Flinders Ports Pty Ltd

Outer Harbor Channel Widening Project

Response to EPA RFI#3

DA 010/VO48/17

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1 Overarching Methodology

Throughout the Development Application (DA) Report and analysis for Dredge Material Placement Area (DMPA) options (refer DA Report Appendix B, July 2017) there has been a consistent approach adopted to ensure the three key elements for determining impacts, mitigations and informing key decisions for the Outer Harbor Channel Widening (OHCW) Project have been undertaken, namely:

- Technically feasible
- Environmentally appropriate
- Economically viable

To enable critical assessment across the multitude of potential project development scenarios, and to address the often competing and inter-connected issues associated with scenarios, the DA Report and technical works have focussed on a macro, risk based assessment, to efficiently identify the most viable and appropriate development scenarios that warrant more detailed investigation and assessment, leading to the preferred option as presented in the DA Report and subsequent Addenda 1 and 2 (July 2017).

It is also noted that there is an extensive body of knowledge developed relating to the OHCW Project derived from the 2005 Deepening Project, additional studies and investigations undertaken between 2005 and now, as well as relevant benchmark projects and engineering knowledge from across Australia and Internationally. This is further supported by the relevant legislation, guidelines and standards applicable to the OHCW Project and as detailed in the DA Report.

EPA RFI #3 seeks clarification on the technical details for transferring material to a land based DMPA. Specific RFI #3 questions are italicised and highlighted below with each one addressed individually.

2 Responses to RFI

*What information was used to evaluate the feasibility of pumping dredge spoil with ~30% clay content that considers pipe blockage, pump clogging or any other technical constraints?*

DA Report Appendix B, Section 2 Prior Investigations (pg. 4-5) outlines the investigations undertaken as part of the 2005 Deepening Project. Four reports were cited that all recommended ocean based DMPA as preferred due to the overarching risk based assessment and not purely on one single factor such as technical issues relating to pumping (though all noted this as one of the contributing factors eliminating a land based DMPA).

DA Report Appendix B, Section 4 Land Based DMPA Option Assessment (pg. 12-18) outlines the most recent review and assessment for potential land based DMPA. This was supported by a detailed study undertaken in 2014 (KBR, 2014)
that undertook a Multi-Criteria Analysis (MCA) for potential land based DMPA, assessing a multitude of technical, environmental and economic factors.

This section raised (as one of a range of risk factors) that the existing geology represents a non-uniform mix of sands, clays and gravels (Refer Chapter 3 of DA Report for complete details and Figure 1 below). The non-uniform mix of materials means that it is not feasible to be selective in the destination of the materials for beneficial uses.

![Diagram of geological section](image)

**Figure 1 Inferred Geological Section (Golder, 2004a)**

It was noted (DA Report Appendix B, pg.13, 2nd paragraph) that these material properties “present challenges for slurry pumping” and goes on to outline a range of factors that present technical challenges (and hence risk) to the viability of this option, including inefficiencies in operations, potential blockages within pipe network, and additional seawater to facilitate pumping. The assessment noted that the pipeline presented was for “proof of concept” and was chosen following internal (not published) assessment of viable scenarios for comparison with the alternative ocean based DMPA. All other options, as supported by KBR (2014) and multiple other studies as outlined were eliminated due to significant risks and issues which did not enable a reasonable comparison and assessment against ocean based DMPA.

The most viable land based option (Cheetham salt works site) was selected for “proof of concept” on the basis of the following after broader assessment:

- Land site (size (capacity), existing detention capability (large bunded areas existing), proximity)
- Ability to deposit slurry without critical time factors or requirements for engineering fill capability enabling natural drying to occur and avoiding high costs for earthworks, additives or working to generate engineering fill qualities
• Considerations for tie-in wharf / barge facility in suitably located area
  (achieving depth, proximity to works)

**What is the level of confidence in this information and interpretation (e.g. historical incidents of pipe blockage).**

From experience in previous dredging projects and discussions with dredge contractors, clay content of dredge material is a known issue for pipe blockage risk. Assessment of historical data and/or levels of confidence were not assessed as a detailed engineering feasibility study was not conducted for the purposes of the DA Report. Detailed engineering would identify mitigation actions through detailed design to address identified risks if such a study was warranted.

The risk of blockage is assessed as low likelihood, but with significant consequences should any blockage eventuate, as it would likely occur within a sensitive marine environment. Works to remove any blockage would be addressed with mitigating actions, likely to include temporary construction of a containment area (localised earthworks) prior to dismantling the pipes and clearing a blockage. Subject to the location of any blockage, heavy plant and equipment access is likely to be required which may include clearance of access tracks and lay-down areas for plant and pipes. Clean up activities post-blockage will include the need to remove any spillage and/or treatment of water prior to release back into the ocean or adjacent environment in accordance with anticipated EPA permit requirements.

The delay costs to the dredge campaign will also be incurred which adds to the consequence.

**Is there anything that can be done to mitigate such risks?**

Detailed engineering design and route selection would be applied to reduce the scale of identified risks. It is impossible to eliminate all risks, and mitigating actions typically add to time and costs associated with the project.

The provision of booster pumps (exact quantity would be defined in any detailed design undertaken) would be required and considered a mitigating measure against blockage risk. However, booster pumps introduce additional risk factors into the project. Depending on the dredge discharge point and material disposal location, this project would require between 4 to 6 booster pumps to achieve the necessary project requirements. Each booster pump will require additional infrastructure to be temporarily created, including clearance, appropriate foundations and retaining structures, environmental controls, fuel source (including access for re-fuelling trucks), maintenance (access for vehicles) and possibly access to water for operations of the pump system selected (this may require creating detention basins to contain excess, recycled water prior to disposal).

The DA Report and attached plume modelling report highlighted that the majority of impacts to the marine environment were associated with dredging of material at the removal location (i.e. release of turbid water), not placement at sea. Therefore, land placement would increase the overall environmental impacts of the project,
as it would likely incur land-based impacts additional to that of dredging the material from the channel.

**What information is available that demonstrates the potential duration of dewatering and drying of the dredge spoil on land? Does this include reworking the spoil to increase the drying?**

There are significant factors that impact the rate of drying for the material when placed on land. The detailed assessment for this has not been undertaken for the purposes of this DA Report as the option for land based DMPA was eliminated upon the range of factors outlined in the DA Report and above. The addition consideration of drying time and re-working options only further reducing the viability of this option. Refer KBR (2014) for details on Beneficial Re-use which includes timing and estimates for re-working materials to achieve necessary quality requirements for all re-use options considered.

The following (extract from Ports Australia Dredging Code of Practice (2016)) also provides summary details of the issue as detailed by KBR (2014):

*Material needs to be dried and consolidated to a stable form before the disposal area can be used for another purpose or the material relocated. The period required to dry the material using natural processes depends upon the thickness of the placed material and the climatic conditions (especially rainfall), and may take many years (potentially decades). Options are available to enhance drying rates (e.g. chemical thickeners, surcharging, sand and wick drainage).*

Depending on the disposal site, significant site preparation works is likely to be required including decontamination, construction of bunded containment and treatment areas, treatment of acidic or sodic soils and lining of the site to prevent impacts to groundwater and groundwater dependent ecosystems. Significant volumes of water would need to be treated and discharged from the site to prevent harm to sensitive marine habitats which surround the most likely disposal sites. Most potential placement sites also contain vegetation and habitat that would require clearance, necessitating further approvals and attracting SEB costs.

The duration of dewatering and drying of material on land is dependent upon the placement site area and the method of delivery of dredge material. Attached is an extract from KBR (2014) outlining a concept design for a land based DMPA adjacent the Grand Trunkway Road (refer Appendix B). This concept layout was prepared for 1.5M m³ of material and so provides an invaluable reference for this analysis. The total area estimated for this concept was nominally 62ha with a depth of material at 5m height.

If material is transported via pumping through a pipeline this will be in a slurry of 80% water 20% dredge material. This will require a volume of storage of 2-4 times the volume of material to be dredged (dependent upon rate of delivery) in order to contain the hydraulic material. After dewatering, the damp material remaining in the bunds will likely be 2-3m deep and could be expected to take decades to dry (without re-working).
If a land based dredge spoil disposal option was preferred, what dredging technology would be used?

The dredging technology is unlikely to alter significantly for a land based option, but the utilisation and methodology would be altered. The current proposal involves the use of two hydraulic dredgers, a TSHD and CSD, supported by Split Hopper Barges (SHB). Both dredgers remove the material from the sea bed, directly into the TSHD hopper or SHB for transport to the DMPA in Gulf St Vincent.

For a land based option, the key addition is that the material is required to be pumped as a slurry from the working dredge plant into the slurry pipe system. The TSHD has the ability to directly pump from its hopper into a pipe at a temporary wharf or berthing structure. The SHB’s would require a pump to remove their material from the hoppers into the slurry pipe system.

Hydraulic dredging is considered the most feasible methodology given the constraints associated with the project, including the volumes of materials involved and transport options to any sizeable land option.

What additional infrastructure would be required to enable this (e.g. barge or wharf loading facility, additional booster pumps etc.)?

The DA Report Appendix B Section 4 Land Based DMPA Option Assessment provides details for the necessary supporting infrastructure required to undertake this scenario. Additional detailed engineering has not been undertaken for the DA Report as this option was not deemed suitable following the assessment.

The typical associated infrastructure that would be required (subject to more detailed engineering design and environmental and risk assessments based upon a preferred location / site) include:

- Temporary mooring / pipe network tie-in point suitable for the anticipated TSHD size. This could be either temporary mooring dolphins (piled structures) or a floating barge moored in location

- Temporary pipe network nominally 1m diameter steel pipes augmented by flexible pipes as determined through design development and final route selection etc. Pipe route would be subject to a detailed analysis, including geotechnical and environmental investigations and assessment of impacts to neighbouring operations to determine appropriate supporting infrastructure and type of pipe network to be employed. There will also be associated infrastructure required to construct the pipe network including lay-down, manufacturing area, access for excavators and heavy lift equipment as well as maintenance and refuelling vehicles.

- Additional pump boosters. Final quantity would be determined based upon detailed design including material properties, distance and elevations to the DMPA but indicative would be at between 4 to 6 assuming minimum distance to any viable DMPA on land is greater than 8km distance. Each booster pump will require provision of power (generators requiring fuelling, possible water supply for cooling and maintenance
pending selected pump types, possible bunding, earthworks and possible acoustic shielding subject to location and noise emissions).

- Pending final DMPA destination, there are a range of civil and infrastructure works that may or may not be required to meet technical and environmental requirements (such as detention basins, clearance and lining of basins, distribution network to place the material etc). Design of detention basin and outfall will be required to ensure return water is of suitable quality.

The final intended usage for the material also impacts significantly upon the DMPA design and hence infrastructure requirements. These have not been factored into this outline at such a preliminary level and have been assumed the DMPA will receive a mixed slurry for long term detention as a non-engineered fill.

**What are the likely costs?**

Additional detailed engineering has not been undertaken for the DA Report as this option was not deemed suitable following the assessment. KBR (2014) highlighted a range of costs for multiple different scenarios and usages of the material across multiple assessed locations.

The KBR report outlines the sensitivity in cost impacts across the broad range of options, including outlining the assumptions required to enable any comparable assessment. The final determination of a potential DMPA site dictates significantly upon the potential costs, noting any land based DMPA will impact upon overall capital cost through the following:

- Decreased efficiency of dredge campaign (take longer). Whilst the travel distance from the works to disposal point for the dredge is smaller, there are inefficiencies between utilising the bottom dumping technique versus mooring to the tie-in point, connecting to the pipe network, and pumping the material from the hopper. Can assume project will take 30% longer, which represents $10-$20 million estimated additional cost for the dredging plant.

- Additional infrastructure (as outlined above) which is all additional to the base case capital estimate, and will range from $15 to $30+ million or more to transport the material to a land DMPA pending distance and final engineering details (c.f. KBR (2014) range of rates for transport of between $10 to $20 per cubic metre in 2014 dollar terms)

- Potential infrastructure and costs associated with the DMPA site to appropriately contain and de-water the material, and avoid environmental impacts (PASS etc) were highlighted by KBR (2014) to widely range across potential sites and comparisons are too disparate to meaningfully assess for this project without determination of a hypothetical DMPA location or end use requirements for the material. The DA Report assessment focussed on lowest cost option at Gillman for non-engineered fill placement (amongst a range of assessment criteria). This had estimated
cost of $5-$10 million for containment construction, but did not look at a comparative volume to the current proposed dredging project.

- Additional costs for detailed engineering feasibility and design, environmental approvals and permits, geotechnical and field investigations, project management and other associated indirect costs have not been estimated but need to be considered and will increase costs over the base case (nominally 10% to 20% of the predicted capital cost).

To summarise, the potential range of costs directly associated with a land based DMPA (subject to concept engineering assessment and design) ranges from $33M to $72M. This does not include any additional costs associated with the DMPA other than placement and initial de-watering to contain the material within bunded settling ponds.
Appendix A

Potential Land Disposal Options
- For Information Only
Intertidal Seagrass
Intertidal Flat
Intertidal Mangrove
Intertidal Samphire
Channel
Supratidal Samphire
Supratidal Saline Patch Bare
Supratidal / Estuarine Mangrove 1+/Samphire
Supratidal / Estuarine Flat
Chenier / Beach Ridge Vegetated
Tidal Stream
Stranded Tidal Flat
Stranded Tidal Flat Samphire
Land Outside Study Area

Pipeline Options
Proposed Swing Basin
and Channel

Title:
Potential Land Placement Areas
For Information Only to support risk based assessment

Figure: 1
Rev: A

Filepath: I:\B22346_Adeleade Port Channel Widening\DRG\ECO_042_180227_PotentialPlacementSites.wor
### A1 Risk Summary / Comments

<table>
<thead>
<tr>
<th>1. Ridley Salt Fields: Notes / Risk Factors</th>
</tr>
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<tbody>
<tr>
<td>Shortest distance of options requiring least amount of temporary infrastructure, will require least amount of all options for additional booster pumps along pipe route, either land based or moored on barge(s) and include provisions (access) for re-fuelling and maintenance</td>
</tr>
<tr>
<td>Land size suitable for volumes involved and no current time frames for development, providing long time for drying.</td>
</tr>
<tr>
<td>Tenure by third party, no inclusion / consideration for zoning / approvals / existing caveats on site or future use of land etc. Core assumption site able to receive material in accordance to OHCW Program with all risk, management, approvals and costs associated post-delivery by others.</td>
</tr>
<tr>
<td>Unknown final usage of site, meaning materials may require removal or treatment in the future (not considered or costed as part of this review) as deemed unsuitable for engineering purposes, bulk fill only.</td>
</tr>
<tr>
<td>Pipeline traverses sensitive ecological areas (intra-tidal seagrass and mangroves) with requirement for clearance / disturbance for construction, maintenance during operations and removal. The salt pans are also recorded to provide habitat for internationally protected migratory birds. Prior to placement of the material, treatment of hypersaline waters/soil within the salt pans would be required to avoid release of this material to the marine environment.</td>
</tr>
<tr>
<td>Tailwater from dredge material storage ponds would also require discharging to this environment with potential adverse impacts to water quality, particularly given the already saline nature of the salt fields. There are substantial areas of mangrove and saltmarsh habitat immediately downstream of the site.</td>
</tr>
<tr>
<td>Pipeline likely to impact upon amenity, with restrictions or possible loss of access to local boating and fishing for duration of project.</td>
</tr>
</tbody>
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<table>
<thead>
<tr>
<th>2. Cheetham: Notes / Risk Factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Distance from site will require additional booster pumps along pipe route, either land based or moored on barge(s) and include provisions (access) for re-fuelling and maintenance</td>
</tr>
<tr>
<td>Land size suitable for volumes involved and no current time frames for development, providing long time for drying</td>
</tr>
</tbody>
</table>
Tenure by third party, no inclusion / consideration for zoning / approvals / existing caveats on site or future use of land etc. Core assumption site able to receive material in accordance to OHCW Program with all risk, management, approvals and costs associated post-delivery by others.

Unknown final usage of site, meaning materials may require removal or treatment in the future (not considered or costed as part of this review) as deemed unsuitable for engineering purposes, bulk fill only.

Similarly to the Ridley Salt Fields, there is a high risk of potential water quality issues with placing material within an already saline environment. The pipeline would also traverse and likely require clearing of mangrove, seagrass and saltmarsh communities. There is also the potential to adversely impact migratory bird habitat.

### 3. Gillman: Notes / Risk Factors

Distance from site will require additional booster pumps along pipe route, either land based or moored on barge(s) and include provisions (access) for re-fuelling and maintenance

No single parcel of land available / suitable for volume of material without significant earthworks to contain material and de-water upon receipt requiring significant volumes of imported material and earthworks to construct detention ponds. This will increase drying times and introduce new risk factors due to height of retaining structures (refer concept image attached from KBR (2014) report.

Distance from site will require additional booster pumps along pipe route, either land based or moored on barge(s) and include provisions (access) for re-fuelling and maintenance

Tenure by third party, no inclusion / consideration for zoning / approvals / existing caveats on site or future use of land etc. Core assumption site able to receive material in accordance to OHCW Program with all risk, management, approvals and costs associated post-delivery by others.

The Gilman site, whilst partially cleared contained areas of federally and state-protected habitat (saltmarsh) which would likely be disturbed by placement at this location.

Gilman Masterplan indicates planned future uses for the site. Material only suitable as bulk fill once dry, and pending final location, design of DMPA, is anticipated to require removal or impact planned development zones for the future. These impacts have not been considered as part of this review.

All options above will require the following investigations and works as part of any conceptual analysis over and above this summary of the risks and considerations undertaken to inform the DA Report assessment as detailed in the report.
1. Field investigations (surveys (flora & fauna, cultural, geotechnical, topographical etc)

2. Detailed soil analysis to inform slurry pipe design which includes determination of booster pump requirements, incorporate final dredge plant pump capacity etc

3. Detailed hydrological studies to determine potential impacts of placement on groundwater and downstream water quality/sensitive marine environments.

4. Construction of a temporary dredge mooring facility to enable connection to slurry pipe system, comprising potentially piled moorings or barge mooring at a suitable location to avoid operational impacts and appropriate for the final dredge plant parameters

5. Depending on the site detailed investigations and engineering studies to determine bund wall requirements

6. Development Application and associated licenses / permits, including further referral under the Environment Protection and Biodiversity Act 1999

7. Construction activities associated with the works, including potentially lay-down area(s) for pipes, access requirements for mechanical plant for construction (access tracks on land, barges for marine based works), earthworks for pipe access
Appendix B

Gilman Concept Layout (KBR, 2014)
4.2 EXAMPLE

Figure 4.1 shows an example of dredgate ponds on the land west of Grand Trunkway. Similar arrangements (in different shapes and numbers of cells) would be used at each of the land sites.

The external walls of the containment at the Northern Breakwater site would be higher and more armoured than at any other site, since they have to withstand greater erosional forces such as wind-driven waves and tidal flows. They would also have to be designed to key into the substrates to prevent leakage through unconsolidated sediments on the river and sea beds.
Gilman (West of Grand Trunkway) Layout (Option 4)

Scale 1:20 000

Example of Large Scale Dredge Disposal (Clunies Flats, Port of Brisbane)

Not to Scale

Typical Section - Gilman (West of Grand Trunkway) (Capacity = 1.5 million m³)

Not to Scale

Table 4.1

Example of concept
(Land west of Grand Trunkway)