Independent Review –
Technical Appendices H, I, K
and B

NQBP - Sustainable Sediment
Management Assessment for
Navigational Maintenance

Prepared for
Great Barrier Reef Marine Park Authority

22 October 2018
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1 Introduction

1.1 Background

North Queensland Bulk Ports (NQBP) is the Port Authority responsible for the management and operation of the seaport at Hay Point. In January 2017, NQBP completed a study regarding how the day to day operations at the Port are affected by marine sedimentation and determine the best way to manage accumulated material. NQBP’s study is called the Port of Hay Point – Sustainable Sediment Management Assessment for Navigational Maintenance (the SSM).

The assessment approach for the SSM is shown in Figure 1-1. The SSM comprises a summary report supported by the following technical appendices:¹

> Appendix A List of Technical Advisory Consultative Committee Members
> Appendix B Comparative Analysis Technical Report
> Appendix C Sediment Dynamics Report
> Appendix D1 Bathymetric Analysis and Modelling Report
> Appendix D2 TC Debbie Bathymetric Analysis Report
> Appendix E Predictive Modelling Technical Report
> Appendix F Sedimentation Impacts on Port Operations
> Appendix G Economic Impacts on not Maintaining Sediment Accumulation
> Appendix H Assessment for Navigational Maintenance
> Appendix I Comprehensive Beneficial Reuse Assessment
> Appendix J Marine Sediment Properties Assessment
> Appendix K Onshore Pond and Reclamation Engineering Design
> Appendix L Environmental Values Assessment.

These documents, together with Environmental Risk Assessment and Management Plans (see NQBP website) support a current application for a Marine Parks Permit and a Sea Dumping Permit for the loading and placement of accumulated marine sediment by Trailer Suction Hopper Dredge (maintenance dredging). Both permits are sought for a period of 10-years from the Great Barrier Reef Marine Park Authority (GBRMPA).

As part of a due-diligence exercise, GBRMPA commissioned Cardno to conduct an independent review of 4 of the SSM technical appendices (Figure 1-1).

1.2 Purpose, Scope and Objectives

This document presents the findings of Cardno’s independent review of the following reports appended to the SSM summary report:

1. Assessment for Navigational Maintenance - Royal Haskoning DHV (Appendix H of the SSM)
2. Comprehensive Beneficial Reuse Assessment – Advisian (Appendix I of the SSM)
3. Onshore Pond and Reclamation Engineering Design - Royal Haskoning DHV( Appendix K of the SSM)

The focus of Cardno’s review was to evaluate the adequacy of each report in accordance with GBRMPA’s Terms of Reference (Annex A) which include general instructions and assessment criteria.

1.3 Review Team

The review team comprised the experienced personnel identified in Table 1-1. CV’s for Cardno’s review team are included in Annex B. Cardno’s nominated personnel are independent from GBRMPA and have not previously contributed to the SSM or been consulted during its development.

<table>
<thead>
<tr>
<th>Name (initials) and position</th>
<th>Role</th>
<th>Appendices evaluated</th>
</tr>
</thead>
<tbody>
<tr>
<td>Andrew Costen (AC) – Principal Marine Environment</td>
<td>Project Manager and lead author</td>
<td>Appendix: B, H and I</td>
</tr>
<tr>
<td>Dr Marcus Lincoln Smith (MLS) – Senior Principal Ecologist</td>
<td>Final review (QA/QC)</td>
<td>NA</td>
</tr>
<tr>
<td>Dr David Provis (DP) – Senior Principal Oceanographer</td>
<td>Independent reviewer</td>
<td>Appendix B, H,</td>
</tr>
<tr>
<td>Nicole Neale (NN) – Senior Principal Sustainability</td>
<td>Independent reviewer</td>
<td>Appendix B, H, I and K</td>
</tr>
<tr>
<td>Nathan Burmeister (NB) – Principal Ports Engineer</td>
<td>Independent reviewer</td>
<td>Appendix K</td>
</tr>
<tr>
<td>Madelaine Hooper MH) – Environmental Scientist and Economist</td>
<td>Independent reviewer</td>
<td>Appendix B, H, I and K</td>
</tr>
</tbody>
</table>

1.4 Document Structure

The structure and content of this report is shown below. Supporting information is provided in a series of annexes – where tables are used to help expedite review and relay key messages.

Section 1  Context, purpose, scope, objectives and structure of this report
Section 2  Overview of methods, approach, implementation schedule and qualifications / assumptions
Section 3  Overall findings and assessment
Section 4  References cited herein.
2 Methodology

2.1 Overview
Cardno’s approach is broadly based on the guidance provided in the US EPA’s Peer Review Handbook 4th Edition (EPA, 2015). Tasks are shown diagrammatically in Figure 2-1. The logical sequence of tasks, the competency of each review team member and the provision of standardised templates for the initial review (including GBRMPA instructions and assessment criteria) and adherence to Cardno’s QA/QC system ensured the evaluation was completed in an independent, consistent and methodical manner. The inclusion of a workshop to openly discuss the results, the evaluation of the draft report by an audit and review specialist and the provision of comments (from each review team member) provide transparency.
2.2 Terms of Reference

GBRMPA’s Terms of Reference, which include instructions and the assessment criteria for the review are included in Annex A.

2.3 Implementation

Figure 2-1 also includes an implementation schedule for the independent review, including the dates when tasks were completed. Further information relating to these tasks are included in sections 2.3.1 to 2.3.5.

2.3.1 Project Inception

Following acceptance of our proposal, Cardno’s Project Manager and representatives of GBRMPA attended (by teleconference) an inception meeting. The primary objectives of this meeting included:

- Agreeing on a review plan (including the criteria for the review)
- Confirming key dates and milestones and finalise the schedule
- Confirming the study methodology, communication requirements
- Initiating the transfer of other relevant information required for the peer review.

Following the inception meeting, an internal ‘kick-off meeting’ was held with members of the review team. The primary objectives of this meeting were:

- Provide an overview of the project scope
- Assign responsibility to team members (appendices)
- Communicate the project objectives, requirements (including assessment criteria), schedule and budget for the review
- Provide templates and guidance notes for the review.

2.3.2 Initial Review

The initial review comprised:

- Each team member reviewing their identified appendices in detail
- Each team member providing comments / findings (in the nominated templates).

2.3.3 Workshop

Following the completion of the initial review, the project manager facilitated a workshop with all review team members. The workshop involved:

- Each team member presenting the results of the initial review
- Openly discussing results
- Seeking consensus regarding the adequacy of each appendix (in accordance with GBRMPA’s ToR).

2.3.4 Report development

Using the results of the initial review and workshop the project manager compiled a draft report for internal review.

2.3.5 Review and report finalisation

The draft report was provided to Cardno’s nominated audit and review specialist (in-line with Cardno’s QA/QC system). Upon receiving feedback, the draft report was updated and submitted to GBRMPA for review (this version).

2.4 Qualifications and Assumptions

1. This review was limited to the 4 appendices listed in Section 1.2
2. Evidence is cited from reports not part of this review are assumed accurate.
3 Findings and Assessment

This section includes an assessment of the adequacy of each appendix reviewed against the assessment criteria and a summary finding against each criterion. Comments / responses from review team members for each appendix reviewed are included in Annex’s C, D, E and F of this document.

3.1 Assessment for Navigational Maintenance: SSM - Appendix H

3.1.1 Purpose

“To identify realistic and feasible alternatives to traditional maintenance dredging and disposal at the Port of Hay Point.”

3.1.2 Overview

The approach adopted to evaluate prudent and feasible alternatives to dredging and disposal is based on both PIANC and US Army Corps of Engineers guidance for minimising harbour and channel sedimentation. This guidance is considered best practice and subsequent methodology used for the comparative assessment sound.

With regard to the assessment criteria, the review team concluded that the rationale for rejecting siltation reduction solutions were valid; the costs estimates for the siltation reduction solutions were reasonably accurate and while there are some minor inconsistencies in the analysis, these do not affect the overall results and conclusions, which are reasoned and justified.

3.1.3 Overall Findings and Assessment

Based on a review of the option identification and analysis process and supporting information provided within Appendix H, the review team determined that the report ‘adequately meets requirements in its present form’. See Annex A for a completed ‘Reviewers Report’.

Table 3-1 includes GBRMPA provided assessment criteria and a simple yes or no response. Individual reviewer responses to each criterion are included in Annex C.

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Finding</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Are the technical reasons for rejecting each siltation reduction solution valid?</td>
</tr>
<tr>
<td>2</td>
<td>Are the cost estimates for each siltation reduction solution reasonably accurate?</td>
</tr>
<tr>
<td>3</td>
<td>Is the constraints analysis and are the conclusions reasonably accurate and justified?</td>
</tr>
</tbody>
</table>

3.2 Comprehensive Beneficial Reuse Assessment: SSM - Appendix I

3.2.1 Purpose

“To undertake a comprehensive analysis of potential beneficial reuse options for the Port of Hay Point maintenance dredge material.”

3.2.2 Overview

The approach adopted to undertake the beneficial reuse investigations is detailed and robust, with a comprehensive list of performance criteria taken into consideration. The performance evaluation provides adequate and clear definition as to what constitutes high, medium and low performance for each of the criteria. Noting the nature of the dredged material, it is considered that authors have evaluated all reasonable alternatives for beneficial reuse with the results justified. The cost estimates appear to be relatively thorough, with clearly stated and reasonable assumptions.

3.2.3 Overall Findings and Assessment

Based on a review of the option identification and analysis process and supporting information it is the review teams’ opinion that Appendix I ‘adequately meets requirements in its present form’. See Annex A for a completed ‘Reviewers Report’.

Table 3-2 includes GBRMPA provided assessment criteria and a simple yes or no response. Individual reviewer responses to each criterion are included in Annex D.
Table 3-2  Criteria and responses - Comprehensive Beneficial Reuse Assessment - Appendix I, SSM

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Finding</th>
</tr>
</thead>
<tbody>
<tr>
<td>1  Are the analysis method robust and adequate to identify reuse options and analyse their opportunity, feasibility and achievability?</td>
<td>yes</td>
</tr>
<tr>
<td>2  Have all reasonable alternative options for use of the dredge material been identified?</td>
<td>yes</td>
</tr>
<tr>
<td>3  Have all the relevant performance criteria been considered and are they sufficiently measurable?</td>
<td>yes</td>
</tr>
<tr>
<td>4  Does the beneficial reuse analysis of each reuse option accurately determine a level of performance for each performance criteria?</td>
<td>yes</td>
</tr>
<tr>
<td>5  Are the costs (financial and time) stated reasonably accurate?</td>
<td>yes</td>
</tr>
</tbody>
</table>

3.3 Onshore Pond and Reclamation Engineering: SSM - Appendix K

3.3.1 Purpose

“Guided by accepted US Army Corps engineering standards, the purpose of this study was to describe onshore pond and reclamation storage options (for maintenance dredge material) in the context of predicted maintenance dredging requirements, to inform a comparative analysis. In particular, NQBP was interested in understanding how an initial volume of approximately 200,000m³ of maintenance dredge material would be managed/stored if brought onshore.”

3.3.2 Overview

The approach adopted is considered sound and the assumptions in terms of activities, operations, materials volumes etc. are reasonably well outlined. The resultant cost estimates outlined in Appendix D and Table 11 are considered reasonable. The GHG Protocol method used to calculate likely GHG emissions is considered one of the most robust “best practice” methodologies for these types of calculations. The calculations and resulting GHG emissions figures are therefore considered adequate to support the conclusions.

3.3.3 Overall Findings and Assessment

Based on a review of the evidence used to support the findings of Section 5.2 of Appendix K, it is the review teams’ opinion that the document ‘adequately meets requirements in its present form’. See Annex A for a completed ‘Reviewers Report’.

Table 3-3 includes GBRMPA provided assessment criteria and a simple yes or no response. Individual reviewer responses to each criterion are included in Annex E.

Table 3-3  Criteria and responses - Assessment for navigational maintenance – Appendix K section 3, Table 11 and Section 5.2.

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Finding</th>
</tr>
</thead>
<tbody>
<tr>
<td>1  Are the technical reasons for rejecting each onshore pond and reclamation option valid?</td>
<td>yes</td>
</tr>
<tr>
<td>2  Are the rough order of magnitude cost estimates for each dredging reasonably accurate?</td>
<td>yes</td>
</tr>
<tr>
<td>3  Are the greenhouse gas emissions reasonably accurate?</td>
<td>yes</td>
</tr>
</tbody>
</table>

3.4 Comparative Analysis Technical Report: SSM - Appendix B

3.4.1 Purpose

“The purpose of this study was to undertake a comparative analysis of the various alternatives for managing marine sediments and maintaining effective port operations at the Port of Hay Point.”

3.4.2 Overview

The review team considers that the approach used for the comparative analysis of dredge material disposal strategies provides a robust and transparent process for assessing disparate measures. Importantly, the “Principles of Structured Decision Making” process is an entirely appropriate and robust methodology for the comparative analysis of the various dredge material disposal options presented. This is of particular note from
a sustainability/ Triple Bottom Line perspective, with consideration of the interplay between social, economic and environmental aspects together. The non-linear, iterative approach is noted and commended.

Relatively strong evidence is provided in the document to substantiate conclusions. However, some evidence was derived from other reports, which have not been part of this review (see assumptions / qualifications).

Notwithstanding the above comment, it is the review teams’ opinion that the results are logical and findings sound.

### 3.4.3 Overall Findings and Assessment

Based on a review of Appendix B and the evidence used to support the findings, the review team determined that the report ‘adequately meets requirements in its present form’. See Annex A for a completed ‘Reviewers Report’.

<table>
<thead>
<tr>
<th>Table 3-4</th>
<th>Criteria and responses - Comparative Analysis Technical Report – Appendix B (SSM)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Criteria</strong></td>
<td><strong>Finding</strong></td>
</tr>
<tr>
<td>1</td>
<td>Is the structured decision making process appropriate for the comparative analysis of various dredge material disposal strategies?</td>
</tr>
<tr>
<td>2</td>
<td>Is the decision making process legitimate and transparent with the results for each material disposal strategy supported by accurate and factual evidence?</td>
</tr>
<tr>
<td>3</td>
<td>In Step 2, have all the appropriate Themes been identified and have all appropriate Objectives and Measures been developed to measure the performance of alternative options against?</td>
</tr>
<tr>
<td>4</td>
<td>In Step 4 are the units of measure used to determine the performance score/measure for each objective supported by evidence and accurate relative to the evidence provided (see Appendix B of this Appendix)?</td>
</tr>
<tr>
<td></td>
<td>Is there any alternative credible evidence that could be reasonably used to derive a significantly different performance score/measure for each Objective?</td>
</tr>
<tr>
<td>5</td>
<td>In Step 5, is the process of applying normalised scores and weighted scores a credible process that can be used to compare the performance of each strategy without introducing bias?</td>
</tr>
<tr>
<td></td>
<td>In the development of the combined options, have any reasonably viable long term combined options been left out?</td>
</tr>
<tr>
<td>6</td>
<td>Are the conclusions reasonably supported by evidence within the document?</td>
</tr>
</tbody>
</table>

### 3.5 Concluding Remarks

It is the review teams’ opinion that the approach used to develop the 4 technical appendices is appropriate and robust, the supporting information considerable and the conclusions drawn by the various authors / consulting teams sound. In summary, we conclude that the documents reviewed more than adequately meet requirements.
4 References

ANNEX A
REVIEW PROFORMA, TERMS OF REFERENCE
GREAT BARRIER REEF MARINE PARK
AUTHORITY REVIEWER’S REPORT

PROJECT TITLE
Port of Hay Point: Assessment for navigational maintenance – Appendix K section 3, Table 11 and Section 5.2. of the Sustainable Sediment Management Assessment document;

AUTHORS: Royal Haskoning DHV

ORGANISATION: North Queensland Bulk Ports

BRIEF OVERVIEW OF FINDINGS
See main body of report and Annex's C, D, E and F

OVERALL ASSESSMENT:
Adequately meets requirements in present form

Andrew Costen
Principal, Marine Environment
Cardno

(Please complete your details, noting that *review are provided anonymously)

Please return this form and the report to:

Kristin Dobbs
Director, Environmental Assessment and Protection
GBRMPA, PO Box 1379,
Townsville, Qld 4810, Australia
Tel: (07) 4750 0734
E-mail: kirstin.dobbs@gbrmpa.gov.au
INSTRUCTIONS TO EXPERT PEER REVIEWER

Background

The Authority requires expert peer review of the Port of Hay Point – Sustainable Sediment Management Assessment for the following sections of Appendix K (section 3, Table 11 and Section 5.2). These sections are a total of 6 pages in length. Appendix K provides information about the onshore pond and reclamation engineering design options in the context of predicted maintenance dredging requirements, to inform a comparative analysis of options for disposal of material, specifically in the context of a review of dredging assessment and dredging costs and a review of greenhouse gas emissions. This information is relevant to the Assessment for Navigational Maintenance.

Instructions to service provider

For the Assessment of the sections of Appendix K outlined above we require an independent review of the evidence used to support the findings. In addition, please provide expert advice on any aspect of the report that is deemed relevant to the conclusions drawn in the documents.

Please assess all the technical aspects that are relevant to the results and conclusions drawn. The criteria outlined below should be considered in addition to the expert assessment. The expert opinion of the peer reviewer(s) and the answers to the questions below should be used to decide if the report adequately meets requirements or not (see previous page). Please provide a detailed report of the assessors’ findings as an appendix.

In addition to your expert assessment, please address these criteria when conducting your assessment –

1. Are the technical reasons for rejecting each onshore pond and reclamation option valid?
2. Are the rough order of magnitude cost estimates for each dredging reasonably accurate?
3. Are the greenhouse gas emissions reasonably accurate?
GREAT BARRIER REEF MARINE PARK
AUTHORITY REVIEWER’S REPORT

PROJECT TITLE
Port of Hay Point: Assessment for navigational maintenance - Appendix H of the Sustainable Sediment Management Assessment document;

AUTHORS: Royal Haskoning DHV

ORGANISATION: North Queensland Bulk Ports

BRIEF OVERVIEW OF FINDINGS
See main body of report and Annex’s C, D, E and F

OVERALL ASSESSMENT: Adequately meets requirements in present form

Andrew Costen
Principal, Marine Environment
Cardno

(Please complete your details, noting that *review are provided anonymously)

Please return this form and the report to:

Matt Fraser,
Permit Manager- Assessments and Permissions
GBRMPA, PO Box 1379,
Townsville, Qld 4810, Australia
Tel: (07) 4750 0873
E-mail: matthew.fraser@gbrmpa.gov.au
cc. rean.gilbert@gbrmpa.gov.au
INSTRUCTIONS TO EXPERT PEER REVIEWER

Background

The Authority requires expert peer review of the Port of Hay Point – Assessment for Navigational Maintenance report (Appendix H of the SSM). The report is 33 pages in length plus appendicies. The Assessment for Navigational Maintenance report compares traditional maintenance dredging against four alternative methods including using a sediment trap, jett array, drag barring and propeller wash agitation for maintaining navigational maintenance within a port. It measures their performance against environmental impacts, operational impacts, ongoing maintenance, confidence it will be effective, regulatory approval requirements, financial cost and greenhouse gas emissions.

Instructions to service provider

For the Assessment for Navigational Maintenance report we require an independent review of the option identification and analysis process and the evidence used to support the findings of this process. In addition, please provide expert advice on any aspect of the report that is deemed relevant to the conclusions drawn in the documents.

Please assess all the technical aspects that are relevant to the results and conclusions drawn within the report. The criteria outlined below should be considered in addition to the expert assessment. The expert opinion of the peer reviewer(s) and the answers to the questions below should be used to decide if the report adequately meets requirements or not (see previous page). Please provide a detailed report of the assessors’ findings as an appendix.

In addition to your expert assessment, please address these criteria when conducting your assessment –

1. Are the technical reasons for rejecting each siltation reduction solution valid?
2. Are the cost estimates for each siltation reduction solution reasonably accurate?
3. Is the constraints analysis and are the conclusions reasonably accurate and justified?
GREAT BARRIER REEF MARINE PARK
AUTHORITY REVIEWER'S REPORT

PROJECT TITLE
Port of Hay Point: Comparative Analysis Technical Report (Appendix B of SSM); and Comprehensive Beneficial Reuse Assessment (Appendix I of SSM)

AUTHORS: Open Lines Consulting and Adaptive Strategies (Appendix B) and Advisian (Appendix I)

ORGANISATION: North Queensland Bulk Ports

BRIEF OVERVIEW OF FINDINGS
See main body of report and Annex's C, D, E and F

OVERALL ASSESSMENT: Adequately meets requirements in present form

Andrew Costen
Principal, Marine Environment
Cardno

(Please complete your details, noting that review are provided anonymously)

Please return this form and the report to:

Matt Fraser,
Permit Manager- Assessments and Permissions
GBRMPA, PO Box 1379,
Townsville, Qld 4810, Australia
Tel: (07) 4750 0873
E-mail: matthew.fraser@gbrmpa.gov.au
cc. rean.gilbert@gbrmpa.gov.au
INSTRUCTIONS TO EXPERT PEER REVIEWER

Background

The Authority requires expert peer review of the Comparative Analysis Technical Report (Appendix B of SSM) and Comprehensive Beneficial Reuse Assessment (Appendix I of SSM) reports which form part of a broader assessment of options for dealing with dredge spoil (called the Sustainable Sediment Management Assessment - SSM). The Comparative Analysis Technical Report is 41 pages in length and the Comprehensive Beneficial Reuse Assessment is 121 pages in length plus various appendices for both reports.

The Comparative Analysis Technical Report compares various alternative strategies for managing marine sediments removed from the port by dredging. It uses a structured decision making process to assess 11 decision objectives with discrete measures across several categories including:

- Environmental;
- Cultural Heritage;
- Port Economics and Operations;
- Health and Safety;
- Social;
- Innovation; and
- World Heritage.

For the Comprehensive Beneficial Reuse Assessment report we require an independent review of the option identification and analysis process and the evidence used within the process. The assessment identifies 11 re-use options for marine sediments removed during dredging. The analysis process considers 13 performance criteria and assigns a high, moderate or low performance category to each performance criterion for all the re-use options based on the supporting evidence provided.

Instructions to service provider

Please assess all the technical aspects that are relevant to the results and conclusions drawn within the report. The criteria outlined below should be considered in addition to the expert assessment. For both documents, please provide expert advice on any aspect of the reports that are deemed relevant to the conclusions drawn in the documents. The expert opinion of the peer reviewer(s) and the answers to the questions below should be used to decide if the report adequately meets requirements or not (see previous page). Please provide a detailed report of the assessors’ findings as an appendix.

In addition to your expert assessment, please address these criteria when conducting your assessment –

Comparative Analysis Technical Report (Appendix B of SSM);
1. Is the structured decision making process appropriate for the comparative analysis of various dredge material disposal strategies?
2. Is the decision making process legitimate and transparent with the results for each material disposal strategy supported by accurate and factual evidence?
3. In Step 2, have all the appropriate Themes been identified and have all appropriate Objectives and Measures been developed to measure the performance of alternative options against?
4. In Step 4 are the units of measure used to determine the performance score/measure for each objective supported by evidence and accurate relative to the evidence provided (see Appendix B of this Appendix)?
   a. Is there any alternative credible evidence that could be reasonably used to derive a significantly different performance score/measure for each Objective?
5. In Step 5, is the process of applying normalised scores and weighted scores a credible process that can be used to compare the performance of each strategy without introducing bias?
   a. In the development of the combined options, have any reasonably viable long term combined options been left out?
6. Are the conclusions reasonably supported by evidence within the document?
   (note: Step 3 of Appendix B is covered by the peer review of Appendix I)

Comprehensive Beneficial Reuse Assessment (Appendix I of SSM):

1. Is the analysis method robust and adequate to identify reuse options and analyse their opportunity, feasibility and achievability?
2. Have all reasonable alternative options for use of the dredge material been identified?
   a. If not, are there any reasonable alternative options that have not been identified?
3. Have all the relevant performance criteria been considered and are they sufficiently measurable?
4. Does the beneficial reuse analysis of each reuse option accurately determine a level of performance for each performance criteria and is the level of performance reasonably supported?
   a. Is there alternative credible evidence that would support an alternative level of performance for each performance criteria?
5. Are the costs (financial and time) stated reasonably accurate?
Annex B
REVIEW TEAM CV’S
Andrew Costen

Summary of Experience
Andrew is a Principal Marine and Coastal Scientist within Cardno’s Asia-Pacific Water and Environment practice. He has worked extensively for specialist science and engineering consultancies and Government environmental management agencies.

Andrew has considerable experience in the design, capture and analysis of sediment and water quality data for complex, large scale coastal and maritime development projects. He has also developed expertise in coordinating multidisciplinary studies required to support environmental impact assessments, approval applications and monitoring programs.

Andrew has a particular academic and professional interest in the identification of impacts associated with dredging programs and delivering fit-for-purpose dredged material management solutions.

Select Project Experience: Sediment Quality – Sampling Design, Analysis and Assessment
- Yarra River Dredging Approvals and Management, Wesley College Melbourne (2017 - 2018)
- Paisley Bay Dredged Material Options Assessment, Hornsby Shire Council (2017)
- Yarra River Dredging Approvals and Management, Parks Victoria (2014)
- Port Phillip and Western Port Dredge Management Plan, Parks Victoria (2014)
- Bancroft Bay (Metung) Marina Redevelopment, East Gippsland Shire Council (2012-2014)
- Chinamans Creek Jetties Project, East Gippsland Shire Council (2012-2014)
- Tankerton Jetty Dredged Material Placement Site Identification, Parks Victoria (2012-2014)
- Landing Helicopter Dock Williamstown Shipyard Waterfront Project, BAE (2010-2012)
- Ship Grounding Assessment (including TBT contamination) Douglas Shoal, Great Barrier Reef, ITOIF (2010-2014)
- Dampier Port Berth 5 Port Upgrade, Dampier Port Authority (2007)
- Gorgon LNG Project, Dredge Material Sediment Study, Barrow Island, Chevron (2007)
- Gorgon LNG Project, Barrow Island, Department of Environment and Conservation (2007)
- Cape Lambert Port Expansion, Department of Environment and Conservation (2007)
- Port of Townsville Lead (Pb) Ore Loading Berth Dredging Study, Great Barrier Reef Marine Park Authority (2005)
- Cairns Port Authority LTDMS, Cairns Port Authority, Great Barrier Reef Marine Park Authority (2003)
- Invasive Species Assessment (benthic fauna), Cairns Port Authority, Great Barrier Reef Marine Park Authority (2000)

Dredging Related Publications

Madelaine Hooper

Summary of Experience

Madelaine is an environmental scientist with a strong multidisciplinary background in both environmental science (biology and ecology) and economics with Cardno’s Water and Environment team. She contributes to a range of marine ecology, resource management and environmental impact assessment projects. She has well developed skills in environmental monitoring, chemical analysis, complex sampling design, data collection and analysis, technical report writing and environmental software such as ESdat and Plog.

Madelaine previously worked in Cardno’s Geosciences team undertaking site investigations, including PSI/DSI investigations, creating and implementing site inspection and sampling plans and managing sub-contractors. She has experience as a field scientist undertaking soil, sediment, surface and groundwater sampling. Madelaine is the current manager for ESdat for Water & Environment, with an excellent knowledge of chemicals of potential concern and environmental standards for various site uses. Madelaine often applies this to both ecology and contamination investigations.

As a qualified economist, Madelaine has undertaken projects using behavioural economic theory in its application to competitive insurance markets and alternative insurance models. Madelaine also has experience in non-market valuation techniques and cost benefit analyses. Madelaine’s experience extends to risk management and is passionate about managing risk for clients to deliver favourable, risk adverse outcomes for clients.

Madelaine has 4 years industry experience, with 2 years’ in professional consulting.

Significant Projects

> Offshore open ocean marine water sampling, 2018: Madelaine undertook a five day offshore field sampling operation. The sampling involved deployment of a niskin rosette, YSI fluorometry and ADCP instruments to assist in real time monitoring and sampling of discharge plume.

> Rhodamine WT dye production for offshore plume tracing, 2018: Madelaine led the field program to prepare a 20 % active solution of Rhodamine dye in an industrial chemistry experiment. The six day field program involved a series of serial dilutions and sub-experiments to ensure the solution concentration was both accurate and reliable for release offshore.

> In-situ Produced Formation Water, Marine Water and Sediment Sampling Program (ESSO), 2018: Madelaine contributed to the sampling design and development of the Sediment Sampling and Analysis Plan (SSAP), Water Sampling and Analysis Plan (WSAP) (including Rhodamine WT dye SAP) for four separate extensive offshore sampling program, including all HSE management, development of standard operating procedures and co-led field work planning.
> Tuncurry Slipway (NSW Department of Industry), 2018: Madelaine worked with Cardno's Ecological and Human Health Risk Assessor to determine risk of contaminants of interest identified in sediments, brackish and pore water, at the slipway, to ecological integrity and human health. This involved developing site specific criteria and toxicological profiles to assist in the assessment of risk.

> Kangaroo Management Plan (Gault), 2018: Madelaine led the field program for a kangaroo field survey in Wyndham Vale (Victoria) to identify the presence of the Grey Kangaroo and produced a Kangaroo Management Plan for the construction phase of the development works.

> Solar Farm Development Weed Survey (Downer), 2018: Madelaine conducted a weed survey across a 515 ha site area in rural Victoria, to identify noxious weed species to form part of a Weed Management Plan for the construction and operational phase of the project.

> Oil Spill Response Simulation (ESSO), 2017: Madelaine led Cardno's field team to undertake a simulation exercise assessing shoreline characteristics pre and post spill impact using custom designed mapping software packages capturing data in real time.

> Detailed Design of Artificial Reefs and Fish Attracting Devices (Northern Territory Department of Primary Industries and Resources), 2018: Madelaine provided input into the assessment of biological and behavioural constraints and opportunities for target species.

> Yarra River Sedimentation Study (Wesley College), 2018: Madelaine assisted in developing a SAP and undertook the sediment sampling for physico-chemical analysis to inform the long term dredge program.

> Preliminary Site Assessment (Great Barrier Reef Marine Park Authority), 2017: Madelaine contributed to a comprehensive review of existing technical information relating to the grounding of Shen Neng 1 to the southern portion of the Great Barrier Reef.

> Environmental Constraints Assessment (Cardinia Shire Council), 2018: Madelaine undertook a preliminary environmental assessments to determine the flora and fauna constraints and opportunities concerning the upgrade of seven intersections.

> Flora and Fauna Due Diligence Assessments (VicRoads), 2017: Madelaine undertook assessment of flora and fauna constraints and opportunities for proposed road upgrade works across sites in Victoria.

> Flora and Fauna Assessment (Fowlers Road), 2018: Madelaine authored the Flora and Fauna Management Plan for Upgrade works in a sensitive environment of West Dapto, New South Wales.

> ESdat chemical analysis and data management for various projects across the Business Unit. Some examples include Esso Marine Water and Sediment Monitoring, Sydney Airport East Upgrade Works, Bateman's Bay Groundwater Monitoring Event, Ultimo Remediation Validation, Loftus Street Contamination and Geotechnical Investigation, Tuncurry Slipway Remediation.

> Construction Environmental Management Plan (Blacktown International Sports Park), 2018: Madelaine prepared the CEMP for the construction works to upgrade the sports park.
> Tuncurry Slipway Remediation (NSW Department of Industry), 2017: Madelaine undertook the assessment of environmental factors for the remediation of known contamination and redesign at the Tuncurry slipway.

> Urban Greening Review of Best Practice (NSW Office of Environment and Heritage), 2016: Madelaine undertook a review of international best practice for mitigation of urban heat and developed key performance indicators for OEH to employ in their pilot studies.


> Alexandria to Moore Park Business Case (NSW Roads and Maritime Services), 2016: Madelaine was a primary author for the final business case.

> Western Distributor Design and Construct Tender (VIC FastFlow and Arup Joint Venture), 2016: Madelaine undertook the assessment of contamination within the project area, including the presence of acid sulfate soils and leachability potential of contaminants. A conceptual site model and environmental risk assessment was developed.

> Waste Classification Assessments (Citywide), 2016-2017: Madelaine has undertaken sampling and assessment of soils at various locations across Victoria to determine the chemical characteristics governing disposal options.

> Review of Environmental Factors (REF), 2016-2017: for various projects in New South Wales and Victoria. Madelaine has prepared REFs for numerous private and public sector clients assessing the potential environmental impacts and mitigation measures of projects.

> Orica Deer Park (Phase II/DSI). Madelaine worked on the review of soil and groundwater reports produced by Orica as part of a highly complex remediation of Deer Park, Victoria.

> Preliminary / Detailed Site Investigations (Phase I/PSI and Phase II/DSI) (various clients), 2016-2017: Madelaine has contributed to a range of contamination assessments from environmental data management (chemical results) to reporting.
Dr David Provis

Summary of Experience

David is a Senior Principal of Cardno with more than 35 years' experience in coastal oceanography including the design and execution of oceanographic field work, data analysis and numerical modelling. He is a corresponding member of the National Committee on Coastal and Ocean Engineering, of Engineers Australia and a member of the Victorian Coastal Council. David leads the Cardno Melbourne-based team in Coast, Ocean and the Environment. His experience includes marine meteorology and the application of measured data in numerical modelling. He has expertise in coastal oceanographic phenomena including dispersion and fate modelling in the coastal environment as well as coastal processes, navigation and port operations. His diverse experience across a range of specialty areas includes:

> Oceanographic instrumentation selection, deployment, mooring, design and ship-board operations;
> Analysis, interpretation and presentation of oceanographic data including tide and sea level analysis and application in climate-change scenarios;
> Use of numerical models in oceanography and the application of modelling in ports for design and operational issues;
> Use of oceanographic data and models to support planning and sea-level rise assessments;
> Preparation of environmental assessments on marine and related topics;
> Expert witness and peer reviewer on coastal and marine issues;
> Interpretation and modelling of sediment movement; and
> Conceptual design of coastal protection structures.

Significant Projects

> Channel Deepening Project, for Port of Melbourne Corporation: Project Manager and principal investigator for the Hydrodynamics, Sediment Transport and Water Quality Modelling and Coastal Engineering.
> Port of Hastings Development Authority, Hydrodynamics for planning and business case development of a potential major container port
> Bellarine Peninsula Corio Bay Local Coastal Hazard Assessment
> Investigation of vessel-generated waves for port operations
> Port Phillip Bay wave climate and sea-levels for coastal process studies
> BassGas Project, for Origin Energy Resources: Development of design criteria and marine, coastal and surface water input into the environmental impact assessment for offshore platform in Bass Strait and subsea pipeline to Victoria.
> Modelling and measurement of dredge plumes and advice on spoil-ground stability for both capital and maintenance dredging projects.
> Victorian Desalination Project: Team leader for oceanographic and dispersion modelling including functional design of the diffusers.
> Technical specialist, field measurement program, Browse Basin Nearshore and Offshore Field Measurement Program.
Summary of Experience

Nicole is an environmental management and sustainability professional with over 16 years’ experience in environmental and sustainability consulting and construction management. Prior to joining Cardno in October 2017 Nicole was Group Environmental & Sustainability Manager of one a Tier 1 construction firm.

Nicole’s professional expertise encompasses construction and infrastructure environmental management, infrastructure design and construction sustainability, approvals management, environmental impact assessment, and sustainability strategy and implementation. Her experience lies strongly in environmental and sustainability management associated with major civil infrastructure, including major pipeline and water infrastructure, and has carried out project work in Australia, New Zealand, the UK, Italy and Africa across a range of sectors.

Nicole has significant experience working on sustainability assessments, multi-criteria analyses and sustainability advisory on construction and infrastructure projects. In 2016 she was also a lead author of ISCA’s Developing a Business Case for Sustainability Initiatives in Infrastructure: A "How To" Guide.

She plays active roles in industry associations, and current and recent past affiliations include the ISCA Contractor’s Working Group (of which she was Co-Chair), ISCA Resource Advisory Group, United Nations Global Compact Network Australia, Australian Constructor’s Association (ACA) Sustainability Working Party, and Civil Contractors Federation (VIC) Environmental Management Committee. She is also a former Vice President of the Environmental Institute of Australia and New Zealand (EIANZ) Victoria Division.

Nicole was recently presented with the 2017 Individual Leadership in Infrastructure Sustainability Award from the Infrastructure Sustainability Council of Australia (ISCA).

Significant Projects:

> Western Program Alliance (part of Level Crossing Removal Project), Project Challenge Team and Internal Due Diligence (ISCA/Sustainability Lead), VIC

> Officer Partnership Project Integrated Infrastructure Solution Options Assessment, Sustainability Appraisal and Business Case Support, VIC

> Pristina Road Bypass Sustainability Appraisal, Multi-Criteria Analysis and Due Diligence for World Bank Funding, Kosovo

> City Rail Link - Contract 2 Enabling Works (including Stormwater Diversion), Project Sustainability Oversight, Advisory and ISCA Rating Challenge Team (Sustainability Lead), Auckland

> Gold Coast Light Rail Project, Sustainability Advisory and Management Oversight, QLD

> Environmental and Sustainability Management oversight of several construction projects including:
  - Roy Hill Iron Ore Marine Load Out Facility, WA
  - Army Bay Stormwater Outfall, Auckland
  - Port of Melbourne Port Capacity Project, VIC
  - Northern Has Pipeline, QLD/NT
Marcus Lincoln-Smith

Summary of Experience

Marcus has over 30 years’ experience in the field of aquatic ecology and environmental impact assessment, with extensive tertiary training and a wide practical knowledge of the aquatic flora and fauna occurring in numerous coastal, estuarine and freshwater habitats. Marcus has a high level of involvement in statistical design of ecological investigations and regularly undertakes design and implementation of aquatic sampling programs in aquatic ecosystems.

Marcus has undertaken numerous studies on tropical ecosystems in Australia and in the Pacific and Indian Oceans. His extensive experience with large projects for urban development, utilities, the oil and petroleum industry, and mining and extractive industries extends from the late 1980s. He has also participated in studies in relation to threatened aquatic species and aquatic reserves. Specific tasks have included design and implementation of baseline ecological studies, impact assessments, monitoring and provision of expert testimony in jurisdictions in New South Wales, Queensland, Victoria and Tasmania.

Throughout his career he has placed a strong emphasis on being able to communicate his research results and has sought to promote the importance of expanding our general understanding of aquatic ecosystems. He has also maintained close links with Australian universities, including Sydney University, Macquarie University, UTS, Newcastle University, UNSW, Queensland University and Bond University. These links have included collaborative studies, guest lectures, collaboration on scientific publications, careers’ advice and placement of students as volunteers or staff within Cardno.

Significant Projects

- Monitoring program development, implementation and reporting of environmental impacts of dredging operations on the Darwin marine environment as part of the Ichthys LNG Project for INPEX Operations Australia Pty Ltd. Marcus provided technical direction specifically related to water quality, fish health, recreational fishing and habitats including corals, seagrasses and mangroves.

- Ecological audit and surveys of biodiversity and introduced species for Mackay Marina. Work involved sampling water quality and diver-based inspections of the seabed, jetty piles and the inner wall of the Mackay harbour breakwall. Surveys included colonisation and growth of corals on harbour breakwaters, growth of algae and invertebrates on jetty piles and pontoons (including identification of pest species), seagrasses, fish and an inventory of debris.

- Sydney Port Corporation (Sydney Harbour studies and Botany Bay terminals) environmental assessments for dredging, beach nourishment/restoration and reclamation and monitoring including habitat mapping (mangroves, saltmarsh and seagrasses), surveys of fish (including Syngnathidae), benthos and water/sediment chemistry.

> Ecological studies for a large urban and commercial development and marina at Caboolture, SE Queensland, for Northeast Business Park Pty Ltd. This project included baseline mapping of estuarine habitats (mainly saltmarshes and mangroves) and surveys of water quality (including development of water quality baseline focusing on nutrients, pH, DO and turbidity), sediment chemistry, fish and invertebrates in Caboolture River and tidal creeks. Assisted with stakeholder consultation, preparation of the EIS for the project and responses to submissions on the EIS following exhibition.

> Site evaluation and environmental assessment of upgrade of the Shute Harbour Ferry Terminal, QLD. Engaged by Port Binnli Pty Ltd. Work involved site inspection and inventory of marine habitats (e.g. seagrasses, algae, corals) at the site of the existing terminal and preparation of a report assessing the likely impacts of the proposed upgrade.

> Review of evidence and expert advice on the ecological effects of the grounding of the La Pampa bulk carrier in Curtis Channel, Port of Gladstone. Engaged by lawyers Norton White (specialist shipping lawyers) on behalf of the Gladstone Port Authority to compile existing information and review statements on the effects of the grounding of a large bulk carrier. Issues related to marine habitats (corals, seagrasses, mangroves and saltmarshes) fisheries and conservation of the Great Barrier marine Park.

> Review of draft EIS for a proposed port development at Balaclava Island, at the entrance to the Fitzroy River, tropical Queensland. Engaged by Hansen Bailey consultants on behalf of Xstrata Coal to review marine ecology issues for a project involving dredging, reclamation and port construction and operation – impacts related to mangroves, soft sediments and nearshore corals.

> Expert advice and review of marine resources for the oil spill from the Pacific Adventurer, SE Queensland. Assessment of likely impacts on marine habitats primarily rock and coral reefs), marine resources and fisheries (predominantly offshore trawling and aquarium collecting on local reefs) due to extensive loss of fuel oil and cargo. On behalf of shipping company (Swire & Bayside Shipping).
Nathan Burmeister

Summary of Experience

Nathan Burmeister is a Principal Maritime Engineer with experience on port and coastal infrastructure projects throughout Australia. Nathan has experience in all phases of the project life cycle, including feasibility studies, concept and detailed design, and construction.

Nathan is on the National Committee on Coastal and Ocean Engineering (NCCOE) which is a specialist sub-committee of the Civil College within Engineers Australia.

Through his roles, Nathan has gained experience in maritime infrastructure design (jetties, wharves, pontoons, etc), port and marina planning, condition assessments, coastal engineering projects, dredging, navigation and mooring studies. Nathan has presented multiple papers on the topics of maritime planning and design to conference in Australia and abroad.

Significant Projects

- Eden Wave Screen (2018): Nathan was the project manager for a $20M wave screen in Eden working for Waterways Construction during the tender phase and Early Contractor involvement phases. The project is still ongoing.
- Fiji 3 Year Strategy (2018): Nathan is part of the study team for the 3 year strategy for Fiji Ports. The study includes strategy workshops with the board of directors, review of current operations and use of port planning tools.
- Footscray Wharf & Promenade (2018): Nathan was the project manager and design manager for the highly multidisciplinary Footscray Wharf and Promenade project which is to be a $12M-$18M investment by Maribyrnong City Council to redevelop a 500 m length of prime waterfront land.
- Nauru Port Development Project, Nauru (2016): Nathan is the design lead for an $80m AUD Port design project funded by the Asian Development Bank. Nathan undertake most of the detailed design works for this project.
- Shute Harbour Transit Facility Redevelopment Project, Queensland (2016): Nathan lead a study team across multiple investigations ultimately aimed at redeveloping the Transit Facility maritime infrastructure to meet current needs.
- Eden Wharf upgrade, New South Wales (2015): The 200-metre multi-purpose wharf and dual lane 560-metre long jetty required upgrade to accommodate a new ALHD vessel acquired by the Australian Defence Force. Nathan was involved in concept design and OPTIMOR mooring analysis for an option to install three large spacer fenders and mooring dolphins.
- Browse LNG project, James Price Point, Western Australia (2010-2012): Nathan was a member of the planning team for construction of maritime facilities for the Browse LNG project in Western Australia, and led a team of four engineers in designing a $200 million early offloading facility and achieving a significant reduction in its anticipated capital and operational costs.
Professional History

February 2016 – Current

Principal Maritime Engineer

Ports and Maritime, Cardno

> Multiple confidential cruise terminal feasibility studies
> Footscray Wharf and Promenade Detailed Design, Victoria (Client: Maribyrnong City Council)
> Eden Wave Screen D&C, NSW (Client: Waterways Construction)
> Snowy Hydro 2.0 (involvement confidential)
> Port Botany WSCAM condition assessments, NSW (Client: NSW Ports)
> Fiji Ports 3 year strategy, Fiji (Client: Fiji Ports Corporation Limited)
> Nauru Second Port detailed design, Nauru (Client: ADB)
> Short Rd Tug Facility D&C, Melbourne (Client: Geotechnical Engineering)
> Peer review of maritime structures condition assessments, Shute Harbour, Queensland (Client: Whitsunday Regional Council)
> Option Study, Shute Harbour Redevelopment Project, Queensland (Client: Whitsunday Regional Council)
> Condition assessment and physical investigations, Shute Harbour Redevelopment Project, Queensland (Client: Whitsunday Regional Council)
> Nelson Bay Boat Ramp Detailed Design of Repair Works, NSW (Client: DPI-Lands)
> Marine Outloading Facility Detailed Design of Upgrade Works, Half Tide Tug Harbour, Hay Point, Queensland (Client: North Queensland Bulk Ports)
> Advanced Condition Assessment in accordance with the Ports Australia Wharf Structure Condition Assessment Manual (WSCAM) for a 6 berth tug facility in Half Tide Tug Harbour, Hay Point, Queensland (Client: North Queensland Bulk Ports)
> Condition assessment and monitoring plan for coastal structures in Currumbin Creek, Gold Coast, QLD (Gold Coast City Council)
> Coastal Harbours (21 in total) condition assessment, NSW (Client: DPI-Lands)
> Concept options design for coastal protection infrastructure, Tassels Cove, Victoria (Client: Mornington Shire Council)
> Independent Certifier for Balmoral Quay Marina, VIC (Client: Department of Environment, Land, Water and Planning)
> Feasibility study, Point Sampson viewing platform and fishing jetty, Western Australia (Client: Karratha City Council)
> Condition assessment and detailed design, John's Creek Jetty Replacement, Point Sampson, Western Australia (Client: Karratha City Council)
> Detailed design, Renourishment of Hampton Beach, Victoria (Client: DELWP)
> Detailed design, Port Macquarie Wharf Replacement, NSW (Client DPI-Lands)
Maritime Engineer
Kellogg Brown and Root Pty Ltd (KBR), Melbourne

Nathan was a Maritime Engineer in KBR’s Ports and Maritime Group. His work included major infrastructure detailed design projects, concept and feasibility design, condition assessment, and coastal engineering projects.

> Detailed design and construction phase services, Burke Road, North Road, McKinnon Road and Centre Road level crossing removals, Victoria
> Berthing study, upgrade of the multi-purpose wharf at Eden, Twofold Bay, New South Wales
> Sediment budget and dredging study, Kananook Creek, Victoria
> Coastal Management Plan, Frankston City Council Municipal Coastline, Victoria
> Dredging study, Port Phillip and Western Port Maintenance Dredging, Victoria
> Erosion protection study, Otway and Surf Coast, Victoria
> Detailed design, relocation and modification of the Metropolitan Fire Brigade Marine Response Unit, Port of Melbourne, Victoria
> Investigation of storm damage, Port Phillip, Victoria
> Condition assessment, foreshore promenade, Beacon Cove, Victoria
> Concept development and feasibility study, Mordialloc Pier upgrade, Victoria
> Project management of upgrade of aids to navigation, Boating and Swimming Zones, East Port Phillip, Victoria
> Wave study, investigation of wave climate in Mordialloc Creek, Port Phillip, Victoria
> Detailed design, Station Pier rehabilitation, Port Melbourne, Victoria
> Temporary works design, Station Pier rehabilitation, Port Melbourne, Victoria
> Tender design, international container terminal, Webb Dock East, Port of Melbourne, Victoria
> Wharf load checks, Berth 10, Fremantle Port, Western Australia
> Detailed design, rehabilitation of piers at St Kilda, Dromana and Portarlington, Victoria
> Load rating, Eden Wharf, Twofold Bay, New South Wales
> Navigation studies, Webb Dock redevelopment, Port of Melbourne, Victoria
> Front-end engineering and design, Browse LNG project, James Price Point, Western Australia
> Preliminary design, Webb Dock precinct development, Port of Melbourne, Victoria
> Options study, marine piles options assessment, Port Phillip and Western Port, Victoria

Graduate Maritime Engineer
Hyder Consulting Pty Ltd

Nathan worked as a Maritime Engineer. His experience included the following projects:

> Tender design, oil and gas marine supply base, Darwin, Northern Territory
> Condition assessment of coastal protection assets, Victoria
> Condition assessment and load rating of maritime assets in Port Phillip and Western Port, Victoria
> Pipeline development framework, Darwin, Northern Territory
> Pre-feasibility study, East Arm Marine Precinct, Darwin, Northern Territory
> Condition assessment and load rating of Central Pier, Victoria
> Proof engineering, temporary cofferdam, Victoria
> Review of maritime facilities for disabled access, Victoria
> Site audits, disability access to bus stops, Victoria


**Reviewer:** Dr. David Provis

David is a Senior Principal of Cardno with more than 35 years' experience in coastal oceanography including the design and execution of oceanographic field work, data analysis and numerical modelling. He is a corresponding member of the National Committee on Coastal and Ocean Engineering, of Engineers Australia and was a member of the Victorian Coastal Council from 2015 - 2018. His experience includes marine meteorology and the application of measured data in numerical modelling. He has expertise in coastal oceanographic phenomena including currents, waves, sediment transport and dispersion and fate modelling in the coastal environment as well as coastal processes, navigation and port operations.

**Comments and Responses**

### Overall Assessment

Adequately meets requirements in present form

<table>
<thead>
<tr>
<th>Assessment Criteria</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Are the technical reasons for rejecting each siltation reduction solution valid?</td>
<td>Yes</td>
</tr>
<tr>
<td>3. Is the constraints analysis and are the conclusions reasonably accurate and justified?</td>
<td>Yes. There are some minor inconsistencies in the analysis, but these do not affect the overall analysis and conclusions, which are reasoned and valid.</td>
</tr>
</tbody>
</table>
Nicole Neal is an environmental management and sustainability professional with over sixteen years’ experience in consulting and construction management. Nicole’s expertise encompasses construction and infrastructure environmental management, construction sustainability, approvals management, environmental impact assessment, and sustainability strategy and implementation. In late 2017, Nicole received the ISCA Individual Leadership in Infrastructure Sustainability award. Her experience lies strongly in environmental and sustainability management associated with major civil infrastructure. In addition to her recent corporate roles, she has carried out project work in the UK, Italy, Australia and New Zealand across a range of sectors. She also has significant experience working on sustainability assessments, multi-criteria analyses and sustainability advisory on construction and infrastructure projects.

Nicole is a respected environmental and sustainability leader in Australian industry, with constructors, consultants, clients and regulators alike. Current and recent past industry associations include the ISCA Contractor’s Working Group (of which she was inaugural Co-Chair), ISCA Resources Advisory Group, and Australian Constructor’s Association (ACA) Sustainability Working Party. She is a former Vice President of the Environment Institute of Australia and New Zealand (EIANZ) Victorian Division.

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<td>Overview of findings</td>
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Adequately meets requirements in present form

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<tr>
<td>1 Are the technical reasons for rejecting each siltation reduction solution valid?</td>
<td>Technical reasons for rejecting the various siltation reduction solutions are well considered and reasonable.</td>
</tr>
<tr>
<td>2 Are the cost estimates for each siltation reduction solution reasonably accurate?</td>
<td>The basis for the development of the comparative costs seems sound and reasonably robust.</td>
</tr>
<tr>
<td>3 Is the constraints analysis and are the conclusions reasonably accurate and justified?</td>
<td>The constraints analysis and conclusions reached are relatively accurate and justified.</td>
</tr>
</tbody>
</table>
Reviewer: **Andrew Costen**

Andrew is a Principal Marine Scientist and Cardno’s dredge management practice leader. For the past 23 years, he has worked extensively for specialist science and engineering consultancies and Government environmental management agencies. Andrew has considerable experience in the design, capture and analysis of sediment and water quality data for dredging programs. He has also developed expertise in coordinating multidisciplinary studies required to support environmental impact assessments, approval applications and monitoring programs associated with dredging and dredged material management studies.

Andrew has a particular academic and professional interest in turbid water corals and the identification of impacts to tropical marine environments associated with dredging programs.

### Comments and Responses

#### Overview of findings

Adequately meets requirements in present form

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<td>Are the technical reasons for rejecting each siltation reduction solution valid?</td>
<td>Yes</td>
</tr>
<tr>
<td>Are the cost estimates for each siltation reduction solution reasonably accurate?</td>
<td>The cost estimates are considered sound</td>
</tr>
<tr>
<td>Is the constraints analysis and are the conclusions reasonably accurate and justified?</td>
<td>The approach is well considered and based on a structured approach to evaluate constraints. The results of this analysis considered sound and the results justified.</td>
</tr>
</tbody>
</table>
Madelaine Hooper is a multidisciplinary environmental scientist and economist with experience across a range of marine ecology, contamination assessments, resource management and environmental impact assessment projects.

Madelaine has experience with sample planning, implementation and management and well developed analytical, interpretative and technical reporting skills. Madelaine has undertaken ecological assessments for urban developments including roads and infrastructure development, marinas and landings. Madelaine has a sound understanding of environmental impact assessment processes, including appropriate risk management measures.

Madelaine has experience using behavioural economic theory in its application to competitive insurance markets and alternative insurance models. Madelaine is also has experience in non-market valuation techniques, triple bottom line and economic impact assessments.

### Assessment Criteria

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<tr>
<td>1 Are the technical reasons for rejecting each siltation reduction solution valid?</td>
<td>Technical reasoning for Section 5 Feasibility are valid and provide sufficient justification for suitability of each solution.</td>
</tr>
<tr>
<td>2 Are the cost estimates for each siltation reduction solution reasonably accurate?</td>
<td>Cost estimates of each solution are reasonably accurate and comparable. Breakdown of cost determination may aid in acceptability of data.</td>
</tr>
<tr>
<td>3 Is the constraints analysis and are the conclusions reasonably accurate and justified?</td>
<td>The constraints analysis and conclusions are reasonably accurate and justified and contain all the necessary inputs and considerations to draw justifiable conclusions. Incorporating an overarching table for simple comparison of impacts and opportunities of each solution would aid in understanding.</td>
</tr>
</tbody>
</table>
Madelaine Hooper is a multidisciplinary environmental scientist and economist with experience across a range of marine ecology, contamination assessments, resource management and environmental impact assessment projects. Madelaine has experience with sample planning, implementation and management and well developed analytical, interpretative and technical reporting skills. Madelaine has undertaken ecological assessments for urban developments including roads and infrastructure development, marinas and landings. Madelaine has a sound understanding of environmental impact assessment processes, including appropriate risk management measures. Madelaine has experience using behavioural economic theory in its application to competitive insurance markets and alternative insurance models. Madelaine is also has experience in non-market valuation techniques, triple bottom line and economic impact assessments.

**Overview of findings**

Adequately meets requirements in present form

**Minor Comments**

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>1 Is the analysis method robust and adequate to identify reuse options and analyse their opportunity, feasibility and achievability?</td>
<td>Analysis method is detailed and robust with each reuse option explored equally. The opportunities, feasibility and achievability of each option is discussed in detail.</td>
</tr>
<tr>
<td>2 Have all reasonable alternative options for use of the dredge material been identified? If not, are there any reasonable alternative options that have not been identified?</td>
<td>All reasonable options for re-use appear to have been explored.</td>
</tr>
<tr>
<td>3 Have all the relevant performance criteria been considered and are they sufficiently measurable?</td>
<td>Performance criteria appears to be included and sufficiently measurable.</td>
</tr>
<tr>
<td>4 Does the beneficial reuse analysis of each reuse option accurately determine a level of performance for each performance criteria? and is the level of performance reasonably supported? Is there alternative credible evidence that would support an alternative level of performance for each performance criteria?</td>
<td>Yes, the re-use analysis is reasonably accurate and performance supported. I do not consider that additional evidence would modify the results provided by the authors.</td>
</tr>
<tr>
<td>5 Are the costs (financial and time) stated reasonably accurate?</td>
<td>Financial costs have been determined, however appear to be very approximate in nature. More robust financial costings, including time and risk elements, would assist in determining accuracy.</td>
</tr>
</tbody>
</table>
**Expert Review and Assessment** - Comprehensive Beneficial Reuse Assessment - Appendix I, SSM

**Reviewer:** Andrew Costen

Andrew is a Principal Marine Scientist and Cardno’s dredge management practice leader. For the past 23 years, he has worked extensively for specialist science and engineering consultancies and Government environmental management agencies. Andrew has considerable experience in the design, capture and analysis of sediment and water quality data for dredging programs. He has also developed expertise in coordinating multidisciplinary studies required to support environmental impact assessments, approval applications and monitoring programs associated with dredging and dredged material management studies.

Andrew has a particular academic and professional interest in turbid water corals and the identification of impacts to tropical marine environments associated with dredging programs.

**Comments and Responses**

**Overview of findings**

Adequately meets requirements in present form

**Assessment Criteria**

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<tbody>
<tr>
<td>1</td>
<td>Is the analysis method robust and adequate to identify reuse options and analyse their opportunity, feasibility and achievability?</td>
<td>Yes. The authors have used an standard approach to identifying re-use options and analysing performance (based on US Army Corp of Engineers methods and the waste hierarchy).</td>
</tr>
<tr>
<td>2</td>
<td>Have all reasonable alternative options for use of the dredge material been identified? If not, are there any reasonable alternative options that have not been identified?</td>
<td>Yes. The authors have considered an extensive suite of options to beneficially re-use the dredged material – all within a best practice framework to evaluate performance.</td>
</tr>
<tr>
<td>3</td>
<td>Have all the relevant performance criteria been considered and are they sufficiently measurable?</td>
<td>Yes. The performance criteria are adequate, with a well-considered approach that allows performance to be measured (for each criterion and as a total).</td>
</tr>
<tr>
<td>4</td>
<td>Does the beneficial reuse analysis of each reuse option accurately determine a level of performance for each performance criteria? And is the level of performance reasonably supported? Is there alternative credible evidence that would support an alternative level of performance for each performance criteria?</td>
<td>Yes, the analysis allows each re-use option to be considered against each criterion and as a function of total performance. Yes, the results are supported by credible data. No</td>
</tr>
<tr>
<td>5</td>
<td>Are the costs (financial and time) stated reasonably accurate?</td>
<td>Cost estimates are reasonably accurate (in the context of the aims and objectives of the SSM). Assumptions are considered and clear.</td>
</tr>
</tbody>
</table>
Nicole Neal is an environmental management and sustainability professional with over sixteen years’ experience in consulting and construction management. Nicole’s expertise encompasses construction and infrastructure environmental management, construction sustainability, approvals management, environmental impact assessment, and sustainability strategy and implementation. In late 2017, Nicole received the ISCA Individual Leadership in Infrastructure Sustainability award. Her experience lies strongly in environmental and sustainability management associated with major civil infrastructure. In addition to her recent corporate roles, she has carried out project work in the UK, Italy, Australia and New Zealand across a range of sectors. She also has significant experience working on sustainability assessments, multi-criteria analyses and sustainability advisory on construction and infrastructure projects. Nicole is a respected environmental and sustainability leader in Australian industry, with constructors, consultants, clients and regulators alike. Current and recent past industry associations include the ISCA Contractor’s Working Group (of which she was inaugural Co-Chair), ISCA Resources Advisory Group, and Australian Constructor’s Association (ACA) Sustainability Working Party. She is a former Vice President of the Environment Institute of Australia and New Zealand (EIANZ) Victorian Division.

### Comments and Responses

#### Overview of findings

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<tr>
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<tbody>
<tr>
<td>1. Is the analysis method robust and adequate to identify reuse options and analyse their opportunity, feasibility and achievability?</td>
<td>Yes, identifying sediment properties before then moving onto identify appropriate sediment disposal options is sensible. The subsequent analysis method is broad ranging, detailed and robust, with a good number of performance criteria taken into consideration. The performance evaluation criteria table provides adequate and clear definition as to what constitutes high, medium and low performance for each of the criteria.</td>
</tr>
<tr>
<td>2. Have all reasonable alternative options for use of the dredge material been identified? If not, are there any reasonable alternative options that have not been identified?</td>
<td>Yes, all reasonable alternatives for the nature of the dredge material appear to have been identified here.</td>
</tr>
<tr>
<td>3. Have all the relevant performance criteria been considered and are they sufficiently measurable?</td>
<td>Yes, good coverage of relevant performance criteria, all of which are sufficiently measurable. Potential to consider OH&amp;S aspects of the various options also.</td>
</tr>
<tr>
<td>4. Does the beneficial reuse analysis of each reuse option accurately determine a level of performance for each performance criteria and is the level of performance reasonably supported? Is there alternative credible evidence that would support an alternative level of performance for each performance criteria?</td>
<td>Yes, the beneficial reuse analysis of each reuse options appears to relatively accurately determine a level of performance for each criteria, with information provided as to the determination of that level. No.</td>
</tr>
<tr>
<td>5</td>
<td>Are the costs (financial and time) stated reasonably accurate?</td>
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</table>
ANNEX E
RESPONSES – SSM: APPENDIX K
Madelaine Hooper is a multidisciplinary environmental scientist and economist with experience across a range of marine ecology, contamination assessments, resource management and environmental impact assessment projects.

Madelaine has experience with sample planning, implementation and management and well developed analytical, interpretative and technical reporting skills. Madelaine has undertaken ecological assessments for urban developments including roads and infrastructure development, marinas and landings. Madelaine has a sound understanding of environmental impact assessment processes, including appropriate risk management measures.

Madelaine has experience using behavioural economic theory in its application to competitive insurance markets and alternative insurance models. Madelaine is also has experience in non-market valuation techniques, triple bottom line and economic impact assessments.

Comments and Responses

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<tbody>
<tr>
<td>1 Are the costs (financial and time) stated, responsibly accurate?</td>
<td>Reviewed Appendix D to Appendix K costs expressed as ROM. Using ROM is entirely suitable for the current stage in the project lifecycle.</td>
</tr>
<tr>
<td>2 Does the report provide reasonably sufficient evidence to support its conclusions / costs?</td>
<td>As above.</td>
</tr>
<tr>
<td>3 Are the greenhouse gas emissions reasonably accurate</td>
<td>Not assessed by this reviewer</td>
</tr>
</tbody>
</table>
Reviewer: Nathan Burmeister

Nathan Burmeister is a Principal Maritime Engineer with experience on port and coastal infrastructure projects throughout Australia. Nathan has experience in all phases of the project life cycle, including feasibility studies, concept and detailed design, and construction.

Nathan is on the National Committee on Coastal and Ocean Engineering (NCCOE), which is a specialist sub-committee of the Civil College within Engineers Australia.

Nathan has experience in maritime infrastructure design (jetties, wharves, pontoons, etc), port and marina planning, condition assessments, coastal engineering projects, dredging, navigation and mooring studies. Nathan has presented multiple papers on the topics of maritime planning and design to conference in Australia and abroad. Nathan has also acted as an expert witness for lawyers and insurers in matters of maritime structural engineering.

Overview of findings

Adequately meets requirements in present form

Assessment Criteria | Response
--- | ---
1. Are the costs (financial and time) stated, reasonably accurate? | The costs are noted in the report to be ‘rough order of magnitude’ costs. They are stated to be for the purpose of option comparison. To that end, the costs themselves cannot be considered accurate, however the costing approach may be considered “reasonably accurate” considering the task at hand. It is my opinion that even with a more mature design and more accurate estimating approach, it is likely that the capital cost based conclusions would remain largely the same, e.g. that the onshore options are less capital intensive than the reclamation options. The conclusions are therefore reasonable.

2. Does the report provide reasonably sufficient evidence to support its conclusions / costs? | Evidence is adequate. See last paragraph form criterion 1.

3. Are the greenhouse gas emissions reasonably accurate | Not assessed by this reviewer
Reviewer: **Nicole Neal**

Nicole Neal is an environmental management and sustainability professional with over sixteen years’ experience in consulting and construction management. Nicole’s expertise encompasses construction and infrastructure environmental management, construction sustainability, approvals management, environmental impact assessment, and sustainability strategy and implementation. In late 2017, Nicole received the ISCA Individual Leadership in Infrastructure Sustainability award. Her experience lies strongly in environmental and sustainability management associated with major civil infrastructure. In addition to her recent corporate roles, she has carried out project work in the UK, Italy, Australia and New Zealand across a range of sectors. She also has significant experience working on sustainability assessments, multi-criteria analyses and sustainability advisory on construction and infrastructure projects. Nicole is a respected environmental and sustainability leader in Australian industry, with constructors, consultants, clients and regulators alike. Current and recent past industry associations include the ISCA Contractor’s Working Group (of which she was inaugural Co-Chair), ISCA Resources Advisory Group, and Australian Constructor’s Association (ACA) Sustainability Working Party. She is a former Vice President of the Environment Institute of Australia and New Zealand (EIANZ) Victorian Division.

Comments and Responses

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<tr>
<td>1 Are the costs (financial and time) stated, reasonably accurate?</td>
<td>The costs outlined in Appendix D and Table 11 seem relatively reasonable</td>
</tr>
<tr>
<td>2 Does the report provide reasonably sufficient evidence to support its conclusions / costs?</td>
<td>Other assumptions in terms of activities, operations, materials volumes and so on are reasonably well outlined.</td>
</tr>
<tr>
<td>3 Are the greenhouse gas emissions reasonably accurate?</td>
<td>GHG Protocol method was used to calculate likely GHG emissions, and this is one of the robust “best practice” methodologies to use in these types of calculations. The calculations and resulting GHG emissions figures are therefore considered reasonably sufficient to support the conclusions.</td>
</tr>
</tbody>
</table>
Andrew is a Principal Marine Scientist and Cardno’s dredge management practice leader. For the past 23 years, he has worked extensively for specialist science and engineering consultancies and Government environmental management agencies. Andrew has considerable experience in the design, capture and analysis of sediment and water quality data for dredging programs. He has also developed expertise in coordinating multidisciplinary studies required to support environmental impact assessments, approval applications and monitoring programs associated with dredging and dredged material management studies. Andrew has a particular academic and professional interest in turbid water corals and the identification of impacts to tropical marine environments associated with dredging programs.

### Comments and Responses

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<tr>
<td>1 Is the structured decision making process appropriate for the comparative analysis of various dredge material disposal strategies?</td>
<td>Yes. The review team considers that the approach used for the comparative analysis of dredge material disposal strategies provides a robust and transparent process for assessing disparate measures.</td>
</tr>
<tr>
<td>2 Is the decision making process legitimate and transparent with the results for each material disposal strategy supported by accurate and factual evidence?</td>
<td>Yes.</td>
</tr>
<tr>
<td>3 In Step 2, have all the appropriate Themes been identified and have all appropriate Objectives and Measures been developed to measure the performance of alternative options against?</td>
<td>Yes, the assessment spanned a comprehensive list of categories: environmental, cultural heritage, economics, and port operations, health and safety, social values, innovation and world heritage. The objectives are clearly articulated.</td>
</tr>
<tr>
<td>4 In Step 4 are the units of measure used to determine the performance score/measure for each objective supported by evidence and accurate relative to the evidence provided (see Appendix B of this Appendix)? Is there any alternative credible evidence that could be reasonably used to derive a significantly different performance score/measure for each Objective?</td>
<td>Yes. The scoring system is logical and easily understood. Evidence is provided in the document to substantiate conclusions (see assumptions / qualifications). Noting the robustness of the approach and evidence cited, the report addresses the requirements and is more than adequate.</td>
</tr>
<tr>
<td>5 In Step 5, is the process of applying normalised scores and weighted scores a credible process that can be used to compare the performance of each strategy without introducing bias?</td>
<td>Yes, the process is logical and transparent. While there is always the opportunity to introduce bias, the stakeholder engagement and the application of a sensitivity analysis significantly reduces likelihood (in this study).</td>
</tr>
<tr>
<td><strong>In the development of the combined options, have any reasonably viable long term combined options been left out?</strong></td>
<td>No, the approach has considered a 25 year planning horizon, which is considered reasonable.</td>
</tr>
<tr>
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</tr>
<tr>
<td><strong>Are the conclusions reasonably supported by evidence within the document?</strong></td>
<td>Yes. The conclusions are based on a broad range of evidence provided in the report. Please note that not all evidence was cited as this review was limited to 4 appendices only. See qualifications/ assumptions.</td>
</tr>
</tbody>
</table>

Note: Step 3 of Appendix B is covered by the peer review of Appendix I.
Review: Dr. David Provis

David is a Senior Principal of Cardno with more than 35 years' experience in coastal oceanography including the design and execution of oceanographic field work, data analysis and numerical modelling. He is a corresponding member of the National Committee on Coastal and Ocean Engineering, of Engineers Australia and was a member of the Victorian Coastal Council from 2015 - 2018. His experience includes marine meteorology and the application of measured data in numerical modelling. He has expertise in coastal oceanographic phenomena including currents, waves, sediment transport and dispersion and fate modelling in the coastal environment as well as coastal processes, navigation and port operations.

Comments and Responses

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<tr>
<td>1. Is the structured decision making process appropriate for the comparative analysis of various dredge material disposal strategies?</td>
<td>Yes. The method provides a robust and transparent process for assessing disparate measures and allowing for a range of options.</td>
</tr>
<tr>
<td>2. Is the decision making process legitimate and transparent with the results for each material disposal strategy supported by accurate and factual evidence?</td>
<td>Have not reviewed all supporting documents and thus cannot certify the accuracy of the evidence used. However, the assessment is consistent with experience from other similar dredging projects. The decision-making process is transparent, when considered in conjunction with the sensitivity analysis, although this analysis is relatively coarse and only considers variation in weighting of one criteria at a time. It does not consider the combined variability in weighting of variables. It is unlikely that this would change the outcomes and would require significantly more subjective judgement of weighting linkages.</td>
</tr>
<tr>
<td>3. In Step 2, have all the appropriate Themes been identified and have all appropriate Objectives and Measures been developed to measure the performance of alternative options against?</td>
<td>Yes, the selected themes cover the range of issues. The objectives and measures are robust and also cover the range of relevant issues. The process used to derive these, based on stakeholder engagement, is unlikely to miss any significant issues.</td>
</tr>
<tr>
<td>4. In Step 4 are the units of measure used to determine the performance score/measure for each objective supported by evidence and accurate relative to the evidence provided (see Appendix B of this Appendix)?</td>
<td>The measures selected are able to be supported by evidence and this process has been followed. The innovation performance measure potentially introduces an element of risk due to the “untried” nature of innovative solutions. This could be included more explicitly. However, it is not likely to result in any change in the overall outcome.</td>
</tr>
<tr>
<td></td>
<td>In Step 5, is the process of applying normalised scores and weighted scores a credible process that can be used to compare the performance of each strategy without introducing bias? In the development of the combined options, have any reasonably viable long term combined options been left out?</td>
</tr>
<tr>
<td>6</td>
<td>Are the conclusions reasonably supported by evidence within the document?</td>
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Note: Step 3 of Appendix B is covered by the peer review of Appendix I
Madelaine Hooper is a multidisciplinary environmental scientist and economist with experience across a range of marine ecology, contamination assessments, resource management and environmental impact assessment projects. Madelaine has experience with sample planning, implementation and management and well developed analytical, interpretative and technical reporting skills. Madelaine has undertaken ecological assessments for urban developments including roads and infrastructure development, marinas and landings. Madelaine has a sound understanding of environmental impact assessment processes, including appropriate risk management measures. Madelaine has experience using behavioural economic theory in its application to competitive insurance markets and alternative insurance models. Madelaine is also has experience in non-market valuation techniques, triple bottom line and economic impact assessments.

**Comments and Responses**

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<tbody>
<tr>
<td>1. Is the structured decision making process appropriate for the comparative analysis of various dredge material disposal strategies?</td>
<td>Yes on the whole the structured decision making methodology is clear and appropriate for the objectives of the SSM. Where potential for improvements exist, these are detailed below.</td>
</tr>
<tr>
<td>2. Is the decision making process legitimate and transparent with the results for each material disposal strategy supported by accurate and factual evidence?</td>
<td>The decision making process identified is a simple and legitimate method for evaluating competing interests and is appropriate for this comparative analysis of various dredge material disposal strategies. Determining accuracy is difficult to ascertain in isolation without express consideration of supporting information used as inputs to Appendix B and without some technical references, it is difficult to provide a determination of factual accuracy.</td>
</tr>
</tbody>
</table>
| 3. In Step 2, have all the appropriate Themes been identified and have all appropriate Objectives and Measures been developed to measure the performance of alternative options against? | Most of the appropriate themes have been identified. Stakeholder involvement as the basis for objectives worked toward ensuring key themes were all identified and informs part of a good assessment. Some themes that could have been evaluated include:  
  - Net environmental benefits (particularly in light of the inclusion of Objective 10)  
  - Benthic environmental impacts (to be expressed in Objective 1)  
  - Establishment costs and maintenance costs divided into separate financial measures  
  - Monitoring, reporting and permit implications (as these represent a time and cost factor for options). |
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| 4 | In Step 4 are the units of measure used to determine the performance score/measure for each objective supported by evidence and accurate relative to the evidence provided (see Appendix B of this Appendix)? Is there any alternative credible evidence that could be reasonably used to derive a significantly different performance score/measure for each Objective? | - Port innovation (Objective 10) is not objectively a ‘key theme’, particularly in the absence of including other innovation objectives (i.e. environmental innovation, social innovation, and health and safety innovations). Including Objective 10 without other theme-centric innovations can lead to potentially skewing the decision process.  
- The methodology to determine the numerically defined units of measure is not explicitly stated and would provide greater understanding if this was stated during discussion.  
- The derivation of normalised scores is clear and technically accurate.  
- The raw scores are only based on a narrow range (0-3) and do not allow for much variation in evaluation. |
| 5 | In Step 5, is the process of applying normalised scores and weighted scores a credible process that can be used to compare the performance of each strategy without introducing bias? In the development of the combined options, have any reasonably viable long term combined options been left out? | - Yes the process followed in Step 5 is both accurate and allows for comparison of options without bias.  
- Raw scores – Not abundantly clear how the raw scores were assumed and the performance score ranges.  
- Normalising scores – adequate  
- Weighting scores – adequate  
- Sensitivity analysis – Unclear how sensitivity analysis considered independent variables. |
| 6 | Are the conclusions reasonably supported by evidence within the document? | Yes the conclusions are reasonable given the evidence provided. Overall an assessment that satisfies the objectives of the SSM. |

*Note: Step 3 of Appendix B is covered by the peer review of Appendix I*
Reviewer: **Nicole Neal**

Nicole Neal is an environmental management and sustainability professional with over sixteen years’ experience in consulting and construction management. Nicole’s expertise encompasses construction and infrastructure environmental management, construction sustainability, approvals management, environmental impact assessment, and sustainability strategy and implementation. In late 2017 Nicole was honoured to receive the ISCA Individual Leadership in Infrastructure Sustainability award. Her experience lies strongly in environmental and sustainability management associated with major civil infrastructure. In addition to her recent corporate roles, she has carried out project work in the UK, Italy, Australia and New Zealand across a range of sectors. She also has significant experience working on sustainability assessments, multi-criteria analyses and sustainability advisory on construction and infrastructure projects.

Nicole is a well-known and respected environmental and sustainability leader in Australian industry, with constructors, consultants, clients and regulators alike. Current and recent past industry associations include the ISCA Contractor’s Working Group (of which she was inaugural Co-Chair), ISCA Resources Advisory Group, and Australian Constructor’s Association (ACA) Sustainability Working Party. She is a former Vice President of the Environment Institute of Australia and New Zealand (EIANZ) Victorian Division.

### Comments and Responses

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<tr>
<td>1 Is the structured decision making process appropriate for the comparative analysis of various dredge material disposal strategies?</td>
<td>The “Principles of Structured Decision Making” process is an entirely appropriate and robust methodology for the comparative analysis of the various dredge material disposal options presented. This is of particular note from a sustainability/ Triple Bottom Line perspective, with consideration of the interplay between then social, economic and environmental aspects together. The non-linear, iterative approach is noted and commended.</td>
</tr>
<tr>
<td>2 Is the decision making process legitimate and transparent with the results for each material disposal strategy supported by accurate and factual evidence?</td>
<td>The decision making process is entirely legitimate and transparent from a sustainability (Triple Bottom Line) perspective for each of the disposal options. Evidence presented. Evidence is referred to in document, but references not sighted or reviewed in this Peer Review, therefore no comment as to the robustness or appropriateness of that evidence can be given.</td>
</tr>
<tr>
<td>3 In Step 2, have all the appropriate Themes been identified and have all appropriate Objectives and Measures been developed to measure the performance of alternative options against?</td>
<td>Yes, appropriate key themes have been identified across environmental, social and economic considerations. May have wanted to also consider potential for contamination issues associated with introduction of material to land, potential for contamination from vessels, and potential for other environmental impacts from vessels (i.e. contact with reef).</td>
</tr>
<tr>
<td></td>
<td>In Step 4 are the units of measure used to determine the performance score/measure for each objective supported by evidence and accurate relative to the evidence provided (see Appendix B of this Appendix)? Is there any alternative credible evidence that could be reasonably used to derive a significantly different performance score/measure for each Objective?</td>
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Note: Step 3 of Appendix B is covered by the peer review of Appendix I
About Cardno

Cardno is a professional infrastructure and environmental services company, with expertise in the development and improvement of physical and social infrastructure for communities around the world. Cardno’s team includes leading professionals who plan, design, manage and deliver sustainable projects and community programs. Cardno is an international company listed on the Australian Securities Exchange [ASX:CDD].

Contact

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