GOVERNMENT OF WESTERN AUSTRALIA

Environmental Protection Authority

EPA REFERRAL FORM

Referral of a Proposal to the Environmental Protection Authority under Section 38 of the *Environmental Protection Act 1986*.

PURPOSE OF THIS FORM

Section 38 of the *Environmental Protection Act 1986* (EP Act) makes provision for the referral to the Environmental Protection Authority (EPA) of a proposal (significant proposals, strategic proposals and proposals under an assessed scheme) by a proponent, a decision making authority (DMA), or any other person.

The purpose of this form is to ensure that EPA has sufficient information about a proposal to make a decision about the nature of the proposal and whether or not the proposal should be assessed under Part IV of the EP Act. Information provided in the referral form must be brief (no more than 30 pages), sharp and succinct to achieve the purposes of this form.

This form does not prevent the referrer from providing a supplementary referral report. Should a referrer choose to submit a supplementary referral report please ensure the following.

i. Information is short, sharp and succinct.
ii. Attachments are below eight megabytes (8 MB) as they will be published on the EPA's website (exemptions apply) for public comment. To minimise file size, "flatten" maps and optimise pdf files.
iii. Cross-references are provided in the referral form to the appropriate section/s in the supplementary referral report.

This form is to be used for all proposals[1] which can be referred to the EPA under section 38 of the EP Act; i.e. referrals from: **proponents** of proposals (significant proposals, strategic proposals, derived proposals, proposals under an assessed scheme); **DMAs** (significant proposals); and **third parties** (significant proposals).

This form is divided into several sections, including; Referral requirements and Declaration; Part A - Information of the proposal and proponent; and Part B Environmental Factors. Guidance on successfully completing this form is provided throughout the form and is also available in the EPA's *Environmental Assessment Guideline for Referral of a Proposal under s38 of the EP Act (EAG 16)*.

Send completed forms to
Office of the Environmental Protection Authority
Locked Bag 10, East Perth WA 6892

or

Email: Registrar@epa.wa.gov.au

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Office of the Environmental Protection Authority
18 APR 2016

Enquiries
Office of the Environmental Protection Authority

[1] Please note that this form consolidates and replaces the following forms: *Referral of a Proposal by the Proponent to the EPA under section 38(1) of the EP Act*; *Referral of a Proposal by a third party to the EPA under section 38(1) of the EP Act*; and *Referral of a development proposal to the EPA by the decision making authority*.

Referral requirements and Declaration

The following section outlines the referral information required from a proponent, decision making authority and third party.

(a) Proponents

Proponents are expected to complete all sections of the form and provide GIS spatial data to enable the EPA to consider the referral. Spatial GIS data is necessary to inform the EPA's decision.

The EPA expects that a proponent will address Part B of the form as thoroughly as possible to demonstrate whether or not the EPA's objectives for environmental factors can be met.

If insufficient information is provided the EPA will request more information and processing of the referral will commence once the information is provided or the EPA decides to make a precautionary determination on the available information.

Proponent to complete before submitting form	
Completed all the questions in Part A (essential)	☒ Yes ☐ No
Completed all the questions in Part B	☒ Yes ☐ No
Completed all other applicable questions	☒ Yes ☐ No
Included Attachment 1 – any additional document(s) the proponent wishes to provide	☒ Yes ☐ No
Included Attachment 2 – confidential information (if applicable)	☐ Yes ☒ No
Enclosed an electronic copy of all referral information, including spatial data and contextual mapping but clearly separating any confidential information	☒ Yes ☐ No
Completed the Declaration	☒ Yes ☐ No
What is the type of proposal being referred? ** a referred proposal seeking to be declared a derived proposal*	☒ significant ☐ strategic ☐ derived* ☐ under an assessed scheme
Do you consider the proposal requires formal environmental impact assessment?	☐ Yes ☒ No
If yes, what level of assessment? *API = Assessment of Proponent Information* *PER = Public Environmental Review*	☐ API Category A ☐ API Category B ☐ PER

NB: The EPA may apply an Assessment on Proponent Information (API) level of assessment when the proponent has provided sufficient information about:

- the proposal;
- the proposed environmental impacts;
- the proposed management of the environmental impacts; and
- when the proposal is consistent with API criteria outlined in the *Environmental Impact Assessment (Part IV Division 1 and 2) Administrative Procedures 2012*.

If an API A formal level of assessment is considered appropriate, please refer to Environmental Assessment Guideline No. 14 *Preparation for an Assessment on Proponent Information (Category A) Environmental Review Document EAG 14* (EAG14).

Declaration

I, IAN MCMILLAN, *(full name)* declare that I am authorised on behalf of BAE SYSTEMS (being the person responsible for the proposal) to submit this form and further declare that the information contained in this form is true and not misleading.

Signature	Ian McMillan	Name (print)	IAN MCMILLAN
Position	General Manager, Henderson Facility	Organisation	BAE Systems Australia Ltd
Email	Ian.McMillan@baesysstems.com		
Address	42	Quill Way	
	HENDERSON	WA	6166
Date	13-4-16		

(b) Decision-making authority

The EPA expects decision-making authorities to complete applicable sections of Part A of the form and provide the proponent an opportunity to provide additional information in Part B of the form where appropriate.

Wherever possible the DMA should obtain relevant spatial information from the proponent and provide this to the EPA with the referral.

DMA to complete before submitting form	
Completed all the questions in Part A (essential)	☐ Yes ☐ No
Provided Part B to the proponent for completion	☐ Yes ☐ No
Completed all other applicable questions	☐ Yes ☐ No
Included Attachment 1 – any supporting information	☐ Yes ☐ No
Enclosed an electronic copy of all referral information, including spatial data and contextual mapping	☐ Yes ☐ No
Completed the below Declaration	☐ Yes ☐ No
Do you consider the proposal requires formal environmental impact assessment?	☐ Yes ☐ No
What is the type of proposal being referred?	☐ significant proposal ☐ significant proposal under an assessed scheme

Declaration

I, ..., *(full name)* submit this referral to the EPA for consideration of the environmental significance of its impacts.

Signature		Name (print)	
Position		Organisation	
Email			
Address			
Date			

(c) Third Party

Third parties are asked to have consideration for the Significance Test outlined in Part A Section 1.5 of this form before referring a significant proposal to the EPA. The EPA will only consider proposals that are likely, if implemented, to have a significant effect on the environment.

Third parties are to provide sufficient information to clearly identify the significant proposal, the proponent, and their reasons for referring the proposal. This can be done by completing as much of Part A of the form as possible, taking into consideration the information available. Third parties may wish to fill in Part B of the form to advance their own views of the significance of the environmental impacts and the need for EPA assessment.

In most cases the EPA will seek additional information from the proponent. This will be to confirm or amend the identity of the proponent, the proposal, and to allow the proponent opportunity to provide its views on the significance of the environmental impacts and the need for EPA assessment.

Third Party to complete before submitting form	
Complete all applicable questions in Part A and B	☐ Yes ☐ No
Completed the Declaration	☐ Yes ☐ No
Do you consider the proposal requires formal environmental impact assessment?	☐ Yes ☐ No

Declaration

I, ..., *(full name)* submit this referral to the EPA for consideration of the environmental significance of its impacts.

Signature	Name (print)		
Email			
Position			
Address			
Date			

PART A: Information on the proposal and the proponent

All fields of Part A must be completed by the proponent and/or decision-making authority for this document to be processed as a referral. Third party referrers are only expected to fill in the fields they have information for.

1 PROPONENT AND PROPOSAL DESCRIPTION

1.1 The proponent of the proposal

Proponent and/or DMA to complete	
Name of the proponent	BAE Systems Australia Ltd
Joint Venture parties (if applicable)	
Australian Company Number(s)	ABN: 29 008 423 005
Postal Address *(Where the proponent is a corporation or an association of persons, whether incorporated or not, the postal address is that of the principal place of business or of the principal office in the State)*	42 Quill Way HENDERSON WA 6166
Key proponent contact for the proposal *Please include: name; physical address; phone; and email.*	Jonathan Keith Facilities Project Manager BAE Systems Australia 42 Quill Way HENDERSON WA 6166 Tel: 6399 3000 Email: jonathan.keith@baesystems.com
Consultant for the proposal (if applicable) *Please include: name; physical address; phone; and email.*	

1.2 Proposal

Proposal is defined under the EP Act to mean a "project, plan, programme policy, operation, undertaking or development or change of land use, or amendment of any of the foregoing, but does not include scheme". Before completing this section please refer to Environmental Protection Bulletin 17 – Strategic and derived proposals (EPB 17) and Environmental Assessment Guideline for Defining the Key Characteristics of a proposal (EAG 1).

Proponent and/or DMA to complete	
Title of the proposal	Henderson Facility dredging
What project phase is the proposal at?	☐ Scoping ☐ Feasibility ☐ Detailed design ☒ Other Project tendering phase
Proposal type *More than one proposal type can be identified, however for filtering purposes it is recommended that only the primary proposal type is identified.*	☐ **Power/Energy Generation** ☐ Hydrocarbon Based – coal ☐ Hydrocarbon Based – gas ☐ Waste to energy ☐ Renewable – wind ☐ Renewable – wave

Proponent and/or DMA to complete	
	☐ Renewable – solar ☐ Renewable – geothermal ☐ **Mineral / Resource Extraction** ☐ Exploration – seismic ☐ Exploration – geotechnical ☐ Development ☐ **Oil and Gas Development** ☐ Exploration ☐ Onshore – seismic ☐ Onshore – geotechnical ☐ Onshore – development ☐ Offshore – seismic ☐ Offshore – geotechnical ☐ Offshore – development ☐ **Industrial Development** ☐ Processing ☐ Manufacturing ☐ Beneficiation ☐ **Land Use and Development** ☐ Residential – subdivision ☐ Residential – development ☐ Commercial – subdivision ☐ Commercial – development ☐ Industrial – subdivision ☐ Industrial – development ☐ Agricultural – subdivision ☐ Agricultural – development ☐ Tourism ☐ **Linear Infrastructure** ☐ Rail ☐ Road ☐ Power Transmission ☐ Water Distribution ☐ Gas Distribution ☐ Pipelines ☐ **Water Resource Development** ☐ Desalination ☐ Surface or Groundwater ☐ Drainage ☐ Pipelines ☐ Managed Aquifer Recharge ☐ **Marine Developments** ☐ Port ☐ Jetties ☐ Marina ☐ Canal

Proponent and/or DMA to complete	
	☐ Aquaculture ☒ Dredging *If other, please state below:* ☐ **Other** _____
Proponent and/or DMA to complete	
Description of the proposal – describe the key characteristics of the proposal in accordance with EAG 1.	The proposal is to dredge approximately 3 hectares (ha) of seabed adjacent to waterfront infrastructure operated by BAE Systems Australia (BAESA) Henderson facility. The BAESA facility is situated within the Australian Marine Complex shipyard at Henderson which is located in Jervoise Bay on the eastern shore of Cockburn Sound. The development is being undertaken to deepen an area of seabed from -6.0 metres (m) to -8.0 m Chart Datum (CD), over an area that was dredged to -6.0 m CD in 2013. This will enable BAESA to provide safe access to a broader range of vessels alongside existing wharfs. The proposed works will generate approximately 37,000 cubic metres of dredged material. This material will be stockpiled ashore and excess water drained and returned to the sea prior to being transported for offsite disposal at a licenced landfill facility. Please refer to the attached Map (301012-02259-GE-DWG-0001) and Drawings (301012-02259-GE-DWG-0002 and 301012-02259-MA-DWG-0005).
Timeframe in which the proposal is to occur (including start and finish dates where applicable).	Dredging is proposed to take approximately 18 weeks and is currently scheduled to commence in June 2016.
Details of any staging of the proposal.	Not applicable
What is the current land use on the property, and the extent (area in hectares) of the property?	The property is used for shipbuilding, ship maintenance and related activities. BAE Systems Henderson Facility covers a total area of 14.5 ha and includes freehold land as well as leasehold land. This land is adjacent the site of the proposed works.
Have pre-referral discussions taken place with the OEPA? If yes, please provide the case number. If a case number was not provided, please state the date of the meeting and names of attendees.	No
DMA (Responsible Authority) to complete	
For a proposal under an assessed scheme (as	

Proponent and/or DMA to complete	
defined in section 3 of the EP Act, applicable only to the proponent and DMA) provide details (in an attachment) as to whether: • *The environmental issues raised by the proposal were assessed in any assessment of the assessed scheme.* • *The proposal complies with the assessed scheme and any environmental conditions in the assessed scheme.*	

1.3 Strategic / derived proposals

*Complete this section if the proposal being referred is a strategic proposal or you are seeking the proposal to be declared a derived proposal. **N**ote: Only a proponent may refer a strategic proposal and seek a proposal to be declared a derived proposal.*

Proponent to complete	
Is this referred proposal a strategic proposal?	☐ Yes ☒ No
Are you seeking that this proposal be declared a derived proposal?	☐ Yes ☒ No
If you are seeking that this proposal be declared a derived proposal, what is the Ministerial Statement number (MS #) of the associated strategic proposal?	MS #: _____

1.4 Location

Proponents and DMAs must provide spatial data. Please refer to EAG 1 for more detail.

Proponent, DMA and Third Party to complete	
Name of the Local Government Authority in which the proposal is located.	City of Cockburn
Location: a) street address; lot number; suburb; and nearest road intersection; or b) if remote the nearest town; and distance and direction from that town to the proposal site.	42 Quill Way HENDERSON WA 6166 Nearest road intersection: Redemptora Road / Quill Way
Have maps and figures been included with the referral (consistent with EAG 1 where appropriate)? *The types of maps and figures which need to be provided (depending on the nature of the proposal) include:* • *maps showing the regional location and context of the proposal; and* • *figures illustrating the proposal elements.*	☒ Yes ☐ No
Proponent and DMA to complete	
Have electronic copies of spatial data been included with the referral? ***NB:** Electronic spatial (GIS or CAD) data, geo-referenced and conforming to the following parameters:*	☒ Yes ☐ No

Proponent, DMA and Third Party to complete	
• *GIS: polygons representing all activities and named;* • *CAD: simple closed polygons representing all activities and named;* • *datum: GDA94;* • *projection: Geographic (latitude/longitude) or Map Grid of Australia (MGA);* • *format: ESRI geodatabase or shapefile, MapInfo Interchange Format, Microstation or AutoCAD..*	

1.5 Significance test and environmental factors

Proponent, DMA and Third Party to complete	
What are the likely significant environmental factors for this proposal?	☐ Benthic Communities and Habitat ☐ Coastal Processes ☒ Marine Environmental Quality ☐ Marine Fauna ☐ Flora and Vegetation ☐ Landforms ☐ Subterranean Fauna ☐ Terrestrial Environmental Quality ☐ Terrestrial Fauna ☐ Hydrological Processes ☐ Inland Waters Environmental Quality ☐ Air Quality & Atmospheric Gases ☐ Amenity ☐ Heritage ☐ Human Health ☐ Offsets ☐ Rehabilitation and Decommissioning
Having regard to the Significance Test (refer to Section 7 of the *EIA Administrative Procedures 2012*) in what ways do you consider the proposal may have a significant effect on the environment and warrant referral to the EPA?	*Please outline in two paragraphs or less.* The proposal will directly impact up to 3 ha of Cockburn Sound. The impact includes removal of seabed substrate with a resultant increase in turbidity in the marine environment for the duration of dredging activities.

1.6 Confidential information

All information will be made publically available unless authorised for exemption under the EP Act or subject to the Freedom of Information Act 1992.

Proponent to complete	
Does the proponent request that the EPA treat any part of the referral information as confidential?	☐ Yes ☒ No

Ensure all confidential information is provided in a separate attachment in hard copy.	

2 REGULATORY CONSIDERATIONS

This section applies to the Local, State and Commonwealth regulatory considerations for the referred proposal.

2.1 Government approvals

2.1.1 State or Local Government approvals

DMA to complete	
What approval(s) is (are) required from you as a decision-making authority?	
Is rezoning of any land required before the proposal can be implemented? If yes, please provide details.	☐ Yes ☐ No

2.1.2 Regulation of aspects of the proposal

Complete the following to the extent possible.

Proponent to complete	
Do you have legal access required for the implementation of all aspects of the proposal? *If yes, provide details of legal access authorisations / agreements / tenure.* *If no, what authorisations / agreements / tenure is required and from whom?*	☐ Yes ☒ No Proposed works to an area of harbour seabed (Part of Lot 4552, on Dep. Plan 220690, on CTV LR3116/733) requiring planning approval from Fremantle Ports and the City of Cockburn. Determination for planning approval to be sought from the Western Australian Planning Commission.

Outline both the existing approvals and approvals that will be / are being sought as a part of this proposal.

Proponent to complete			
Aspects* of the proposal	Type of approval	Legislation regulating this activity	Which State agency /entity regulate this activity?
Dredging	*Planning approval*	*Port Authorities Act 1999*	*Minister for Transport*

Dredging	*Planning approval – City of Cockburn Town Planning Scheme No. 3 & Metropolitan Region Scheme (Waterways)*	*Local Government Act 1995*	*DLGC*
Dredging	*Development approval - Metropolitan Region Scheme*	*Planning and Development Act 2005*	*WAPC*

**e.g. mining, processing, dredging*

2.1.3 Commonwealth Government *Environment Protection and Biodiversity Conservation Act 1999* approvals

Refer to the assessment bilateral agreement between the Commonwealth of Australia and the State of Western Australia for assistance on this section.

Proponent to complete	
1. Does the proposal involve an action that may be or is a controlled action under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act)?	☐ Yes ☒ No *If no continue to Part A section 2.1.4.*
2. What is the status of the decision on whether or not the action is a controlled action?	☐ Proposal not yet referred ☐ Proposal referred, awaiting decision ☐ Assessed – controlled action ☐ Assessed – not a controlled action
3. If the action has been referred, when was it referred and what is the reference number (Ref #)?	Date: _____ Ref #: _____
4. If the action has been assessed, provide the decision in an attachment. Has an attachment been provided?	☐ Yes ☐ No
5. Do you request this proposal to be assessed under the bilateral agreement?	☐ Yes ☐ No

Complete the following to the extent possible for the Public Comment of EPBC Act referral documentation.

Proponent to complete	
6. Have you invited the public to comment on your referral documentation?	☐ Yes ☐ No
7. How was the invitation published?	☐ newspaper ☐ website
8. Did the invitation include all of the following?	
(a) brief description of the action	☐ Yes ☐ No
(b) the name of the action	☐ Yes ☐ No

Proponent to complete	
(c) the name of the proponent	☐ Yes ☐ No
(d) the location of the action	☐ Yes ☐ No
(e) the matters of national environmental significance that will be or are likely to be significantly impacted	☐ Yes ☐ No
(f) how the relevant documents may be obtained	☐ Yes ☐ No
(g) the deadline for public comments	☐ Yes ☐ No
(h) available for public comment for 14 calendar days	☐ Yes ☐ No
(i) the likely impacts on matters of national environmental significance	☐ Yes ☐ No
(j) any feasible alternatives to the proposed action	☐ Yes ☐ No
(k) possible mitigation measures	☐ Yes ☐ No
9. Were any submissions received during the public comment period?	☐ Yes ☐ No
10. Have public submissions been addressed? If yes provide attachment.	☐ Yes ☐ No

2.1.4 Other Commonwealth Government Approvals

Proponent, DMA and Third Party to complete			
Is approval required from other Commonwealth Government/s for any part of the proposal?		☐ Yes ☒ No *If yes, please complete the table below.*	
Agency / Authority	Approval required	Application lodged?	Agency / Local Authority contact(s) for proposal
		☐ Yes ☐ No	
		☐ Yes ☐ No	

3. SUPPORTING INFORMATION

Please attach copies of any relevant information on the proposal, supporting evidence and / or existing environmental surveys, studies or monitoring information undertaken and list the documents below.

Proponent, DMA and Third Party to complete			
(1)	*Sediment Quality Assessment Report (2013)* *Report no. 301012-*	*WorleyParsons*	*Unpublished report prepared for BAE Systems Australia (BAESA) Henderson facility.* *The report, which includes a sampling*

Proponent, DMA and Third Party to complete			
	01750-EN-REP-004		*and analysis plan, was prepared to support construction of the land-backed wharf and dredging works carried out at BAESA Henderson facility in 2013.*
(2)	*Capital Dredging Environmental Management Plan (2016)* *Report no. 301012-02259-EN-REP-0001*	*WorleyParsons*	*Unpublished report prepared for BAESA Henderson facility.* *The proposed works will be undertaken in accordance with this plan.*

PART B: ENVIRONMENTAL FACTORS

The purpose of Part B is to assist the EPA to determine the significance of the likely environmental impacts of the proposal in accordance with the EPA's *Environmental Assessment Guideline for Environmental factors and objectives* (EAG 8) and *Environmental Assessment Guideline for Application of a significant framework in the EIA process* (EAG 9). Referrers completing Part B should refer closely to EAG 8 and EAG 9.

The EPA has prepared *Referral of a Proposal under s38 of the EP Act EAG No.16 - Appendix A* (Appendix A) to assist in identifying factors and completing the below table. Further guidance can be found in the guidance and policy documents cited in Appendix A under each factor.

How to complete Part B
For each environmental factor, that is likely to be significantly impacted by the implementation of the proposal, make a copy of the table below and insert a summary of the relevant information relating to the proposal. The table can be broken down into more than one table per factor, if the need arises. For example the hydrological processes factor can be presented in two separate tables, one for surface water and one for groundwater, or similarly one for construction and one for operations.

For complex proposals a supplementary referral report can be provided in addition to the referral form. If this option is chosen the table must still be completed (summaries are acceptable) to assist the Office of the EPA with statistical reporting and filtering proposals for processing.

Proponents expecting an API level of assessment must provide information in accordance with the EPA's *Environmental Assessment Guideline for Preparation of an API-A environmental review document* (EAG 14).

For each of the significant environmental factors, complete the following table (Questions 1 – 10).

Proponent to complete. DMA and Third Party to complete to the best of their knowledge.		
1	Factor, *as defined in EAG 8*	Marine Environmental Quality
2	EPA Objective, *as defined in EAG 8*	To maintain the quality of water, sediment and biota so that the environmental values, both ecological and social, are protected.

Proponent to complete. DMA and Third Party to complete to the best of their knowledge.		
3	Guidance - what established policies, guidelines, and standards apply to this factor in relation to the proposal?	Environmental Assessment Guideline No. 1 – *Defining the Key Characteristics of a Proposal.* Environmental Protection Authority, Perth, Western Australia, May 2012. This referral identifies the key characteristics of the proposal. EAG No. 3 – *Protection Of Benthic Primary Producer Habitats in Western Australia's Marine Environment.* EPA, Perth, WA, Dec. 2009. The works will have no direct or indirect impact on benthic primary producer habitat. EAG No. 7 – *Marine Dredging Proposals.* EPA, Perth, WA, Sept. 2011. The relevant environmental considerations have been addressed. Site investigations to obtain information that would be required to support a formal assessment were undertaken in 2013. EAG No. 8 – *Environmental principles, factors and objectives.* EPA, Perth, WA, Jan. 2015. This referral identifies one significant factor.
4	Consultation - outline the need for consultation and the outcomes of any consultation in relation to the potential environmental impacts, including: • *anticipated level of public interest in the impact;* • *consultation with regulatory agencies; and* • *consultation with community.*	Consultation will take place with relevant government agencies, Cockburn Sound Management Council, and the lessee. Broader public consultation is not proposed because the proposal will not have a significant impact on areas or facilities used by the general public. In the context of the shipbuilding and marine services industrial area at Henderson the proposal is small in scale.

Proponent to complete. DMA and Third Party to complete to the best of their knowledge.		
5	Baseline information - describe the relevant characteristics of the receiving environment. *This may include: regional context; known environmental values, current quality, sensitivity to impact, and current level of cumulative impacts.*	The BAE Systems Henderson Facility is situated in the northern portion of the 'Western Trade Coast' where marine construction and associated industry is the primary land use. The immediate receiving environment of this project proposal is Jervoise Bay, a marine embayment located to the east of Cockburn Sound (ref. attached map). The proposed development will occur in marine waters immediately adjacent the coast. It will further modify up to 200 m of disturbed coastline that is currently in a highly modified state. A moderate level of ecological protection has been established for waters along the eastern margin of Cockburn Sound (State Environmental (Cockburn Sound) Policy 2015). The State of Cockburn Sound Report 2014 noted that water quality in most parts of Cockburn Sound, and along the mainland coastline, met the relevant guidelines for the 2013-14 monitoring period. The Cockburn Sound Management Council Community Summary Paper "Benthic Habitat Mapping of the Eastern Shelf of Cockburn Sound 2004" identifies the habitat in the project area as soft sediment – "unvegetated areas in which soft sediments were dominant." The mapping indicates that the nearest sensitive benthic communities are greater than one kilometre away from the project site. The Native Vegetation Map Viewer on the Department of Environment Regulation website was consulted to confirm that the proposal site is not within an Environmentally Sensitive Area (ESA). The boundaries of the nearest ESAs are more than 500 m to the north and to the south of the development site

Proponent to complete. DMA and Third Party to complete to the best of their knowledge.		
6	Impact assessment - describe the potential impact/s that may occur to the environmental factor as a result of implementing the proposal.	The proposal will directly impact up to 3 ha of Cockburn Sound. The impact includes removal of (previously disturbed) seabed substrate and an associated increase, albeit localised and temporary, in turbidity in the marine environment. The area impacted comprises less than 0.03% of Cockburn Sound which covers an area of approximately 124 km^2 (12,400 ha) (WA Auditor General Report 8, Sept. 2010).

Proponent to complete. DMA and Third Party to complete to the best of their knowledge.		
7	Mitigation measures - what measures are proposed to mitigate the potential environmental impacts? The following should be addressed: • *Avoidance - avoiding the adverse environmental impact altogether;* • *Minimisation - limiting the degree or magnitude of the adverse impact;* • *Rehabilitate – restoring the maximum environmental value that is reasonably practicable; and* • *Offsets – actions that provide environmental benefits to counterbalance significant residual environmental impacts or risks of a project or activity.*	Measures to mitigate dredge induced turbid plumes include: - Selection of equipment (i.e. backhoe dredge and loading barge or cutter suction dredge and loading barge and/or pipeline). Dredged material will be contained and stockpiled on land prior to offsite disposal; - short duration and slow rate of production for the proposed works; - small volume of material to be dredged; and - geotechnical review undertaken in 2016 reported that the material to be dredged is predominantly composed of rock and coarse rubble. Smaller sized particles such as sand and silt that are able to remain suspended in the water column for longer periods of time will comprise a negligible fraction of the total volume of dredged material. A seawall situated to the west of the dredge footprint will also act to confine suspended sediment within the semi-enclosed harbour. Further, sediment from the works area tested in 2013 (ref. 301012-01750-EN-REP-004) showed that metal concentrations were below relevant sediment quality criteria and the concentration of tributyltin, as assessed for leachability, was below the 90% ecological protection level set for nearshore marine water within Cockburn Sound. It is expected that, subsequent to the dredging carried out in 2013, negligible concentrations of these chemicals remain in the dredging footprint. Additional mitigation measures as outlined in Dredging Environmental Management Plan (301012-02259-EN-REP-0001) include: - Use of fit-for-purpose, well-maintained vessels and equipment; - Use of suitably trained operators - Dredge fitted with positioning system; - Use of suitable onshore storage bunds to prevent direct discharge of turbid return water; - Use of silt curtains to contain turbid water until fines have settled out; and - Monitoring of environmental conditions and potential plume/s for duration of works. A hierarchy of management controls will be triggered in the event that a sediment plume extends beyond a designated area (ref. Fig. 2 of EMP).

Proponent to complete. DMA and Third Party to complete to the best of their knowledge.		
	Residual impacts – review the residual impacts against the EPA objectives. *It is understood that the extent of any significant residual impacts may be hard to quantify at the referral stage. Referrers are asked to provide, as far as practicable, a discussion on the likely residual impacts and form a conclusion on whether the EPA's objective for this factor would be met if residual impacts remain. This will require:* • *quantifying the predicted impacts (extent, duration, etc.) acknowledging any uncertainty in predictions;* • *putting the impacts into a regional or local context, incorporating knowable cumulative impacts; and* • *comparison against any established environmental policies, guidelines, and standards.*	As the proposed works are limited both in scale and duration and will occur at a previously dredged location that is situated further than one kilometre from the nearest sensitive marine receptor, potential residual impacts to marine environmental quality from this proposal are expected to be negligible.
9	EPA's Objective – from your perspective and based on your review, which option applies to the proposal in relation to this factor? *Refer to EAG 9*	☒ *meets the EPA's objective* ☐ *may meet the EPA's objective* ☐ *is unlikely to meet the EPA's objective*
10	Describe any assumptions critical to your conclusion (in Question 9). *e.g. particular mitigation measures or regulatory conditions.*	

In circumstances where there was some uncertainty on the level of significance of a particular factor it is recommended that a brief summary (no longer than 1 - 2 paragraphs) is provided on the steps taken to determine why a factor was not considered to be significant.

Attachments

1. Map 301012-02259-GE-DWG-0001
2. Drawing 301012-02259-GE-DWG-0002
3. Drawing 301012-02259-MA-DWG-0005
4. Sediment Quality Assessment Report (301012-01750-EN-REP-004)
5. Environmental Management Plan (301012-02259-EN-REP-0001)
6. CD containing spatial data

WorleyParsons
resources & energy

BAE SYSTEMS

BAE SYSTEMS

Capital Dredging

Environmental Management Plan

301012-02259 – EN-REP-0001

6 April 16

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WorleyParsons
resources & energy

BAE SYSTEMS

BAE SYSTEMS
CAPITAL DREDGING
ENVIRONMENTAL MANAGEMENT PLAN

Disclaimer

PROJECT 301012-02259 - CAPITAL DREDGING

REV	DESCRIPTION	ORIG	REVIEW	WORLEY-PARSONS APPROVAL	DATE	CLIENT APPROVAL	DATE
0	Issued for Use	N Claydon	H Flouridis	KWilm	6 April 16		

CONTENTS

1. INTRODUCTION

1.1 General

WorleyParsons has been engaged by BAE Systems to prepare an Environmental Management Plan (EMP) for the dredging activities proposed at the Henderson facility as part of a proposed capital dredging program.

1.2 Site Expansion

BAE Systems operate a 14.5 hectare waterfront facility within the Australian Marine Complex shipyard at Henderson. The site is immediately adjacent to Cockburn Sound, approximately 22 km southwest of Perth, Western Australia. The shipyard is used for the construction, repair and maintenance of defence and commercial vessels.

BAE Systems completed Phase 1 of its capital dredging program in 2014. In order to further develop BAE Systems infrastructure, Phase 2 dredging is proposed. This will include approximately 37,000 m^3 of material sediment (bank volume excluding overdredging), with a dredge footprint area of approximately 29,500 m^2. Further details of the dredging are outlined in Section 2.

1.3 Objectives

This EMP is to provide a framework for the environmental management of the dredging and dredge spoil disposal activities undertaken as part of a proposed site expansion at Henderson, Cockburn Sound. The EMP provides management measures (where relevant) that may apply to on-site activities as they apply to dredging, stockpiling and reclamation activities.

If a significant change in the duration or nature of the dredging works occurs, the EMP will be reviewed and amended accordingly. The review will include a reassessment of the environmental risks posed by the works. If an increase in risk to the environment is identified, corresponding mitigation and management strategies will be implemented.

2. PROJECT DESCRIPTION

BAE Systems proposes to undertake a second phase of capital dredging and disposal of the material to be carried out as part of waterfront expansion at the Henderson site at Cockburn Sound. To allow access to the new wharf, the second phase of dredging is required to create a navigable area with a draft of up to -8m CD. The dredge footprint covers an area of 29,500 m^2. A total dredge volume of approximately 37,000 m^3 of sediment (bank volume excluding overdredge) will require removal and disposal. Refer to Figure 1 for the proposed dredge area. Dredging is proposed to take approximately 4.5 months and is currently scheduled for June 2016.

The preferred method of dredging has not been confirmed but may include:

- using a backhoe dredge (BHD) to excavate and a loading barge(s) for disposal, or
- a cutter suction dredge (CSD) to excavate and a loading barge(s) and/or pipeline for disposal of material onshore.

It is proposed that all material dredged during the Phase II program will be temporarily stockpiled onshore before being disposed of at a local licensed landfill. No material will be reused on the site.

If material segregation is required, separate stockpiles for the different classes of material will be established in the stockpile area. The proposed stockpile locations are also shown in Figure 2 This area is existing hardstand. The material will be left in stockpile to drain before being disposed of offsite.

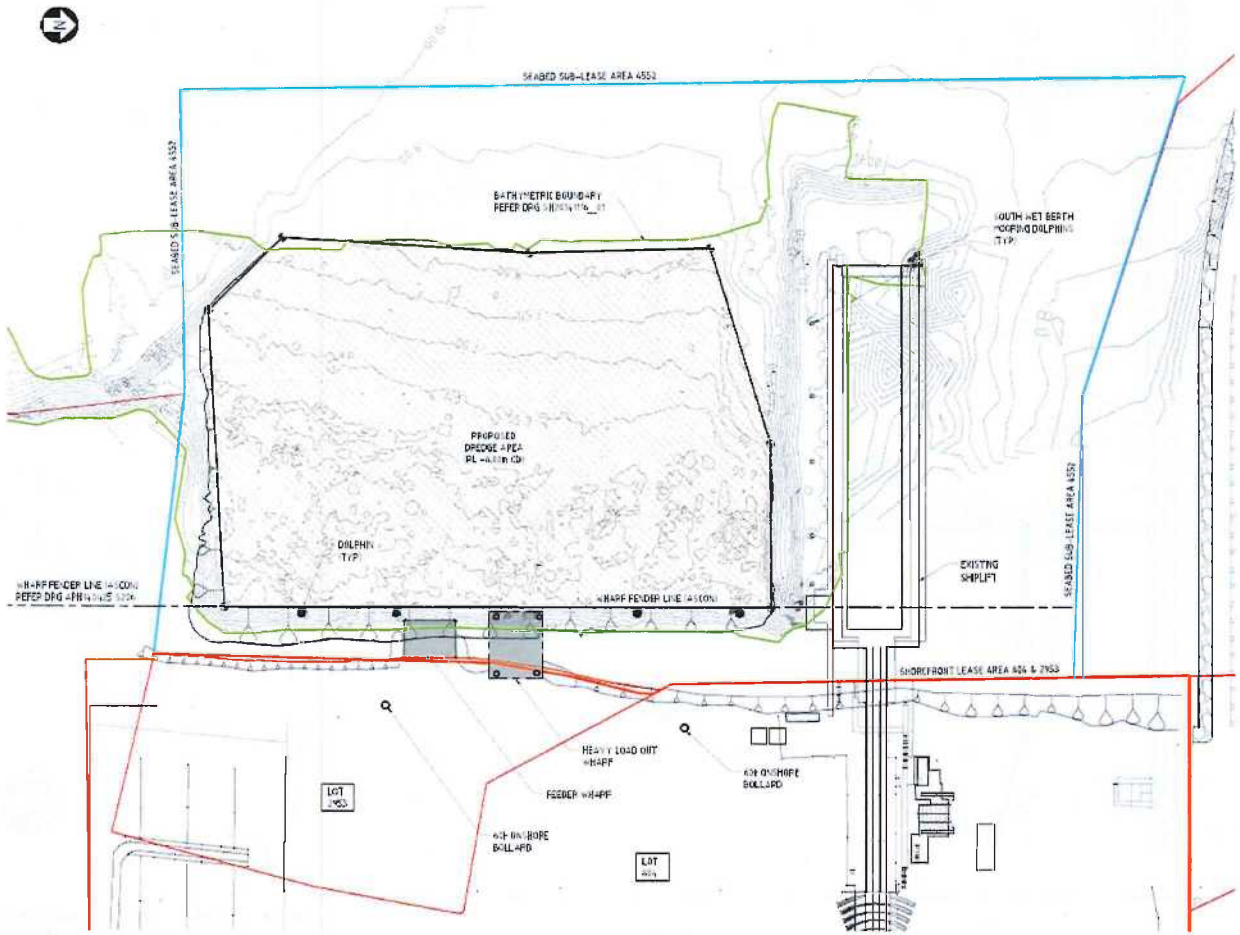

Figure 1: Proposed Dredge Area, BAE Systems Henderson shipyard, Cockburn Sound

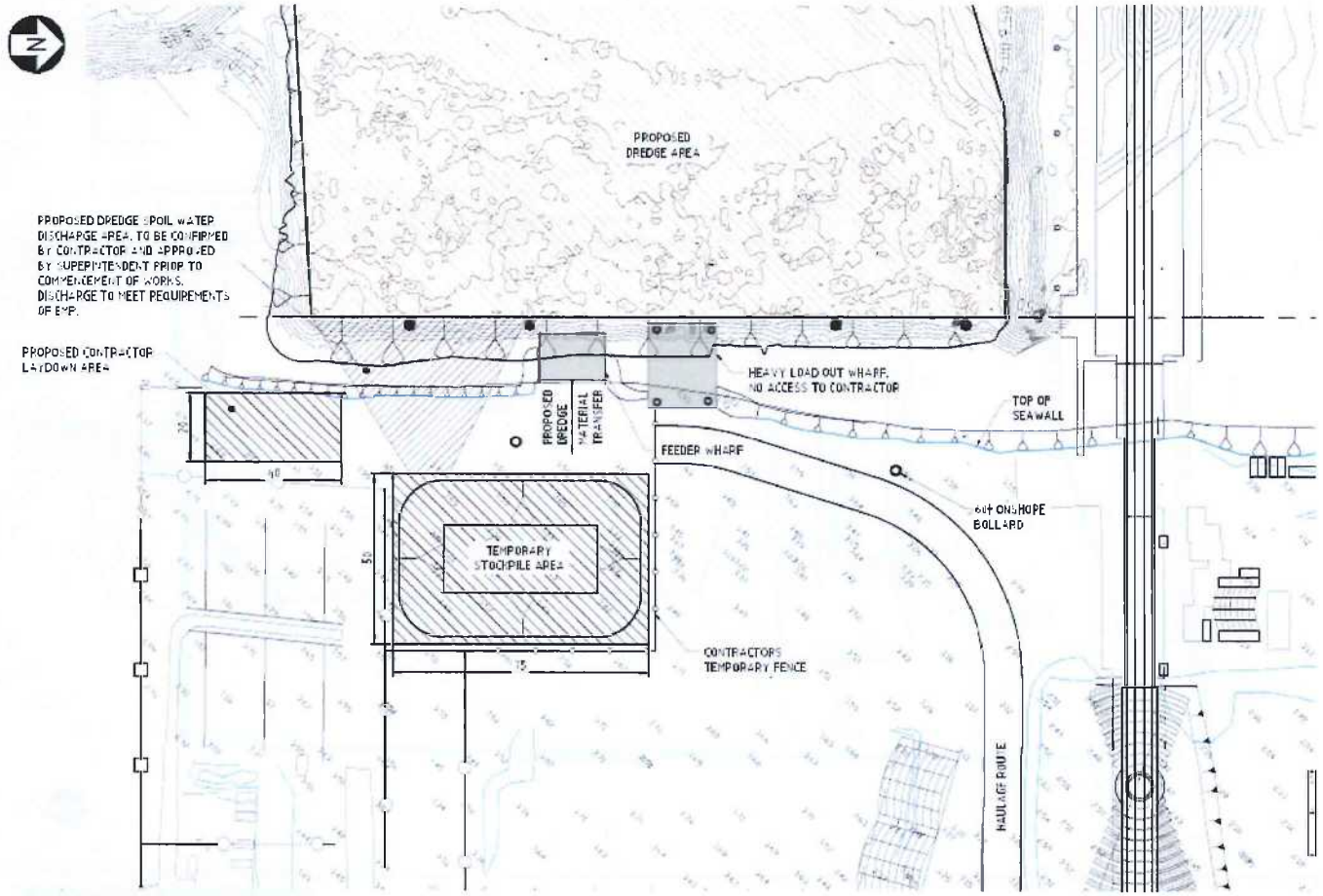

Figure 2: Proposed Landside Stockpile Area, BAE Systems Henderson shipyard, Cockburn Sound

3. MANAGEMENT OF POTENTIAL IMPACTS

The Henderson shipyard is located in an existing industrial zone within the City of Cockburn. Both the marine and terrestrial environment has been heavily modified through historical development of the site that involved clearing and modification of the original environs.

3.1 Water Quality

The environmental objective for marine water quality is to maintain the quality of water so that existing and potential environmental values are protected, including the environmental values and environmental quality objectives set for Cockburn Sound by the EPA (2005).

Water quality in Cockburn Sound is managed in accordance with the following:

- Government of Western Australia, 2005. State Environmental (Cockburn Sound) Policy 2005. Western Australia State Environmental Policy Series 1.
- Environmental Protection Authority. 2005. Revised Environmental Quality Criteria Reference Document (Cockburn Sound). A Supporting Document to the State Environment (Cockburn Sound) Policy 2005, and;
- ANZECC and ARMCANZ (2000) Australian and New Zealand Guidelines for Fresh and Marine Water Quality

The State Environmental (Cockburn Sound) Policy 2005 defines the ecological protection zone for this section of Cockburn Sound as:

- Moderate level of protection – to allow moderate changes in the quality of water, sediment and biota (i.e. moderate changes in contaminant concentrations that could cause small changes beyond natural variation in ecosystem processes and abundance/biomass of marine life, but no detectable changes from the natural diversity of species and biological communities).

3.1.1 Potential Impacts

The generation of a turbid plume is one of the most likely adverse environmental effects associated with dredging operations. The generation of dredge induced turbid plumes generally results from the resuspension of existing fine sedimentary material from the seabed during dredging and mobilisation during disposal.

Potential impacts to water quality include:

- Increased turbidity (NTU) levels caused by suspended sediments released into the water column during dredging;

- Mobilisation of potential contaminants through the disturbance of sediments during dredging; and
- Increased turbidity caused by return water from spill pond if a CSD is used.

The plumes generated by the Project are expected to be very limited in temporal and spatial extent. This is due to the type of dredging equipment proposed, the short duration (approximately 4.5 months with slow production rate), the small volume of material to be dredged, and the composition of the sediments which are predominantly sand and coarse rubble.

The sediment quality assessment undertaken for the Project has also confirmed that sediments are uncontaminated. This will limit any potential mobilisation of contaminants into the water column or into groundwater once the materials is placed on shorefront land prior to subsequent disposal to a licensed landfill facility.

3.1.2 Objectives

The water quality objectives for the Project are to:

- maintain marine water quality so that existing and potential environmental values are protected;
- cause no increase in turbidity that creates persistent plumes outsides the immediate zone of dredging; and
- cause no deterioration in water quality from any potential return water discharge.

3.1.3 Management Measures

The following management measures will be put in place:

- trained operators will be used to ensure minimal loss of turbid water from the dredge;
- dredging is to be undertaken from well maintained and inspected vessels which are free from structural defects and potential sources of leakages
- well-maintained barges will be used for transport of dredged material;
- the dredge should be fitted with a suitably accurate positioning system, that ensures reasonable accuracy of dredging both horizontally and vertically;
- material placed on shore should be suitably bunded and managed to prevent the direct discharge of turbid return water and/or run-off back into Cockburn Sound;
- Silt curtains should be used to impound an area along the shore to contain the turbid return water until fines have settled out.

3.1.4 Monitoring

Because of the nature and duration of the dredging proposed direct monitoring of water quality has not been recommended for the dredging program. There are no sensitive receptors adjacent to the dredge footprint; however the dredge plume should be monitored visually on a daily basis to confirm that the plume is not spreading outside the industrial precinct (as indicated in Figure 3).

These observations will be undertaken from an elevated location and will include information on the plume extent (e.g. estimated distance in metres from dredging site), plume direction and prevailing conditions (e.g. wind, tide, swell) and any other notable visual characteristics of the plume or dredging activity.

If turbidity is more extensive or persistent than anticipated, additional monitoring will be undertaken to determine the plume extent. If exceedance of turbidity levels is attributable to the dredging, BAE Systems staff will liaise directly with the dredging contractor to determine:

a) Which part of the process is likely responsible for the exceedance, and;

b) What can be done in the context of the operating environment on the day to change this factor.

The hierarchy of controls will be:

c) Modify dredging operations;

d) Modify loading operations;

e) Modify dredging cycle;

f) Cease dredging.

Figure 3: Industrial Precinct (Noted by Red Area)

3.1.5 Reporting

A daily log of observations of the plume will be maintained and provided to BAE Systems on demand and at the conclusion of the dredging works.

3.2 Introduced Marine Organisms

3.2.1 Potential Impacts

Vessels used during the construction phase of the project e.g. dredge and hopper barges, that may be mobilised from State waters have the potential to introduce marine species from other locations.

Marine pests are often introduced either by release of ballast water in water adjacent to the port, or from biofouling species that become attached to the hulls of vessels or released from niche spaces such as sea chests and intakes.

Potential environmental impacts that may occur as a result of the introduction of marine organisms include the following:

- establishment of non-indigenous marine pest species;
- competition for food and space with native species;
- removal of native species;
- predation of native species; and
- introduction of associated pests and disease.

3.2.2 Objectives

The environmental objective for introduced marine organisms is to minimise the risk of marine pest species introduction, establishment and spread into and within Western Australian waters as a result of dredging activities.

The objective for the Project in relation to introduced marine organisms is to:

- prevent the introduction of introduced marine organisms from dredging operations; and
- implement appropriate management measures where known or suspected introduced marine organisms are detected during vessel inspections or during dredging operations.

3.2.3 Management Measures

Prior to the dredge mobilising to site, it will be a condition of the dredging contract that it has received all necessary approvals with respect to introduced marine pest species from the Department of Fisheries.

An appropriate risk assessment (supported by relevant documentation) of the dredge, associated equipment and vessels should be undertaken to demonstrate, to the satisfaction of the Department of Fisheries, that the vessels and associated equipment present a low risk in terms of the introduction of non-indigenous marine organisms e.g. in sediment, as biofouling (or in ballast water).

3.2.4 Reporting

Documentation demonstrating compliance with the above conditions will be provided to BAE Systems before the arrival of vessels to site.

3.3 Hydrocarbons

3.3.1 Potential impacts

The potential exists for hydrocarbon spills and leaks from equipment during implementation of the Project.

3.3.2 Objectives

The objectives for the Project in relation to hydrocarbons are to:

- cause no significant hydrocarbon spills;
- ensure all spills are responded to as per BAE Systems requirements; and
- ensure no deterioration in local marine water quality occurs as a result of the use of hydrocarbons associated with the dredging activities.

3.3.3 Management measures

The following management measures will be put in place:

- All hydrocarbon spills to the marine environment (regardless of volume) will be reported to BAE Systems. This will set in motion BAE Systems' process for marine oil pollution response and official communication protocol;
- the dredge contractor will maintain an oil spill response capability commensurate with its risk of oil spill;
- relevant staff will be trained to use oil spill response equipment;
- a pre-task job hazard analysis (JHA) will be performed before refuelling activities; and
- oily wastes will be segregated from general wastes and removed from the site in an approved manner.

3.3.4 Monitoring

Refuelling activities will be continuously monitored to ensure no leak or spillage of hydrocarbons.

3.3.5 Reporting

All hydrocarbon spills to the marine environment (regardless of volume) will be reported to BAE Systems.

3.4 Reporting

3.4.1 Incident reporting

Any incident with the potential for environmental harm will be reported to BAE Systems as soon as practicable. Incidents will be reported to BAE Systems initially by phone, then followed up with a formal incident report (including incident details, corrective and preventative actions taken), which will be presented to the BAE Systems no more than 48 hours from the incident occurrence.

BAE Systems will notify the relevant authorities, such as Department of Environmental Regulation, WA Fisheries and Department of Transport within 24 hours of being notified of the incident.

3.4.2 Roles and responsibilities

As the proponent, the BAE Systems is ultimately accountable for the implementation of the proposal and adherence to the commitments made within the Dredging and Disposal Management Plan (D&DMP). However, the dredging contractor will be made responsible for implementing the Project D&DMP and complying with the associated statutory approvals. Table 3-1 below identifies the key accountabilities and responsibilities associated with key positions for this Project:

Table 3-1 Roles and Responsibilities

Authority	Responsibility
BAE Systems	Overall accountability for implementation of the DMP. Overall accountability for compliance with statutory requirements.
BAE Systems Superintendent and Superintendent's Representative	Provides advice to Dredging Contractor on dredging and dredge material management related issues. Oversees implementation of environmental controls, monitoring programs, inspections and audits. Completes compliance reporting requirements to regulatory authorities.
Dredging Contractor	Responsible for implementation of the BAE Systems approved Project D&DMP. Responsible for compliance with statutory requirements. Day to day implementation of the BAE Systems approved Project D&DMP. Day to day coordination of the Project Responsible for monitoring and survey work. Ensures adequate training of all staff within area of responsibility. Coordinates the training and induction process.
All Persons Involved in Project	Comply with the requirements of the BAE Systems approved Project D&DMP. Comply with all legal requirements under the approvals documents and relevant Acts. Exercise a Duty of Care to the environment at all times. Report all environmental incidents.

4. REFERENCES

ANZECC/ARMCANZ (2000) Australian and New Zealand Guidelines for Fresh and Marine Water Quality.

Commonwealth of Australia (2009) National Assessment Guidelines for Dredging. In: Department of the Environment W, Heritage and the Arts (ed), Canberra

DEC (2009) Landfill Waste Classification and Waste Definition.

DEC (2010) Assessment Levels for Soil, Sediment and Water In: Conservation DoEa (ed). Contaminated Sites Management Series

Department of Water Western Australia (2013) Hydrogeological Atlas. http://www.water.wa.gov.au/Tools/Maps+and+atlases/Hydrogeological+atlas/default.aspx

URS (2009) BAE Systems Henderson Shipyard Historical Trend Analysis. Prepared for BAE Systems

LOCALITY PLAN
N.T.S.

CAPITAL DREDGING
AT BAE SYSTEMS HENDERSON

SITE PLAN
N.T.S

DRG. No.	DESCRIPTION
301012-02259-GE-DWG-0001	SITE PLAN, DRAWING LIST & NOTES
301012-02259-GE-DWG-0002	DREDGE AREA & LEASE PLAN
301012-02259-MA-DWG-0001	DREDGING PLAN - OPTION 1: -7.6m CD
301012-02259-MA-DWG-0002	DREDGING PLAN - OPTION 2: -8.0m CD
301012-02259-MA-DWG-0003	DREDGING SECTIONS - OPTION 1: -7.6m CD
301012-02259-MA-DWG-0004	DREDGING SECTIONS - OPTION 2: -8.0m CD
301012-02259-MA-DWG-0005	DREDGE STOCKPILE PLAN

GENERAL NOTES

1. ALL DRAWINGS SHALL BE READ IN CONJUNCTION WITH ALL OTHER DRAWINGS NOTED ON THIS DRAWING & THE SPECIFICATIONS.
2. ORDER OF PRECEDENCE SHALL BE AS FOLLOWS (HIGHEST FIRST):
   1. APPLICABLE LEGISLATION AND STATUTORY REQUIREMENT
   2. THE SPECIFICATION
   3. CONTRACT DRAWINGS
3. ALL DIMENSIONS ARE IN METRES U.N.O.
4. DESIGN DRAWINGS SHALL NOT BE SCALED. FIGURED DIMENSIONS SHALL BE USED IN PREFERENCE TO SCALED DIMENSIONS
5. ALL DIMENSIONS RELATING TO EXISTING STRUCTURES AND BOUNDARIES SHALL BE CHECKED BY THE CONTRACTOR BEFORE COMMENCEMENT OF WORK.
6. ANY DISCREPANCIES WITHIN THE DOCUMENTATION SHALL BE REPORTED TO THE SUPERINTENDENT FOR CLARIFICATION BEFORE COMMENCEMENT OF THE WORK.
7. ALL WORK SHALL BE IN ACCORDANCE WITH THE SPECIFICATIONS AND THESE DRAWINGS .
8. U.N.O. = UNLESS NOTED OTHERWISE.
   REF. = REFERENCE DIMENSION
   NOM. = NOMINAL DIMENSION
9. DURING CONSTRUCTION THE CONTRACTOR SHALL MAINTAIN THE STRUCTURE AND ANY ADJACENT EXISTING STRUCTURES IN A STABLE CONDITION AND ENSURE NO PART IS OVER STRESSED DURING CONSTRUCTION ACTIVITIES.
10. CONTRACTOR SHALL BE RESPONSIBLE FOR DETERMINING LOCATIONS OF ALL SERVICES ON SITE. THE CONTRACTOR SHALL TAKE NECESSARY CARE DURING EXCAVATION TO ENSURE EXISTING SERVICES ARE NOT DAMAGED.

INFORMATION ONLY
NOT TO BE USED
FOR CONSTRUCTION

REV	DATE	REVISION DESCRIPTION	DRAWN	DRAFT CHK	DESIGNED	ENG CHK	APPROVED	CUSTOMER	REF DRAWING No	REFERENCE DRAWING TITLE
C	30.03.16	ISSUED FOR TENDER	DJH	TMJ	CM	AB	KYL			
B	23.03.16	ISSUED FOR CLIENT REVIEW	DJH	TMJ	CM					
A	21.03.16	ISSUED FOR INTERNAL REVIEW	DJH	TMJ	CM					

A1 SHEET | SCALE N.T.S.

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WORLEYPARSONS PROJECT No
301012-02259

WorleyParsons resources & energy

CUSTOMER
BAE SYSTEMS

CAPITAL DREDGING
AT BAE SYSTEMS HENDERSON
SITE PLAN, DRAWING LIST & NOTES

DRG No 301012-02259-GE-DWG-0001 | REV C

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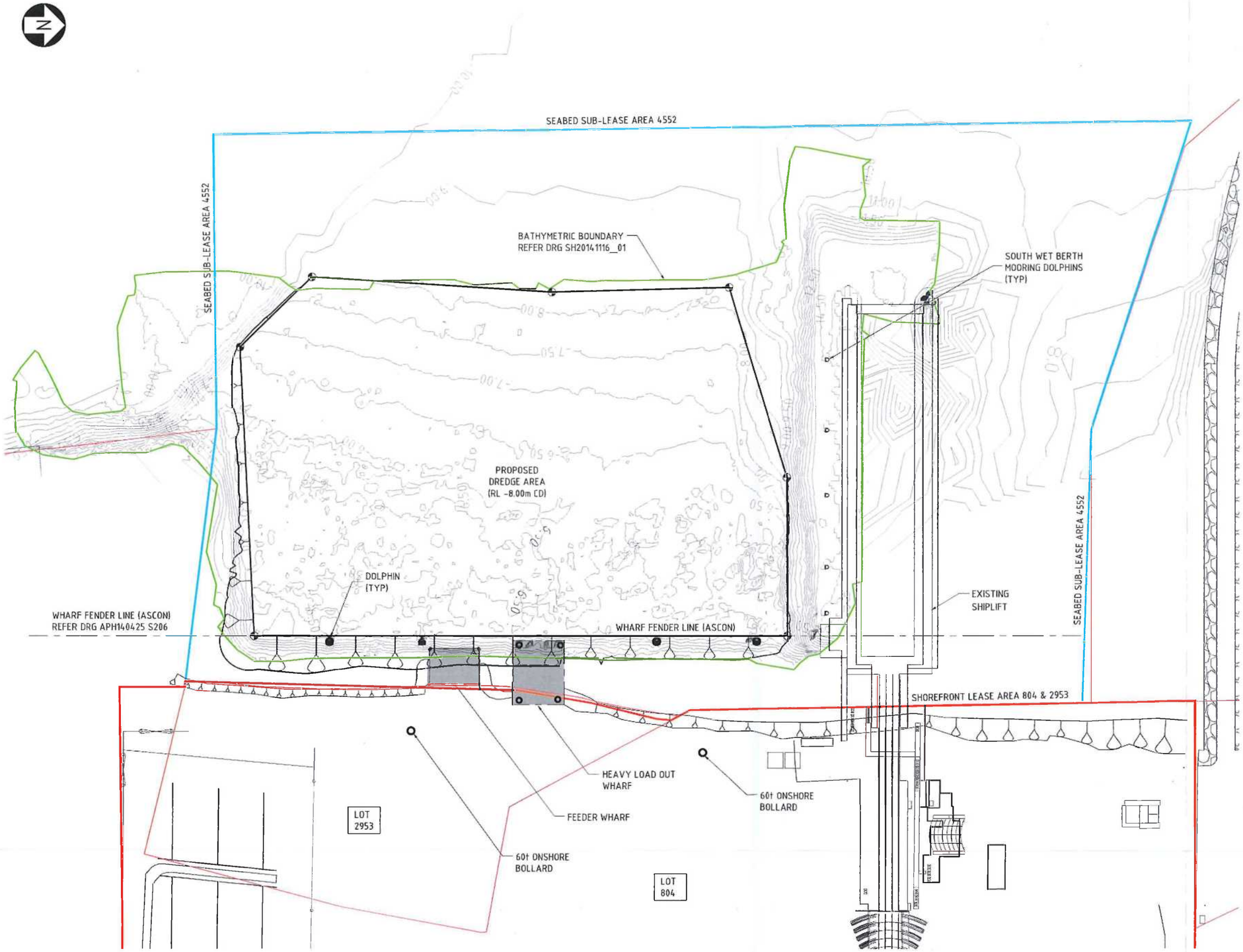

NOTES:

1. ALL DIMENSIONS ARE IN METRES U.N.O.
2. HORIZONTAL DATUM - GDA 94
   PROJECTION - MGA Z50
   VERTICAL DATUMS
   OFFSHORE - CHART (m CD)
   ONSHORE - AUSTRALIAN HEIGHT DATUM (m AHD)
3. EXISTING BATHYMETRY DATA FROM:
   CHART NO. SH20141116_01 (4th DECEMBER 2014)

FREMANTLE TIDE LEVELS CHART

AUST. HEIGHT DATUM (AHD)	CHART DATUM (CD)
	1.36 HAT
	1.10 MHHW
	1.00 MLHW
0.00m	0.76 MSL
	0.53 MHLW
	0.42 MLLW
	0.21m LAT

ALL LEVELS SOURCED FROM DEPARTMENT OF TRANSPORT - SUBMERGENCE CURVE DOT 696-33-01 (6th SEPT 2010)

INFORMATION ONLY
NOT TO BE USED
FOR CONSTRUCTION

15 0 15 30 45 60 75
SCALE OF METRES 1:750

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C	30.03.16	ISSUED FOR TENDER	DJH	TMJ	CM	AB	KYL		APH140425 S206	WHARF FENDER LINE (ASCON)
B	23.03.16	ISSUED FOR CLIENT REVIEW	DJH	TMJ	CM				SH20141116_01	BAE CAPITAL DREDGING 2014
A	17.03.16	ISSUED FOR REVIEW	DJH	TMJ	CM				FAC-DWG-ARCH-1300 Rev 3	GENERAL SITE PLAN

A1 SHEET SCALE 1:750

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WORLEYPARSONS PROJECT No
301012-02259

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CUSTOMER
BAE SYSTEMS

CAPITAL DREDGING AT BAE SYSTEMS HENDERSON DREDGE AREA & LEASE PLAN

DRG No 301012-02259-GE-DWG-0002
REV C

DATE & TIME 31/03/2016 10:18:42 AM
USER NAME michael.adams
LOCATION Q:\301012-02259\MA\DWG\301012-02259-GE-DWG-0002.dwg

PROPOSED DREDGE AREA

PROPOSED DREDGE SPOIL WATER DISCHARGE AREA. TO BE CONFIRMED BY CONTRACTOR AND APPROVED BY SUPERINTENDENT PRIOR TO COMMENCEMENT OF WORKS. DISCHARGE TO MEET REQUIREMENTS OF EMP.

PROPOSED CONTRACTOR LAYDOWN AREA

20

40

PROPOSED DREDGE MATERIAL TRANSFER

HEAVY LOAD OUT WHARF. NO ACCESS TO CONTRACTOR

TOP OF SEAWALL

FEEDER WHARF

60t ONSHORE BOLLARD

TEMPORARY STOCKPILE AREA

50

75

CONTRACTORS TEMPORARY FENCE

HAULAGE ROUTE

HAULAGE ROUTE

HAULAGE ROUTE

NOTES:

1. ALL DIMENSIONS ARE IN METRES U.N.O.
2. HORIZONTAL DATUM - GDA 94
   PROJECTION - MGA Z50
   VERTICAL DATUMS
   OFFSHORE - CHART (m CD)
   ONSHORE - AUSTRALIAN HEIGHT DATUM (m AHD)

FREMANTLE TIDE LEVELS CHART

AUST. HEIGHT DATUM (AHD)	CHART DATUM (CD)
	1.36 HAT
	1.10 MHHW
	1.00 MLHW
0.00m	0.76 MSL
	0.53 MHLW
	0.42 MLLW
	0.21m LAT

ALL LEVELS SOURCED FROM DEPARTMENT OF TRANSPORT - SUBMERGENCE CURVE DOT 696-33-01 (6th SEPT 2010)

3. ALL DREDGED MATERIAL TO BE DISPOSED OF OFF SITE IN A APPROVED LICENSED LANDFILL.
4. EXISTING BATHYMETRY DATA FROM: CHART NO. SH20141116_01 (4th DECEMBER 2014)
5. PRE 2013 BATHYMETRY DATA FROM: DOT SURVEY REFER DRAWING 107-T-TRANSPORT BARGE T1. BAE SURVEY SITE-054 WHARFAGE AREA PROPOSED DREDGING SITE.
6. ADDITIONAL STOCKPILE AREA MUST BE APPROVED BY SUPERINTENDENT.

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15 0 15 30 45 60 75
SCALE OF METRES 1:750

REV	DATE	REVISION DESCRIPTION	DRAWN	DRAFT CHK	DESIGNED	ENG CHK	APPROVED	CUSTOMER	REF DRAWING No	REFERENCE DRAWING TITLE
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B	23.03.16	ISSUED FOR CLIENT REVIEW	DJH	TJ	CM				SH20141116_01	BAE CAPITAL DREDGING 2014
A	17.03.16	ISSUED FOR INTERNAL REVIEW	DJH	TJ	CM				FAC-DWG-ARCH-1300 Rev3	GENERAL SITE PLAN

A1 SHEET SCALE 1:750

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WorleyParsons resources & energy

CUSTOMER: BAE SYSTEMS

CAPITAL DREDGING AT BAE SYSTEMS HENDERSON DREDGE STOCKPILE PLAN

DRG No 301012-02259-MA-DWG-0005

REV C

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BAE SYSTEMS

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BAE Dredging Project Support and Consultancy Services

Sediment Quality Assessment Report

301012-01750

18/06/13

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BAE SYSTEMS
BAE DREDGING PROJECT SUPPORT AND CONSULTANCY SERVICES
SEDIMENT QUALITY ASSESSMENT REPORT

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PROJECT 301012-01750 - BAE DREDGING PROJECT SUPPORT AND CONSULTANCY SERVICES

REV	DESCRIPTION	ORIG	REVIEW	WORLEY-PARSONS APPROVAL	DATE	CLIENT APPROVAL	DATE
0	Issued for Use	N Willson	H Houridis	A Blanksby	18/06/13	N/A	

CONTENTS

Appendices

1. EXECUTIVE SUMMARY

WorleyParsons was commissioned by BAE Systems to undertake a sediment quality assessment to assess the suitability of sediments for dredging and disposal to land. BAE Systems propose to expand the facilities on the site at Henderson Point and develop the waterfront infrastructure including a 75 metre wharf. The area around the wharf requires the dredging of approximately 22,500m^3 of sediment.

The preferred method of dredging is based on using a backhoe dredge (BHD), loading sediment onto barge(s) which will then be unloaded onshore. The dredge material will be unloaded from the barges using crane mounted grab equipment and stockpiled onshore.

Sediment quality of sediments were sampled and assessed in accordance with the requirements of the National Assessment Guidelines for Dredging (NAGD) (Commonwealth of Australia 2009). Their suitability for disposal to land was assessed against adopted EIL and HIL criteria for re-use on site (DEC 2010).

The assessment confirmed that metal concentrations were low and well below the relevant sediment quality criteria. The concentration of TBT was generally low but slightly higher than the recommended screening level at three of the sites tested. These were resubmitted for leachability assessment to assess the risk to groundwater quality and nearshore marine water within Cockburn Sound. All samples were below the 90 percent ecological protection level (0.02 µg/L Sn) (ANZECC/ARMCANZ 2000).

Based on these findings, there will be no impediment to using this material as fill on-site as all sediment concentrations were below relevant assessment criteria. Sediment is also likely to be suitable for disposal to landfill to a Class I landfill facility if offsite disposal is required.

2. INTRODUCTION

WorleyParsons was commissioned by BAE Systems to undertake a sediment quality assessment to assess the suitability of sediments for dredging and disposal to land.

BAE Systems operate a 14.5 hectare waterfront facility within the Australian Marine Complex shipyard at Henderson. The site is immediately adjacent to Cockburn Sound, approximately 22 km southwest of Perth, Western Australia. The shipyard is used for the construction, repair and maintenance of defence and commercial vessels.

BAE Systems propose to expand the facilities on the site at Henderson and develop the waterfront infrastructure including a 75 metre wharf. The area around the wharf requires the dredging of approximately 22,500m^3 of sediment. Further details of the dredging are outlined in Section 3.

Sediment quality of sediments were sampled and assessed in accordance with the requirements of the National Assessment Guidelines for Dredging (NAGD) (Commonwealth of Australia 2009). Their suitability for disposal to land was assessed against adopted EIL and HIL criteria for re-use on site.

2.1 Objectives

The principal aim of the study is to assess the quality of marine sediments and their suitability for dredging and disposal. More specifically, the objectives of this report are to:

- analyse sediments for a range of physical and chemical properties;
- provide comparison of chemical concentrations against the NAGD Screening Levels and other relevant guidelines;
- determine the suitability of dredged sediment for use as fill onsite; and to
- determine the suitability of dredged sediment for disposal offsite.

3. DESCRIPTION OF PROPOSED DREDGING

BAE require dredging and disposal of capital dredged material to be carried out as part of waterfront expansion at the Henderson site at Cockburn Sound. To allow access to the new wharf, dredging is required to create a navigable area with a draft of – 6.0m. The dredge footprint is 13,000 m^2 with a total dredge volume of approximately 22,500m^3 (see Figure 1). Dredging is proposed to take approximately 4 weeks and is currently scheduled for September 2013.

The preferred method of dredging is based on using a backhoe dredge (BHD), loading sediment onto barge(s) which will then be unloaded onshore. The dredge material will be unloaded from the barges using crane mounted grab equipment and stockpiled onshore.

It is proposed all material dredged will be disposed of onshore, with some of the material used as backfill for the land-backed wharf at the rear of the new berth. It is estimated that 13,500 m^3 of dredge spoil can be used for this purpose. The remainder of the dredge material is expected to be used for hardstand levelling and maintenance purposes on the project site, depending on volumes of backfill required and the suitability of dredged material.

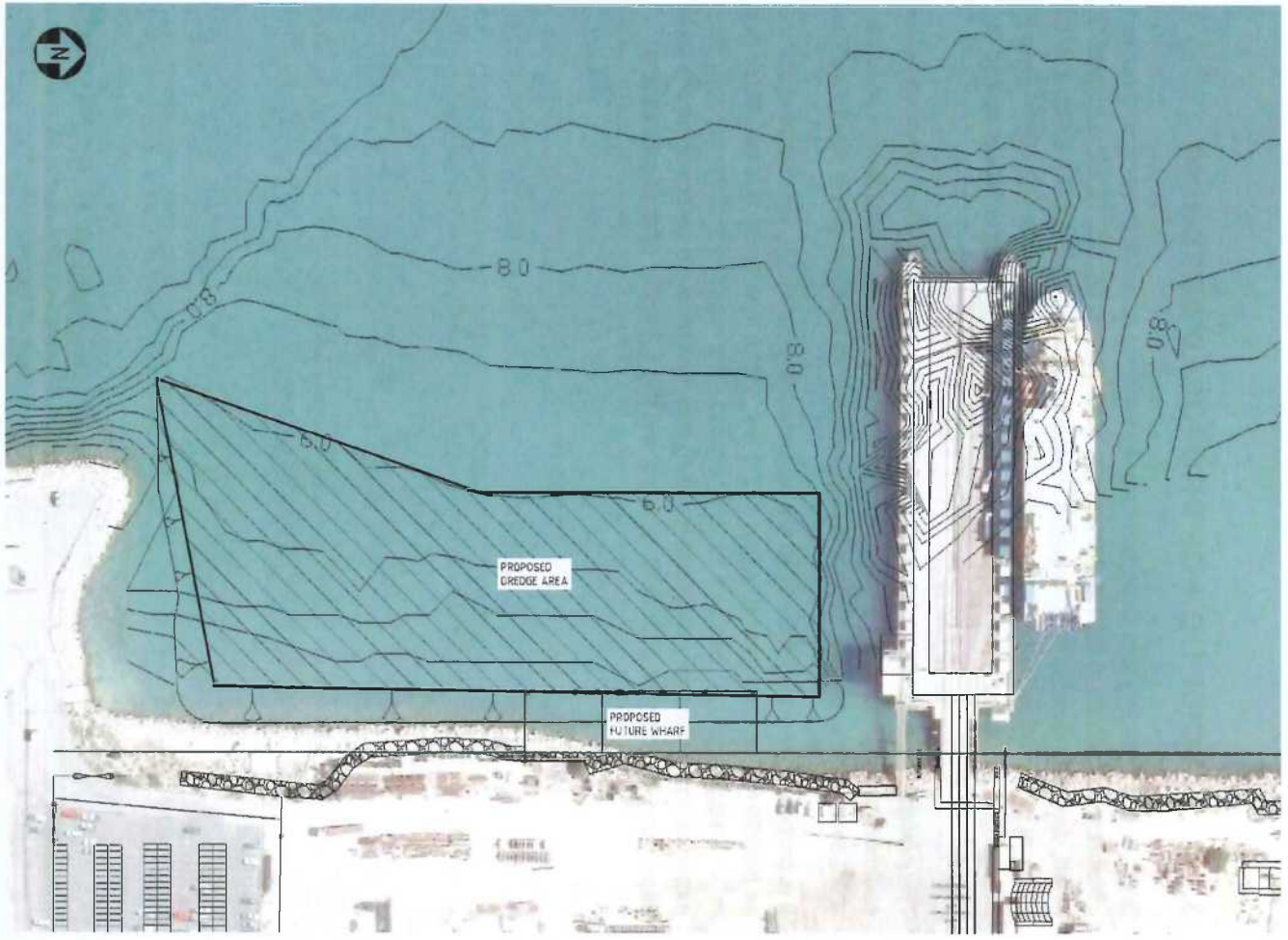

Figure 1: Proposed dredge footprint, BAE Systems Henderson shipyard, Cockburn Sound

4. REVIEW OF EXISTING INFORMATION

4.1 Site condition

The site has been a working shipyard since the 1960's. The infrastructure includes dry berths, administration buildings and bitumen car parks. The area surrounding the project site is for industrial use. The soil and sediment at the project site has been contaminated by waste from the removal and reapplication of antifouling treatments (AEC Environmental 2011b). Further details on the types of contaminants are outlined in Section 5.2.

4.2 Geotechnical conditions

The geology underlying the site is surficial sediments overlying limestone and calcrete of the Quaternary Age (AEC Environmental 2011b). A benthic mapping survey in 2004 also confirmed the presence of limestone bedrock (DALSE 2004).

4.3 Previous relevant studies

Sediment, soil and groundwater monitoring was undertaken quarterly between 2005 and 2010 under the Department of Conservation (DEC) licence conditions (Environmental Protection Act 1986 Licence No 5897/9) (AEC Environmental 2011b). The results for marine sediments were assessed against the Revised Environmental Quality Criteria (EQC) for Cockburn Sound (EPA 2005).

Sediment within and around the dredge footprint was monitored quarterly for metals, TBT and diuron at 14 locations during 2005 to 2010 (Figure 2) (AEC Environmental 2011a). All metals and contaminants were below the Cockburn sounds EQC guideline levels (EPA 2005) except:

- Copper at site T06 was consistently above the guideline;
- Nickel and zinc exceeded the guideline at site T07 in the April 2007 monitoring event;
- TBT in the majority of locations; and
- In March 2005, T09 had exceedences for all metals except for lead. This is thought to be an isolated contamination caused by a heavy ship being unloaded at the port.

Zinc, copper and TBT were also present in groundwater and soil samples recorded between 2005 and 2010 (AEC Environmental 2011a).

Figure 2: Sediment monitoring locations 2005 to 2010 (reproduced from (URS 2009))

An additional sediment study was carried out in 2010 as part of a baseline site investigation (AEC Environmental 2011a). Five sediment sample sites were analysed for metals and metalloids, pH and TBT. These sample sites were parallel to the shoreline at a distance of approximately 1 metre, in close proximity to sites T05, T07, T08 and T11 (Figure 2). The results were compared to the ANZECC low and high Interim Sediment Quality Guidelines (ISQG's) (ANZECC/ARMCANZ 2000). ISQG-low is a threshold level at which adverse environmental impacts are unlikely to occur. ISQG-high levels are threshold levels at which adverse environmental impacts are more likely to occur. Across the sites, copper exceeded the ISQG-low and TBT exceeded the ISQG-high trigger levels.

4.4 Benthic habitat

No benthic primary producer habitat or other significant habitat type is present within or adjacent to the dredge footprint. The seabed in the dredge footprint is bare sediment. Benthic habitats in the broader Cockburn Sound are shown in Figure 3.

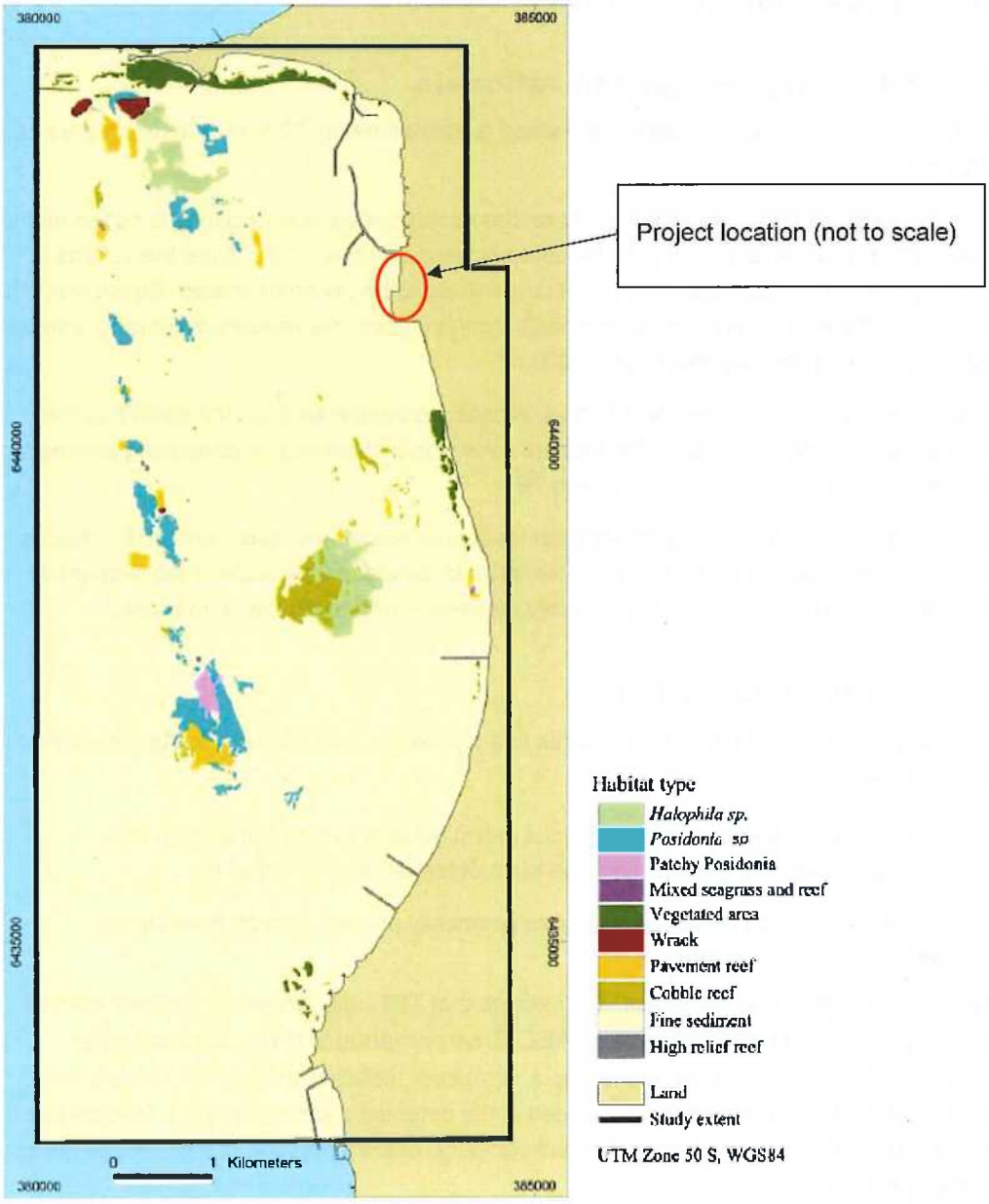

Figure 3: Benthic habitat

(reproduced from (DALSE 2004))

5. SAMPLING AND ANALYSIS

A sampling and analysis plan (SAP) for the project was prepared by WorleyParsons on behalf of BAE (Appendix 1 -) and executed on the 24th April 2013.

5.1 Sampling design and rationale

The dredge volume for safe access to the wharf is approximately 22,500 m^3 over an area of 13,000 m^2.

As the proposed dredging is capital in nature, the number of sample locations is based on the layer of recent sediments which could be contaminated and does not include the volume of underlying natural geological materials which are likely to be uncontaminated. Based on up to 1 m of soft surface sediments being potentially contaminated, the relevant volume for sample number determination is estimated at 13,000 m^3.

Sediments to be dredged were classified as 'probably contaminated' on the basis that the dredge area is located in an area that has previously been identified as containing sediment contaminated with some heavy metals and TBT.

Additional physical and chemical information for characterisation of sediments to full dredge depth has been collected as part of a geotechnical investigation separate to the proposed sediment quality investigation and is reported elsewhere (WorleyParsons, in prep).

5.2 Contaminants list

Appendix A (page 27) of the NAGD requires that a potential contaminants list be developed and should include:

- toxic substances known, from previous investigations, to occur in dredge area sediments at levels greater than one tenth of the screening levels; or
- based on historical review, substances potentially present at such levels in the sediments to be dredged.

Previous investigations at the project site indicate that TBT, copper, nickel and zinc are the main contaminants of potential concern (AEC Environmental 2011b). While all other contaminants were below screening levels, a number of metals were recorded above their respective detection limits and were included in the potential contaminants list. Particle size distribution has also been included to provide physical characterisation of surface sediments within the dredge footprint.

For clarity, the following parameters comprise the list of physical and chemical analytes that were analysed.

Based on contaminants of concern found during previous investigations and NAGD guidelines (Commonwealth of Australia 2009, AEC Environmental 2011b,) the contaminants list proposed for analysis was:

- metals and metalloids:
  - arsenic (As)
  - chromium (Cr)
  - copper (Cu)
  - lead (Pb)
  - nickel (Ni)
  - zinc (Zn)
- organics:
  - organotins (TBT);
- total organic carbon; and
- particle size distribution (to 2 µm);

5.3 Sampling locations

The number of sample locations required was determined using Table 6 of the NAGD (Commonwealth of Australia 2009). A total number of 8 sampling locations have been calculated for the dredge footprint as shown in Figure 4 . Sampling locations were chosen at random within the dredge footprint. Table 1 provides a list of the GPS coordinates of the sampling locations. All samples were collected using a Van Veen grab.

Table 1: Sampling sites

Site	Latitude	Longitude
S1	- 32.15488	115.76550
S2	- 32.15499	115.76566
S3	- 32.15531	115.76564
S4	- 32.15470	115.76510
S5	- 32.15500	115.76500
S6	- 32.15580	115.76556
S7	- 32.15566	115.76551
S8	- 32.15580	115.76490

Figure 4: SAP sampling locations

5.4 Sampling procedures

Surface samples were retrieved using a Van Veen grab from a 6.4m commercial vessel. The sampling was led by a suitably qualified environmental scientist/ engineer with experience in the application of the NAGD and sediment quality assessments. The vessel was anchored at each sampling location prior to sampling. Each sampling location was recorded on a handheld GPS.

Any potential contaminants, e.g lead diving weights, antifoulants, fuels and oils and sunscreen) were removed from the sampling area prior to mobilisation to minimise the potential for cross contamination of samples. The sample processing area was cleaned with a decontamination solution (Decon 90) and rinsed with seawater prior to sampling.

5.4.1 Sample processing

Sediment samples were logged and processed onboard the sampling vessel. At each sample location a site description sheet was completed to document sample collection and sediment descriptions (Appendix 2). The following information was collected:

- Name of client;
- Sampling date;
- General location number and sample identifiers assigned;
- Name of the sample collector;
- Type of sampler used;
- Weather conditions at the time of sampling;
- Sea state at the time of sampling;
- General comments (eg level of shipping traffic etc);
- GPS location;
- Time of sampling;
- Water depth at each sampling location; and
- Photograph of each sediment sample.

A sediment log of each core was recorded on a field data sheet, providing a description of the composition of each sample which included the following information (Appendix 2):

- Colour;

- Field texture;
- Observed sand grain size;
- Plasticity;
- Moisture content of sample;
- Consistency;
- % stones;
- Presence of shell/shell grit; and
- Odour (eg marine, sulphurous).

Sample handling on-board the vessel included sediment description logging, sample homogenisation, and preparation for dispatch to analytical laboratories (ALS and Advanced Analytical Laboratories) under Chain-of-Custody (CoC) documentation. Samples were homogenised in Pyrex mixing bowls using powderless latex gloves. A table of containers used for samples is provided in Table 2. Sample containers were labelled using indelible ink to record the sample location number and date, stored in eskies with ice packs for until dispatched to the testing laboratories (Advanced Analytical Australia) for analysis.

Table 2: Sample containers

Analyte	Containers
Metals	1 x 500 ml solvent washed, glass jar with a Teflon lined lid
TBT	1 x 500 ml solvent washed, glass jar with a Teflon lined lid
Particle size	1 x 250 ml ziplock plastic bag to hold a minimum of 500 g sample

5.4.2 Laboratory analysis

Table 3 provides a summary of details regarding the laboratory method information for the suite of whole sediment analyses that were undertaken. All limit of reporting (LOR) concentrations met the practical quantitation limits in accordance with NAGD.

Table 3: Analytical method information for sediments

Activity/test	Method reference	Method summary	PQL
Moisture content	EA055: In house	Oven-dry overnight, measure weight before and after drying	1%
Particle size distribution	Sieve and hydrometer	Sieve and hydrometer	To 2um
Total organic carbon	Handbook of soil & water	Dilute acid treatment, high temperature dry combustion, infrared detection.	0.02%
Organotins (TBT)	EP090	Acidified solvent extraction, ethylation, derivitisation, GC/MS (EI mode)	0.5 ug Sn/kg
Trace metals	EG020SD	Nitric/hydrochloric acid digestion, ICPMS	1.0 mg/kg
TBT leachate test	EN60a EN60-DIa	AS4439.3 Preparation of Leachates	2ngSn/L
Soluble organotin (TBT) compounds	EP090	Sample extracts are analysed by GC/MS coupled with high volume injection and quantification is by comparison against an established 5 point calibration curve.	0.1%

5.5 Quality control – field sampling

Quality Control during sampling was ensured by:

- using suitably qualified environmental staff experienced in sediment sampling, field supervision and sediment logging;
- logs were completed for each sample collected including time, location, initials of sampler, duplicate type, chemical analyses to be performed and site observations;

- chain of custody forms identifying (for each sample) the sampler, nature of the sample, collection date and time, analyses to be performed, sample preservation method and time samples were relinquished;
- using a surveyed vessel which is thoroughly inspected and washed down;
- samples contained in appropriately cleaned, pre-treated and labelled sample containers;
- samples kept cool (4°C) using ice after sampling and transported to laboratories in eskies with pre-frozen ice bricks;
- transportation of samples under CoC documentation;
- additional QC samples to be generated in accordance with the NAGD (refer Section 5.6 below);
- all field QC duplicate/triplicate samples are to be 'blind' labelled in the field with QC field numbers which do not relate to sampling location names; and
- all sampling equipment, including mixing bowls etc. were decontaminated between sampling locations using a decontamination procedure involving a wash with ambient seawater and a laboratory grade detergent, and successive rinsing with deionised water; or by a similarly acceptable method.

5.6 Quality control – laboratory

ALS was used as the primary laboratory and are NATA-accredited for the methods used for analysis of marine sediments and for all chemicals analysed in this investigation. Consistent with NAGD requirements, the following quality control measures were implemented:

- Collection of field triplicates (3 separate samples taken at the same location) at 10% of sites, to determine the variability of the sediment physical and chemical characteristics; and
- Collection of split triplicates (1 sample split into 3 containers) at 5 percent of sites, to assess variation in results between laboratory analysis method and process and variation between laboratory associated with sub-sample handling.

One field triplicate (i.e. three separate samples collected in the field at the same sampling location) was collected to test for sediment homogeneity. Contaminant results were compared through calculation of the Relative Standard Deviation (RSD). The NAGD states that the RSD for field triplicates should be within 50 percent.

Split triplicates (intra laboratory) are samples that are split from the same original sample into three samples and one sample submitted to a secondary laboratory for analysis. Contaminant concentrations are compared between the two split samples through calculation of the

Relative Percent Difference (RPD). The RPD value provides an indication of the accuracy of laboratory analysis between samples. The NAGD states that the relative percent difference (RPD) for duplicate split samples should be within 35 percent.

Inter-batch duplicates to determine analytical variation between batches were not collected as the samples were collected in one batch.

A summary of samples and QA samples is presented in Table 4.

Table 4: QA samples

Site	Field triplicate	Split triplicate
S1		
S2		
S3		
S4		
S5	X	
S6		X
S7		
S8		

The analytical laboratory complied with the laboratory and quality assurance procedures specified in Appendix A and Appendix F of the NAGD (Commonwealth of Australia 2009).

5.7 Data analysis

Contaminant levels for sediments were compared against the following guidelines:

- the NAGD Screening Level concentrations listed in Appendix A, Table 2 of the NAGD (Commonwealth of Australia 2009) to assess marine sediment quality;
- Ecological Investigation Level (EIL) and Health Investigation Level for residential use (HIL_A) in the 'Assessment Levels for Soil, Sediment and Water' (DEC 2010) to assess the suitability of dredged material placed onshore. The use of the HIL-A is to provide a conservative approach to the assessment of sediments for onshore disposal. The project site is in an area designated for industrial use under HIL-F, which is a far less conservative HIL than HIL-A;

- Environmental quality criteria reference document for Cockburn Sound (2003-2004), (EPA 2005)
- ANZECC/ARMCANZ guidelines (ANZECC/ARMCANZ 2000) to identify potential toxic impacts from onshore disposal of sediments and discharges to the marine environment or groundwater. The ANZECC guidelines include the ISQG-low and ISQG-high assessment levels. The ISQG-low level is a threshold below which the frequency of adverse effects is expected to be very low. The ISQG-high level is a threshold above which adverse biological effects are expected to occur more frequently.

The comparison against guideline levels involves the comparison of mean contaminant concentrations at the 95 percent upper confidence level (UCL) of the mean. For the purposes of calculation of 95 percent UCLs, values below detection limits were set to half of the LOR in accordance with NAGD recommendations.

The methods used to calculate the 95 percent UCLs were based on those required in Appendix A of the NAGD. Normality of datasets was determined using Shapiro-Wilks test and quantile-quantile plots in ProUCL Version 4.1 (4.1.01). Datasets were determined as being normal, log-normal or neither in their distributions. Normal datasets were analysed using the 1-tailed Student's 't' UCL. Log-normal datasets were analysed using non-parametric jacknife analysis as recommended in the NAGD. Similarly, datasets that were neither normal nor log-normally distributed were analysed using non-parametric jacknife analysis.

Where results were recorded above the NAGD screening levels, EIL's or HIL-A's a further phase of testing will be initiated. As it is proposed sediment will be disposed of onshore, Australian Standard Leaching Procedure (ASLP) testing, as set out in the 'Landfill Waste Classification and Waste Definitions (DEC 2006/ 2009) was undertaken on all results above the NAGD screening level, the most conservative of the guidelines listed above. This test is designed to measure analyte levels that could potentially leach into the aquatic environment.

6. RESULTS

All laboratory results are presented in full in Appendix 3. Photos and the sediment quality log are included in Appendix 4. All COC documentation and laboratory QA/QC reports are included in Appendix 5.

6.1 Chemical

6.1.1 Trace metals

Metal concentrations (arsenic, chromium, copper, lead, nickel and zinc) were all below the NAGD screening levels, DEC EIL levels and HIL-A levels at all sampling sites.

The 95 percent UCL of all metals were also below the NAGD screening levels, DEC EIL levels and HIL-A levels.

Results for arsenic, nickel and lead were similar to the levels found in the baseline investigation (AEC Environmental 2011a). Copper and zinc results were generally lower than levels found during the baseline investigation.

All metal results are presented in Table 5.

Table 5: Individual metal results and 95 percent UCLs

Analyte	Moisture Content	Arsenic	Chromium	Copper	Lead	Nickel	Zinc
Unit of measurement	%	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
PQL	0%	1	1	1	1	1	1
NAGD Screening Level	N/A	20	80	65	50	21	200
EIL Screening Level	N/A	20	N/A	100	600	60	200
HIL-A Screening Level	N/A	100	N/A	1,000	300	600	7,000
Sampling Site							
S1	27.3	2.22	8.9	5.8	2.4	0.5	10.6
S2	26.3	2.6	9.1	6.7	2.3	0.5	8.9
S3	27.3	1.56	7.6	7	2.8	0.5	17.1
S4	26.4	2.12	7.8	10.6	2.8	0.5	11.9
S5	32.8	2.49	11.4	8.4	3.8	0.5	18.6
S6	28.5	2.22	11.5	7.4	2.3	2.5	13.1
S7	29.2	2.2	10.5	7.7	2.8	2.5	14.7
S8	32.2	1.78	9.9	4.9	2.8	2.5	11.9
Mean	28.75	2.14875	9.5875	7.3125	2.75	1.25	13.35
Standard Deviation	2.52	0.34	1.50	1.72	0.48	1.04	3.28
95% UCL	**30.44**	**2.377**	**10.59**	**8.465**	**3.074**	**0.493**	**15.54**

6.1.2 TBT

Non-normalised TBT levels ranged between 3.1 and 16.9 µg Sn/kg. The 95 percent UCL (12.05 µg Sn/kg) was above the NAGD screening level (9 µg Sn/kg). The TBT results were closer to the ISQ- low level (5 µg Sn/kg), than the ISQG-high level (70 µg Sn/kg), indicating a low likelihood of adverse effects (to marine species). TBT results are presented in Table 6, with exceedences highlighted in yellow. All samples that exceeded the NAGD screening level were analysed for leachability. This was intended to assess the risk to groundwater if sediments were disposed onshore (see Section 5.7).

Table 6: TBT concentrations (non-normalised) individual site and 95% UCL results

Analyte	TBT	TOC
Unit of measurement	µg Sn/kg	%
PQL	0.5	0.02
NAGD Screening Level	9	N/A
ISQG-Low Level	5#	N/A
ISQG-High Level	70^	N/A
Sampling Site		
S1	7.8	0.18
S2	7.1	0.19
S3	13.1	0.28
S4	5.6	0.24
S5	5.2	0.50
S6	16.9	0.18
S7	12.3	0.24
S8	3.1	0.34
Mean	8.88	0.27
Standard Deviation	8.91	0.11
95% UCL	12.05	0.44

No EIL for TBT - ISQG low (ANZECC/ARMCANZ 2000)

^ No HIL for TBT - ISQG high (ANZECC/ARMCANZ 2000)

6.1.3 TBT Leachability

Sediment samples exceeding the NAGD screening level for TBT were analysed for leachability. Leachability was assessed using the ASLP leachate test and the DI (dionised) leachate test. Results for the DI test which are the most relevant are presented in Table 7. ASLP results have also been included in Appendix 3.

All leachability results were below the 90 percent ecological protection level (EPL) (Table 7). The 90 percent EPL is the recommended species protection guideline trigger level for toxicants in the industrial precinct of Cockburn Sound (EPA 2005).

Table 7: TBT leachability concentrations for three sites exceeding NAGD screening levels

Analyte	TBT
Unit of measurement	ng Sn/L
LOR	2
ANZECC/ARMCANZ (2000) 95% EPL	6
ANZECC/ARMCANZ (2000) 90% EPL	20
ANZECC/ARMCANZ (2000) 80% EPL	50
Sampling Site	
S3	13
S6	8
S7	10

6.1.4 Particle Size

All samples sites were dominated by sand (65 - 89%) with an overlying layer of fine silts and clay (11-23%). No sample was retrieved at S4 due to low sample volume.

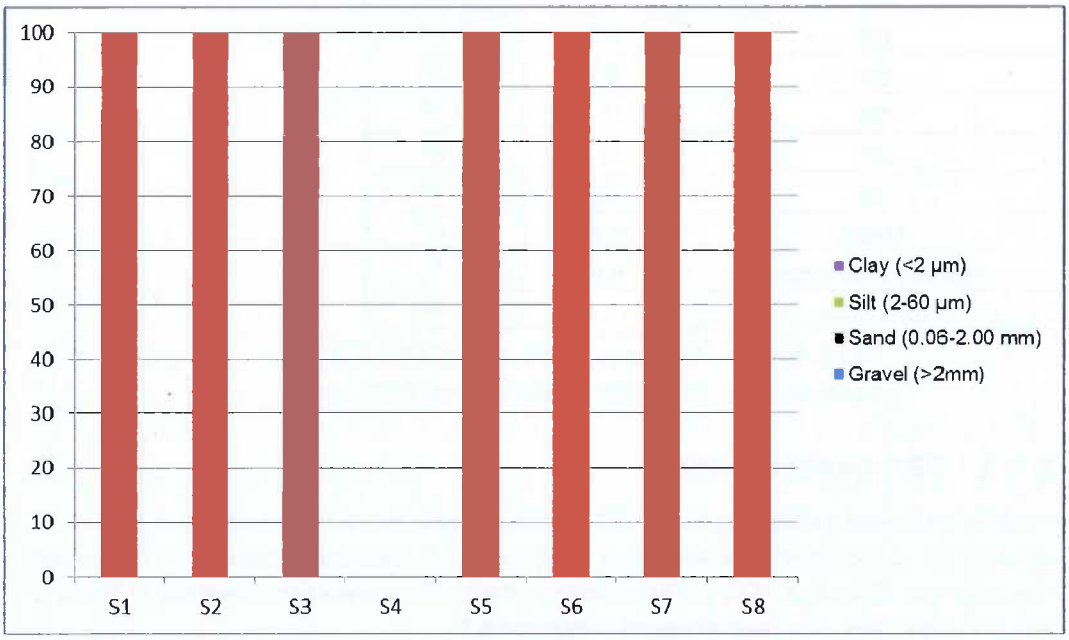

Figure 5: Particle Size Distribution

7. QUALITY ASSURANCE/ QUALITY CONTROL

Field based and laboratory QA/QC procedures were assessed by collecting triplicate samples. Further detail on quality control procedures are detailed in Sections 5.5 and 5.6.

7.1 Field triplicates and split triplicates

7.1.1 Split triplicates

The NAGD states that the RPD for split triplicates should be within 35 percent. Inter laboratory RPDs exceeded the 35 percent guideline level for arsenic, copper, nickel and TBT. The LOR was raised for nickel in the primary laboratory; this would have caused an increase in the RPD in nickel (Table 8). Also, low levels of contaminants, i.e arsenic and lead can exaggerate the RPD.

7.1.2 Field triplicates

The NAGD states that the RSD for field triplicates should be within 50 percent. The RSD for all metals and TBT were below 50 percent (Table 9). This shows that the chemical composition of sediments within the proposed dredge footprint can be considered relatively homogenous.

Table 8: Quality Control results for split triplicates

Sample Type	Site	Moisture Content	Arsenic	Chromium	Copper	Lead	Nickel	Zinc	TBT
Original Sample	S6	28.5	2.22	11.5	7.4	2.3	2.5	13.1	16.9
Split Triplicate	ST1	25	2.03	10.7	7.1	2.4	2.5	14.4	9.6
Split Triplicate	ST2	21.8	3.5	11	13	2.3	0.86	12	7.4
	Inter Lab RPD (%)	**-23.5**	**57.7**	**-4.3**	**75.7**	**0.0**	**-65.6**	**-8.4**	**-56.2**
	Intra Lab RPD (%)	**-12.3**	**-8.6**	**-7.0**	**-4.1**	**4.3**	**0.0**	**9.9**	**-43.2**

Table 9: Quality Control results for field triplicates

Sample Type	Site	Moisture Content	Arsenic	Chromium	Copper	Lead	Nickel	Zinc	TBT
Original Sample	S5	32.8	2.49	11.4	8.4	3.8	0.5	18.6	5.2
Field Triplicate	FT1	28	2.26	10.5	6.6	3.4	0.5	14.2	6.4
Field Triplicate	FT2	46	2.65	13.9	9.4	5.2	0.25	19.9	12.6
	RSD	**26.2%**	**7.9%**	**14.8%**	**17.4%**	**22.9%**	**34.6%**	**17.0%**	**49.2%**

7.2 Holding times

Samples were kept chilled whilst in the field, during storage and delivery, and stored under refrigeration on arrival at each of the laboratories. No holding time breaches were recorded as all sample analyses were undertaken within required holding times specified in the NAGD by the laboratory (Appendix 5).

7.3 Laboratory quality control assurance

The laboratories (AAA and ALS) incorporated a range of QA/QC methods to ensure accuracy of data. These are detailed further below. Analytical quality control data (blanks, duplicates and spiked samples) for the various sediment analyses are contained in the laboratory reports in Appendix 5, including the quality control data for the analytical data.

7.3.1 Laboratory blanks

Laboratory blanks are samples submitted by the laboratory during sample analysis to assist in identifying any cross contamination of samples during laboratory preparation, extraction or analysis. Analysis of laboratory blank samples should result in a concentration not exceeding the detection limit for a particular contaminant. An assessment of laboratory blank samples reported by AAA and ALS demonstrates concentrations below the detection limit for all parameters. Therefore cross contamination of samples does not appear to have occurred.

7.3.2 Laboratory duplicates

The precision of analysis performed by the laboratory is determined by the calculation of the relative percent difference (RPD). The RPD is calculated based on a comparison of an intra-laboratory split of the sample material with results representing the percent difference between the two sample concentrations for a specific contaminant.

Laboratory duplicates in accordance to NATA standards specify no RPD limit for results <10 times the LOR and 0-50 percent limit on results >10 times the LOR. All RPD results were within NATA accreditation criteria for both laboratories. NAGD states that the RPD should be within ±35 percent. All laboratory duplicate RPD results were within the 35 percent RPD guideline.

7.3.3 Matrix spikes

Matrix spikes are undertaken by the laboratory to identify the amount of interference from the sediment matrix on contaminant recovery. Samples collected from the field are split from the base sample and spiked with a known contaminant concentration. The percent recovery of the contaminant is then calculated.

The accuracy of the data is determined through analysis of spiked samples. NAGD recommends that "recovery rates (for matrix spiked samples) should be within the limits specified for the analysis method (typically 75-125 percent)".

Primary and secondary laboratory matrix spike percent recovery values were within the specified spike recovery range for all metals. The test for the matrix spike for TBT was not determined as reported contaminant concentrations by the laboratory are potentially lower than actual contaminant concentrations found within sediment samples. Appendix 5 contains the laboratory quality control reports and results from both the primary and secondary laboratories.

8. CONCLUSIONS

Based on results of this investigation, the following conclusions are applicable:

- Metal concentrations were generally low and well below the relevant criteria;
- The concentrations of non-normalised TBT in sediment were less than the screening level in five of the eight samples tested. The 95th percentile UCL was also relatively low (12.05 µg Sn/kg) compared to previous findings but slightly higher than the NAGD screening level (9 µg Sn/kg);
- Samples from the three locations containing elevated TBT were resubmitted for leachability assessment to assess the risk to groundwater quality and nearshore marine water and sediment quality within Cockburn Sound. All samples were below the 90 percent ecological protection level (0.02 µg/L Sn) (ANZECC/ARMCANZ 2000);
- There will be no impediment to using this material as fill on-site as all sediment concentrations were below relevant assessment criteria;
- Particle size distribution of sample sediments showed that sand was the dominant fraction confirming that any turbidity generated by dredging is likely to be limited in spatial extent and duration; and
- Sediment is also likely to be suitable for disposal to landfill to a Class I landfill facility if offsite disposal is required.

9. REFERENCES

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Appendix 1 - Sampling and Analysis Plan

WorleyParsons
resources & energy

BAE SYSTEMS

BAE SYSTEMS

Henderson Point Shipyard Dredging

Sediment Sampling and Analysis Plan

301012-01750

20/04/13

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Disclaimer

PROJECT 301012-01750 - HENDERSON POINT SHIPYARD DREDGING

REV	DESCRIPTION	ORIG	REVIEW	WORLEY-PARSONS APPROVAL	DATE	CLIENT APPROVAL	DATE
A	Issued for internal review	HH N Willson	PM H Houridis	PM P Mellor	16/04/13	N/A	
B	Issued for implementation	 N Wilson	 H Houridis		20/04/13		

CONTENTS

Appendices

ACRONYMS

Acronym	Definition
BTEX	Benzene, Toluene, Ethylbenzene, and Xylene
DBT	Dibutyltin
DCW	Dampier Cargo Wharf
DEC	Department of Environment and Conservation
DSEWPaC	Department of Sustainability, Environment, Water, Population and Communities.
DHLO	Dampier Heavy Load Out Area
DPA	Dampier Port Authority
DTACC	Dampier Technical Advisory and Consultative Committee
DWT	Dead Weight Tonnage
EPA	Environmental Protection Authority
DHLO	Dampier Heavy Load Out
LAT	Lowest Astronomical Tide
LOR	Limit of Reporting
MBT	Monobutyltin
NAGD	National Assessment Guidelines for Dredging
NATA	National Association of Testing Authorities
NODGDM	National Ocean Disposal Guidelines for Dredged Material
NWSV	North West Shelf Venture
PAH	Polycyclic Aromatic Hydrocarbons
PQL	Practical Quantitation Limits
SAP	Sampling and Analysis Plan
SRM	Standard Reference Material
TBT	Tributyltin
TOC	Total Organic Carbon

Acronym	Definition
TPH	Total Petroleum Hydrocarbons
TSS	Total Suspended Solids
UCL	Upper Confidence Limit

1. INTRODUCTION

BAE Systems operate a 14.5 hectare waterfront facility within the Australian Marine Complex shipyard at Henderson Point. The site is immediately adjacent to Cockburn Sound, approximately 22 km southwest of Perth, Western Australia. The shipyard is used for the construction, repair and maintenance of defence and commercial vessels.

During vessel maintenance activities antifouling treatments are removed and reapplied in one of the five vessel repair dry docks. Removal methods include the use of wet and dry pressure washing methods and sand blasting the hull in dry docks. These treatment removal methods produce waste containing toxic substances. Historically, antifouling treatments contained tributyltin (TBT) or heavy metals such as copper and zinc. Although the use of antifouling treatments containing TBT have been banned in Australia there are still vessels that are coated with antifouling treatments containing TBT that will be maintained and repaired at the site.

The primary environmental concern with the shipyard operations is that contaminants, particularly from antifouling treatments may be introduced to the marine environment. When contaminants are discharged into the marine environment they readily bind with sediment on the seafloor. If this sediment is disturbed, for example, through dredging, contaminants are released into the water column.

BAE want to expand the facilities on the site at Henderson Point and develop the water front infrastructure. The area around the wharf requires the dredging of approximately 20,000m^3 of sediment (Figure 1). Further details of the dredging are outlined in Section 1.2.

This document provides the plan for the sampling and analysis of sediments from the proposed dredging area. This sampling and analysis plan (SAP) is designed to comply with the sampling and analysis requirements of the *National Assessment Guidelines for Dredging* (NAGD), (Commonwealth of Australia 2009).

1.1 Objectives

This SAP aims to develop a set of procedures that will provide a statistically valid representation of the physico-chemical properties of sediments to be dredged, and an assessment of the likely impacts of sea disposal (if this disposal method is chosen) of the dredged sediment. Its specific objectives are to:

- provide a brief summary of the dredging operations relevant to the SAP;
- provide a summary of the land-use activities with the potential to impact on dredged material quality;
- identify a contaminants list for testing of sediments, based on potential contaminant sources and results of prior testing;

- identify the number of samples required to provide an adequate representation of the mean and upper 95 percent confidence interval for the contaminants list analytes;
- develop protocols for the collection and handling of sediment samples for analysis;
- identify the types of analyses to be performed on sediment samples;
- outline quality assurance and quality control (QA/QC) procedures for the collection, handling and laboratory analysis of samples;
- describe statistical techniques to determine the status of potential contaminants within dredged material; and
- prescribe a reporting framework for all data, results and discussion which will address the requirements of BAE Systems and the Determining Authority.

1.2 Description of the Proposed Dredging

BAE require dredging and disposal of capital dredged material to be carried out as part of waterfront expansion at the Henderson Point site at Cockburn Sound. To allow access to the new wharf dredging is required to create a navigable area with a draft of – 6.0m. The dredge footprint is 14,500 m^2 with a total dredge volume of approximately 20,000m^3 (Figure 1).

The preferred method of dredging is based on using a backhoe dredge (BHD) loading onto barge(s) which will be unloaded onshore. Loading and unloading of barges shall be carried out in order to minimise the environmental impact of these operations and meeting the applicable environmental conditions. All dredging must be undertaken to comply with the Project Environmental Management Plan (EMP).

It is proposed all material dredged will be disposed of onshore, with some of the material dredged as backfill for the land-backed wharf at the rear of the new berth and elsewhere on the BAE site, depending on volumes of backfill required and suitability of dredged material.

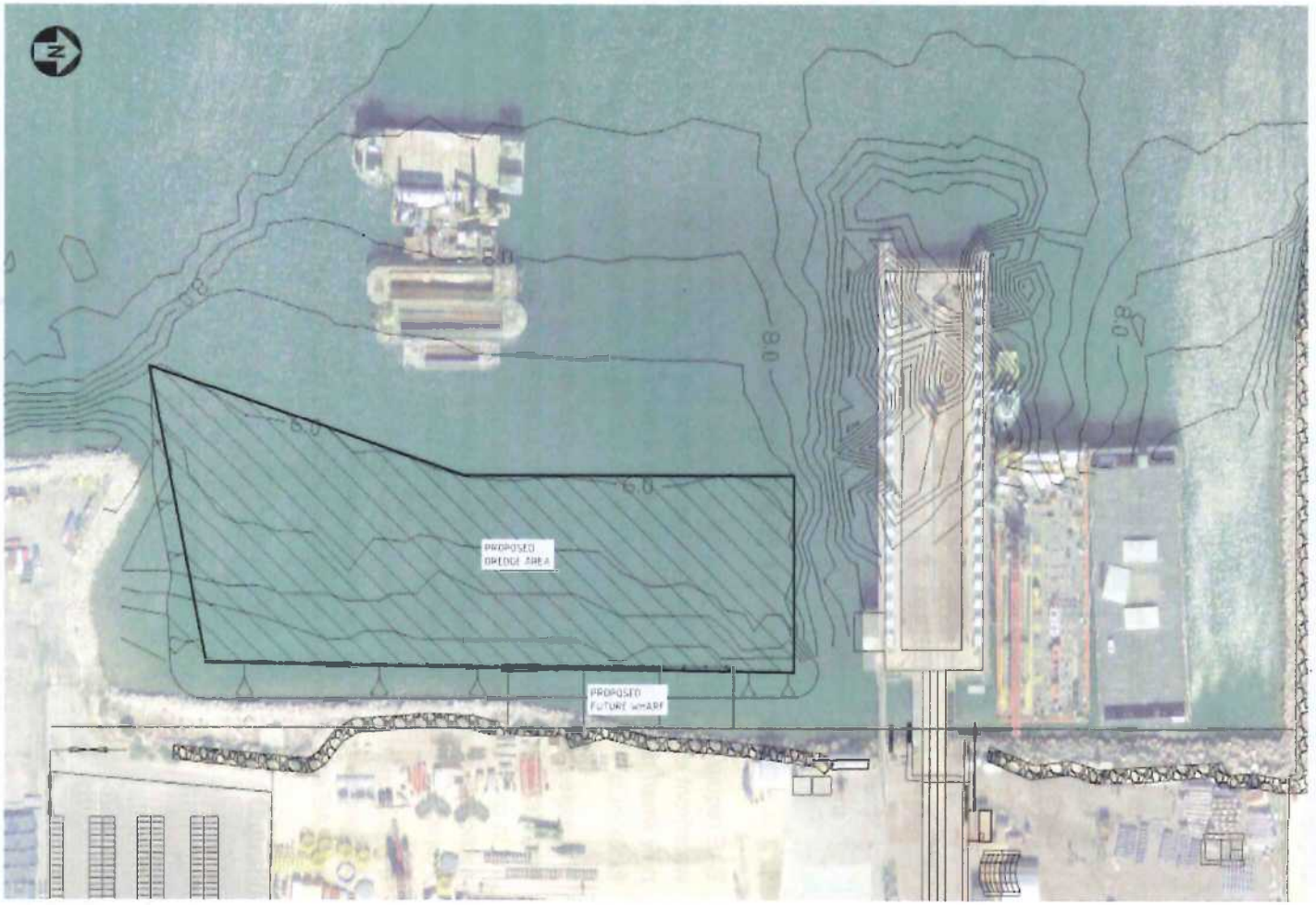

Figure 1: Proposed dredge footprint, BAE Systems, Cockburn Sound