuel - 12 hour day
		Mobilisation of Dredge and Associated plant	1	Item	$ 35,500	$ 35,500	Based on similar dredging project
		Channel Dredging - Eastern and Western Channel	45	Rates (m3)	$ 7,000.00	$ 318,5[illegible]	12 hr/day operation with 65% equipment utilisation, ~$7000/day
		Dredged Material Management	46	Day	$ 4,260	$ 195,884.51	Wet Hire 1 x 20T Excavator ($300 ph) and 1 x D6 dozer ($250 ph), 12 hour day
		Demobilisation of civil works equipment and associated plant	1	Item	$ 1,065	$ 1,065	1 x Excavator ($300 ph) and 1 x D6 dozer ($250 ph), 8 hour travel
		Demobilisation of dredge and associated plant	1	Item	$ 25,000	$ 25,000	Based on similar dredging project
		ASS Management	35500	Rate (m3)	$ 3	$ 106,500	Assumed rate - to be further assessed following consultation with regulators and completion of Sampling Analysis Plan
		Construction Management Services	39	Hour	$ 190	$ 7,410	1 visit per week, 3 hr per visit
3	Close Out/Decommissioning						
		Environmental Monitoring and reporting	1	Provisional Sum	$10,000.00	$ 10,000	Assumed rate - to be further assessed following consultation with regulators and completion of Sampling Analysis Plan
		Rehabilitation	1	Provisional Sum	$25,560.00	$ 25,560	From Repurposing component of Decommissioning
					Subtotal	**$1,052,924**	
					Contingency (30%)	**$315,877**	
					GST	**$136,880**	
					Total	**$1,505,682**	

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Title: Planning Phase Cost Estimate

Item	Approximate cost ($000)					
	Eastern channel		Western channel		Both channels	
	Lower	Upper	Lower	Upper	Lower	Upper
Pre-Feasibility Study						
Conceptual Design (incl. drafting)	8	10	8	10	8	10
Project Staging and Planning	5	8	5	8	5	8
Project Cost Estimate and Financial Analysis (Net Present Cost)	5	8	5	8	5	8
Project Risk Management (risk identification and mitigation)	1	2	1	2	1	2
Approvals						
Liaison with OEPA including pre-referral meeting	3	5	3	5	3	5
Preparation of referral document to OEPA[1]	3	5	3	5	3	5
Liaison with DER	1	2	1	2	1	2
Liaison with DoW and application for Licence to Dredge and/or Permit to interfere with bed and banks	1	2	1	2	1	2
Sediment Sampling and Analysis						
Preparation of SAP	10	15	10	15	10	15
Sampling program	40	45	40	45	60	65
Laboratory analysis	10	15	20	25	25	30
Environmental Impact Assessment						
Preparation of DEIA	15	20	15	20	15	20
Detailed Feasibility Study and Design						
Detailed Design Development	8	10	8	10	8	10
Detailed Project Staging and Planning	4	6	4	6	4	6
Project Cost Estimate and Financial Analysis (Net Present Cost)	2	4	2	4	2	4
Project Construction Risk Management (risk identification and mitigation)	1	2	1	2	1	2
Environmental Monitoring and Management						
Preparation of DEMP[2]	7	10	7	10	7	10
Preparation and submission of ASSMP[2]	10	15	10	15	10	15
Procurement Services and Management						
Preparation of RFT and Contract Documentation	8	10	8	10	8	10
Tender Support, Evaluation and Award	4	5	4	5	4	5
Total	**146**	**199**	**156**	**209**	**181**	**234**

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Title:	Geotube Option Assessment
Placement Site:	Disused Netball Court

Option no.	Geotube Size (m circumference)	Width required (3m space allowance)	Storage Capacity per lineal metre (m3/m)	Max. Number of Tube in Row	Linear Length of Tube	Storage Capacity (within the constraint of the court)	Cost per Lineal Mts
1	13.5	16.5	8.2	5	70	2870	190
2	18	21	13.4	4	70	3752	240
3	27	30	21.7	3	70	4557	390
4	36	39	31.5	2	70	4410	540

Option No.	Dredging Volume (m^3)	Estimated Bulk Volume (m^3)	Length of Tube Required (m)	Estimated Cost (Supply Only)	Bunding Requirement (on high perimeter bund)	Estimated Cost (Decommission - Haulage)	Total Costs
1	5,500	7,810	380	$ 140,400	$ 126,140	$ 51,613	$ 192,013
2	30,000	42,600	1964	$ 735,840	$ 126,140	$ 278,973	$ 1,044,933
3	55,500	93,410	2724	$ 907,740	$ 126,140	$ 329,933	$ 1,236,293

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Title:	Decommissioning Cost Calculation - Netball		
Dredging Option	1	2	3
Dredged Volume (m3)	5,500	30,000	35,500
Bulked Volume (m3(	7,900	42,700	50,500
HAULAGE COST			
Semi Trailer Truck Load Capacity (m3)	20	20	20
Number of trucks required	395	2,135	2525
Travel Time to Landfill (return Trip in Hours)	1.33	1.33	1.33
Total Time Required to Cart Material to Landfil	526.67	2,846.67	3,366.67
Haulage cost (Wet Hire - Semi Trailer Truck (20m3) - $98/Hr)	51,613.33	278,973.33	329,933.33
Indicative Cost per m3	**6.53**	**6.53**	**6.53**
LANDFILL COSTS			
Material in Tonnes	15010	81130	95950
Landfill charges ($26/T)	**390,260**	**2,109,380**	**2,494,700**
TOTAL COSTS	**441,873.33**	**2,388,353.33**	**2,824,633.33**

Title:	Decommissioning Cost Calculation - Gun Club		
Dredging Option	1	2	3
Dredged Volume (m3)	5,500	30,000	35,500
Bulked Volume (m3(	7,900	42,700	50,500
Earthworks Cost - Reprofiling (incl 1x 20T excavator and 1 Dozer)			
Days required	2	5	6
Day Cost	4,260	4,260	4,260
TOTAL COSTS	**8,520.00**	**21,300.00**	**25,560.00**

APPENDIX F
SITE OVERVIEW
DRAWING # 1254_00_001_01

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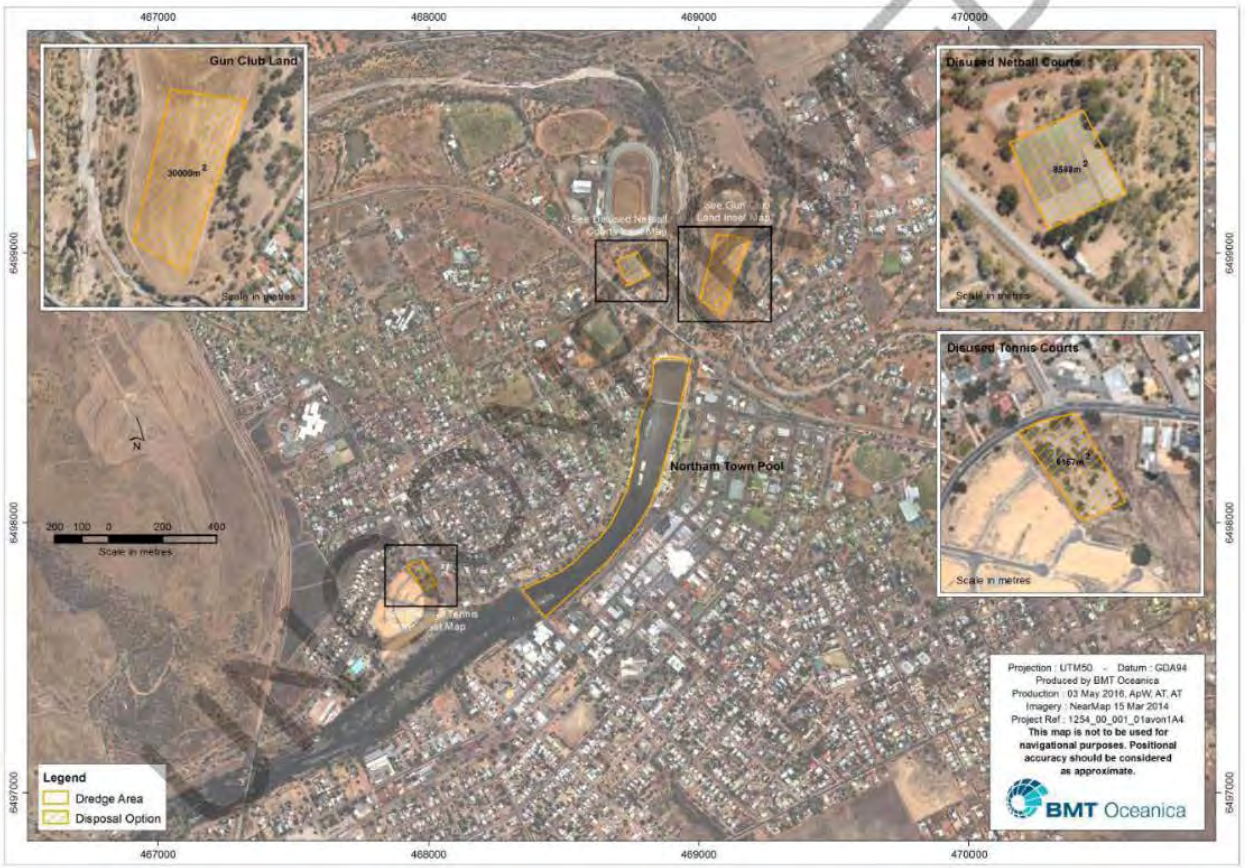

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6.2 GROWTH PLAN PROJECTS

Name of Applicant:	Internal Report
File Ref:	3.1.8.13
Officer:	Chadd Hunt/Jason Whiteaker
Officer Interest:	N/A
Policy:	Local Government Act 1995
Voting:	Simple Majority

PURPOSE

To provide the Committee with an update on the progress of projects from the adopted Northam Growth Plan and to reconfirm priority projects.

BACKGROUND

As the Committee would be aware the Northam Growth Plan was prepared as part of the Regional Centres Development Program for the purposes of identifying growth in the Northam Townsite and ultimately the Avon Sub-Region. As a component of the growth plan key issues inhibiting growth were identified and subsequently a number of key projects to achieve that aspirational growth plan were identified in the plan.

At the Committee meeting in September 2015 the Committee recommended the following which was subsequently endorsed by Council at its ordinary meeting in September –

1. *That Council, accepts the update as provided noting that business case funding allocated in the 2015/16 budget is to be prioritised to progress;*
   1.1. The Urban Renewal Partnership with the Wheatbelt Development Commission and Department of Housing; and
   1.2. Recreation Centre Stage 2.

Prior to this resolution the Committee and Council considered the prioritisation of projects in 2014 and resolved the following –

That Council;
1. *Identifies the following projects for development of detailed business cases to allow for funding submissions within the next six months;*
   a) CBA Development including
      i) Mixed Use development (subject to State Government Commitment to proceed)
      ii) Government Office Accommodation (as above)
      iii) Including costs for relocating Beavis place and area development

b) Bernard Park Precinct Development, including;
- *i) Minson Avenue implementation (street scaping)*
- *ii) Aboriginal and Environmental Interpretive Centre*
- *iii) Bernard Park Master Plan Implementation*

c) Train Station Development
- *i) Aesthetic and street scaping improvements*
- *ii) Establishment of clear linkages back to the Northam CBD*

2. Identifies the following projects for further concept development with the view of positioning for funding submissions in 2016 and beyond.
- *a) Finalisation of Health Precinct*
- *b) Education Precinct*
- *c) Identification and Planning for redevelopment of social housing areas*
- *d) Recreation Centre Stage 2*

STATUORY REQUIREMENTS

N/A

CONFORMITY WITH THE COMMUNITY STRATEGIC PLAN

OBJECTIVE C3	Provide active and passive recreation facilities and reserves
STRATEGY C3.1	Develop, maintain and support appropriate recreation facilities throughout the Shire.
OBJECTIVE E1	Support business and investment opportunities
STRATEGY E1.1	Promote new commercial and industrial development through appropriate zoning of land, provision of suitable infrastructure and efficient & effective business approval process
STRATEGY E1.3	Support sustainable business and commerce initiatives
STRATEGY E1.4	Enhance the aesthetic environment to support business Opportunities

BUDGET IMPLICATIONS

Council has funds set aside to assist in the development of detailed business cases ($50,000). The Council also have funds available (reserve) to be utilised to assist in leveraging capital projects (for example $815,000 in Regional Development Reserve, $388,000 in Road & Bridgework Reserve, $400,000 in Recreation & Community Facilities Reserve)

OFFICERS COMMENTS

The following progress has been made around each of the identified projects;

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a) The Urban Renewal Partnership with the Wheatbelt Development Commission and Department of Housing

The WDC is in the process of developing a business case for funding. Staff's understanding is that a project brief is required to be submitted to the Regional Development Council with the basic information relating to the proposed project. It is then subject to preliminary assessment and a formal business case is then invited to be submitted.

b) Recreation Centre Stage 2

Council is in the process of determining the most appropriate option with regard to aquatic facilities within the townsite of Northam. This will provide guidance on the scope and nature of Stage 2 of the recreation centre. Basically should the determination be made that a new pool be developed at the current recreation centre site then the business case will be significant as it will involve additional parking areas, location and orientation of swimming pool, major earthworks etc.

c) CBA Development including

i) Mixed Use development (subject to State Government Commitment to proceed)
ii) Government Office Accommodation (as above)
iii) Including costs for relocating Beavis place and area development

It is suggested that any business case for a CBA/D development includes a level of street scaping with a focus on Fitzgerald Street, Minson Avenue and perhaps critically the linkage between Fitzgerald Street and the new shopping precinct.

d) Bernard Park Precinct Development, including;

i) Minson Avenue implementation (street scaping)
ii) Aboriginal and Environmental Interpretive Centre
iii) Bernard Park Master Plan Implementation

The ongoing development of Bernard Park is occurring and the Committee is aware of the progress of the AEIC project. The works associated with the "swan enclosure" is about to commence which is a major component of the master plan. Similarly the drainage works associated with Minson Avenue are nearing completion.

e) Train Station Development

i) Aesthetic and street scaping improvements
ii) Establishment of clear linkages back to the Northam CBD

The proposed grant to assist with the street scaping and improvements to the appearance of the railway station were not successful. The establishment of clear linkages from the station back to the CBD is progressing through another grant.

f) Finalisation of Health Precinct

The Wheatbelt GP Superclinic is completed and the construction of the St John Ambulance Regional Sub-Centre and training centre is imminent. A component of the proposed second stage is likely to be completed as a component of the Urban Renewal project being completed in that locality.

g) Education Precinct

The planning for this is proposed to be undertaken in the 2016-17 financial year

h) Identification and Planning for redevelopment of social housing areas

The approach that staff is taking with this project is to await the outcomes of the current revitalisation application being developed. This can then be used as a template for further planning in other identified areas.

RECOMMENDATION / COMMITTEE DECISION

Minute No: RCI.19

Moved: Paul Tomlinson
Seconded: Amanda Marshall

That Council accepts the update as provided noting that business case funding allocated in the 2016/17 budget is be progressed for the following;

1. **Planning for social housing areas redevelopment.**
2. **Recreation Centre Stage 2; and**
3. **CBA/D Development**

CARRIED 7/0

SHIRE OF NORTHAM
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7. DATE AND TIME OF NEXT MEETING

To be confirmed.

8. DECLARATION OF CLOSURE

There being no further business the Presiding Member declared the meeting closed at 2.07pm.

"I certify that the Minutes of the Regional Centres Implementation Committee Meeting held on 13 June 2016 have been confirmed as a true and correct record."

_____ Presiding Officer

_____ Date

12. SPECIAL ITEMS

12.1 2016/17 ROAD PROGRAM
2016/17 DRAFT BUDGET – ROADS PROGRAM

Name of Applicant:	Engineering Services
File Ref:	
Officer:	Clinton Kleynhans
Officer Interest:	Nil
Policy/ Legislation:	Local Government Act 1995
Voting:	Simple Majority
Date:	24th June 2016

PURPOSE
For Council to review and endorse the final list of proposed roads to be included in the 2014 /2015 budget.

BACKGROUND
Attached is a list of projects being recommended to Council for inclusion in the 2016/17 Annual Budget.

A loose attachment has been provided which outlines a more expanded list of 'potential protects which were also considered by staff in their initial assessments, this has been placed in the Councillor depository (road considerations.pdf).

STATUTORY REQUIREMENTS
Nil.

CONFORMITY WITH THE STRATEGIC COMMUNITY PLAN
OBJECTIVE E3: Provide and support an effective and efficient transportation network.

STRATEGY E3.1: Plan for the provision and delivery of transport services and infrastructure in the Shire in close consultation with the State and Federal Governments.

BUDGET IMPLICATIONS
The attached Appendix A outlines estimated costs for shortlist of roads previously provided with the recommended final list highlighted for inclusion of the 2016/2017 Road Program.

These costs are based on current contracted rates for road re-surfacing services as well as historic data for internal construction crew's productivity and capacity.

The table below provides a comparison to the previous year.

	2016/17	2015/16
Road Construction - Cost	**3,520,029**	**3,487,847**
	$ 3,520,028.60	**3,487,847**
Labour	$ 529,664.76	587,075
Plant	$ 311,996.84	245,389
Cost of materials	**2,678,367**	**$ 2,655,383.00**
Materials as % of total	76%	76%
Road Construction - Revenue	**- 3,235,875**	**- 3,208,432**
From Reserve / Funding	**-**	- 170,000
Funds Carried forward	**- 531,535**	- 555,251
Grants Commission - Roads	- 760,000	- 768,237
Blackspot	- 239,715	- 206,564
Grants Commission - Bridges	-	- 60,000
Main Roads - Bridges	-	-
Regional Road groups	- 299,625	- 226,405
Commodity Route	- 205,000	- 140,000
Roads 2 Recovery	- 1,200,000	- 1,081,975
Deproclamation GEH (Gravel Re-sheeting)		-
Overall Net cost to Council	284,154	279,415
Total net material subsidy	- 557,508	- 553,049

OFFICER'S COMMENT

In determining the proposed roads the following guidelines and selection criteria were used;

1. Funded Projects – Projects that will receive funding from an external source are given highest priority in the Program.
2. Asset Data – Interrogation of ROMAN/ RAMM asset data to determine a priority list or "ranking" The higher the ranking the higher the priority of the project. This desktop assessment was then followed by field investigation to validate the data, with consideration of joining recent year's resurfaced sections as well as grouping projects in close proximity to provide greater value for money through reduced mobilisation and demobilisation costs.
3. External Requests and Internal Advice – Council staff have also utilised external requests from ratepayers as an indicator to pressure points within the Shire. These requests are being assessed against other projects identified through ROMAN/ RAMM and considered to warrant works being undertaken.

Similarly internal requests/suggestions have also been incorporated into the program, these emanate from staff who utilise their knowledge and experience to identify projects worth of consideration.

RECOMMENDATION
That Council;
1. Endorse the following 2016/17 Road Program for incorporation into the 2015/16 Draft Budget

Resurface/Rehabilitate

Road Name	Start	End	Treatment Type
O'NEILL ROAD	2490	4810	Resurface
OLD QUARRY ROAD	260	460	Resurface
STRICKLAND AVENUE	0	340	Resurface
MOUNT OMMANNEY ROAD	540	590	Resurface
PERINA PLACE	0	110	Resurface
LAWLEY AVENUE	0	310	Resurface
TRIMMER ROAD	2580	4160	Resurface
GILLETT ROAD	270	420	Resurface
THOMAS STREET	350	830	Resurface
IRISHTOWN ROAD LINK ROAD	0	320	Resurface
CHARLES STREET	570	1070	Resurface
DR DUNLOP GROVE	0	190	Resurface
GILLETT ROAD	30	270	Resurface
ENSIGN DALE PLACE	20	120	Resurface
BIRDIE PLACE	0	80	Resurface
ELIZABETH PLACE	0	130	Resurface
ELIZABETH PLACE	230	320	Resurface
MITCHELL AVENUE	0	2190	Resurface – Commodity Route Funded
CHIDLOW/ HAWES/ BURGOYNE ST	320	330	Resurface
COATES ROAD	1650	4350	Resurface
JENNAPULLIN ROAD	8800	9240	Resurface – RG Funded
LANCE STREET	0	230	Resurface
WILSON STREET	0	580	Resurface
QUEEN STREET	210	380	Rehabilitation

Construction

Road Name	Start	End	Treatment Type
SPENCERS BROOK ROAD	7360	8200	Reconstruction – RRG Funded
SPENCERS BROOK ROAD	2900	5400	Reconstruction – Blackspot Funded
SOUTHERN BROOK ROAD	3600	6400	Reconstruction – RRG Funded
NEWMAN ROAD	0	500	Reconstruction
YATES STREET	0	130	Reconstruction
BEDFORD STREET	0	100	Reconstruction

Gravel Re-Sheet

Road Name	Start	End	Treatment Type

AUGUSTINI ROAD	0	1300	Reconstruction
CHEDARING ROAD	1660	3040	Reconstruction
CHINGANNING ROAD	6000	7110	Reconstruction
LEAVER ROAD	0	2000	Reconstruction

12.1 SWIMMING POOL REVITALISATION

Name of Applicant:	Shire of Northam
Name of Owner:	Shire of Northam
File Ref:	1.3.8.4
Officer:	Ross Rayson
Officer Interest:	N/A
Policy:	N/A
Voting:	Simple Majority

PURPOSE

For Council to consider options for the future development of Northam Swimming Pool, and to provide endorsement on the recommended option.

BACKGROUND

The Northam Swimming Pool has recently had a condition assessment (Ninnes 2015) undertaken to ascertain its immediate and long term future The result of this assessment showed that the pool was at the end of its useful life, and consideration should be given to a redevelopment of the existing pool or a development of a new pool within Northam.
The Northam pool has been the subject of debate for the last decade as its condition began to noticeably deteriorate, and its future location was discussed as part of the recommendations from the 2009 Recreation Facilities Development Plan, compiled by CCS Strategic.

Since 2009, a review of the Recreation Facilities Development Plan (CCS 2016), Community Perceptions Survey (Catalyse 2014), and Swimming Pool Redevelopment survey (Catalyse 2016) have all received community input about the future design and location of the Swimming Pool. The Swimming pool development survey 2016 presented Council with 3 preferences, although there was no clear preference:

- building an outdoor, heated 8 lane x 50m pool and toddlers' pools at Northam Recreation Centre
- build an indoor, heated 8 lane x 25m pool at Northam Recreation Centre
- A complete redevelopment of the existing site with a new 8 lane x 50m pool to replace the existing pool and new heated toddlers' pool

The Shire of Northam Swimming Pool Development assessment is attached. This report provides a summary of previous discussions, indicative capital cost analysis for each of

the options, and an indicative 12 monthly operating budget for each option. As requested by Council, some indicative costs for the construction of a hydrotherapy/programme pool have also been included.

STATUTORY REQUIREMENTS
N/A

CONFORMITY WITH THE STRATEGIC COMMUNITY PLAN
Objective C3-Provide active and passive recreation services and facilities

C3.1- Develop, maintain and support appropriate recreation facilities throughout the shire.

BUDGET IMPLICATIONS

The Shire of Northam currently has capacity to use a mix of funding for this project. Modelling within the provided report is around utilisation of $500,000 from reserve with the remaining funds coming from debt and external sources. In saying this the Council contribution could be increased significantly if required.

OFFICER'S COMMENT

It is apparent that the condition of the Northam Pool is poor, with it at the end of, or nearing the end of its economic life. Consequently a decision around its future is viewed as imperative given it is estimated to be a twelve to eighteen month lead time between decision and work commencing on the ground. Further to this, potential funding avenues with Department of Sport and Recreation Community Sport & Recreation Facilities Fund (CSRFF) major grants close in mid-September 2016, for project to be funded in 2017/18. Consequently if this timeframe were missed the project would not be able to commence until 2018/19. Staff have serious concerns that the current pool will require remedial action prior to this to enable it to continue to be operational.

It is clear from the attached reports and previous studies undertaken on the pool that there is a number of options which will have different benefits to the community. Whilst the final decision on the development may depend ultimately on Councils willingness or ability to fund each of the options, officers are of the opinion that the final decision is between either location (existing vs Recreation Centre); and water space and usability (i.e. retaining an existing 50 metre pool vs smaller 25m pool).

In formulating the recommendation to Council it became apparent that there is no 'right' or 'wrong' decision. The final decision, resting with Council, is around the context of what is considered affordable and in the best interest of the Community.

The context for the decision is around Council resolving previously to develop a 25m Pool at the Recreation Centre in 2010, whilst the 'draft' Recreation facilities Plan recommends to develop a 50m Pool at the Recreation Centre, making provision for it to be covered into

the future. Staff have made their recommendation based on the context as stated previously of affordability and perceived community interest.

Given that Council has resolved previously to build a 25m Pool at the Northam recreation Centre a rescission motion would be required. The relevant form is provided.

RECOMMENDATION

That Council:

1. **endorses the redevelopment of the existing site, by building inside the existing pool shell, as the preferred option to replace the current pool, subject to funding and with the intent of undertaking the project on a design and construction tender basis;**

2. **Request officers to undertake conceptual infrastructure and cost planning for the new facility in order to make application to the Department of Sport & Recreation, CSRFF in 2016; and**

3. **Request officers to seek alternative funding opportunities to offset the capital cost of the project.**

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AGENDA

SPECIAL COUNCIL MEETING TO BE HELD ON 29 JUNE 2016

NOTICE TO REVOKE DECISION OF COUNCIL OR COMMITTEE

Local Government Act 1995

5.25. Regulations about council and committee meetings and committees

(1) Without limiting the generality of section 9.59, regulations may make provision in relation to —

(e) the circumstances and manner in which a decision made at a council or a committee meeting may be revoked or changed (which may differ from the manner in which the decision was made);

Local Government (Administration) Regulations 1996

10. Revoking or changing decisions (Act s. 5.25(1)(e))

(1) If a decision has been made at a council or a committee meeting then any motion to revoke or change the decision must be supported —

(a) in the case where an attempt to revoke or change the decision had been made within the previous 3 months but had failed, by an absolute majority; or

(b) in any other case, by at least 1/3 of the number of offices (whether vacant or not) of members of the council or committee, inclusive of the mover.

(1a) Notice of a motion to revoke or change a decision referred to in sub regulation

(1) is to be signed by members of the council or committee numbering at least 1/3 of the number of offices (whether vacant or not) of members of the council or committee, inclusive of the mover.

(2) If a decision has been made at a council or a committee meeting then any decision to revoke or change the first-mentioned decision must be made —

(a) in the case where the decision to be revoked or changed was required to be made by an absolute majority or by a special majority, by that kind of majority; or

(b) in any other case, by an absolute majority.

(3) This regulation does not apply to the change of a decision unless the effect of the change would be that the decision would be revoked or would become substantially different.

Notice is hereby given by the following

	Councillor Name	Signature
1.		
2.		
3.		
4.		

To revoke or change the following decision

Meeting / Date	
Agenda Item No	
Agenda Item Name	
File Reference	
Resolution No	

13. NEW BUSINESS OF AN URGENT NATURE INTRODUCED BY DECISION OF MEETING

13.1. Elected Members

Nil.

13.2. Officers

Nil.

14. DECLARATION OF CLOSURE