

EPBA 2019/8520

Port Hedland Spoilbank Marina

Annual Compliance Report 2024/2025

Prepared for:
Department of Transport and Major
Infrastructure

Date:
29 August 2025

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Project/File:
304501863



rpt_304501863_a01

Revision Schedule

Revision No.	Date	Description	Prepared by	Quality Reviewer	Independent Reviewer	Project Manager Final Approval
A01	28/08/2025	Draft ACR	JM & JD	GS	GS	TS
00	29/08/2025	Final ACR	JD	GS	GS	TS

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Executive Summary

This document forms the Annual Compliance Report (ACR) for the 2024/2025 reporting period, as required under Condition 14 of *Environment Protection and Biodiversity Conservation Act 1999* approval (EPBC 2019/8520) for the Spoilbank Marina Project.

This ACR has been prepared by Stantec on behalf of the Department of Transport and Major Infrastructure (DTMI) (previously Department of Transport (DoT)), the new approval holder for the Spoilbank Marina Project development activities undertaken during the (Reporting Period 8 June 2024-7 June 2025). Responsibility for the Marina was transferred to DTMI from the previous approval holder, Pilbara Ports Authority (PPA), on 9 July 2024.

Before the Reporting Period, the Marina's construction activities included works on the inner revetment walls and outer breakwaters, the excavation of the marina basin, dredging activities, marine piling, completion of installation of the boat pens and boat ramp, and opening of the boat ramp to the public. During the Reporting Period, completion of all landscaping, landside amenities and carpark took place, with the Marina officially being opened on 29 November 2024. Only limited operations took place initially on site with only the public boat ramp in use. Boat pens were completed in March 2025.

Two significant cyclones (Sean and Zelia) passed near Port Hedland interrupting activities but not causing any major damage to the facility. The extreme weather, including the first cyclone, also impacted Pilbara turtle hatchling success as described in this article: [Extreme weather decimates Pilbara turtle hatchling populations - ABC News](#). These weather events also made it difficult to mobilise staff and contractors to Port Hedland to undertake monitoring.

The EBBC 2019/8520 comprises of 26 conditions. Over the Reporting Period, 25 of these conditions were complied with. The exception includes Condition 6, which requires the approval holder to implement the Operational Environmental Management Plan (OEMP), including the components described in Condition 5a, b and c. The water and sediment monitoring requirements were fulfilled in 2024/25 as per Condition 5c. However, parts a and b of Condition 5 (comprising the Artificial Light and Sediment Management Plans) were not fully addressed. Specifically, light monitoring and turtle hatchling orientation surveys, and the biannual sediment and coastal monitoring surveys, were not undertaken as per their respective management plans. The Department of Climate Change, Energy, the Environment and Water (DCCEEW) was notified by DTMI via email on 26 February 2025 to inform on the status of the surveys. Corrective actions have been taken where applicable.

This ACR was prepared in accordance with the Department's Annual Compliance Report Guidelines (2014) and will be published on DTMI's website within 10 business days of receiving the Department's approval of the audit report.

Signed:



Full Name: Shelley Grice
 Position: A/ Director Maritime Assets
 Organisation: Department of Transport and Major Infrastructure
 Date: 01 September 2025



1 Introduction

Pilbara Ports was the nominated Developer of the Port Hedland Spoilbank Marina (Project), a government initiative originally led by the Department of Transport (DTMI) in partnership with the Town of Port Hedland (ToPH). On 27 June 2024, Pilbara Ports submitted a Deed of Agreement to the Department of Climate Change, Energy, the Environment and Water (the Department) to enable the transfer of the Project Commonwealth environmental approval (EPBC 2019/8520) back to DTMI. The deed was executed by the Department and the approval transferred on 9 July 2024.

The Project is located in Port Hedland, Western Australia, on the western side of the spoil bank sand formation, which is a man-made coastal landform created in the late-1960s and early-1970s as a result of disposing dredge material associated with Port Hedland's inner harbour development.

The Project included the development of a marina basin, rock armoured breakwaters, a dredged access channel, boat pens, a boat ramp and landside infrastructure such as carparks, amenities, public open space, lighting, paths, and landscaping. The implementation of the Project began in 2021 with the commencement of the mobilisation of equipment to the construction site on the 8 June 2021 (commencement date), and first ground disturbance activities commencing soon after.

Prior to this Reporting Period, marine side construction activities for the marina had been completed. Land-based activities including landscaping, amenities and a carpark were completed during this Reporting Period. The Spoilbank Marina was officially opened on 29 November 2024. Only limited operations took place initially on site with the public boat ramp in use, whilst the boat pens were completed and made available for use towards the end of March 2025.

This report has been prepared to meet Condition 14 of EPBC 2019/8520, whereby the approval holder must prepare an Annual Compliance Report (ACR) for each 12-month period following the date of commencement of the action. As the new approval holder of EPBC 2019/8520, DTMI has prepared an ACR for the Project's activities undertaken during the period 8 June 2024 to 7 June 2025 (Reporting Period).

This ACR will be made publicly available and published on DTMI's website, as the approval holder for the Reporting Period.



2 Compliance Audit Table and Current Compliance Status

During the Reporting Period, DTMI was responsible for ensuring compliance with the implementation conditions of EPBC 2019/8520. **Table 1** presents a summary of DTMI's compliance with each of the implementation conditions for the Reporting Period. Many of the implementation conditions of EPBC 2019/8520 relate to the construction activities of the Project, which were all complete prior to this Reporting Period except for landscaping works which were completed before the marina officially opened on 29 November 2024. In that instance, many of the conditions were found to be compliant or not applicable within this Reporting Period.

Under Condition 5c, a Marine Environment and Water Quality Management Plan (MEWQMP) must be implemented as part of the Operational Environmental Management Plan (OEMP). The MEWQMP specifies the quality indicators to be monitored and timing of monitoring to prevent impacts to protected matters, including specific trigger criteria and limits, and clear, detailed corrective actions that will be implemented to prevent impacts to protected matters should trigger criteria and limits be reached.

In fulfilment of this condition, marine environmental quality sampling was conducted over the Reporting Period, comprising of quarterly monitoring and reporting. **Table 3** provides a summary of the approval holder's performance against the trigger criteria over the Reporting Period. Further details are provided in **Appendix A** to **Appendix D**.



Table 1: EPBC 2019/8520 Spoilbank Marina – Annual Compliance Report 2024/2025.

ITEM	COMMITMENT	COMPLIANCE	EVIDENCE
<i>Environment Protection and Biodiversity Conservation Act 1999 (Cth) Approval Decision Notice (2019/8520) – Conditions</i>			
C1	Condition 1 To minimise impacts to protected matters, the approval holder must not remove or modify more than: a) 15 ha of Flatback Turtle inter-nesting habitat; b) 2.3 ha of Green Turtle foraging habitat; and c) 10 ha of Green Sawfish foraging habitat, within the project area	Compliant	All marine construction activities ceased prior to the Reporting Period. The entire footprint of the Spoilbank Marina project does not remove or modify more than the area shown in conditions a, b, & c. No marine construction works were conducted outside of the permitted area.
C2A	Condition 2A To minimise impacts to protected matters, the approval holder must not undertake any marine construction activities during the following dates and times for the period of the approval: a) Flatback Turtle peak nesting period, between 1 December and 31 March. b) Green Sawfish key movement period, between the hours of 19:00 and 07:00.	Compliant	All marine construction activities ceased prior to the Reporting Period. a) No marine construction activities occurred during Flatback Turtle peak nesting period, between 1 December and 31 March of the Reporting Period. All marine construction activities ceased prior to 1 December 2024, avoiding the nesting period. b) No marine construction activities were to occur during Green Sawfish key movement period, between the hours of 19:00 and 07:00. The hours of permitted marine construction are outlined in the CEMP, which are from 7.00am to 7.00pm.
C3	Condition 3 To minimise impacts to protected matters, the approval holder must not dredge outside of the dredge area. If any dredge material is disposed of offshore, this must be undertaken in accordance with all requirements of a Permit issued under the <i>Environmental Protection (Sea Dumping) Act 1981</i>.	Compliant	All marine construction activities, including dredging, ceased prior to the Reporting Period. All dredging activities were conducted within the permitted dredge area and in accordance with sea dumping permit SD2021/4009 in 2022, prior to this Reporting Period.



ITEM	COMMITMENT	COMPLIANCE	EVIDENCE
C4	Condition 4 To ensure that marine construction activities and construction do not significantly impact protected matters, the approval holder must implement the Dredging Environmental Management Plan (DEMP) and Construction Environmental Management Plan (CEMP).	Compliant	All marine construction activities ceased prior to the Reporting Period. All dredging and construction activities ceased prior to this Reporting Period. The DEMP and CEMP were implemented throughout the dredging and construction campaign with regular inspections and audits.
C5	Condition 5 The approval holder must submit an Operational Environment Management Plan (OEMP), at least three months prior to the anticipated commencement of the operation of the marina, for the Minister's approval to ensure that the operation of the marina does not significantly impact protected matters. The OEMP must: a) include an Artificial Lighting Management Plan (ALMP) that ensures artificial lighting associated with the operation of the marina does not impact upon Flatback Turtle nesting on Cemetery Beach. The ALMP must be consistent with the Department's National Light Pollution Guidelines for Wildlife including Marine Turtles, Seabirds and Migratory Shorebirds (2020) and include: i. the finalised artificial lighting design of the marina; ii. justification of how the proposed design will prevent impacts to Flatback Turtle hatchlings on Cemetery Beach; iii. a monitoring and reporting program, which includes baseline data that monitoring and reporting will be evaluated against, to be undertaken for a minimum length of two years post commencement of operation of the marina to provide certainty that the artificial lighting of the marina is not impacting Flatback Turtle hatchlings or nesting on Cemetery Beach; and	Compliant	The OEMP was submitted by DTMI to the DCCEEW on 16 August 2024 and was approved by the Minister in writing on 20 September 2024. The public boat ramp became operational on 20 January 2024 in alignment with Condition 5A, and the marina officially opened on 29 November 2024. The OEMP includes: a) Artificial Light Management Plan (ALMP), i. A light audit report (Appendix E) was completed by Pendoley on 22 August 2024 as part of the ALMP, to confirm the lighting design of the marina meets the National Light Pollution Guidelines and that the final lighting will not impact on turtle nesting or hatchlings at Cemetery beach. ii. As above. iii. The ALMP includes a monitoring and reporting program, with a monitoring schedule outlined in Table 14. The monitoring schedule indicates that annual light monitoring and hatchling orientation monitoring must be undertaken in the first year post-commencement of full operations. iv. The ALMP includes management measures and corrective actions. b) Sediment Management Plan (SMP); The SMP includes measures to monitor for denuding of Cemetery



ITEM	COMMITMENT	COMPLIANCE	EVIDENCE
	iv. management measures and corrective actions to be implemented should monitoring indicate that the marina's artificial lighting is likely to impact Flatback Turtle hatchlings on Cemetery Beach. b) Include a Sediment Management Plan (SMP) that ensures anthropogenic activities of the action do not result in, or contribute to, the denuding of Cemetery Beach. The SMP must include measures to monitor for denuding of Cemetery Beach and specify intervention measures to be implemented should denuding of Cemetery Beach be predicted or detected as a result of: i. anthropogenic activities; and/or ii. environmental factors in combination with anthropogenic activities. c) Include a Marine Environment and Water Quality Management Plan (MEWQMP) that addresses how marine water quality, sediment quality and accumulation of marine debris will be monitored and managed to prevent impacts to protected matters from the operation of the marina. The MEWQMP must specify and justify the quality indicators to be monitored and timing of monitoring to prevent impacts to protected matters, including specific trigger criteria and limits, and clear, detailed corrective actions that will be implemented to prevent impacts to protected matters should trigger criteria and limits be reached.		Beach and species intervention measures to be implemented should denuding of Cemetery Beach be predicted or detected as a result of anthropogenic activities; and/or environmental factors in combination with anthropogenic activities. c) Marine Environment and Water Quality Management Plan (MEWQMP). The MEWQMP includes monitoring and management provisions for water quality, sediment quality and accumulation of marine debris. The MEWQMP specifies quality indicators, trigger criteria and limits to be monitored, with associated timings depicted in Table 17. In line with monitoring Table 17 and Section 7.3. Internal Reporting of the MEWQMP, quarterly and annual monitoring was conducted by the Program during the Reporting Period. Quarterly internal reports outlining the monitoring results in line with the trigger criteria, and the corrective actions implemented where trigger criteria exceeded, were produced during the Reporting Period (Appendix A; Appendix B; Appendix C; Appendix D). A summary of quarterly results against the trigger criteria for MEQ indicators across the Reporting Period are outlined in Table 3.



ITEM	COMMITMENT	COMPLIANCE	EVIDENCE
C5A	Condition 5A The approval holder may enable use of the public boat ramp prior to operation of the marina, subject to meeting the commitments of the Construction Environmental Management Plan. In enabling use of the public boat ramp the approval holder must: a) fully comply with the Construction Environmental Management Plan (CEMP); b) during each period commencing on 1 December and ending on 31 March in the same financial year, prevent use of the public boat ramp after 6.00 pm each day and until 6.00 am the next day; c) not provide or permit any artificial lighting in the vicinity of the public boat ramp; d) install gates and close them to prevent the use of the public boat ramp outside the period between 6.00 am and 6.00 pm each day; and e) erect clear signage at the public boat ramp prohibiting its use outside the period between 6.00 am and 6.00pm each day.	Compliant	The public boat ramp opened to the public prior to the Reporting Period (20 January 2024) on the condition of only being open between 0600 and 1800 each day.
C6	Condition 6 The approval holder must not commence operation of the marina unless the Minister has approved the OEMP in writing. If the Minister approves the OEMP then the approved OEMP must be implemented.	Potentially Non-compliant	The public boat ramp became operational on 20 January 2024 in alignment with Condition 5A, and the marina officially opened on 29 November 2024. The OEMP was submitted to the DCCEW on 16 August 2024 and was approved by the Minister in writing on 20 September 2024. Following approval by the Minister, the OEMP was partially implemented, whereby certain components of Condition 5 have been implemented to be compliant with Condition 6. The components of the OEMP, in line with Condition 5, which have not been implemented are as follows: C5 a) iii) - As per the monitoring schedules outlined in Table 14 of the ALMP, annual light monitoring and hatchling orientation monitoring must be undertaken in the first year post-commencement of full operations.



ITEM	COMMITMENT	COMPLIANCE	EVIDENCE
			However, these monitoring surveys were not conducted for the 2024/2025 turtle season. C5 a) iv) - Management measures and corrective actions within the ALMP could not be implemented as the above monitoring surveys were not conducted for the Reporting Period. C5 b) - As outlined in Section 3.1.4 of the SMP, sediment and coastal process monitoring is to be completed bi-annually, once during post-Summer (April/May) and once during post-winter (September), until at least September 2025, where it is conducted annually. During the Reporting Period, the post-Summer survey was completed by MP Rogers in May 2025 with an associated SMP report submitted 10 July 2025 (Appendix F), however the post-Winter survey, expected September 2024, was not undertaken within the Reporting Period. DCCEEW was notified by DTMI via email on 26 February 2025 to inform on the status of these surveys.
C7	Condition 7 All plans required under these conditions must be consistent with the Department's Environmental Management Plan Guidelines, and must include: a) The environmental objectives, relevant protected matters and a reference to EPBC Act approval conditions to which the plan refers; b) A table of commitments made in the plan to achieve the objectives, and a reference to where the commitments are detailed in the plan; c) Reporting and review mechanisms, and documentation standards to demonstrate compliance with the commitments made in the plan; d) An assessment of risks to achieving the environmental objectives and risk management strategies that will be applied; e) Impact avoidance, mitigation and/or repair measures, and their timing; and	Compliant	The CEMP, DEMP and OEMP have been submitted to the Department and subsequently been approved for use on the Spoilbank Marina Project.



ITEM	COMMITMENT	COMPLIANCE	EVIDENCE
	f) A monitoring program, which must include: i. measurable performance indicators; ii. trigger values for corrective actions; iii. the timing and frequency of monitoring to detect trigger values and changes in the performance indicators; and iv. proposed corrective actions, if trigger values are reached.		
Part B – Standard administrative conditions Notification of date of commencement of the action			
C8	Condition 8 The approval holder must notify the Department in writing of the date of commencement of the action within 10 business days after the date of commencement of the action. The approval holder must notify the Department in writing of the date of commencement of the operation of the marina within 10 business days after the date of commencement of the operation of the marina.	Compliant.	The Department was notified of the commencement of action via letter on 17 June 2021. Acknowledgement of commencement was received from the Department on 21 June 2021. The Department was notified by email of the commencement of operation on 26 February 2025. No acknowledgement of commencement of the operation from the Department was received by DTMI.
C9	Condition 9 If the commencement of the action does not occur within 5 years from the date of this approval, then the approval holder must not commence the action without the prior written agreement of the Minister.	Compliant	The action commenced on 8 June 2021.
Compliance records			
C10	Condition 10 The approval holder must maintain accurate and complete compliance records.	Compliant.	DTMI maintains a management system where all documents, including compliance records, are kept.



ITEM	COMMITMENT	COMPLIANCE	EVIDENCE
C11	Condition 11 If the Department makes a request in writing, the approval holder must provide electronic copies of compliance records to the Department within the timeframe specified in the request.	Compliant.	No requests were made by the Department during the Reporting Period.
Submission and publication of plans			
C12	Condition 12 The approval holder must: a) submit plans electronically to the Department; b) unless otherwise agreed to in writing by the Minister, publish each plan on the website within 20 business days of the date: i. of this approval, if the version of the plan to be implemented is specified in these conditions; or ii. that the plan is submitted to the Department, if the plan does not require the approval of the Minister but was not finalised before the date of this approval; or iii. that the plan has been approved by the Minister in writing, if the plan requires the approval of the Minister; c) exclude or redact sensitive ecological data from plans published on the website or provided to a member of the public; and d) keep plans published on the website until the end date of this approval.	Compliant.	a) The CEMP, DEMP and OEMP have been submitted to the Department and subsequently approved for use on the Spoilbank Marina Project. b) DTMI published the OEMP on the website: Spoilbank Marina Transport WA. c) There is no sensitive ecological data redacted from the plans. d) All plans will remain published on DTMI's website until the end date of this approval.



ITEM	COMMITMENT	COMPLIANCE	EVIDENCE
C13	Condition 13 The approval holder must ensure that any monitoring data (including sensitive ecological data), surveys, maps, and other spatial and metadata required under a plan, is prepared in accordance with the Department's <i>Guidelines for biological survey and mapped data</i> (2018) and submitted electronically to the Department in accordance with the requirements of the plan.	Compliant.	No sensitive ecological data was recorded during the Reporting Period. All monitoring and spatial data within monitoring reports were prepared in accordance with the Department's <i>Guidelines for biological survey and mapped data</i> (2018) and are available upon request.
Annual compliance reporting			
C14	Condition 14 The approval holder must prepare a compliance report for each 12 month period following the date of commencement of the action, or otherwise in accordance with an annual date that has been agreed to in writing by the Minister. The approval holder must: a) publish each compliance report on the website within 60 business days following the relevant 12 month period; b) notify the Department by email that a compliance report has been published on the website and provide the weblink and documentary evidence providing proof of the date of publication for the compliance report within five business days of the date of publication; c) keep all compliance reports publicly available on the website until this approval expires; d) exclude or redact sensitive ecological data from compliance reports published on the website; and e) where any sensitive ecological data has been excluded from the version published, submit the full compliance report to the Department within 5 business days of publication.	Compliant.	The action commenced on 8 June 2021. a) the first Annual Compliance Report (ACR) was published on the Pilbara Ports website on 26 August 2022. The second ACR was published on the Pilbara Ports website on 25 August 2023. The third ACR was published on the Pilbara Ports website by 31 August 2024. b) The Department was notified that the ACR was published on the website by 31 August 2024. c) Previous ACRs prior to the Reporting Period have been published on the previous approval holder's website. On 9 July 2024, the approval holder of EPBC 2019/8520 was transferred from Pilbara Ports to DTMI. This is the first ACR since DTMI became the approval holder during this Reporting Period, and this ACR will be published on DTMI's once completed. d) There has not been any sensitive ecological data excluded or redacted from previous ACRs.



ITEM	COMMITMENT	COMPLIANCE	EVIDENCE
Reporting non-compliance			
C15	Condition 15 The approval holder must notify the Department in writing of any: incident; non-compliance with the conditions; or non-compliance with the commitments made in plans. The notification must be given as soon as practicable, and no later than two business days after becoming aware of the incident or non-compliance. The notification must specify: a) any condition which is or may be in breach; b) a short description of the incident and/or non-compliance; and c) the location (including co-ordinates), date, and time of the incident and/or non-compliance. In the event the exact information cannot be provided, provide the best information available.	Compliant.	The Department was notified by DTMI via email on 26 February 2025 to inform that light monitoring and turtle hatchling orientation surveys, and the biannual sediment and coastal monitoring surveys, were not undertaken as per their respective management plans as part of the OEMP. No other instances of non-compliance or potential non-compliance were identified or reported during the Reporting Period.
C16	The approval holder must provide to the Department the details of any incident or non-compliance with the conditions or commitments made in plans as soon as practicable and no later than 10 business days after becoming aware of the incident or non-compliance, specifying: a) any corrective action or investigation which the approval holder has already taken or intends to take in the immediate future; b) the potential impacts of the incident or non-compliance; and c) the method and timing of any remedial action that will be undertaken by the approval holder.	Compliant.	The 26 February 2025 email to the Department identified which monitoring surveys under the OEMP were not undertaken during the Reporting Period, due to the transfer of the approval holder from PPA to DTMI. Contracts were being put in place at the time of the correspondence and corrective actions have since been undertaken.



ITEM	COMMITMENT	COMPLIANCE	EVIDENCE
Independent audit			
C17	The approval holder must ensure that independent audits of compliance with the conditions are conducted as requested in writing by the Minister.	Not applicable	No requests were made by the Minister for auditing.
C18	For each independent audit, the approval holder must: a) provide the name and qualifications of the independent auditor and the draft audit criteria to the Department; b) only commence the independent audit once the audit criteria have been approved in writing by the Department; and c) submit an audit report to the Department within the timeframe specified in the approved audit criteria.	Not applicable	No requests were made by the Minister for auditing.
C19	The approval holder must publish the audit report on the website within 10 business days of receiving the Department's approval of the audit report and keep the audit report published on the website until the end date of this approval.	Not applicable	No requests were made by the Minister for auditing.
Revision of action management plans			
C20	Condition 20 The approval holder may, at any time, apply to the Minister for a variation to an action management plan approved by the Minister under conditions 4 and 5, or as subsequently revised in accordance with these conditions, by submitting an application in accordance with the requirements of section 143A of the EPBC Act. If the Minister approves a revised action management plan (RAMP) then, from the date specified, the approval holder must implement the RAMP in place of the previous action management plan.	Not applicable	No variations to an action management plan were applied for during the Reporting Period.



ITEM	COMMITMENT	COMPLIANCE	EVIDENCE
C21	Condition 21 The approval holder may choose to revise an action management plan approved by the Minister under conditions 4 and 5 or as subsequently revised in accordance with these conditions, without submitting it for approval under section 143A of the EPBC Act, if the taking of the action in accordance with the RAMP would not be likely to have a new or increased impact.	Not applicable	No revisions to an action management plan occurred during the Reporting Period.
C22	Condition 22 If the approval holder makes the choice under condition 21 to revise an action management plan without submitting it for approval, the approval holder must: a) notify the Department in writing that the approved action management plan has been revised and provide the Department with: i. an electronic copy of the RAMP; ii. an electronic copy of the RAMP marked up with track changes to show the differences between the approved action management plan and the RAMP; iii. an explanation of the differences between the approved action management plan and the RAMP; iv. the reasons the approval holder considers that taking the action in accordance with the RAMP would not be likely to have a new or increased impact; and v. written notice of the date on which the approval holder will implement the RAMP (RAMP implementation date), being at least 20 business days after the date of providing notice of the revision of the action management plan, or a date agreed to in writing with the Department. b) subject to condition 24 implement the RAMP from the RAMP implementation date.	Not applicable	No revisions to an action management plan occurred during the Reporting Period. Outside of this Reporting Period, a RAMP (CEMP) and cover letter which addressed condition 22 (a) was submitted to the Minister 28 March 2022 (A1065284). Acknowledgement of the RAMP was received from the Department on 6 April 2022 (A1065283). The RAMP was implemented on 2 May 2022.



ITEM	COMMITMENT	COMPLIANCE	EVIDENCE
C23	Condition 23 The approval holder may revoke their choice to implement a RAMP under condition 21 at any time by giving written notice to the Department. If the approval holder revokes the choice under condition 21, the approval holder must implement the action management plan in force immediately prior to the revision undertaken under condition 21.	Not applicable.	Outside of this Reporting Period, a RAMP (CEMP) and cover letter which addressed condition 22 (a) was submitted to the Minister 28 March 2022 (A1065284). Acknowledgement of the RAMP was received from the Department on 6 April 2022 (A1065283). The RAMP was implemented on 2 May 2022. Within this Reporting Period, DTMI has not revoked their choice to implement a RAMP.
C24	Condition 24 If the Minister gives a notice to the approval holder that the Minister is satisfied that the taking of the action in accordance with the RAMP would be likely to have a new or increased impact, then: a) condition 21 does not apply, or ceases to apply, in relation to the RAMP; and b) the approval holder must implement the action management plan specified by the Minister in the notice.	Not applicable.	No notice has been given by the Minister to the approval holder that the Minister is satisfied that the taking of the action in accordance with the RAMP would be likely to have a new or increased impact.
C25	Condition 25 At the time of giving the notice under condition 24, the Minister may also notify that for a specified period of time, condition 21 does not apply for one or more specified action management plans.	Not applicable.	No notice has been given by the Minister to the approval holder that the Minister is satisfied that the taking of the action in accordance with the RAMP would be likely to have a new or increased impact.
Completion of the action			
C26	Condition 26 Within 20 business days after the completion of the action, the approval holder must notify the Department in writing and provide completion data.	Not applicable.	The action (operation of the Project) is not expected to be completed until the end of the approval on 19 February 2065.



2.1 Marine Environmental Quality

The results of the quarterly monitoring conducted for the MEWQMP are summarised in **Table 3** against the relevant Environmental Quality Guidelines (EQG) and Environmental Quality Standards (EQS). EQGs are threshold numerical values or narrative statements, which if exceeded, indicate an uncertainty of not achieving the environmental quality objective (EQO), whereas exceedance of EQSs indicates a significant risk the EQO may not be achieved. If both are met, the EQO is considered to have been achieved. A summary of which EQGs trigger values were met for EQO1 '*Maintenance of ecosystem integrity*' are presented in **Table 3**.

In respect of EQO1, EQGs have been derived for the following environmental indicators:

- Physical and chemical stressors in water;
- Toxicants in water; and
- Toxicants in sediments.

Table 2: Summary of the legend for the results of the 2024/2025 Reporting Period.

Outcome	Legend
EQG met (continue monitoring)	
EQG not met (continue monitoring for EQS criteria exceedance, management response may be required)	
EQS not met (management response and corrective actions required)	



Table 3: Summary of quarterly MEQ monitoring results.

Indicator	Environmental Quality Guideline				Result				Context
	Moderate Protection		High Protection						
	Summer	Winter	Summer	Winter	Q1	Q2	Q3	Q4 ¹	
Physical and chemical stressors in water									
DO (% Saturation)	>74.3	>97.3	>74.3	>99.6					Values exceeded the EQGs at SBM1, SBM2 and REF4 (Q2 & Q3) and SBM1 and SBM2 (Q4).
Temperature (°C)	27.5-31.3	20.9-25.5	27.5-31.0	21.4-24.0					Values exceeded the EQGs at SBM1, SBM2 and REF4 (Q2), REF4 (Q3) and were below at SBM1 and SBM2 in Q4.
Salinity (o/oo)	35.2-38.8	32.8-38.9	36.2-38.8	32.9-38.9					Values exceeded the EQGs at SBM1, SBM2 and REF4 (Q2).
pH	7.34-8.28	7.9-8.35	7.41-8.21	8.17-8.35					Values exceeded the EQGs at SBM1, SBM2 and REF4 (Q3).
Turbidity (NTU)	<9.1	<9.1	<6.7	<6.7					
Chlorophyll-a (µg/L)	<0.0020	<0.0020	<0.0010	<0.0010					
Toxicants in water – dissolved metals (mg/L)									
Al	-		-		-	-	-	-	
As	0.003		0.003		-	-	-		Although not set by the OEMP, Arsenic concentration at REF2 exceeded the EQG (Q4).
Cd	0.014		0.0007						
Cr (III)	0.049		0.0077						
Cr (VI)	0.020		0.00014						
Cu	0.003		0.0003						Concentration exceeded the EQG at REF4 (Q3).



Indicator	Environmental Quality Guideline				Result				Context
	Moderate Protection		High Protection						
	Summer	Winter	Summer	Winter	Q1	Q2	Q3	Q4 ¹	
Fe					-	-	-	-	
Pb	0.0066		0.0022						
Hg	0.0007		0.0001						Concentration exceeded the EQG at SBM2 (Q3).
Ni	0.2		0.007						
Zn	0.012		0.0033						Concentration exceeded the EQG at SBM2 (Q1), SBM1, SBM2 and REF4 (Q2) SBM2 and REF4 (Q3) and REF2 (Q4).
Toxicants in water – hydrocarbons (mg/L)									
TRH-Silica C6-C14	0.025		0.025						
TRH-Silica C15-C36	0.1		0.1						
Benzene	0.9		0.5						
Toluene	0.23		0.11						
Ethylbenzene	0.11		0.05						
Xylene	0.1		0.05						
Napthalene	0.09		0.05						
Toxicants in sediment – metals (mg/kg)									
Al	9100		9100						



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Indicator	Environmental Quality Guideline				Result				Context
	Moderate Protection		High Protection						
	Summer	Winter	Summer	Winter	Q1	Q2	Q3	Q4 ¹	
As	20		20						Arsenic concentrations exceeded the EQG at sites SBM1 and Ref4.
Cd	1.5		1.5						
Cr (III/VI)	80		80						
Cu	65		65						
Pb	50		50						
Hg	0.15		0.15						
Ni	21		21						Nickel concentrations exceeded the EQG at site SBM1.
Zn	200		200						
Toxicants in water – hydrocarbons (mg/L)									
Total TRH	250		250						
TRH C6-C14	25		25						
TRH C15-C36	100		100						
Low Molecular weight PAHs	0.55		0.55						
High Molecular weight PAHs	1.7		1.7						
Total PAHs	4		4						

¹Trigger criteria values for Q4 water quality monitoring differ from those values listed within the table for physical and chemical stressors. Please refer to **Appendix D** for specific Q4 trigger criteria values.



3 Non-Compliances and Corrective Actions

As per Condition 6, DTMI is required to implement the OEMP, as specified in Condition 5, comprising an Artificial Light Management Plan (Condition 5a), a Sediment Management Plan (Condition 5b) and a Marine Environment and Water Quality Management Plan (Condition 5c). During the Reporting Period, the MEWQMP (Condition 5c) was implemented. As outlined in **Table 1**, Conditions 5a and 5b were not implemented, indicating potential non-compliance with Condition 6. Further context and rationale for the non-compliances in these instances is provided below.

- a) Artificial Light Management Plan (ALMP);
 - iii. **Non-compliant:** As per Table 14 of the ALMP, annual light monitoring and hatchling orientation surveys were not conducted over the Reporting Period.
 - iv. **Non-compliant:** The extent to which management measures and corrective actions were needed could not be ascertained.

When it was identified that 2024/2025 turtle hatchling orientation and light monitoring was not undertaken, DTMI collaborated with Care for Hedland Environmental Association (CFHEA) to assess data from their community-based turtle monitoring program for the 2024/2025 season. CFHEA's data indicated that there was no change in hatchling orientation during the year prior to the Project being operational, where the data did not show any negative influence of Project on hatchlings as disorientation to the west did not increase (the data showed a decrease). DTMI will continue to collaborate with CFHEA for future years for light monitoring and hatchling orientation surveys. Correspondence and CFHEA datasets can be provided upon request.

- b) Sediment Management Plan (SMP);

Non-compliant: Sediment and coastal process monitoring was not fully completed in the Reporting Period. The summer survey was completed by MP Rogers in May 2025, however the post-winter survey, due in September 2024, was not undertaken.
- c) Marine Environment and Water Quality Management Plan (MEWQMP);

Compliant: Under the MEWQMP, there were some exceedances of the EQGs across the Reporting Period, as summarised in **Table 3**, however all were false positives and none were of ecological consequence (refer to **Appendix A** to **Appendix D**). All results were considered of an acceptable quality and within the range expected for Pilbara waters, and the EQO was achieved.

DTMI has taken a corrective action to ensure all components of the OEMP are completed in the 2025/26 reporting period.

4 Public Availability and Future Annual Compliance Reports

DTMI will make a copy of this report publicly available on its website for Spoilbank Marina ([Spoilbank Marina | Transport WA](#)). All future ACRs for the Project will be the responsibility of DTMI to make publicly available as the new approval holder of EPBC 2019/8520.



Appendices



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Appendix A Spoilbank Marina MEWQMP Summary Report Q1



Subject	DoT Spoilbank Marina Water Quality Summary Report		
Date	28/01/2025	Reference	24ENV368 / T240445
To	Mark Briant	Email	Mark.Briant@transport.wa.gov.au
From	Cameron Holder	Email	cameron.holder@o2marine.com.au
From	Russell Stevens	Email	russell.stevens@o2marine.com.au

1. Introduction

The Spoilbank Marina (the Marina) is located on Lot 5751 and Lot 5550 on a site commonly known as the ‘Spoilbank’ which is an artificial coastal landform created in the late-1960s/early-1970s from the disposal of material dredged from Port Hedland’s inner harbour and shipping channel. The Spoilbank Marina will replace the existing Richardson Street boat ramp (which will be closed) and redirect boating activities away from the commercial operations of Port Hedland’s inner harbour and navigation channel (Town of Port Hedland 2019). The Marina development plans included a four-lane boat ramp, 80 boat pens, 208 trailer and 86 car parking bays, dry dock area for commercial vessels, public and pen holder amenities, public open space, and recreation and event space (**Figure 1**).

Federal environmental approval for the construction of the Marina was granted by the Department of Climate Change, Energy, the Environment and Water (DCCEEW) under the Environmental Protection and Biodiversity Conservation Act 1999 (Cth) (EPBC Act) on 19 February 2021 via EPBC 2019/8520. As part of the approval Conditions, the proponent was required to:

- Condition 5: submit an Operational Environment Management Plan (OEMP), at least three months prior to the anticipated commencement of the operation of the marina, for the Minister’s approval to ensure that the operation of the marina does not significantly impact protected matters. The OEMP must:
 - Condition 5 part c): include a Marine Environment and Water Quality Management Plan (MEQMP) that addresses how marine water quality, sediment quality and accumulation of marine debris will be monitored and managed to prevent impacts to protected matters from the operation of the marina.

1.1. Approach

The approach detailed within the MEQMP was developed in the context of the Environmental Quality Management Framework (EQMF). The approach to establishing an EQMF, including identification of Environmental Values (EVs), EQOs, levels of ecological protection (LEP) and EQC is clearly described in EPA (2016), and is based on the principles and guidelines of the National Water Quality Management Strategy (NWQMS), with regard to the Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZG 2018). The focus of the approach is on maintaining existing environmental quality and identifying where management and/or remediation may be required and to measure its effectiveness. The EQMF can also be used to provide measurable performance objectives for unplanned events or discharges (EPA 2016). The MEQMP forms the basis of this report and will be referred to consistently throughout.

1.2. Purpose

The purpose of this report is to present a summary of sampling results in accordance with the MEQMP for the first implementation round conducted on the 26 and 27 November 2024.

2. Methodology

The MEQMP prescribes marine environmental quality sampling over an annual period (**Table 1**). This report presents results from the first quarterly sampling event (Q1).

Field logs for this sampling event are presented in **Appendix A**. All sampling methods were conducted in accordance with the MEQMP (O2M 2020).

Table 1: Overview of sampling events to be undertaken during the annual reporting period.

Sampling Event	Water	Sediment	Season	Month
Q1	X	-	Summer	26-27/10/2024
Q2	X	-	Autumn	-
Q3	X	X	Winter	-
Q4	X	-	Spring	-

2.1. Sampling Locations

A summary of the sampling locations and tasks conducted is presented in **Table 2**. Sampling locations are displayed in Table 2.

Table 2: Spoilbank Marina sample sites, parameters, and location.

Site Name	Ecological Protection Area	Site Type	Easting	Northing	Sampling Tasks Conducted						
					Aesthetic Observations	Physico-chemical Water Column Profiling ¹	General Sediment Sample Analysis	Water Sample Collection			Sediment Sample Analysis
								General Water Sample Analysis	Bacterial Sample Analysis	Phytoplankton Sample Analysis	
SBM1	Moderate	Impact	666047	7753746	✓	✓	✓	✓	✓	✓	✓
SBM2	High	Impact	665686	7754176	✓	✓	✓	✓	✓	✓	✓
REF4	High	Reference	658166	7755976	✓	✓	✓	✓	✓	✓	✓



Figure 1: Water quality sampling locations

2.2. Data Analysis and QA/QC

The following data analysis and QA/QC was conducted during the reporting period:

- Physiochemical profile data analysis and QA/QC included:
 - data trimming was conducted to remove data points occurring outside the range of 0.5 m below the surface and 0.5 m above the seafloor;
 - manual and automated QC checks were conducted to remove erroneous entries;
 - Data smoothing and bias reduction through applying a gaussian depth weighted average to each profile;
 - Calculation of a median value for each parameter for each profile; and
 - Comparison of the median value against interim EQGs.
- Laboratory reported water quality results have been compared against relevant EQCs.
- Aesthetic observations have been compared to relevant EQCs.

Field QA/QC sampling included collection of one rinsate sample.

All laboratory analysis were completed in accordance with the relevant NATA accreditation¹. Comprehensive QA/QC testing of samples will be undertaken in accordance with their respective NATA accreditation and include testing of laboratory control samples, method blanks, matrix spikes, laboratory duplicates and surrogate recovery outliers (where applicable)

¹ LORs for metals Al, Cr (VI), and Cu reported are not sufficient to provide suitable assessment against the EQGs for the High Ecological Protection Area due to limitations of laboratory testing NATA accreditation.

3. Results

3.1. General Observations

During sampling weather conditions were calm, with low cloud cover (**Table 3**). Sample collection times, sample depths and tidal regimes are outlined in **Table 4**.

Table 3: General observations made during sampling event.

Weather Observations & Sea State				General Observations
26-27 th October 2024				
General Conditions	Low wind/Swell, Sunny, Clear Skies	Wave Height (metres)	<1m	Low wind/swell, low cloud cover, calm sea state.
Air Temp (°C)	~38 °C	Wave Direction	SW	
Wind Speed (knots)	<10 Knots			
Wind Direction	SW			

Table 4: Sample timing and depth – note samples are presented in chronological order of sampling event.

Site	Date	Depth (m)	Tide Time and Height (m) ê (outgoing) é (incoming)	Sample Time (24hr)
SBM1	26/10/24	6.0	3.7 m ↓	0918
SBM2	26/10/24	5.5	3.6 m ↓	0945
REF4	27/10/24	5.5	4.1 m ↓	1009

3.2. EQO1: Ecosystem Health

3.2.1. Physical and Chemical Stressors

Chlorophyll- α and physicochemical profile results for the reporting period are presented in **Table 5**. Water column profiles are displayed in **Figure 2**. In summary:

- No EQG exceedances were reported for DO
- Temperature values ranged between 27.7°C and 28.0°C.
- pH values ranged between 8.0 and 8.3.
- Turbidity values ranged between 0.2 and 1.7.
- Salinity values ranged between 37.3 ppt and 37.5 ppt.

Table 5: Median values for physical and chemical stressors. Exceedances of numerical EQGs indicated by highlighted cells.

Site ID	LEP Area	Temp	DO	EC	Salinity	pH	Turbidity	Chl α
		°C	% Saturation	mS/cm	ppt	-	NTU	mg/L
Moderate EQG		-	80	-	-	-	-	-
High EQG		-	90	-	-	-	-	-
Impact Sites								
SBM1	MEPA	27.8	91.2	59.3	37.3	8.1	1.7	<0.001
SBM2	HEPA	27.7	93.7	59.2	37.3	8.3	1.2	<0.001
Reference Sites								
REF4	HEPA	28.0	100.9	59.8	37.5	8.0	0.2	<0.001

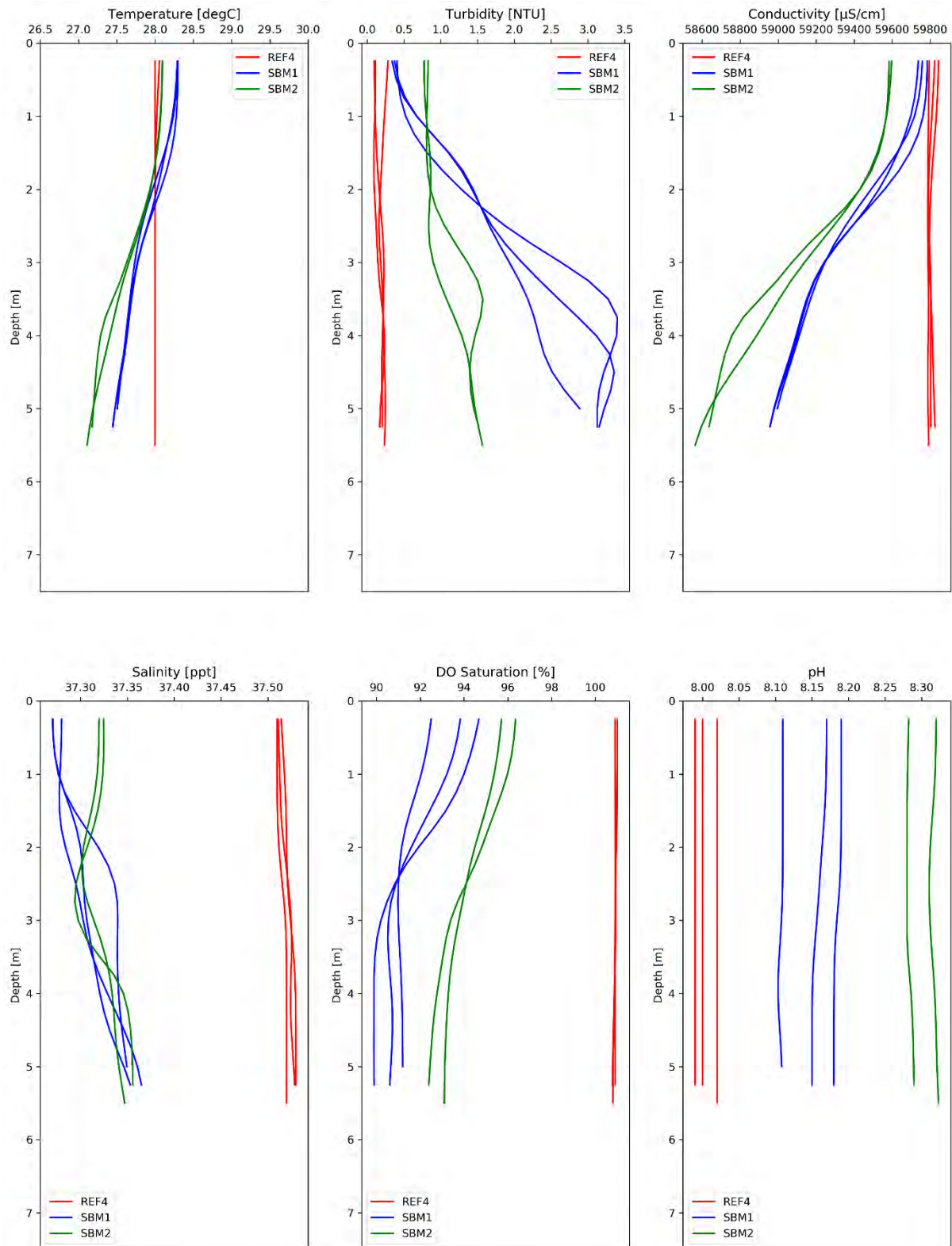


Figure 2: Physico-chemical profiles collected at the Spoilbank Marine during October 2024.

3.3. Toxicants in Water

3.3.1.1. Dissolved Metals

Analytical certificates of analysis and quality control reports for toxicants in water are presented in Table 6. A summary of the dissolved metal concentrations is presented in **Table 6**. In summary:

- Dissolved metals concentrations were generally low or reported below the LOR.
- Zinc concentrations exceeded the HEPA EQG at site SBM2.

Table 6: Dissolved metals concentrations. EQG exceedances indicated by highlighted cells.

Site ID	LEP Area	Al	As	Cd	Cr (III)	Cr (VI)	Cu	Fe	Pb	Mn	Hg	Ni	Ag	V	Zn*
		mg/L													
Moderate EQG		-	-	0.014	0.049	0.020	0.003	-	0.0066	0.014	0.0007	0.2	0.0018	0.16	0.012
High EQG		-	-	0.0007	0.0077	0.00014	0.0003	-	0.0022	0.014	0.0001	0.007	0.0008	0.05	0.0033
Impact Sites															
SBM1	MEPA	<0.05	<0.001	<0.0001	<0.001	<0.001	<0.001	0.001	<0.001	<0.005	<0.0001	<0.001	<0.0001	<0.005	0.005
SBM2	HEPA	<0.05	<0.001	<0.0001	<0.001	<0.001	<0.001	0.001	<0.001	<0.005	<0.0001	<0.001	<0.0001	<0.005	0.008
Reference Sites															
REF4	HEPA	<0.05	<0.001	<0.0001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.005	<0.0001	<0.001	<0.0001	<0.005	0.002

* EQG for zinc has changed since the OEMP was approved due to an update for this parameter in the Guidelines for Fresh & Marine Water Quality

3.3.1.2. Hydrocarbons

Hydrocarbons results are presented in **Appendix C**. All hydrocarbon concentrations were reported below the LOR.

3.4. EQO4/EQO5/EQO6: Recreation and Aesthetics

3.4.1. Recreation and Aesthetics

Assessment of data including aesthetic observations (**Appendix A**) and laboratory analysis of nuisance organisms and pathogens (**Appendix C**) are presented in **Table 7**.

In summary, pathogens, nuisance organisms, water quality and general observations indicate:

- No interim EQG exceedances for primary or secondary contact (EQO4/EQO5).
- No aesthetics EQG (EQO6) exceedances were reported.
- No Department of Health Western Australia (DOHWA) watch list species were detected.

Table 7: Pathogenic bacteria, nuisance organisms, field observations. EQG exceedances indicated by highlighted cells.

Site ID	LEP Area	Pathogenic Bacteria	Nuisance Organisms		Oil	Debris	Wrack	Odour	Fauna deaths
		Enterococci/100mL	Cells/mL	Public reports					
EQG – Primary Contact (EQO4)		<200	<10,000	Nil	-	-	-	-	-
EQG - Secondary Contact (EQO5)		<2000	<25,000	Nil	-	-	-	-	-
EQG – Aesthetics (EQO6)		-	-	-	Minor surface scums ¹	Refer to Section 3.2 of the MEQMP	Refer to Section 3.2 of the MEQMP	Coverage <25%	No objectional odour
Impact Sites									
SBM1	MEPA	<1	153.5	Nil	Nil	Nil	Nil	Nil	No Fauna Deaths
SBM2	HEPA	3	37.6	Nil	Nil	Nil	Nil	Nil	No Fauna Deaths
Reference Sites									
REF4	HEPA	<1	94.5	Nil	Nil	Nil	Nil	Nil	No Fauna Deaths

3.5. QA/QC Assessment

3.5.1. Field QA/QC Results

Rinsate sample results were all reported below the LOR during Q1.

3.5.2. Laboratory QA/QC Results

Full laboratory QA/QC reports for Q1 of the Reporting Period are presented in **Appendix C**. QA/QC results for the Q1 sampling period indicate:

- All laboratory QA/QC tests were within an acceptable range for all analytes.

4. Discussion and Conclusion

4.1. EQO1: Ecosystem Health

4.1.1. Physical and Chemical Stressors in Water

Physico-chemical parameters recorded results typical of the Pilbara coastal waters with no significant outliers. Data indicates low variance among sites, while there were no trends between sites for physico-chemical parameters.

Salinity values were slightly higher than surface water salinity default guideline values reported for the Pilbara (nearshore) mesoscale bioregion, while sea surface temperatures reported during Q1 were mostly consistent with the seasonally derived DGVs (ANZG 2018).

Chlorophyll- α was reported below the LOR across all sample sites.

No EQG exceedances were reported for any physical and chemical stressors in water. Based on this assessment, reported results indicate that EQO1 has been achieved and the EVs are not at risk from physical and chemical water quality issues.

4.1.2. Toxicants in Water

Metal and hydrocarbon toxicant concentrations in water samples were mostly found to be low, while zinc reported an exceedance of the interim EQG at site SBM2. Zinc concentrations exceeding these interim EQG levels have historically been reported in Port Hedland, both within the Port and in nearby creeks (O2 Marine 2023; Wenziker et al. 2006), indicating that zinc may occur naturally at these levels. Furthermore, the results for zinc from SBM2 were lower than within the reported concentration within the Marina, thus unlikely to be a result of activities associated with the Marina.

Hydrocarbons were reported below the LOR across all sample sites.

Based on this assessment, reported results indicate that EQO1 has been achieved and the EVs are not at risk from toxicants in water.

4.2. EQO4/EQO5/EQO6: Recreation and Aesthetics

4.2.1. EQO4/EQO5 Primary and Secondary Contact

E. coli and Enterococci were reported in very low concentrations at site SBM2. Primary and secondary contact results for toxic and nuisance phytoplankton were below the interim EQG at all sites during Q1. No DOHWA watchlist species were detected.

4.2.2. EQO6 Aesthetics

During the reporting period no results are considered to represent a decline in marine environmental quality when assessed against the interim EQGs. No observed incidences of large-scale marine deaths, noticeable visible film or debris on the surface, odour or natural reflectance were recorded above the criteria described within the MEQMP.

5. References

- ANZG (2018). *Australian and New Zealand Guidelines for fresh and Marine Water Quality* - <https://www.waterquality.gov.au/anz-guidelines/guideline-values/default/water-quality-toxicants/search>. Accessed 21/07/2023.
- EPA (2016). Technical Guidance – Protecting the Quality of Western Australia’s Marine Environment. Environmental Protection Authority, December 2016
- O2Marine (2020) Port Hedland Spoilbank Marina Marine Environmental Quality Plan. Report prepared for the Department of Transport, February 2020.
- O2 Marine (2023). Port of Port Hedland Baseline Data Analysis Technical Memo. Report prepared for the Pilbara Ports Authority.
- Wenziker K.J., McAlpine, K. W., Apte, S.C. and Masini, R.J. (2006). Background quality for coastal marine waters of the North West Shelf, Western Australia. North West Shelf Joint Environmental Management Study, CSIRO Marine Research, GPO Box 1538, Hobart Tasmania 7001.

Appendix A. Field Sheets



MEQSAP Field Sampling Record Water

[illegible]

Appendix B. Chain of Custody

29-10-24
0942
95 16C

[illegible]

Appendix C. Laboratory Certificate of Analysis

O2 Marine
Suite 2, 4B Mews Rd
Fremantle
WA 6160



NATA Accredited
Accreditation Number 2377
Site Number 2370 & 2554

Accredited for compliance with ISO/IEC 17025 – Testing
NATA is a signatory to the ILAC Mutual Recognition
Arrangement for the mutual recognition of the
equivalence of testing, medical testing, calibration,
inspection, proficiency testing scheme providers and
reference materials producers reports and certificates.

Attention: Russell Stevens

Report 1154287-W
Project name Port of Port Hedland MEQSAP Monitoring
Project ID 22ENV179
Received Date Oct 29, 2024

Client Sample ID			IH1	IH2	IH3	IH4
Sample Matrix			Water	Water	Water	Water
Eurofins Sample No.			L24- Oc0076417	L24- Oc0076418	L24- Oc0076419	L24- Oc0076420
Date Sampled			Oct 26, 2024	Oct 26, 2024	Oct 26, 2024	Oct 26, 2024
Test/Reference	LOR	Unit				
Naphthalene ^{N02}	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
TRH >C10-C16 after Silica Cleanup less Naphthalene (F2)	0.02	mg/L	< 0.02	< 0.02	< 0.02	< 0.02
Chlorophyll-a	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Chromium (VI)	0.002	mg/L	< 0.002	< 0.002	< 0.002	< 0.002
Chromium (III) (filtered)*	0.002	mg/L	< 0.002	< 0.002	< 0.002	< 0.002
BTEX						
Benzene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Toluene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Ethylbenzene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
m&p-Xylenes	0.002	mg/L	< 0.002	< 0.002	< 0.002	< 0.002
o-Xylene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Xylenes - Total*	0.003	mg/L	< 0.003	< 0.003	< 0.003	< 0.003
BTEX						
4-Bromofluorobenzene (surr.)	1	%	58	105	102	61
Polycyclic Aromatic Hydrocarbons						
Benzo(a)pyrene TEQ (lower bound) *	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Acenaphthene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Acenaphthylene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Anthracene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Benz(a)anthracene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Benzo(a)pyrene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Benzo(b&j)fluoranthene ^{N07}	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Benzo(g,h,i)perylene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Benzo(k)fluoranthene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Chrysene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Dibenz(a,h)anthracene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Fluoranthene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Fluorene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Indeno(1.2.3-cd)pyrene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Naphthalene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Phenanthrene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Pyrene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Total PAH*	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
2-Fluorobiphenyl (surr.)	1	%	115	104	115	79
p-Terphenyl-d14 (surr.)	1	%	139	124	132	85

Client Sample ID Sample Matrix Eurofins Sample No. Date Sampled Test/Reference	LOR	Unit	IH1 Water L24- Oc0076417 Oct 26, 2024	IH2 Water L24- Oc0076418 Oct 26, 2024	IH3 Water L24- Oc0076419 Oct 26, 2024	IH4 Water L24- Oc0076420 Oct 26, 2024
TRH - 2013 NEPM Fractions (after silica gel clean-up)						
TRH >C10-C16 (after silica gel clean-up)	0.02	mg/L	< 0.02	< 0.02	< 0.02	< 0.02
TRH >C16-C34 (after silica gel clean-up)	0.05	mg/L	< 0.05	< 0.05	2.0	< 0.05
TRH >C34-C40 (after silica gel clean-up)	0.05	mg/L	< 0.05	< 0.05	0.44	< 0.05
TRH >C10-C40 (total) (after silica-gel clean up)*	0.05	mg/L	< 0.05	< 0.05	2.4	< 0.05
TRH - 1999 NEPM Fractions (after silica gel clean-up)						
TRH C10-C14 (after silica gel clean-up)	0.02	mg/L	< 0.02	< 0.02	0.27	< 0.02
TRH C15-C28 (after silica gel clean-up)	0.04	mg/L	< 0.04	< 0.04	1.5	< 0.04
TRH C29-C36 (after silica gel clean-up)	0.04	mg/L	< 0.04	< 0.04	0.72	< 0.04
TRH C10-C36 (Total) (after silica gel clean-up)	0.04	mg/L	< 0.04	< 0.04	2.49	< 0.04
Heavy Metals						
Aluminium (filtered)	0.05	mg/L	< 0.05	< 0.05	< 0.05	< 0.05
Arsenic (filtered)	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Cadmium (filtered)	0.0001	mg/L	< 0.0001	< 0.0001	< 0.0001	< 0.0001
Chromium (filtered)	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Cobalt (filtered)	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Copper (filtered)	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Iron (filtered)	0.01	mg/L	< 0.01	0.01	< 0.01	0.01
Lead (filtered)	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Manganese (filtered)	0.005	mg/L	0.012	0.012	0.010	0.011
Mercury (filtered)	0.0001	mg/L	< 0.0001	< 0.0001	< 0.0001	< 0.0001
Nickel (filtered)	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Vanadium (filtered)	0.005	mg/L	< 0.005	< 0.005	< 0.005	< 0.005
Microbiology						
Faecal (Thermotolerant) Coliforms	1	CFU/100mL	-	-	< 1	< 1
E. Coli	1	CFU/100mL	-	-	< 1	< 1
Enterococci	1	CFU/100mL	-	-	< 1	< 1

Client Sample ID Sample Matrix Eurofins Sample No. Date Sampled Test/Reference	LOR	Unit	WEC1 Water L24- Oc0076421 Oct 26, 2024	SWC1 Water L24- Oc0076422 Oct 26, 2024	SOC1 Water L24- Oc0076423 Oct 26, 2024	SEC1 Water L24- Oc0076424 Oct 26, 2024
Naphthalene^{N02}						
TRH >C10-C16 after Silica Cleanup less Naphthalene (F2)	0.02	mg/L	< 0.02	< 0.02	< 0.02	< 0.02
Chlorophyll-a	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Chromium (VI)	0.002	mg/L	< 0.002	< 0.002	< 0.002	< 0.002
Chromium (III) (filtered)*	0.002	mg/L	< 0.002	< 0.002	< 0.002	< 0.002
BTEX						
Benzene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Toluene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Ethylbenzene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
m&p-Xylenes	0.002	mg/L	< 0.002	< 0.002	< 0.002	< 0.002
o-Xylene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Xylenes - Total*	0.003	mg/L	< 0.003	< 0.003	< 0.003	< 0.003
BTEX						
4-Bromofluorobenzene (surr.)	1	%	62	60	57	61

Client Sample ID Sample Matrix Eurofins Sample No. Date Sampled Test/Reference	LOR	Unit	WEC1 Water L24- Oc0076421 Oct 26, 2024	SWC1 Water L24- Oc0076422 Oct 26, 2024	SOC1 Water L24- Oc0076423 Oct 26, 2024	SEC1 Water L24- Oc0076424 Oct 26, 2024
Polycyclic Aromatic Hydrocarbons						
Benzo(a)pyrene TEQ (lower bound) *	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Acenaphthene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Acenaphthylene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Anthracene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Benz(a)anthracene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Benzo(a)pyrene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Benzo(b&j)fluoranthene ^{N07}	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Benzo(g,h,i)perylene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Benzo(k)fluoranthene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Chrysene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Dibenz(a,h)anthracene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Fluoranthene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Fluorene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Indeno(1.2.3-cd)pyrene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Naphthalene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Phenanthrene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Pyrene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Total PAH*	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
2-Fluorobiphenyl (surr.)	1	%	102	118	116	128
p-Terphenyl-d14 (surr.)	1	%	110	130	130	143
TRH - 2013 NEPM Fractions (after silica gel clean-up)						
TRH >C10-C16 (after silica gel clean-up)	0.02	mg/L	< 0.02	< 0.02	< 0.02	< 0.02
TRH >C16-C34 (after silica gel clean-up)	0.05	mg/L	< 0.05	< 0.05	< 0.05	< 0.05
TRH >C34-C40 (after silica gel clean-up)	0.05	mg/L	< 0.05	< 0.05	< 0.05	< 0.05
TRH >C10-C40 (total) (after silica-gel clean up)*	0.05	mg/L	< 0.05	< 0.05	< 0.05	< 0.05
TRH - 1999 NEPM Fractions (after silica gel clean-up)						
TRH C10-C14 (after silica gel clean-up)	0.02	mg/L	< 0.02	< 0.02	< 0.02	< 0.02
TRH C15-C28 (after silica gel clean-up)	0.04	mg/L	< 0.04	< 0.04	< 0.04	< 0.04
TRH C29-C36 (after silica gel clean-up)	0.04	mg/L	< 0.04	< 0.04	< 0.04	< 0.04
TRH C10-C36 (Total) (after silica gel clean-up)	0.04	mg/L	< 0.04	< 0.04	< 0.04	< 0.04
Heavy Metals						
Aluminium (filtered)	0.05	mg/L	< 0.05	< 0.05	< 0.05	< 0.05
Arsenic (filtered)	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Cadmium (filtered)	0.0001	mg/L	< 0.0001	< 0.0001	< 0.0001	< 0.0001
Chromium (filtered)	0.001	mg/L	< 0.001	< 0.001	0.001	< 0.001
Cobalt (filtered)	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Copper (filtered)	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Iron (filtered)	0.01	mg/L	0.01	0.02	0.02	0.02
Lead (filtered)	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Manganese (filtered)	0.005	mg/L	0.018	0.020	0.017	0.054
Mercury (filtered)	0.0001	mg/L	< 0.0001	< 0.0001	< 0.0001	< 0.0001
Nickel (filtered)	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Vanadium (filtered)	0.005	mg/L	< 0.005	< 0.005	< 0.005	< 0.005
Microbiology						
Faecal (Thermotolerant) Coliforms	1	CFU/100mL	< 1	-	-	-
E. Coli	1	CFU/100mL	< 1	-	-	-
Enterococci	1	CFU/100mL	< 1	-	-	-

Client Sample ID Sample Matrix Eurofins Sample No. Date Sampled Test/Reference	LOR	Unit	SRC1 Water L24- Oc0076425 Oct 26, 2024	REF1 Water L24- Oc0076426 Oct 27, 2024	REF2 Water L24- Oc0076427 Oct 27, 2024	REF3 Water L24- Oc0076428 Oct 27, 2024
Naphthalene ^{N02}	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
TRH >C10-C16 after Silica Cleanup less Naphthalene (F2)	0.02	mg/L	< 0.02	< 0.02	< 0.02	< 0.02
Chlorophyll-a	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Chromium (VI)	0.002	mg/L	< 0.002	< 0.002	< 0.002	< 0.002
Chromium (III) (filtered)*	0.002	mg/L	< 0.002	< 0.002	< 0.002	< 0.002
BTEX						
Benzene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Toluene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Ethylbenzene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
m&p-Xylenes	0.002	mg/L	< 0.002	< 0.002	< 0.002	< 0.002
o-Xylene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Xylenes - Total*	0.003	mg/L	< 0.003	< 0.003	< 0.003	< 0.003
BTEX						
4-Bromofluorobenzene (surr.)	1	%	61	57	60	54
Polycyclic Aromatic Hydrocarbons						
Benzo(a)pyrene TEQ (lower bound) *	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Acenaphthene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Acenaphthylene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Anthracene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Benz(a)anthracene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Benzo(a)pyrene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Benzo(b&j)fluoranthene ^{N07}	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Benzo(g,h,i)perylene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Benzo(k)fluoranthene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Chrysene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Dibenz(a,h)anthracene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Fluoranthene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Fluorene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Indeno(1.2.3-cd)pyrene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Naphthalene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Phenanthrene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Pyrene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Total PAH*	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
2-Fluorobiphenyl (surr.)	1	%	115	75	112	109
p-Terphenyl-d14 (surr.)	1	%	134	82	120	131
TRH - 2013 NEPM Fractions (after silica gel clean-up)						
TRH >C10-C16 (after silica gel clean-up)	0.02	mg/L	< 0.02	< 0.02	< 0.02	< 0.02
TRH >C16-C34 (after silica gel clean-up)	0.05	mg/L	< 0.05	< 0.05	< 0.05	< 0.05
TRH >C34-C40 (after silica gel clean-up)	0.05	mg/L	< 0.05	< 0.05	< 0.05	< 0.05
TRH >C10-C40 (total) (after silica-gel clean up)*	0.05	mg/L	< 0.05	< 0.05	< 0.05	< 0.05
TRH - 1999 NEPM Fractions (after silica gel clean-up)						
TRH C10-C14 (after silica gel clean-up)	0.02	mg/L	< 0.02	< 0.02	< 0.02	< 0.02
TRH C15-C28 (after silica gel clean-up)	0.04	mg/L	< 0.04	< 0.04	< 0.04	< 0.04
TRH C29-C36 (after silica gel clean-up)	0.04	mg/L	< 0.04	< 0.04	< 0.04	< 0.04
TRH C10-C36 (Total) (after silica gel clean-up)	0.04	mg/L	< 0.04	< 0.04	< 0.04	< 0.04

Client Sample ID			SRC1	REF1	REF2	REF3
Sample Matrix			Water	Water	Water	Water
Eurofins Sample No.			L24- Oc0076425	L24- Oc0076426	L24- Oc0076427	L24- Oc0076428
Date Sampled			Oct 26, 2024	Oct 27, 2024	Oct 27, 2024	Oct 27, 2024
Test/Reference	LOR	Unit				
Heavy Metals						
Aluminium (filtered)	0.05	mg/L	< 0.05	< 0.05	< 0.05	< 0.05
Arsenic (filtered)	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Cadmium (filtered)	0.0001	mg/L	< 0.0001	< 0.0001	< 0.0001	< 0.0001
Chromium (filtered)	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Cobalt (filtered)	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Copper (filtered)	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Iron (filtered)	0.01	mg/L	0.02	0.02	0.02	0.04
Lead (filtered)	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Manganese (filtered)	0.005	mg/L	0.040	< 0.005	< 0.005	0.013
Mercury (filtered)	0.0001	mg/L	< 0.0001	< 0.0001	< 0.0001	< 0.0001
Nickel (filtered)	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Vanadium (filtered)	0.005	mg/L	< 0.005	< 0.005	< 0.005	< 0.005
Microbiology						
Faecal (Thermotolerant) Coliforms	1	CFU/100mL	-	< 1	-	-
E. Coli	1	CFU/100mL	-	< 1	-	-
Enterococci	1	CFU/100mL	-	< 1	-	-

Client Sample ID			DUP1	RINSE	SBM1	SBM2
Sample Matrix			Water	Water	Water	Water
Eurofins Sample No.			L24- Oc0076429	L24- Oc0076430	L24- Oc0076431	L24- Oc0076432
Date Sampled			Oct 26, 2024	Oct 26, 2024	Oct 26, 2024	Oct 26, 2024
Test/Reference	LOR	Unit				
Naphthalene ^{N02}	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
TRH >C10-C16 after Silica Cleanup less Naphthalene (F2)	0.02	mg/L	< 0.02	< 0.02	< 0.02	< 0.02
Chlorophyll-a	0.001	mg/L	< 0.001	-	< 0.001	< 0.001
Chromium (VI)	0.002	mg/L	< 0.002	< 0.002	< 0.002	< 0.002
Chromium (III) (filtered)*	0.002	mg/L	< 0.002	< 0.002	< 0.002	< 0.002
BTEX						
Benzene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Toluene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Ethylbenzene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
m&p-Xylenes	0.002	mg/L	< 0.002	< 0.002	< 0.002	< 0.002
o-Xylene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Xylenes - Total*	0.003	mg/L	< 0.003	< 0.003	< 0.003	< 0.003
BTEX						
4-Bromofluorobenzene (surr.)	1	%	55	57	62	97
Polycyclic Aromatic Hydrocarbons						
Benzo(a)pyrene TEQ (lower bound) *	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Acenaphthene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Acenaphthylene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Anthracene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Benz(a)anthracene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Benzo(a)pyrene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Benzo(b&j)fluoranthene ^{N07}	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Benzo(g,h,i)perylene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001

Client Sample ID Sample Matrix Eurofins Sample No. Date Sampled Test/Reference	LOR	Unit	DUP1 Water L24- Oc0076429 Oct 26, 2024	RINSE Water L24- Oc0076430 Oct 26, 2024	SBM1 Water L24- Oc0076431 Oct 26, 2024	SBM2 Water L24- Oc0076432 Oct 26, 2024
Polycyclic Aromatic Hydrocarbons						
Benzo(k)fluoranthene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Chrysene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Dibenz(a,h)anthracene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Fluoranthene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Fluorene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Indeno(1.2.3-cd)pyrene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Naphthalene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Phenanthrene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Pyrene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Total PAH*	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
2-Fluorobiphenyl (surr.)	1	%	111	111	106	115
p-Terphenyl-d14 (surr.)	1	%	123	139	123	136
TRH - 2013 NEPM Fractions (after silica gel clean-up)						
TRH >C10-C16 (after silica gel clean-up)	0.02	mg/L	< 0.02	< 0.02	< 0.02	< 0.02
TRH >C16-C34 (after silica gel clean-up)	0.05	mg/L	< 0.05	< 0.05	< 0.05	< 0.05
TRH >C34-C40 (after silica gel clean-up)	0.05	mg/L	< 0.05	< 0.05	< 0.05	< 0.05
TRH >C10-C40 (total) (after silica-gel clean up)*	0.05	mg/L	< 0.05	< 0.05	< 0.05	< 0.05
TRH - 1999 NEPM Fractions (after silica gel clean-up)						
TRH C10-C14 (after silica gel clean-up)	0.02	mg/L	< 0.02	< 0.02	< 0.02	< 0.02
TRH C15-C28 (after silica gel clean-up)	0.04	mg/L	< 0.04	< 0.04	< 0.04	< 0.04
TRH C29-C36 (after silica gel clean-up)	0.04	mg/L	< 0.04	< 0.04	< 0.04	< 0.04
TRH C10-C36 (Total) (after silica gel clean-up)	0.04	mg/L	< 0.04	< 0.04	< 0.04	< 0.04
Heavy Metals						
Aluminium (filtered)	0.05	mg/L	< 0.05	< 0.05	< 0.05	< 0.05
Arsenic (filtered)	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Cadmium (filtered)	0.0001	mg/L	< 0.0001	< 0.0001	< 0.0001	< 0.0001
Chromium (filtered)	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Cobalt (filtered)	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Copper (filtered)	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Iron (filtered)	0.01	mg/L	0.02	< 0.01	0.01	0.01
Lead (filtered)	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Manganese (filtered)	0.005	mg/L	0.011	< 0.005	< 0.005	< 0.005
Mercury (filtered)	0.0001	mg/L	< 0.0001	< 0.0001	< 0.0001	< 0.0001
Nickel (filtered)	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Vanadium (filtered)	0.005	mg/L	< 0.005	< 0.005	< 0.005	< 0.005
Microbiology						
Faecal (Thermotolerant) Coliforms	1	CFU/100mL	-	-	1(Present)	< 1
E. Coli	1	CFU/100mL	-	-	< 1	< 1
Enterococci	1	CFU/100mL	-	-	< 1	3.0

Client Sample ID			REF4
Sample Matrix			Water
Eurofins Sample No.			L24- Oc0076433
Date Sampled			Oct 26, 2024
Test/Reference	LOR	Unit	
Naphthalene ^{N02}	0.001	mg/L	< 0.001
TRH >C10-C16 after Silica Cleanup less Naphthalene (F2)	0.02	mg/L	< 0.02
Chlorophyll-a	0.001	mg/L	< 0.001
Chromium (VI)	0.002	mg/L	< 0.002
Chromium (III) (filtered)*	0.002	mg/L	< 0.002
BTEX			
Benzene	0.001	mg/L	< 0.001
Toluene	0.001	mg/L	< 0.001
Ethylbenzene	0.001	mg/L	< 0.001
m&p-Xylenes	0.002	mg/L	< 0.002
o-Xylene	0.001	mg/L	< 0.001
Xylenes - Total*	0.003	mg/L	< 0.003
BTEX			
4-Bromofluorobenzene (surr.)	1	%	59
Polycyclic Aromatic Hydrocarbons			
Benzo(a)pyrene TEQ (lower bound) *	0.001	mg/L	< 0.001
Acenaphthene	0.001	mg/L	< 0.001
Acenaphthylene	0.001	mg/L	< 0.001
Anthracene	0.001	mg/L	< 0.001
Benz(a)anthracene	0.001	mg/L	< 0.001
Benzo(a)pyrene	0.001	mg/L	< 0.001
Benzo(b&j)fluoranthene ^{N07}	0.001	mg/L	< 0.001
Benzo(g,h,i)perylene	0.001	mg/L	< 0.001
Benzo(k)fluoranthene	0.001	mg/L	< 0.001
Chrysene	0.001	mg/L	< 0.001
Dibenz(a,h)anthracene	0.001	mg/L	< 0.001
Fluoranthene	0.001	mg/L	< 0.001
Fluorene	0.001	mg/L	< 0.001
Indeno(1.2.3-cd)pyrene	0.001	mg/L	< 0.001
Naphthalene	0.001	mg/L	< 0.001
Phenanthrene	0.001	mg/L	< 0.001
Pyrene	0.001	mg/L	< 0.001
Total PAH*	0.001	mg/L	< 0.001
2-Fluorobiphenyl (surr.)	1	%	103
p-Terphenyl-d14 (surr.)	1	%	121
TRH - 2013 NEPM Fractions (after silica gel clean-up)			
TRH >C10-C16 (after silica gel clean-up)	0.02	mg/L	< 0.02
TRH >C16-C34 (after silica gel clean-up)	0.05	mg/L	< 0.05
TRH >C34-C40 (after silica gel clean-up)	0.05	mg/L	< 0.05
TRH >C10-C40 (total) (after silica-gel clean up)*	0.05	mg/L	< 0.05
TRH - 1999 NEPM Fractions (after silica gel clean-up)			
TRH C10-C14 (after silica gel clean-up)	0.02	mg/L	< 0.02
TRH C15-C28 (after silica gel clean-up)	0.04	mg/L	< 0.04
TRH C29-C36 (after silica gel clean-up)	0.04	mg/L	< 0.04
TRH C10-C36 (Total) (after silica gel clean-up)	0.04	mg/L	< 0.04

Client Sample ID			REF4
Sample Matrix			Water
Eurofins Sample No.			L24- Oc0076433
Date Sampled			Oct 26, 2024
Test/Reference	LOR	Unit	
Heavy Metals			
Aluminium (filtered)	0.05	mg/L	< 0.05
Arsenic (filtered)	0.001	mg/L	< 0.001
Cadmium (filtered)	0.0001	mg/L	< 0.0001
Chromium (filtered)	0.001	mg/L	< 0.001
Cobalt (filtered)	0.001	mg/L	< 0.001
Copper (filtered)	0.001	mg/L	< 0.001
Iron (filtered)	0.01	mg/L	< 0.01
Lead (filtered)	0.001	mg/L	< 0.001
Manganese (filtered)	0.005	mg/L	< 0.005
Mercury (filtered)	0.0001	mg/L	< 0.0001
Nickel (filtered)	0.001	mg/L	< 0.001
Vanadium (filtered)	0.005	mg/L	< 0.005
Microbiology			
Faecal (Thermotolerant) Coliforms	1	CFU/100mL	< 1
E. Coli	1	CFU/100mL	< 1
Enterococci	1	CFU/100mL	< 1

Sample History

Where samples are submitted/analysed over several days, the last date of extraction is reported.

If the date and time of sampling are not provided, the Laboratory will not be responsible for compromised results should testing be performed outside the recommended holding time.

Description	Testing Site	Extracted	Holding Time
Naphthalene	Welshpool	Oct 30, 2024	14 Days
- Method: LTM-ORG-2010 TRH C6-C40			
BTEX	Welshpool	Oct 30, 2024	14 Days
- Method: LTM-ORG-2010 TRH C6-C40			
TRH - 2013 NEPM Fractions (after silica gel clean-up)	Welshpool	Oct 30, 2024	7 Days
- Method: LTM-ORG-2010 TRH C6-C40			
TRH - 1999 NEPM Fractions (after silica gel clean-up)	Welshpool	Oct 30, 2024	7 Days
- Method: LTM-ORG-2010 TRH C6-C40			
Chlorophyll-a	Welshpool	Oct 30, 2024	28 Days
- Method: ARL141 - Chlorophyll-a and Pheophytin-a in Water			
Chromium (VI)	Welshpool	Oct 30, 2024	1 Day
- Method: ARL316 - Hexavalent Chromium in Water by Discrete Analyser			
Chromium (III) (filtered)*	Welshpool	Oct 29, 2024	180 Days
- Method: ARL402/403 - Metals in Water by ICPOES/ICPMS			
Polycyclic Aromatic Hydrocarbons	Welshpool	Oct 30, 2024	7 Days
- Method: LTM-ORG-2130 PAH and Phenols in Soil and Water			
Heavy Metals (filtered)	Welshpool	Nov 01, 2024	28 Days
- Method: LTM-MET-3040 Metals in Waters, Soils & Sediments by ICP-MS			
Faecal (Thermotolerant) Coliforms	MicWA	Oct 29, 2024	24 Hours
- Method: PM 4.2A - Total Coliforms, E.coli and Thermotolerant Coliforms by Membrane Filtration			
E. Coli	MicWA	Oct 29, 2024	24 Hours
- Method: PM 4.2A - Total Coliforms, E.coli and Thermotolerant Coliforms by Membrane Filtration			
Enterococci	MicWA	Oct 29, 2024	24 Hours
- Method: PM 4.4 - Faecal Streptococci (Enterococci) by Membrane Filtration			



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Project Name:

Port of Port Hedland MEQSAP Monitoring

Project ID:

22ENV179

Order No.:

Report #:

Phone:

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1154287

Received:

Due:

Priority:

Contact Name:

Oct 29, 2024 9:40 AM

Nov 5, 2024

5 Day

Russell Stevens

Eurofins Analytical Services Manager : Elden Garrett

Sample Detail						Aluminium (filtered)	Arsenic (filtered)	Cadmium (filtered)	Chlorophyll-a	Chromium (III) (filtered)*	Chromium (VI)	Cobalt (filtered)	Copper (filtered)	E. Coli	Enterococci	Faecal (Thermotolerant) Coliforms	Iron (filtered)	Lead (filtered)	Manganese (filtered)	Mercury (filtered)	Nickel (filtered)	Vanadium (filtered)	Polycyclic Aromatic Hydrocarbons	Eurofins Suite B1SG: TRH (With Silica Gel Clean up), BTEXN
Perth Laboratory - NATA # 2377 Site # 2370 & 2554						X	X	X	X	X	X	X	X				X	X	X	X	X	X	X	X
External Laboratory																								
No	Sample ID	Sample Date	Sampling Time	Matrix	LAB ID																			
1	IH1	Oct 26, 2024	1:30PM	Water	L24-Oc0076417	X	X	X	X	X	X	X	X				X	X	X	X	X	X	X	X
2	IH2	Oct 26, 2024	11:45AM	Water	L24-Oc0076418	X	X	X	X	X	X	X	X				X	X	X	X	X	X	X	X
3	IH3	Oct 26, 2024	2:00PM	Water	L24-Oc0076419	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
4	IH4	Oct 26, 2024	10:20AM	Water	L24-Oc0076420	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
5	WEC1	Oct 26, 2024	11:15AM	Water	L24-Oc0076421	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
6	SWC1	Oct 26, 2024	12:15PM	Water	L24-Oc0076422	X	X	X	X	X	X	X	X				X	X	X	X	X	X	X	X
7	SOC1	Oct 26, 2024	1:00PM	Water	L24-Oc0076423	X	X	X	X	X	X	X	X				X	X	X	X	X	X	X	X
8	SEC1	Oct 26, 2024	10:30AM	Water	L24-Oc0076424	X	X	X	X	X	X	X	X				X	X	X	X	X	X	X	X
9	SRC1	Oct 26, 2024	10:51AM	Water	L24-Oc0076425	X	X	X	X	X	X	X	X				X	X	X	X	X	X	X	X
10	REF1	Oct 27, 2024	9:40AM	Water	L24-Oc0076426	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
11	REF2	Oct 27, 2024	9:20AM	Water	L24-Oc0076427	X	X	X	X	X	X	X	X				X	X	X	X	X	X	X	X
12	REF3	Oct 27, 2024	8:55AM	Water	L24-Oc0076428	X	X	X	X	X	X	X	X				X	X	X	X	X	X	X	X
13	DUP1	Oct 26, 2024		Water	L24-Oc0076429	X	X	X	X	X	X	X	X				X	X	X	X	X	X	X	X
14	RINSE	Oct 26, 2024		Water	L24-Oc0076430	X	X	X		X	X	X	X				X	X	X	X	X	X	X	X



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Report #: 1154287
Phone:
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Received: Oct 29, 2024 9:40 AM
Due: Nov 5, 2024
Priority: 5 Day
Contact Name: Russell Stevens

Project Name: Port of Port Hedland MEQSAP Monitoring
Project ID: 22ENV179

Eurofins Analytical Services Manager : Elden Garrett

Sample Detail						Aluminium (filtered)	Arsenic (filtered)	Cadmium (filtered)	Chlorophyll-a	Chromium (III) (filtered)*	Chromium (VI)	Cobalt (filtered)	Copper (filtered)	E. Coli	Enterococci	Faecal (Thermotolerant) Coliforms	Iron (filtered)	Lead (filtered)	Manganese (filtered)	Mercury (filtered)	Nickel (filtered)	Vanadium (filtered)	Polycyclic Aromatic Hydrocarbons	Eurofins Suite B1SG: TRH (With Silica Gel Clean up), BTEXN
Perth Laboratory - NATA # 2377 Site # 2370 & 2554						X	X	X	X	X	X	X	X				X	X	X	X	X	X	X	X
External Laboratory																								
No	Sample ID	Sample Date	Sampling Time	Matrix	LAB ID																			
15	SBM1	Oct 26, 2024	9:18AM	Water	L24-Oc0076431	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
16	SBM2	Oct 26, 2024	9:45AM	Water	L24-Oc0076432	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
17	REF4	Oct 26, 2024	10:09AM	Water	L24-Oc0076433	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Test Counts						17	17	17	16	17	17	17	17	7	7	7	17	17	17	17	17	17	17	17

Internal Quality Control Review and Glossary

General

1. Laboratory QC results for Method Blanks, Duplicates, Matrix Spikes, and Laboratory Control Samples follow guidelines delineated in the National Environment Protection (Assessment of Site Contamination) Measure 1999, as amended May 2013. They are included in this QC report where applicable. Additional QC data may be available on request.
2. Unless otherwise stated, all soil/sediment/solid results are reported on a dry weight basis.
3. Unless otherwise stated, all biota/food results are reported on a wet weight basis on the edible portion.
4. For CEC results where the sample's origin is unknown or environmentally contaminated, the results should be used advisedly.
5. Actual LORs are matrix dependent. Quoted LORs may be raised where sample extracts are diluted due to interferences.
6. Results are uncorrected for matrix spikes or surrogate recoveries except for PFAS compounds where annotated.
7. SVOC analysis on waters is performed on homogenised, unfiltered samples unless noted otherwise.
8. Samples were analysed on an 'as received' basis.
9. Information identified in this report with **blue** colour indicates data provided by customers that may have an impact on the results.
10. This report replaces any interim results previously issued.

Holding Times

Please refer to the 'Sample Preservation and Container Guide' for holding times (QS3001).

For samples received on the last day of holding time, notification of testing requirements should have been received at least 6 hours before sample receipt deadlines as stated on the SRA.

If the Laboratory did not receive the information in the required timeframe, and despite any other integrity issues, suitably qualified results may still be reported.

Holding times apply from the sampling date; therefore, compliance with these may be outside the laboratory's control.

For VOCs containing vinyl chloride, styrene and 2-chloroethyl vinyl ether, the holding time is seven days; however, for all other VOCs, such as BTEX or C6-10 TRH, the holding time is 14 days.

Units

mg/kg: milligrams per kilogram	mg/L: milligrams per litre	ppm: parts per million
µg/L: micrograms per litre	ppb: parts per billion	%: Percentage
org/100 mL: Organisms per 100 millilitres	NTU: Nephelometric Turbidity Units	MPN/100 mL: Most Probable Number of organisms per 100 millilitres
CFU: Colony Forming Unit	Colour: Pt-Co Units (CU)	

Terms

APHA	American Public Health Association
CEC	Cation Exchange Capacity
COC	Chain of Custody
CP	Client Parent - QC was performed on samples pertaining to this report
CRM	Certified Reference Material (ISO17034) - reported as percent recovery.
Dry	Where moisture has been determined on a solid sample, the result is expressed on a dry weight basis.
Duplicate	A second piece of analysis from the same sample and reported in the same units as the result to show comparison.
LOR	Limit of Reporting.
LCS	Laboratory Control Sample - reported as percent recovery.
Method Blank	In the case of solid samples, these are performed on laboratory-certified clean sands and in the case of water samples, these are performed on de-ionised water.
NCP	Non-Client Parent - QC performed on samples not pertaining to this report, QC represents the sequence or batch that client samples were analysed within.
RPD	Relative Percent Difference between two Duplicate pieces of analysis.
SPIKE	Addition of the analyte to the sample and reported as percentage recovery.
SRA	Sample Receipt Advice
Surr - Surrogate	The addition of a similar compound to the analyte target is reported as percentage recovery. See below for acceptance criteria.
TBTO	Tributyltin oxide (<i>bis</i> -tributyltin oxide) - individual tributyltin compounds cannot be identified separately in the environment; however, free tributyltin was measured, and its values were converted stoichiometrically into tributyltin oxide for comparison with regulatory limits.
TCLP	Toxicity Characteristic Leaching Procedure
TEQ	Toxic Equivalency Quotient or Total Equivalence
QSM	US Department of Defense Quality Systems Manual Version 6.0
US EPA	United States Environmental Protection Agency
WA DWER	Sum of PFBA, PFPeA, PFHxA, PFHpA, PFOA, PFBS, PFHxS, PFOS, 6:2 FTSA, 8:2 FTSA

QC - Acceptance Criteria

The acceptance criteria should only be used as a guide and may be different when site-specific Sampling Analysis and Quality Plan (SAQP) have been implemented.

RPD Duplicates: Global RPD Duplicates Acceptance Criteria is ≤30%; however, the following acceptance guidelines are equally applicable:

Results <10 times the LOR:	No Limit
Results between 10-20 times the LOR:	RPD must lie between 0-50%
Results >20 times the LOR:	RPD must lie between 0-30%

NOTE: pH duplicates are reported as a range, not as RPD

Surrogate Recoveries: Recoveries must lie between 20-130% for Speciated Phenols & 50-150% for PFAS. SVOCs recoveries 20 – 150%, VOC recoveries 50 – 150%

PFAS field samples containing surrogate recoveries above the QC limit designated in QSM 6.0, where no positive PFAS results have been reported or reviewed, and no data was affected.

QC Data General Comments

1. Where a result is reported as less than (<), higher than the nominated LOR, this is due to either matrix interference, extract dilution required due to interferences or contaminant levels within the sample, high moisture content or insufficient sample provided.
2. Duplicate data shown within this report that states the word "BATCH" is a Batch Duplicate from outside of your sample batch but within the laboratory sample batch at a 1:10 ratio. The Parent and Duplicate data shown are not data from your samples.
3. pH and Free Chlorine analysed in the laboratory - Analysis on this test must begin within 30 minutes of sampling. Therefore, laboratory analysis is unlikely to be completed within holding time. Analysis will begin as soon as possible after sample receipt.
4. Recovery Data (Spikes & Surrogates) - where chromatographic interference does not allow the determination of recovery, the term "INT" appears against that analyte.
5. For Matrix Spikes and LCS results, a dash "-" in the report means that the specific analyte was not added to the QC sample.
6. Duplicate RPDs are calculated from raw analytical data; thus, it is possible to have two sets of data.

Quality Control Results

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Method Blank							
Naphthalene	mg/L	< 0.001			0.001	Pass	
Chromium (VI)	mg/L	< 0.002			0.002	Pass	
Method Blank							
BTEX							
Benzene	mg/L	< 0.001			0.001	Pass	
Toluene	mg/L	< 0.001			0.001	Pass	
Ethylbenzene	mg/L	< 0.001			0.001	Pass	
m&p-Xylenes	mg/L	< 0.002			0.002	Pass	
o-Xylene	mg/L	< 0.001			0.001	Pass	
Xylenes - Total*	mg/L	< 0.003			0.003	Pass	
Method Blank							
TRH - 2013 NEPM Fractions (after silica gel clean-up)							
TRH >C10-C16 (after silica gel clean-up)	mg/L	< 0.02			0.02	Pass	
TRH >C16-C34 (after silica gel clean-up)	mg/L	< 0.05			0.05	Pass	
TRH >C34-C40 (after silica gel clean-up)	mg/L	< 0.05			0.05	Pass	
Method Blank							
TRH - 1999 NEPM Fractions (after silica gel clean-up)							
TRH C10-C14 (after silica gel clean-up)	mg/L	< 0.02			0.02	Pass	
TRH C15-C28 (after silica gel clean-up)	mg/L	< 0.04			0.04	Pass	
TRH C29-C36 (after silica gel clean-up)	mg/L	< 0.04			0.04	Pass	
Method Blank							
Heavy Metals							
Aluminium (filtered)	mg/L	< 0.05			0.05	Pass	
Arsenic (filtered)	mg/L	< 0.001			0.001	Pass	
Cadmium (filtered)	mg/L	< 0.0001			0.0001	Pass	
Chromium (filtered)	mg/L	< 0.001			0.001	Pass	
Cobalt (filtered)	mg/L	< 0.001			0.001	Pass	
Copper (filtered)	mg/L	< 0.001			0.001	Pass	
Iron (filtered)	mg/L	< 0.01			0.01	Pass	
Lead (filtered)	mg/L	< 0.001			0.001	Pass	
Manganese (filtered)	mg/L	< 0.005			0.005	Pass	
Mercury (filtered)	mg/L	< 0.0001			0.0001	Pass	
Nickel (filtered)	mg/L	< 0.001			0.001	Pass	
Vanadium (filtered)	mg/L	< 0.005			0.005	Pass	
Method Blank							
Polycyclic Aromatic Hydrocarbons							
Acenaphthene	mg/L	< 0.001			0.001	Pass	
Acenaphthylene	mg/L	< 0.001			0.001	Pass	
Anthracene	mg/L	< 0.001			0.001	Pass	
Benz(a)anthracene	mg/L	< 0.001			0.001	Pass	
Benzo(a)pyrene	mg/L	< 0.001			0.001	Pass	
Benzo(b&j)fluoranthene	mg/L	< 0.001			0.001	Pass	
Benzo(g,h,i)perylene	mg/L	< 0.001			0.001	Pass	
Benzo(k)fluoranthene	mg/L	< 0.001			0.001	Pass	
Chrysene	mg/L	< 0.001			0.001	Pass	
Dibenz(a,h)anthracene	mg/L	< 0.001			0.001	Pass	
Fluoranthene	mg/L	< 0.001			0.001	Pass	
Fluorene	mg/L	< 0.001			0.001	Pass	
Indeno(1,2,3-cd)pyrene	mg/L	< 0.001			0.001	Pass	
Naphthalene	mg/L	< 0.001			0.001	Pass	
Phenanthrene	mg/L	< 0.001			0.001	Pass	

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Pyrene	mg/L	< 0.001			0.001	Pass	
LCS - % Recovery							
Naphthalene	%	85			70-130	Pass	
LCS - % Recovery							
BTEX							
Benzene	%	86			70-130	Pass	
Toluene	%	96			70-130	Pass	
Ethylbenzene	%	107			70-130	Pass	
m&p-Xylenes	%	102			70-130	Pass	
o-Xylene	%	99			70-130	Pass	
Xylenes - Total*	%	101			70-130	Pass	
LCS - % Recovery							
TRH - 2013 NEPM Fractions (after silica gel clean-up)							
TRH >C10-C16 (after silica gel clean-up)	%	106			70-130	Pass	
LCS - % Recovery							
TRH - 1999 NEPM Fractions (after silica gel clean-up)							
TRH C10-C14 (after silica gel clean-up)	%	103			70-130	Pass	
LCS - % Recovery							
Heavy Metals							
Aluminium (filtered)	%	86			80-120	Pass	
Arsenic (filtered)	%	97			80-120	Pass	
Cadmium (filtered)	%	94			80-120	Pass	
Chromium (filtered)	%	98			80-120	Pass	
Cobalt (filtered)	%	97			80-120	Pass	
Copper (filtered)	%	93			80-120	Pass	
Iron (filtered)	%	95			80-120	Pass	
Lead (filtered)	%	87			80-120	Pass	
Manganese (filtered)	%	97			80-120	Pass	
Mercury (filtered)	%	101			80-120	Pass	
Nickel (filtered)	%	96			80-120	Pass	
Vanadium (filtered)	%	101			80-120	Pass	
LCS - % Recovery							
Polycyclic Aromatic Hydrocarbons							
Acenaphthene	%	105			70-130	Pass	
Acenaphthylene	%	97			70-130	Pass	
Anthracene	%	104			70-130	Pass	
Benz(a)anthracene	%	98			70-130	Pass	
Benzo(a)pyrene	%	101			70-130	Pass	
Benzo(b&j)fluoranthene	%	99			70-130	Pass	
Benzo(g,h,i)perylene	%	102			70-130	Pass	
Benzo(k)fluoranthene	%	97			70-130	Pass	
Chrysene	%	105			70-130	Pass	
Dibenz(a,h)anthracene	%	101			70-130	Pass	
Fluoranthene	%	97			70-130	Pass	
Fluorene	%	94			70-130	Pass	
Indeno(1,2,3-cd)pyrene	%	108			70-130	Pass	
Naphthalene	%	102			70-130	Pass	
Phenanthrene	%	91			70-130	Pass	
Pyrene	%	91			70-130	Pass	

Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Spike - % Recovery									
Polycyclic Aromatic Hydrocarbons				Result 1					
Acenaphthene	L24-Oc0079798	NCP	%	110			70-130	Pass	
Acenaphthylene	L24-Oc0079798	NCP	%	95			70-130	Pass	
Anthracene	L24-Oc0079798	NCP	%	103			70-130	Pass	
Benz(a)anthracene	L24-Oc0079798	NCP	%	107			70-130	Pass	
Benzo(a)pyrene	L24-Oc0079798	NCP	%	100			70-130	Pass	
Benzo(b&j)fluoranthene	L24-Oc0079798	NCP	%	105			70-130	Pass	
Benzo(g,h,i)perylene	L24-Oc0079798	NCP	%	98			70-130	Pass	
Benzo(k)fluoranthene	L24-Oc0079798	NCP	%	99			70-130	Pass	
Chrysene	L24-Oc0079798	NCP	%	109			70-130	Pass	
Dibenz(a,h)anthracene	L24-Oc0079798	NCP	%	96			70-130	Pass	
Fluoranthene	L24-Oc0079798	NCP	%	96			70-130	Pass	
Fluorene	L24-Oc0079798	NCP	%	95			70-130	Pass	
Indeno(1,2,3-cd)pyrene	L24-Oc0079798	NCP	%	107			70-130	Pass	
Naphthalene	L24-Oc0079798	NCP	%	106			70-130	Pass	
Phenanthrene	L24-Oc0079798	NCP	%	99			70-130	Pass	
Pyrene	L24-Oc0079798	NCP	%	105			70-130	Pass	
Spike - % Recovery									
				Result 1					
Chromium (VI)	L24-Oc0076418	CP	%	103			80-120	Pass	
Spike - % Recovery									
TRH - 2013 NEPM Fractions (after silica gel clean-up)				Result 1					
TRH >C10-C16 (after silica gel clean-up)	L24-Oc0076418	CP	%	94			70-130	Pass	
Spike - % Recovery									
TRH - 1999 NEPM Fractions (after silica gel clean-up)				Result 1					
TRH C10-C14 (after silica gel clean-up)	L24-Oc0076418	CP	%	92			70-130	Pass	
Spike - % Recovery									
				Result 1					
Naphthalene	L24-Oc0076426	CP	%	87			70-130	Pass	
Spike - % Recovery									
BTEX				Result 1					
Benzene	L24-Oc0076426	CP	%	92			70-130	Pass	
Toluene	L24-Oc0076426	CP	%	91			70-130	Pass	
Ethylbenzene	L24-Oc0076426	CP	%	93			70-130	Pass	
m&p-Xylenes	L24-Oc0076426	CP	%	90			70-130	Pass	
o-Xylene	L24-Oc0076426	CP	%	88			70-130	Pass	
Xylenes - Total*	L24-Oc0076426	CP	%	89			70-130	Pass	
Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Duplicate									
				Result 1	Result 2	RPD			
Chromium (VI)	L24-Oc0076417	CP	mg/L	< 0.002	< 0.002	<1	20%	Pass	
Duplicate									
TRH - 2013 NEPM Fractions (after silica gel clean-up)				Result 1	Result 2	RPD			
TRH >C10-C16 (after silica gel clean-up)	L24-Oc0076417	CP	mg/L	< 0.02	< 0.02	<1	30%	Pass	
TRH >C16-C34 (after silica gel clean-up)	L24-Oc0076417	CP	mg/L	< 0.05	< 0.05	<1	30%	Pass	
TRH >C34-C40 (after silica gel clean-up)	L24-Oc0076417	CP	mg/L	< 0.05	< 0.05	<1	30%	Pass	

Duplicate								
TRH - 1999 NEPM Fractions (after silica gel clean-up)				Result 1	Result 2	RPD		
TRH C10-C14 (after silica gel clean-up)	L24-Oc0076417	CP	mg/L	< 0.02	< 0.02	<1	30%	Pass
TRH C15-C28 (after silica gel clean-up)	L24-Oc0076417	CP	mg/L	< 0.04	< 0.04	<1	30%	Pass
TRH C29-C36 (after silica gel clean-up)	L24-Oc0076417	CP	mg/L	< 0.04	< 0.04	<1	30%	Pass
TRH C10-C36 (Total) (after silica gel clean-up)	L24-Oc0076417	CP	mg/L	< 0.04	< 0.04	<1	30%	Pass
Duplicate								
Heavy Metals				Result 1	Result 2	RPD		
Aluminium (filtered)	L24-Oc0076374	NCP	mg/L	< 0.05	< 0.05	<1	30%	Pass
Arsenic (filtered)	L24-Oc0076374	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass
Cadmium (filtered)	L24-Oc0076374	NCP	mg/L	< 0.0001	< 0.0001	<1	30%	Pass
Chromium (filtered)	L24-Oc0076374	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass
Cobalt (filtered)	L24-Oc0076374	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass
Copper (filtered)	L24-Oc0076374	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass
Iron (filtered)	L24-Oc0076374	NCP	mg/L	< 0.01	< 0.01	<1	30%	Pass
Lead (filtered)	L24-Oc0076374	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass
Manganese (filtered)	L24-Oc0076374	NCP	mg/L	< 0.005	< 0.005	<1	30%	Pass
Mercury (filtered)	L24-Oc0076374	NCP	mg/L	< 0.0001	< 0.0001	<1	30%	Pass
Nickel (filtered)	L24-Oc0076374	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass
Vanadium (filtered)	L24-Oc0076374	NCP	mg/L	0.006	0.007	26	30%	Pass
Duplicate								
				Result 1	Result 2	RPD		
Naphthalene	L24-Oc0076420	CP	mg/L	< 0.001	< 0.001	<1	30%	Pass
Duplicate								
BTX				Result 1	Result 2	RPD		
Benzene	L24-Oc0076420	CP	mg/L	< 0.001	< 0.001	<1	30%	Pass
Toluene	L24-Oc0076420	CP	mg/L	< 0.001	< 0.001	<1	30%	Pass
Ethylbenzene	L24-Oc0076420	CP	mg/L	< 0.001	< 0.001	<1	30%	Pass
m&p-Xylenes	L24-Oc0076420	CP	mg/L	< 0.002	< 0.002	<1	30%	Pass
o-Xylene	L24-Oc0076420	CP	mg/L	< 0.001	< 0.001	<1	30%	Pass
Xylenes - Total*	L24-Oc0076420	CP	mg/L	< 0.003	< 0.003	<1	30%	Pass
Duplicate								
Polycyclic Aromatic Hydrocarbons				Result 1	Result 2	RPD		
Acenaphthene	L24-Oc0076425	CP	mg/L	< 0.001	< 0.001	<1	30%	Pass
Acenaphthylene	L24-Oc0076425	CP	mg/L	< 0.001	< 0.001	<1	30%	Pass
Anthracene	L24-Oc0076425	CP	mg/L	< 0.001	< 0.001	<1	30%	Pass
Benz(a)anthracene	L24-Oc0076425	CP	mg/L	< 0.001	< 0.001	<1	30%	Pass
Benzo(a)pyrene	L24-Oc0076425	CP	mg/L	< 0.001	< 0.001	<1	30%	Pass
Benzo(b&j)fluoranthene	L24-Oc0076425	CP	mg/L	< 0.001	< 0.001	<1	30%	Pass
Benzo(g,h,i)perylene	L24-Oc0076425	CP	mg/L	< 0.001	< 0.001	<1	30%	Pass
Benzo(k)fluoranthene	L24-Oc0076425	CP	mg/L	< 0.001	< 0.001	<1	30%	Pass
Chrysene	L24-Oc0076425	CP	mg/L	< 0.001	< 0.001	<1	30%	Pass
Dibenz(a,h)anthracene	L24-Oc0076425	CP	mg/L	< 0.001	< 0.001	<1	30%	Pass
Fluoranthene	L24-Oc0076425	CP	mg/L	< 0.001	< 0.001	<1	30%	Pass
Fluorene	L24-Oc0076425	CP	mg/L	< 0.001	< 0.001	<1	30%	Pass
Indeno(1,2,3-cd)pyrene	L24-Oc0076425	CP	mg/L	< 0.001	< 0.001	<1	30%	Pass
Naphthalene	L24-Oc0076425	CP	mg/L	< 0.001	< 0.001	<1	30%	Pass
Phenanthrene	L24-Oc0076425	CP	mg/L	< 0.001	< 0.001	<1	30%	Pass
Pyrene	L24-Oc0076425	CP	mg/L	< 0.001	< 0.001	<1	30%	Pass
Duplicate								
				Result 1	Result 2	RPD		
Chromium (VI)	L24-Oc0076427	CP	mg/L	< 0.002	< 0.002	<1	20%	Pass

Duplicate								
TRH - 2013 NEPM Fractions (after silica gel clean-up)				Result 1	Result 2	RPD		
TRH >C10-C16 (after silica gel clean-up)	L24-Oc0076428	CP	mg/L	< 0.02	< 0.02	<1	30%	Pass
TRH >C16-C34 (after silica gel clean-up)	L24-Oc0076428	CP	mg/L	< 0.05	< 0.05	<1	30%	Pass
TRH >C34-C40 (after silica gel clean-up)	L24-Oc0076428	CP	mg/L	< 0.05	< 0.05	<1	30%	Pass
Duplicate								
TRH - 1999 NEPM Fractions (after silica gel clean-up)				Result 1	Result 2	RPD		
TRH C10-C14 (after silica gel clean-up)	L24-Oc0076428	CP	mg/L	< 0.02	< 0.02	<1	30%	Pass
TRH C15-C28 (after silica gel clean-up)	L24-Oc0076428	CP	mg/L	< 0.04	< 0.04	<1	30%	Pass
TRH C29-C36 (after silica gel clean-up)	L24-Oc0076428	CP	mg/L	< 0.04	< 0.04	<1	30%	Pass
TRH C10-C36 (Total) (after silica gel clean-up)	L24-Oc0076428	CP	mg/L	< 0.04	< 0.04	<1	30%	Pass

Comments

Sample Integrity

Custody Seals Intact (if used)	N/A
Attempt to Chill was evident	Yes
Sample correctly preserved	Yes
Appropriate sample containers have been used	Yes
Sample containers for volatile analysis received with minimal headspace	Yes
Samples received within HoldingTime	Yes
Some samples have been subcontracted	No

Qualifier Codes/Comments

Code	Description
N02	Where we have reported both volatile (P&T GCMS) and semivolatile (GCMS) naphthalene data, results may not be identical. Provided correct sample handling protocols have been followed, any observed differences in results are likely to be due to procedural differences within each methodology. Results determined by both techniques have passed all QAQC acceptance criteria, and are entirely technically valid.
N07	Please note:- These two PAH isomers closely co-elute using the most contemporary analytical methods and both the reported concentration (and the TEQ) apply specifically to the total of the two co-eluting PAHs
Q05	The matrix spike concentration is less than five times the background concentration in the sample - therefore the spike recovery cannot be determined

Authorised by:

Elden Garrett	Analytical Services Manager
Lauren Killin	Senior Analyst-Inorganic
Lolita Kusnandar	Senior Analyst-Microbiology
Patrick Patfield	Senior Analyst-Organic
Patrick Patfield	Senior Analyst-Volatile
Sean Sangster	Senior Analyst-Metal



Kim Rodgers
General Manager

Final Report – this report replaces any previously issued Report

- Indicates Not Requested

* Indicates NATA accreditation does not cover the performance of this service

Measurement uncertainty of test data is available on request

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Appendix B Spoilbank Marina MEWQMP Summary Report Q2



Subject	DoT Spoilbank Marina Water Quality Q2 Summary Report		
Date	31/03/2025	Reference	24ENV368 / T250051
To	Pearl Delima	Email	Pearl.Delima@transport.wa.gov.au
From	Cameron Holder	Email	cameron.holder@o2marine.com.au
From	Russell Stevens	Email	russell.stevens@o2marine.com.au

1. Introduction

The Spoilbank Marina (the Marina) is located on Lot 5751 and Lot 5550 on a site commonly known as the ‘Spoilbank’ which is an artificial coastal landform created in the late-1960s/early-1970s from the disposal of material dredged from Port Hedland’s inner harbour and shipping channel. The Spoilbank Marina will replace the existing Richardson Street boat ramp (which will be closed) and redirect boating activities away from the commercial operations of Port Hedland’s inner harbour and navigation channel (Town of Port Hedland 2019). The Marina development plans included a four-lane boat ramp, 80 boat pens, 208 trailer and 86 car parking bays, dry dock area for commercial vessels, public and pen holder amenities, public open space, and recreation and event space (**Figure 1**).

Federal environmental approval for the construction of the Marina was granted by the Department of Climate Change, Energy, the Environment and Water (DCCEEW) under the Environmental Protection and Biodiversity Conservation Act 1999 (Cth) (EPBC Act) on 19 February 2021 via EPBC 2019/8520. As part of the approval Conditions, the proponent was required to:

- Condition 5: submit an Operational Environment Management Plan (OEMP), at least three months prior to the anticipated commencement of the operation of the marina, for the Minister’s approval to ensure that the operation of the marina does not significantly impact protected matters. The OEMP must:
 - Condition 5 part c): include a Marine Environment and Water Quality Management Plan (MEQMP) that addresses how marine water quality, sediment quality and accumulation of marine debris will be monitored and managed to prevent impacts to protected matters from the operation of the marina.

1.1. Approach

The approach detailed within the MEQMP was developed in the context of the Environmental Quality Management Framework (EQMF). The approach to establishing an EQMF, including identification of Environmental Values (EVs), EQOs, levels of ecological protection (LEP) and EQC is clearly described in EPA (2016), and is based on the principles and guidelines of the National Water Quality Management Strategy (NWQMS), with regard to the Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZG 2018). The focus of the approach is on maintaining existing environmental quality and identifying where management and/or remediation may be required and to measure its effectiveness. The EQMF can also be used to provide measurable performance objectives for unplanned events or discharges (EPA 2016). The MEQMP forms the basis of this report and will be referred to consistently throughout.

1.2. Purpose

The purpose of this report is to present a summary of sampling results in accordance with the MEQMP for the second implementation round conducted on the 4th to 6th of February 2025.

2. Methodology

The MEQMP prescribes marine environmental quality sampling over an annual period (**Table 1**). This report presents results from the second quarterly sampling event (Q2).

Field logs for this sampling event are presented in **Appendix A**. All sampling methods were conducted in accordance with the MEQMP (O2M 2020).

Table 1: Overview of sampling events to be undertaken during the annual reporting period.

Sampling Event	Water	Sediment	Season	Month
Q1	X	-	Summer	26-27/10/2024
Q2	X	-	Autumn	04-06/02/2025
Q3	X	X	Winter	-
Q4	X	-	Spring	-

2.1. Sampling Locations

A summary of the sampling locations and tasks conducted is presented in **Table 2**. Sampling locations are displayed in Table 2.

Table 2: Spoilbank Marina sample sites, parameters, and location.

Site Name	Ecological Protection Area	Site Type	Easting	Northing	Sampling Tasks Conducted						
					Aesthetic Observations	Physico-chemical Water Column Profiling ¹	General Sediment Sample Analysis	Water Sample Collection			Sediment Sample Analysis
								General Water Sample Analysis	Bacterial Sample Analysis	Phytoplankton Sample Analysis	
SBM1	Moderate	Impact	666047	7753746	✓	✓	✓	✓	✓	✓	✓
SBM2	High	Impact	665686	7754176	✓	✓	✓	✓	✓	✓	✓
REF4	High	Reference	658166	7755976	✓	✓	✓	✓	✓	✓	✓



Figure 1: Water quality sampling locations

2.2. Data Analysis and QA/QC

The following data analysis and QA/QC was conducted during the reporting period:

- Physiochemical profile data analysis and QA/QC included:
 - data trimming was conducted to remove data points occurring outside the range of 0.5 m below the surface and 0.5 m above the seafloor;
 - manual and automated QC checks were conducted to remove erroneous entries;
 - Data smoothing and bias reduction through applying a gaussian depth weighted average to each profile;
 - Calculation of a median value for each parameter for each profile; and
 - Comparison of the median value against interim EQGs.
- Laboratory reported water quality results have been compared against relevant EQCs.
- Aesthetic observations have been compared to relevant EQCs.

Field QA/QC sampling included collection of one rinsate sample.

All laboratory analysis were completed in accordance with the relevant NATA accreditation¹. Comprehensive QA/QC testing of samples will be undertaken in accordance with their respective NATA accreditation and include testing of laboratory control samples, method blanks, matrix spikes, laboratory duplicates and surrogate recovery outliers (where applicable)

3. Results

3.1. General Observations

During sampling weather conditions were calm, with low cloud cover (**Table 3**). Sample collection times, sample depths and tidal regimes are outlined in **Table 4**.

Table 3: General observations made during sampling event.

Weather Observations & Sea State				General Observations
4 th - 6 th February 2025				
General Conditions	Fair/Sunny	Wave Height (metres)	<1m	Low wind/swell, low cloud cover, calm sea state.
Air Temp (°C)	~29 °C	Wave Direction	NE / SW	
Wind Speed (knots)	<10 Knots			
Wind Direction	NE / SW			

Table 4: Sample timing and depth – note samples are presented in chronological order of sampling event.

Site	Date	Depth (m)	Tide Time and Height (m) ↓ (outgoing) ↑ (incoming)	Sample Time (24hr)
SBM1	04/02/2025	4.0	1.8m ↑	0924
SBM2	04/02/2025	4.0	1.8m ↑	0934
REF4	06/02/2025	4.5	5.9m ↑	1425

¹ LORs for metals Al, Cr (VI), and Cu reported are not sufficient to provide suitable assessment against the EQGs for the High Ecological Protection Area due to limitations of laboratory testing NATA accreditation.

3.2. EQO1: Ecosystem Health

3.2.1. Physical and Chemical Stressors

Chlorophyll- α and physicochemical profile results for the reporting period are presented in **Table 5**. Water column profiles are displayed in **Figure 2**. In summary:

- DO values ranged between 85.8 % and 95.7 %. Values were reported below the EQGs.
- Temperature values ranged between 32.4 °C and 32.6 °C. Values exceeded the EQGs at SBM1, SBM2 and REF4.
- pH values ranged between 8.1 and 8.2.
- Turbidity values ranged between 3.3 NTU and 13.9 NTU.
- Salinity values ranged between 38.1 ppt and 38.2 ppt. Values exceeded the EQGs at SBM1, SBM2 and REF4.

Table 5: Median values for physical and chemical stressors. Exceedances of numerical EQGs indicated by highlighted cells.

Site ID	LEP Area	Temp ¹	DO	EC	Salinity ¹	pH	Turbidity	Chl α ¹
		°C	% Saturation	mS/cm	ppt	-	NTU	mg/L
Moderate EQG		32.1	80	-	35.756	-	-	0.00425
High EQG		32.1	90	-	35.756	-	-	0.00425
Impact Sites								
SBM1	MEPA	32.4	85.8	65736.9	38.1	8.1	3.3	<0.001
SBM2	HEPA	32.4	90.0	65775.7	38.2	8.1	6.1	<0.001
Reference Sites								
REF4	HEPA	32.6	95.7	66160.9	38.2	8.2	13.9	<0.001

¹Interim EQGs have been derived from ANZG (2018) IMCRA Pilbara (Nearshore) mesoscale bioregion.

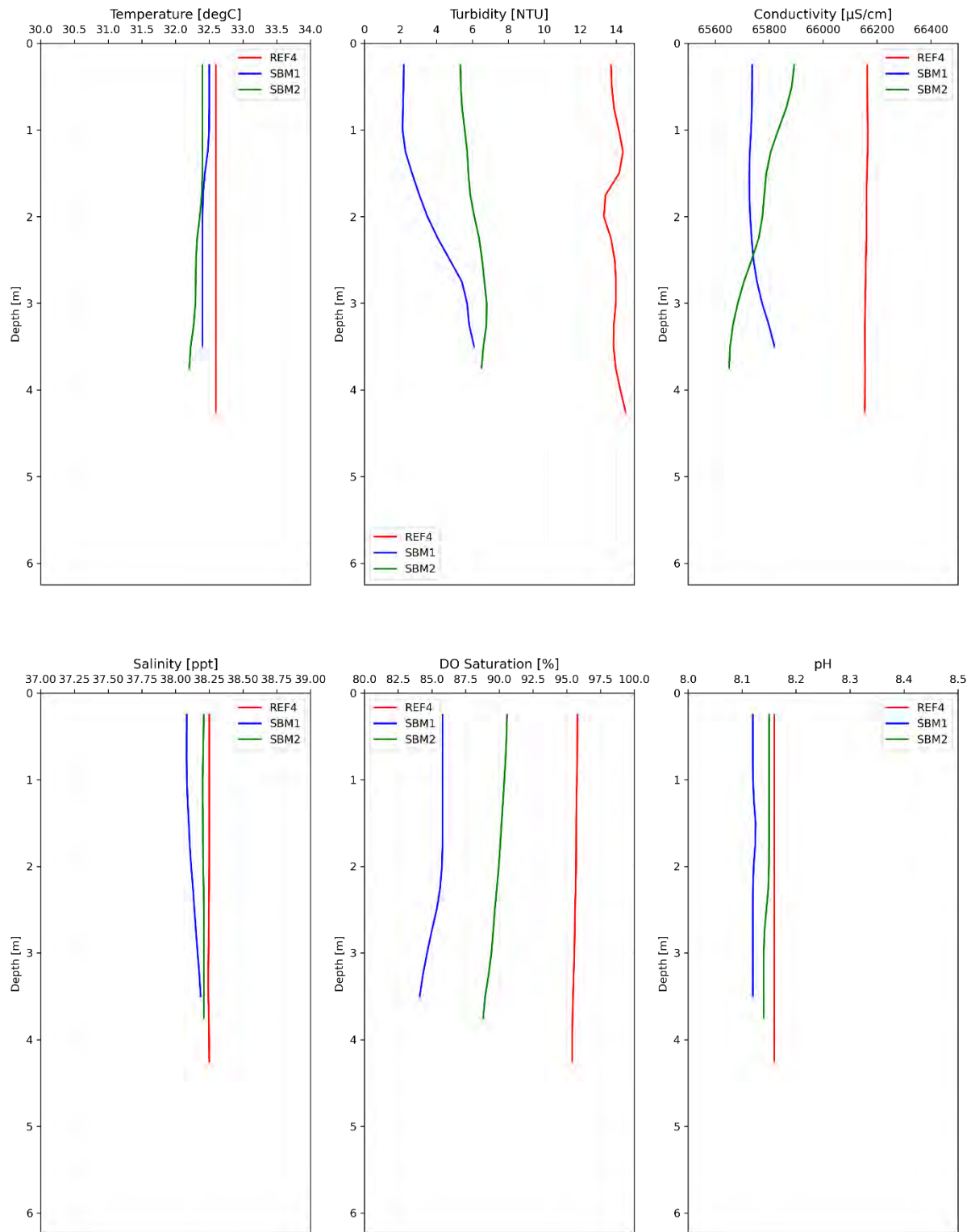


Figure 2: Physico-chemical profiles collected at the Spoilbank Marine during February 2025.

3.3. Toxicants in Water

3.3.1.1. Dissolved Metals

Analytical certificates of analysis and quality control reports for toxicants in water are presented in Table 6. A summary of the dissolved metal concentrations is presented in **Table 6**. In summary:

- Dissolved metals concentrations were generally low or reported below the LOR.
- Zinc concentrations exceeded the EQG at sites SBM1, SBM2, and at REF4.

Table 6: Dissolved metals concentrations. EQG exceedances indicated by highlighted cells.

Site ID	LEP Area	Al	As	Cd	Cr (III)	Cr (VI)	Co	Cu	Fe	Pb	Mn	Hg	Ni	Ag	V	Zn ¹
		mg/L														
Moderate EQG		-	-	0.014	0.049	0.020	0.001	0.003	-	0.0066	0.014	0.0007	0.2	0.0018	0.16	0.012
High EQG		-	-	0.0007	0.0077	0.00014	0.001	0.0003	-	0.0022	0.014	0.0001	0.007	0.0008	0.05	0.0033
Impact Sites																
SBM1	MEPA	0.3	0.002	< 0.0001	< 0.002	< 0.002	< 0.001	< 0.001	0.04	< 0.001	< 0.005	0.0003	< 0.001	< 0.0001	< 0.005	0.006
SBM2	HEPA	0.49	0.003	< 0.0001	< 0.002	< 0.002	< 0.001	< 0.001	0.02	< 0.001	< 0.005	0.0002	< 0.001	< 0.0001	< 0.005	0.005
Reference Sites																
REF4	HEPA	2.1	0.003	< 0.0001	< 0.002	< 0.002	< 0.001	0.002	0.05	< 0.001	< 0.005	0.0002	0.001	< 0.0001	< 0.005	0.006

¹ EQG for zinc has changed since the OEMP was approved due to an update for this parameter in the Guidelines for Fresh & Marine Water Quality

3.3.1.2. Hydrocarbons

Hydrocarbons results are presented in **Appendix C**. All hydrocarbon concentrations were reported below the LOR.

3.4. EQ04/EQ05/EQ06: Recreation and Aesthetics

3.4.1. Recreation and Aesthetics

Assessment of data including aesthetic observations (**Appendix A**) and laboratory analysis of nuisance organisms and pathogens (**Appendix C**) are presented in **Table 7**.

In summary, pathogens, nuisance organisms, water quality and general observations indicate:

- No EQG exceedances for primary or secondary contact (EQ04/EQ05).
- No aesthetics EQG (EQ06) exceedances were reported.
- No Department of Health Western Australia (DOHWA) watch list species were detected.

Table 7: Pathogenic bacteria, nuisance organisms, field observations. EQG exceedances indicated by highlighted cells.

Site ID	LEP Area	Pathogenic Bacteria	Nuisance Organisms			Oil	Debris	Wrack	Odour	Fauna deaths
		Enterococci/100mL	Cells/mL	Public reports	Observation					
EQG – Primary Contact (EQO4)		<200	<10,000	Nil	-	-	-	-	-	-
EQG - Secondary Contact (EQO5)		<2000	<25,000	Nil	-	-	-	-	-	-
EQG – Aesthetics (EQO6)		-	-	-	Minor surface scums ¹	Refer to Section 3.2 of the MEQMP	Refer to Section 3.2 of the MEQMP	Coverage <25%	No objectional odour	-
Impact Sites										
SBM1	MEPA	<1	156.4	Nil	Nil	Nil	Nil	Nil	Nil	No Fauna Deaths
SBM2	HEPA	<1	885.6	Nil	Nil	Nil	Nil	Nil	Nil	No Fauna Deaths
Reference Sites										
REF4	HEPA	<1	1194.6	Nil	Nil	Nil	Nil	Nil	Nil	No Fauna Deaths

3.5. QA/QC Assessment

3.5.1. Field QA/QC Results

Field QAQC assessment conducted during Q2 sampling included collection on one duplicate sample and one rinsate sample. Duplicate RPD results are presented in **Table 8**. In summary:

- RPD exceedances were reported for Al, As, Fe, Hg, and Ni. RPD exceedances were reported as a result of comparison against low level detections of contaminants, resulting in a proportionally higher RPD value.
- Rinsate sample results were all reported below the LOR during Q1.

Table 8: Duplicate RPD results for water quality samples collected in Q2. RPD exceedances (>35%) have been highlighted red.

Site	Al	As	Cd	Cr	Co	Cu	Fe	Pb	Mn	Hg	Ni	Ag	V	Zn
REF4	2.1	0.003	< 0.0001	<0.002	< 0.001	0.002	0.05	< 0.001	< 0.005	0.0002	0.001	0.006	< 0.005	<0.0001
DUP 1	0.33	0.002	< 0.0001	<0.002	< 0.001	< 0.001	0.03	< 0.001	< 0.005	0.0003	0.002	0.005	< 0.005	<0.0001
RPD	145.68%	40.00%	-	-	-	-	50.00%	-	-	40.00%	66.67%	18.18%	-	

3.5.2. Laboratory QA/QC Results

Full laboratory QA/QC reports for Q2 of the Reporting Period are presented in **Appendix C**. QA/QC results for the Q2 sampling period indicate:

- All laboratory QA/QC tests were within an acceptable range for all analytes.

4. Discussion and Conclusion

4.1. EQO1: Ecosystem Health

4.1.1. Physical and Chemical Stressors in Water

Physico-chemical parameters recorded results typical of the Pilbara coastal waters with no significant outliers. Data indicates low variance among sites, while there were no trends between sites for physico-chemical parameters.

Salinity and temperature values were slightly higher than Pilbara (nearshore) mesoscale bioregion default guideline values, however did not represent an EQG exceedance based on comparison against reference site data, which was also elevated with respect to the EQG. These results indicate that elevated salinity and temperature values reported during this quarter were representative of natural environmental variability.

Chlorophyll- α was reported below the LOR across all sample sites.

No EQG exceedances were reported for any physical and chemical stressors in water. Based on this assessment, reported results indicate that EQO1 has been achieved and the EVs are not at risk from physical and chemical water quality issues.

4.1.2. Toxicants in Water

Metal and hydrocarbon toxicant concentrations in water samples were mostly found to be low, while zinc reported exceedances of the EQG at sites SBM1, SBM2, and at REF4. Elevated zinc concentrations with respect to the EQG have historically been reported in Port Hedland, both within the Port and in nearby creeks (O2 Marine 2023; Wenziker et al. 2006), indicating that zinc is occurring naturally at these levels. Furthermore, the results for zinc from SMB1 and SBM2 were consistent with levels reported at the reference site (REF4), thus were considered to be representative of natural concentrations.

Hydrocarbons were reported below the LOR across all sample sites.

Based on this assessment, reported results indicate that EQO1 has been achieved and the EVs are not at risk from toxicants in water.

4.2. EQ04/EQ05/EQ06: Recreation and Aesthetics

4.2.1. EQ04/EQ05 Primary and Secondary Contact

E. coli and *Enterococci* were reported below the LOR at all monitoring locations. Primary and secondary contact results for toxic and nuisance phytoplankton were below the interim EQG at all sites during Q2. No DOHWA watchlist species were detected.

4.2.2. EQ06 Aesthetics

During the reporting period no results are considered to represent a decline in marine environmental quality when assessed against the interim EQGs. No observed incidences of large-scale marine deaths, noticeable visible film or debris on the surface, odour or natural reflectance were recorded above the criteria described within the MEQMP.

5. References

- ANZG (2018). *Australian and New Zealand Guidelines for fresh and Marine Water Quality* - <https://www.waterquality.gov.au/anz-guidelines/guideline-values/default/water-quality-toxicants/search>. Accessed 21/07/2023.
- EPA (2016). Technical Guidance – Protecting the Quality of Western Australia’s Marine Environment. Environmental Protection Authority, December 2016
- O2Marine (2020) Port Hedland Spoilbank Marina Marine Environmental Quality Plan. Report prepared for the Department of Transport, February 2020.
- O2 Marine (2023). Port of Port Hedland Baseline Data Analysis Technical Memo. Report prepared for the Pilbara Ports Authority.
- Wenziker K.J., McAlpine, K. W., Apte, S.C. and Masini, R.J. (2006). Background quality for coastal marine waters of the North West Shelf, Western Australia. North West Shelf Joint Environmental Management Study, CSIRO Marine Research, GPO Box 1538, Hobart Tasmania 7001.

Appendix A. Field Sheets



MEQSAP Field Sampling Record Water

Project Details						Weather Observations						Tides		
Job Number:		24ENV368				General Conditions:		Fair/Sunny				Low Tide	Time:	9:43
Project Title:		Spoilbank Marina MEQP				Air Temp. (°C):		~29°C					Height:	2.3m
Client:		Department of Transport				Wind Speed (knts):		<10knts				High Tide	Time:	15:45
Field Staff:		SWM, JC, RF				Wind Direction:		NE/SW					Height:	6.2m
Sampling Date:		04 - 06/02/25				Sea State:		Calm						
Site Name	Time	Laboratory Analysis				Water Column Profiles	Aesthetics						Comments	
		General Water	Bacterial	Phytoplankton	Duplicate	Depth (m)	A	B	C	D	E	F		
SBM1	954	A	✓	✓	Y	3.98m	1	1	1	1	1	1		
SBM2	924	A	✓	✓	Y	4.0m	1	1	1	1	1	1		
REF4	1425	A	✓	✓	Y	4.5m	1	1	1	1	1	1		
DUP1	954	S	NA	NA	Y	NA	NA	NA	NA	NA	NA	NA		

Comments

S = Standard Suite - 6 Bottles:

1 x 60ml P, 1 x 500ml G, 2 x 40mL V, 2 x 1L G

A = Additional Suite - 8 Bottles:

1 x 60ml P, 1 x 500ml G, 2 x 40mL V, 2 x 1L G, 1 x 500mL P, 1 x 500mL Micro

R = Rinsate Suite/Duplicate - 5/6 Bottles (No Chlorophyl-a for rinsate - 1L glass):

1 x 60ml P, 1 x 500ml G, 2 x 40mL V, 2 x 1L G (1x for rinsate)

Appendix B. Chain of Custody

Project: Port of Port Hedland MEQSAP Monitoring				Laboratory: ARL		Please Note: Please sign copy on receipt of samples and email signed copy of CoC record to O2M Project Manager. Email laboratory analysis results to O2M Project Manager. Marine Water																
Client: Pilbara Ports Authority Job No.: 22ENV179				Address: 46-48 Banksia Road, Welshpool, 6106																		
Lab. Contact: Kim Rogers																						
Lab Quote No.: O2MPH220623 Turnaround Time: Standard																						
O2M Project Manager (Ph. Number): Russell Stevens Email Address: cameron.holder@o2marine.com.au				Sample Matrix: S-Sol / SL-Sludge / W-Water / A-Air Container: B-Bottle / A-Jar / V-Vial / G-Glass / P-Plastic Preservative: Unpreserved / HCL / H ₂ SO ₄ / HNO ₃ / Other No. of Samples: Total Volume (ml): Heavy Metals (Al, As, Cd, Cr(III/VI), Co, Cu, Fe, Pb, Mn, Hg, Ni, V): TRH-Silica BTEXN PAHs Chlorophyll a Phytoplankton Bacterial																		
O2M Sample ID	Laboratory Sample ID	Date	Time													Comments						
SBM1				W	B, P, V				x	x	x	x	x	x	x							Metal Detection Levels (mg/L): As, Pb, Ni - 0.001 Al, Fe, Mn - 0.01 V - 0.005 Hg - 0.0001 Cd - 0.0002 Cu - 0.0003 Cr - 0.002
SBM2				W	B, P, V				x	x	x	x	x	x	x							
REF4				W	B, P, V				x	x	x	x	x	x	x							
DUP1				W	B, P, V				x	x	x	x	x									
Sampled By:				Date/Time:		Relinquished By: <i>AAH</i>				Date/Time:												
Received By Lab: <i>MB</i> <i>AAH</i>				Date/Time: <i>17/12/25 @1426</i>		Courier:																
Sample Cold (Yes/No): <i>Y</i>				Sample Container Sealed (Yes/No): <i>Y</i>																		

1185678

Project: Spoilbank Marine MEQP Monitoring				Laboratory: MAFRL Address: Physical Science Building (340) Level, Room 3.026 Top of Car Park 3; Loading Zone 90 South Street Murdoch, WA, 6150		Please Note: Please sign copy on receipt of samples and email signed copy of CoC record to O2M Project Manager.	
Client: Pilbara Ports	Job No.: 24ENV368	Lab. Contact: Krzysztof Wienczugow		Email laboratory analysis results to O2M Project Manager.		Marine Water	
Lab Quote No.: NA	Turnaround Time: Standard	O2M Project Manager (Ph. Number): Russell Stevens Email Address: cameron.holder@o2marine.com.au		O2M Sample ID		Comments	
Laboratory Sample ID		Date		Time			
Sample Matrix		Container		Analyses			
S-Soil / SL/Sludge / W-Water / A-Air		Type		Preservative		No. of Samples	
B-Bottle / J-Jar / V-Vial / G-Glass / P-Plastic		Unpreserved / HCL / H ₂ SO ₄ / HNO ₃ / Other		Total Volume (mL)		Heavy Metals (Ag, Zn)	
SBM1		W		x			
SBM2		W		x			
REF4		W		x			
DUP1		W		x			
Metal Detection Levels (mg/L):		Ag: 0.0008		Zn: 0.003			
Sampled By:		Date/Time:		Relinquished By:		Date/Time:	
Received By Lab: Li Yang		Date/Time: 10/2/25 2:30 PM		Courier:			
Sample Cold (Yes/No): 0-6°C		Sample Container Sealed (Yes/No):					

LH 7/2/25
13:34
25.9°C

Appendix C. Laboratory Certificate of Analysis

O2 Marine
Suite 2, 4B Mews Rd
Fremantle
WA 6160



NATA Accredited
Accreditation Number 2377
Site Number 2370 & 2554

Accredited for compliance with ISO/IEC 17025 – Testing
NATA is a signatory to the ILAC Mutual Recognition
Arrangement for the mutual recognition of the
equivalence of testing, medical testing, calibration,
inspection, proficiency testing scheme providers and
reference materials producers reports and certificates.

Attention: Cameron Holder

Report 1185678-W
Project name Port of Port Hedland MEQSAP Monitoring
Project ID 22ENV179
Received Date Feb 17, 2025

Client Sample ID			SBM1	SBM2	REF4	DUP 1
Sample Matrix			Water	Water	Water	Water
Eurofins Sample No.			L25-Fe0019621	L25-Fe0019622	L25-Fe0019623	L25-Fe0019624
Date Sampled			Not Provided ¹²	Not Provided ¹²	Not Provided ¹²	Not Provided ¹²
Test/Reference	LOR	Unit				
Naphthalene ^{N02}	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
TRH >C10-C16 after Silica Cleanup less Naphthalene (F2)	0.02	mg/L	< 0.02	< 0.02	< 0.02	< 0.02
TRH C6-C36 (Total) (after silica-gel clean up)	0.1	mg/L	< 0.1	< 0.1	< 0.1	< 0.1
Chlorophyll-a	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Chromium (VI)	0.002	mg/L	< 0.002	< 0.002	< 0.002	< 0.002
Chromium (III) (filtered)*	0.002	mg/L	< 0.002	< 0.002	< 0.002	< 0.002
Total Recoverable Hydrocarbons						
TRH C6-C9	0.02	mg/L	< 0.02	< 0.02	< 0.02	< 0.02
TRH C6-C10 less BTEX (F1) ^{N04}	0.02	mg/L	< 0.02	< 0.02	< 0.02	< 0.02
BTEX						
Benzene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Toluene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Ethylbenzene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
m&p-Xylenes	0.002	mg/L	< 0.002	< 0.002	< 0.002	< 0.002
o-Xylene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Xylenes - Total*	0.003	mg/L	< 0.003	< 0.003	< 0.003	< 0.003
BTEX						
4-Bromofluorobenzene (surr.)	1	%	122	88	87	96
Polycyclic Aromatic Hydrocarbons						
Benzo(a)pyrene TEQ (lower bound) *	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Acenaphthene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Acenaphthylene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Anthracene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Benz(a)anthracene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Benzo(a)pyrene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Benzo(b&j)fluoranthene ^{N07}	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Benzo(g,h,i)perylene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Benzo(k)fluoranthene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Chrysene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Dibenz(a,h)anthracene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Fluoranthene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Fluorene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Indeno(1,2,3-cd)pyrene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Naphthalene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001

Client Sample ID			SBM1	SBM2	REF4	DUP 1
Sample Matrix			Water	Water	Water	Water
Eurofins Sample No.			L25-Fe0019621	L25-Fe0019622	L25-Fe0019623	L25-Fe0019624
Date Sampled			Not Provided ¹²	Not Provided ¹²	Not Provided ¹²	Not Provided ¹²
Test/Reference	LOR	Unit				
Polycyclic Aromatic Hydrocarbons						
Phenanthrene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Pyrene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Total PAH*	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
2-Fluorobiphenyl (surr.)	1	%	112	115	129	100
p-Terphenyl-d14 (surr.)	1	%	139	150	116	144
TRH - 2013 NEPM Fractions (after silica gel clean-up)						
TRH >C10-C16 (after silica gel clean-up)	0.02	mg/L	< 0.02	< 0.02	< 0.02	< 0.02
TRH >C16-C34 (after silica gel clean-up)	0.05	mg/L	< 0.05	< 0.05	< 0.05	< 0.05
TRH >C34-C40 (after silica gel clean-up)	0.05	mg/L	< 0.05	< 0.05	< 0.05	< 0.05
TRH >C10-C40 (total) (after silica-gel clean up)*	0.05	mg/L	< 0.05	< 0.05	< 0.05	< 0.05
TRH - 1999 NEPM Fractions (after silica gel clean-up)						
TRH C10-C14 (after silica gel clean-up)	0.02	mg/L	< 0.02	< 0.02	< 0.02	< 0.02
TRH C15-C28 (after silica gel clean-up)	0.04	mg/L	< 0.04	< 0.04	< 0.04	< 0.04
TRH C29-C36 (after silica gel clean-up)	0.04	mg/L	< 0.04	< 0.04	< 0.04	< 0.04
TRH C10-C36 (Total) (after silica gel clean-up)	0.04	mg/L	< 0.04	< 0.04	< 0.04	< 0.04
Heavy Metals						
Aluminium	0.05	mg/L	0.30	0.49	2.1	0.33
Arsenic	0.001	mg/L	0.002	0.003	0.003	0.002
Cadmium	0.0001	mg/L	< 0.0001	< 0.0001	< 0.0001	< 0.0001
Chromium	0.001	mg/L	< 0.001	< 0.001	0.001	< 0.001
Chromium (filtered)	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Cobalt	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Copper	0.001	mg/L	< 0.001	< 0.001	0.002	< 0.001
Iron	0.01	mg/L	0.04	0.02	0.05	0.03
Lead	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Manganese	0.005	mg/L	< 0.005	< 0.005	< 0.005	< 0.005
Mercury	0.0001	mg/L	0.0003	0.0002	0.0002	0.0003
Nickel	0.001	mg/L	< 0.001	< 0.001	0.001	0.002
Vanadium	0.005	mg/L	< 0.005	< 0.005	< 0.005	< 0.005
Microbiology						
Faecal (Thermotolerant) Coliforms	1	CFU/100mL	< 1	< 1	< 1	-
E. Coli	1	CFU/100mL	< 1	< 1	< 1	-
Enterococci	1	CFU/100mL	< 1	< 1	< 1	-

Sample History

Where samples are submitted/analysed over several days, the last date of extraction is reported.

If the date and time of sampling are not provided, the Laboratory will not be responsible for compromised results should testing be performed outside the recommended holding time.

Description	Testing Site	Extracted	Holding Time
Naphthalene	Welshpool	Feb 18, 2025	14 Days
- Method: LTM-ORG-2010 TRH C6-C40			
BTEX	Welshpool	Feb 18, 2025	14 Days
- Method: LTM-ORG-2010 TRH C6-C40			
TRH - 2013 NEPM Fractions (after silica gel clean-up)	Welshpool	Feb 18, 2025	7 Days
- Method: LTM-ORG-2010 TRH C6-C40			
TRH - 1999 NEPM Fractions (after silica gel clean-up)	Welshpool	Feb 18, 2025	7 Days
- Method: LTM-ORG-2010 TRH C6-C40			
Chlorophyll-a	Welshpool	Feb 18, 2025	28 Days
- Method: ARL141 - Chlorophyll-a and Pheophytin-a in Water			
Chromium (VI)	Welshpool	Feb 18, 2025	1 Day
- Method: ARL316 - Hexavalent Chromium in Water by Discrete Analyser			
Chromium (III) (filtered)*	Welshpool	Feb 18, 2025	180 Days
- Method: ARL402/403 - Metals in Water by ICPOES/ICPMS			
Polycyclic Aromatic Hydrocarbons	Welshpool	Feb 18, 2025	7 Days
- Method: LTM-ORG-2130 PAH and Phenols in Soil and Water			
Heavy Metals	Welshpool	Feb 27, 2025	28 Days
- Method: LTM-MET-3040 Metals in Waters, Soils & Sediments by ICP-MS			
Heavy Metals (filtered)	Welshpool	Feb 24, 2025	28 Days
- Method: LTM-MET-3040 Metals in Waters, Soils & Sediments by ICP-MS			
Faecal (Thermotolerant) Coliforms	MicWA	Feb 18, 2025	24 Hours
- Method: PM 4.2A - Total Coliforms, E.coli and Thermotolerant Coliforms by Membrane Filtration			
E. Coli	MicWA	Feb 18, 2025	24 Hours
- Method: PM 4.2A - Total Coliforms, E.coli and Thermotolerant Coliforms by Membrane Filtration			
Enterococci	MicWA	Feb 18, 2025	24 Hours
- Method: PM 4.4 - Faecal Streptococci (Enterococci) by Membrane Filtration			



web: www.eurofins.com.au
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Eurofins ARL Pty Ltd

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Site# 2370 & 2554

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Company Name: O2 Marine
Address: Suite 2, 4B Mews Rd
Fremantle
WA 6160

Order No.:
Report #: 1185678
Phone: 1300 219 801
Fax:

Received: Feb 17, 2025 2:26 PM
Due: Feb 24, 2025
Priority: 5 Day
Contact Name: Cameron Holder

Project Name: Port of Port Hedland MEQSAP Monitoring
Project ID: 22ENV179

Eurofins Analytical Services Manager : Elden Garrett

Sample Detail																										Eurofins Suite B1SG: TRH (With Silica Gel Clean up), BTEXN
																										Polycyclic Aromatic Hydrocarbons
																										Vanadium
																										Nickel
																										Mercury
																										Manganese
																										Lead
																										Iron
																										Faecal (Thermotolerant) Coliforms
																										Enterococci
																										E. Coli
																										Copper
																										Cobalt
																										Chromium (VI)
																										Chromium (III) (filtered)*
																										Chromium (filtered)
																										Chromium
																										Chlorophyll-a
																										Cadmium
																										Arsenic
																										Aluminium
Perth Laboratory - NATA # 2377 Site # 2370 & 2554						X	X	X	X	X	X	X	X	X				X	X	X	X	X	X	X	X	X
External Laboratory																										
No	Sample ID	Sample Date	Sampling Time	Matrix	LAB ID																					
1	SBM1	Not Provided		Water	L25-Fe0019621	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
2	SBM2	Not Provided		Water	L25-Fe0019622	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
3	REF4	Not Provided		Water	L25-Fe0019623	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
4	DUP 1	Not Provided		Water	L25-Fe0019624	X	X		X	X	X	X	X	X				X	X	X	X	X	X	X	X	X
Test Counts						4	4	3	4	4	4	4	4	4	4	3	3	3	4	4	4	4	4	4	4	4

Internal Quality Control Review and Glossary

General

1. Laboratory QC results for Method Blanks, Duplicates, Matrix Spikes, and Laboratory Control Samples follow guidelines delineated in the National Environment Protection (Assessment of Site Contamination) Measure 1999, as amended May 2013. They are included in this QC report where applicable. Additional QC data may be available on request.
2. Unless otherwise stated, all soil/sediment/solid results are reported on a dry weight basis.
3. Unless otherwise stated, all biota/food results are reported on a wet weight basis on the edible portion.
4. For CEC results where the sample's origin is unknown or environmentally contaminated, the results should be used advisedly.
5. Actual LORs are matrix dependent. Quoted LORs may be raised where sample extracts are diluted due to interferences.
6. Results are uncorrected for matrix spikes or surrogate recoveries except for PFAS compounds where annotated.
7. SVOC analysis on waters is performed on homogenised, unfiltered samples unless noted otherwise.
8. Samples were analysed on an 'as received' basis.
9. Information identified in this report with **blue** colour indicates data provided by customers that may have an impact on the results.
10. This report replaces any interim results previously issued.

Holding Times

Please refer to the 'Sample Preservation and Container Guide' for holding times (QS3001).

For samples received on the last day of holding time, notification of testing requirements should have been received at least 6 hours before sample receipt deadlines as stated on the SRA.

If the Laboratory did not receive the information in the required timeframe, and despite any other integrity issues, suitably qualified results may still be reported.

Holding times apply from the sampling date; therefore, compliance with these may be outside the laboratory's control.

For VOCs containing vinyl chloride, styrene and 2-chloroethyl vinyl ether, the holding time is seven days; however, for all other VOCs, such as BTEX or C6-10 TRH, the holding time is 14 days.

Units

mg/kg: milligrams per kilogram	mg/L: milligrams per litre	ppm: parts per million
µg/L: micrograms per litre	ppb: parts per billion	%: Percentage
org/100 mL: Organisms per 100 millilitres	NTU: Nephelometric Turbidity Units	MPN/100 mL: Most Probable Number of organisms per 100 millilitres
CFU: Colony Forming Unit	Colour: Pt-Co Units (CU)	

Terms

APHA	American Public Health Association
CEC	Cation Exchange Capacity
COC	Chain of Custody
CP	Client Parent - QC was performed on samples pertaining to this report
CRM	Certified Reference Material (ISO17034) - reported as percent recovery.
Dry	Where moisture has been determined on a solid sample, the result is expressed on a dry weight basis.
Duplicate	A second piece of analysis from the same sample and reported in the same units as the result to show comparison.
LOR	Limit of Reporting.
LCS	Laboratory Control Sample - reported as percent recovery.
Method Blank	In the case of solid samples, these are performed on laboratory-certified clean sands and in the case of water samples, these are performed on de-ionised water.
NCP	Non-Client Parent - QC performed on samples not pertaining to this report, QC represents the sequence or batch that client samples were analysed within.
RPD	Relative Percent Difference between two Duplicate pieces of analysis.
SPIKE	Addition of the analyte to the sample and reported as percentage recovery.
SRA	Sample Receipt Advice
Surr - Surrogate	The addition of a similar compound to the analyte target is reported as percentage recovery. See below for acceptance criteria.
TBTO	Tributyltin oxide (<i>bis</i> -tributyltin oxide) - individual tributyltin compounds cannot be identified separately in the environment; however, free tributyltin was measured, and its values were converted stoichiometrically into tributyltin oxide for comparison with regulatory limits.
TCLP	Toxicity Characteristic Leaching Procedure
TEQ	Toxic Equivalency Quotient or Total Equivalence
QSM	US Department of Defense Quality Systems Manual Version 6.0
US EPA	United States Environmental Protection Agency
WA DWER	Sum of PFBA, PFPeA, PFHxA, PFHpA, PFOA, PFBS, PFHxS, PFOS, 6:2 FTSA, 8:2 FTSA

QC - Acceptance Criteria

The acceptance criteria should only be used as a guide and may be different when site-specific Sampling Analysis and Quality Plan (SAQP) have been implemented.

RPD Duplicates: Global RPD Duplicates Acceptance Criteria is ≤30%; however, the following acceptance guidelines are equally applicable:

Results <10 times the LOR:	No Limit
Results between 10-20 times the LOR:	RPD must lie between 0-50%
Results >20 times the LOR:	RPD must lie between 0-30%

NOTE: pH duplicates are reported as a range, not as RPD

Surrogate Recoveries: Recoveries must lie between 20-130% for Speciated Phenols & 50-150% for PFAS. SVOCs recoveries 20 – 150%, VOC recoveries 50 – 150%

PFAS field samples containing surrogate recoveries above the QC limit designated in QSM 6.0, where no positive PFAS results have been reported or reviewed, and no data was affected.

QC Data General Comments

1. Where a result is reported as less than (<), higher than the nominated LOR, this is due to either matrix interference, extract dilution required due to interferences or contaminant levels within the sample, high moisture content or insufficient sample provided.
2. Duplicate data shown within this report that states the word "BATCH" is a Batch Duplicate from outside of your sample batch but within the laboratory sample batch at a 1:10 ratio. The Parent and Duplicate data shown are not data from your samples.
3. pH and Free Chlorine analysed in the laboratory - Analysis on this test must begin within 30 minutes of sampling. Therefore, laboratory analysis is unlikely to be completed within holding time. Analysis will begin as soon as possible after sample receipt.
4. Recovery Data (Spikes & Surrogates) - where chromatographic interference does not allow the determination of recovery, the term "INT" appears against that analyte.
5. For Matrix Spikes and LCS results, a dash "-" in the report means that the specific analyte was not added to the QC sample.
6. Duplicate RPDs are calculated from raw analytical data; thus, it is possible to have two sets of data.

Quality Control Results

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Method Blank							
Naphthalene	mg/L	< 0.001			0.001	Pass	
Chromium (VI)	mg/L	< 0.002			0.002	Pass	
Method Blank							
Total Recoverable Hydrocarbons							
TRH C6-C9	mg/L	< 0.02			0.02	Pass	
Method Blank							
BTEX							
Benzene	mg/L	< 0.001			0.001	Pass	
Toluene	mg/L	< 0.001			0.001	Pass	
Ethylbenzene	mg/L	< 0.001			0.001	Pass	
m&p-Xylenes	mg/L	< 0.002			0.002	Pass	
o-Xylene	mg/L	< 0.001			0.001	Pass	
Xylenes - Total*	mg/L	< 0.003			0.003	Pass	
Method Blank							
Polycyclic Aromatic Hydrocarbons							
Acenaphthene	mg/L	< 0.001			0.001	Pass	
Acenaphthylene	mg/L	< 0.001			0.001	Pass	
Anthracene	mg/L	< 0.001			0.001	Pass	
Benz(a)anthracene	mg/L	< 0.001			0.001	Pass	
Benzo(a)pyrene	mg/L	< 0.001			0.001	Pass	
Benzo(b&j)fluoranthene	mg/L	< 0.001			0.001	Pass	
Benzo(g,h,i)perylene	mg/L	< 0.001			0.001	Pass	
Benzo(k)fluoranthene	mg/L	< 0.001			0.001	Pass	
Chrysene	mg/L	< 0.001			0.001	Pass	
Dibenz(a,h)anthracene	mg/L	< 0.001			0.001	Pass	
Fluoranthene	mg/L	< 0.001			0.001	Pass	
Fluorene	mg/L	< 0.001			0.001	Pass	
Indeno(1,2,3-cd)pyrene	mg/L	< 0.001			0.001	Pass	
Naphthalene	mg/L	< 0.001			0.001	Pass	
Phenanthrene	mg/L	< 0.001			0.001	Pass	
Pyrene	mg/L	< 0.001			0.001	Pass	
Method Blank							
TRH - 2013 NEPM Fractions (after silica gel clean-up)							
TRH >C10-C16 (after silica gel clean-up)	mg/L	< 0.02			0.02	Pass	
TRH >C16-C34 (after silica gel clean-up)	mg/L	< 0.05			0.05	Pass	
TRH >C34-C40 (after silica gel clean-up)	mg/L	< 0.05			0.05	Pass	
Method Blank							
TRH - 1999 NEPM Fractions (after silica gel clean-up)							
TRH C10-C14 (after silica gel clean-up)	mg/L	< 0.02			0.02	Pass	
TRH C15-C28 (after silica gel clean-up)	mg/L	< 0.04			0.04	Pass	
TRH C29-C36 (after silica gel clean-up)	mg/L	< 0.04			0.04	Pass	
Method Blank							
Heavy Metals							
Aluminium	mg/L	< 0.05			0.05	Pass	
Arsenic	mg/L	< 0.001			0.001	Pass	
Cadmium	mg/L	< 0.0001			0.0001	Pass	
Chromium	mg/L	< 0.001			0.001	Pass	
Cobalt	mg/L	< 0.001			0.001	Pass	
Copper	mg/L	< 0.001			0.001	Pass	
Iron	mg/L	< 0.01			0.01	Pass	
Lead	mg/L	< 0.001			0.001	Pass	

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Manganese	mg/L	< 0.005			0.005	Pass	
Mercury	mg/L	< 0.0001			0.0001	Pass	
Nickel	mg/L	< 0.001			0.001	Pass	
Vanadium	mg/L	< 0.005			0.005	Pass	
Method Blank							
Heavy Metals							
Chromium (filtered)	mg/L	< 0.001			0.001	Pass	
Method Blank							
Heavy Metals							
Aluminium	mg/L	< 0.05			0.05	Pass	
Arsenic	mg/L	< 0.001			0.001	Pass	
Cadmium	mg/L	< 0.0001			0.0001	Pass	
Chromium	mg/L	< 0.001			0.001	Pass	
Chromium (filtered)	mg/L	< 0.001			0.001	Pass	
Cobalt	mg/L	< 0.001			0.001	Pass	
Copper	mg/L	< 0.001			0.001	Pass	
Iron	mg/L	< 0.01			0.01	Pass	
Lead	mg/L	< 0.001			0.001	Pass	
Manganese	mg/L	< 0.005			0.005	Pass	
Mercury	mg/L	< 0.0001			0.0001	Pass	
Nickel	mg/L	< 0.001			0.001	Pass	
Vanadium	mg/L	< 0.005			0.005	Pass	
Method Blank							
Heavy Metals							
Chromium (filtered)	mg/L	< 0.001			0.001	Pass	
LCS - % Recovery							
Naphthalene	%	113			70-130	Pass	
LCS - % Recovery							
Total Recoverable Hydrocarbons							
TRH C6-C9	%	123			70-130	Pass	
LCS - % Recovery							
BTEX							
Benzene	%	104			70-130	Pass	
Toluene	%	102			70-130	Pass	
Ethylbenzene	%	111			70-130	Pass	
m&p-Xylenes	%	108			70-130	Pass	
o-Xylene	%	107			70-130	Pass	
Xylenes - Total*	%	107			70-130	Pass	
LCS - % Recovery							
Polycyclic Aromatic Hydrocarbons							
Acenaphthene	%	104			70-130	Pass	
Acenaphthylene	%	103			70-130	Pass	
Anthracene	%	102			70-130	Pass	
Benz(a)anthracene	%	103			70-130	Pass	
Benzo(a)pyrene	%	101			70-130	Pass	
Benzo(b&j)fluoranthene	%	98			70-130	Pass	
Benzo(g,h,i)perylene	%	102			70-130	Pass	
Benzo(k)fluoranthene	%	99			70-130	Pass	
Chrysene	%	100			70-130	Pass	
Dibenz(a,h)anthracene	%	104			70-130	Pass	
Fluoranthene	%	103			70-130	Pass	
Fluorene	%	100			70-130	Pass	
Indeno(1,2,3-cd)pyrene	%	101			70-130	Pass	
Naphthalene	%	101			70-130	Pass	

Test				Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Phenanthrene				%	99			70-130	Pass	
Pyrene				%	102			70-130	Pass	
LCS - % Recovery										
TRH - 2013 NEPM Fractions (after silica gel clean-up)										
TRH >C10-C16 (after silica gel clean-up)				%	106			70-130	Pass	
LCS - % Recovery										
TRH - 1999 NEPM Fractions (after silica gel clean-up)										
TRH C10-C14 (after silica gel clean-up)				%	117			70-130	Pass	
LCS - % Recovery										
Heavy Metals										
Aluminium				%	102			80-120	Pass	
Arsenic				%	111			80-120	Pass	
Cadmium				%	99			80-120	Pass	
Chromium				%	101			80-120	Pass	
Cobalt				%	99			80-120	Pass	
Copper				%	96			80-120	Pass	
Iron				%	104			80-120	Pass	
Lead				%	99			80-120	Pass	
Manganese				%	99			80-120	Pass	
Mercury				%	100			80-120	Pass	
Nickel				%	98			80-120	Pass	
Vanadium				%	95			80-120	Pass	
LCS - % Recovery										
Heavy Metals										
Chromium (filtered)				%	87			80-120	Pass	
LCS - % Recovery										
Heavy Metals										
Aluminium				%	96			80-120	Pass	
Arsenic				%	112			80-120	Pass	
Cadmium				%	99			80-120	Pass	
Chromium				%	93			80-120	Pass	
Chromium (filtered)				%	90			80-120	Pass	
Cobalt				%	91			80-120	Pass	
Copper				%	93			80-120	Pass	
Iron				%	92			80-120	Pass	
Lead				%	93			80-120	Pass	
Manganese				%	89			80-120	Pass	
Mercury				%	93			80-120	Pass	
Nickel				%	89			80-120	Pass	
Vanadium				%	90			80-120	Pass	
LCS - % Recovery										
Heavy Metals										
Chromium (filtered)				%	101			80-120	Pass	
Test	Lab Sample ID	QA Source	Units	Result 1				Acceptance Limits	Pass Limits	Qualifying Code
Spike - % Recovery										
				Result 1						
Naphthalene	L25-Fe0039410	NCP	%	86				70-130	Pass	
Spike - % Recovery										
Total Recoverable Hydrocarbons				Result 1						
TRH C6-C9	L25-Fe0039410	NCP	%	95				70-130	Pass	
Spike - % Recovery										
BTEX				Result 1						
Benzene	L25-Fe0039410	NCP	%	91				70-130	Pass	
Toluene	L25-Fe0039410	NCP	%	91				70-130	Pass	

Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Ethylbenzene	L25-Fe0039410	NCP	%	100			70-130	Pass	
m&p-Xylenes	L25-Fe0039410	NCP	%	97			70-130	Pass	
o-Xylene	L25-Fe0039410	NCP	%	97			70-130	Pass	
Xylenes - Total*	L25-Fe0039410	NCP	%	97			70-130	Pass	
Spike - % Recovery									
Polycyclic Aromatic Hydrocarbons				Result 1					
Acenaphthene	L25-Fe0034802	NCP	%	103			70-130	Pass	
Acenaphthylene	L25-Fe0034802	NCP	%	102			70-130	Pass	
Anthracene	L25-Fe0034802	NCP	%	98			70-130	Pass	
Benz(a)anthracene	L25-Fe0034802	NCP	%	103			70-130	Pass	
Benzo(a)pyrene	L25-Fe0034802	NCP	%	99			70-130	Pass	
Benzo(b&j)fluoranthene	L25-Fe0034802	NCP	%	101			70-130	Pass	
Benzo(g,h,i)perylene	L25-Fe0034802	NCP	%	105			70-130	Pass	
Benzo(k)fluoranthene	L25-Fe0034802	NCP	%	100			70-130	Pass	
Chrysene	L25-Fe0034802	NCP	%	101			70-130	Pass	
Dibenz(a,h)anthracene	L25-Fe0034802	NCP	%	98			70-130	Pass	
Fluoranthene	L25-Fe0034802	NCP	%	100			70-130	Pass	
Fluorene	L25-Fe0034802	NCP	%	103			70-130	Pass	
Indeno(1,2,3-cd)pyrene	L25-Fe0034802	NCP	%	97			70-130	Pass	
Naphthalene	L25-Fe0034802	NCP	%	101			70-130	Pass	
Phenanthrene	L25-Fe0034802	NCP	%	104			70-130	Pass	
Pyrene	L25-Fe0034802	NCP	%	102			70-130	Pass	
Spike - % Recovery									
TRH - 2013 NEPM Fractions (after silica gel clean-up)				Result 1					
TRH >C10-C16 (after silica gel clean-up)	L25-Fe0041955	NCP	%	106			70-130	Pass	
Spike - % Recovery									
TRH - 1999 NEPM Fractions (after silica gel clean-up)				Result 1					
TRH C10-C14 (after silica gel clean-up)	L25-Fe0041955	NCP	%	117			70-130	Pass	
Spike - % Recovery									
Heavy Metals				Result 1					
Aluminium	L25-Fe0044163	NCP	%	76			75-125	Pass	
Arsenic	L25-Fe0044163	NCP	%	86			75-125	Pass	
Cadmium	L25-Fe0044163	NCP	%	78			75-125	Pass	
Chromium	L25-Fe0044163	NCP	%	77			75-125	Pass	
Chromium (filtered)	L25-Fe0034459	NCP	%	93			75-125	Pass	
Cobalt	L25-Fe0044163	NCP	%	75			75-125	Pass	
Copper	L25-Fe0044163	NCP	%	76			75-125	Pass	
Lead	L25-Fe0044163	NCP	%	76			75-125	Pass	
Manganese	L25-Fe0044163	NCP	%	76			75-125	Pass	
Mercury	L25-Fe0044163	NCP	%	77			75-125	Pass	
Nickel	L25-Fe0044163	NCP	%	77			75-125	Pass	
Spike - % Recovery									
				Result 1					
Chromium (VI)	L25-Fe0019622	CP	%	104			80-120	Pass	
Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Duplicate									
				Result 1	Result 2	RPD			
Naphthalene	L25-Fe0034804	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Chromium (VI)	L25-Fe0019621	CP	mg/L	< 0.002	< 0.002	<1	20%	Pass	
Duplicate									
Total Recoverable Hydrocarbons				Result 1	Result 2	RPD			
TRH C6-C9	L25-Fe0034804	NCP	mg/L	< 0.02	< 0.02	<1	30%	Pass	

Duplicate								
BTEX				Result 1	Result 2	RPD		
Benzene	L25-Fe0034804	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass
Toluene	L25-Fe0034804	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass
Ethylbenzene	L25-Fe0034804	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass
m&p-Xylenes	L25-Fe0034804	NCP	mg/L	< 0.002	< 0.002	<1	30%	Pass
o-Xylene	L25-Fe0034804	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass
Xylenes - Total*	L25-Fe0034804	NCP	mg/L	< 0.003	< 0.003	<1	30%	Pass
Duplicate								
Polycyclic Aromatic Hydrocarbons				Result 1	Result 2	RPD		
Acenaphthene	L25-Fe0041135	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass
Acenaphthylene	L25-Fe0041135	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass
Anthracene	L25-Fe0041135	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass
Benz(a)anthracene	L25-Fe0041135	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass
Benzo(a)pyrene	L25-Fe0041135	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass
Benzo(b&j)fluoranthene	L25-Fe0041135	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass
Benzo(g,h,i)perylene	L25-Fe0041135	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass
Benzo(k)fluoranthene	L25-Fe0041135	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass
Chrysene	L25-Fe0041135	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass
Dibenz(a,h)anthracene	L25-Fe0041135	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass
Fluoranthene	L25-Fe0041135	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass
Fluorene	L25-Fe0041135	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass
Indeno(1,2,3-cd)pyrene	L25-Fe0041135	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass
Naphthalene	L25-Fe0041135	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass
Phenanthrene	L25-Fe0041135	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass
Pyrene	L25-Fe0041135	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass
Duplicate								
TRH - 2013 NEPM Fractions (after silica gel clean-up)				Result 1	Result 2	RPD		
TRH >C10-C16 (after silica gel clean-up)	L25-Fe0041964	NCP	mg/L	< 0.02	< 0.02	<1	30%	Pass
TRH >C16-C34 (after silica gel clean-up)	L25-Fe0041964	NCP	mg/L	< 0.05	< 0.05	<1	30%	Pass
TRH >C34-C40 (after silica gel clean-up)	L25-Fe0041964	NCP	mg/L	< 0.05	< 0.05	<1	30%	Pass
Duplicate								
TRH - 1999 NEPM Fractions (after silica gel clean-up)				Result 1	Result 2	RPD		
TRH C10-C14 (after silica gel clean-up)	L25-Fe0041964	NCP	mg/L	< 0.02	< 0.02	<1	30%	Pass
TRH C15-C28 (after silica gel clean-up)	L25-Fe0041964	NCP	mg/L	< 0.04	< 0.04	<1	30%	Pass
TRH C29-C36 (after silica gel clean-up)	L25-Fe0041964	NCP	mg/L	< 0.04	< 0.04	<1	30%	Pass
TRH C10-C36 (Total) (after silica gel clean-up)	L25-Fe0041964	NCP	mg/L	< 0.04	< 0.04	<1	30%	Pass
Duplicate								
Heavy Metals				Result 1	Result 2	RPD		
Aluminium	L25-Fe0050025	NCP	mg/L	< 1	< 1	<1	30%	Pass
Cadmium	L25-Fe0050025	NCP	mg/L	< 0.004	< 0.004	<1	30%	Pass
Chromium	L25-Fe0050025	NCP	mg/L	0.058	0.053	10	30%	Pass
Chromium (filtered)	L25-Fe0034457	NCP	mg/L	0.005	0.005	3.0	30%	Pass
Cobalt	L25-Fe0050025	NCP	mg/L	0.024	< 0.02	<1	30%	Pass
Iron	L25-Fe0050025	NCP	mg/L	130	120	7.0	30%	Pass
Manganese	L25-Fe0050025	NCP	mg/L	2.7	2.5	7.0	30%	Pass
Mercury	L25-Fe0050025	NCP	mg/L	< 0.002	< 0.002	<1	30%	Pass
Vanadium	L25-Fe0050025	NCP	mg/L	< 0.1	< 0.1	<1	30%	Pass

Comments

Sample Integrity

Custody Seals Intact (if used)	N/A
Attempt to Chill was evident	Yes
Sample correctly preserved	Yes
Appropriate sample containers have been used	Yes
Sample containers for volatile analysis received with minimal headspace	N/A
Samples received within HoldingTime	N/A
Some samples have been subcontracted	No

Qualifier Codes/Comments

Code	Description
G01	The LORs have been raised due to matrix interference
N02	Where we have reported both volatile (P&T GCMS) and semivolatile (GCMS) naphthalene data, results may not be identical. Provided correct sample handling protocols have been followed, any observed differences in results are likely to be due to procedural differences within each methodology. Results determined by both techniques have passed all QAQC acceptance criteria, and are entirely technically valid.
N04	F1 is determined by arithmetically subtracting the "Total BTEX" value from the "C6-C10" value. The "Total BTEX" value is obtained by summing the concentrations of BTEX analytes. The "C6-C10" value is obtained by quantitating against a standard of mixed aromatic/aliphatic analytes.
N07	Please note:- These two PAH isomers closely co-elute using the most contemporary analytical methods and both the reported concentration (and the TEQ) apply specifically to the total of the two co-eluting PAHs

Authorised by:

Elden Garrett	Analytical Services Manager
Douglas Todd	Senior Analyst-Metal
Kim Rodgers	Senior Analyst-Volatile
Lolita Kusnandar	Senior Analyst-Microbiology
Patrick Patfield	Senior Analyst-Organic
Sam Becker	Senior Analyst-Inorganic



Kim Rodgers
General Manager

Final Report – this report replaces any previously issued Report

- Indicates Not Requested

* Indicates NATA accreditation does not cover the performance of this service

Measurement uncertainty of test data is available on request

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CLIENT DETAILS

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Project Spoilbank
Samples 3
Date Received 19/02/2025

Principal Laboratory Address
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Dalcon Environmental
Unit 6-7
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Perth, WA 6000

Telephone +61 1300 145 562
Email stuart.hellenen@dalconenvironmental.com.au

Dalcon Environmental Reference DE03386
Report Number DE03386.R0
Date Reported 7/03/2025

COMMENTS

Accredited for compliance with ISO/IEC 17025 - Testing.
NATA accredited laboratory 20077.

These results apply only to the sample(s) as received and tested.
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SIGNATORY

Dr Stuart Hellenen
Principal/Senior Scientist

CLIENT DETAILS

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Project Spoilbank
Samples 3
Date Received 19/02/2025

Principal Laboratory Address

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Telephone +61 1300 145 562
Email stuart.hellenen@dalconenvironmental.com.au

Dalcon Environmental Reference DE03386
Report Number DE03386.R0
Date Reported 7/03/2025

LABORATORY COMMENTS

Sample received unpreserved and chilled. Sample integrity intact.
Sample filtered (1,000 ml -> 10 ml) upon receipt and preserved with Lugol's Iodine.
Sample analysed using method DE-AM-01. Limit of Reporting = 100 cells L⁻¹

Samples received outside of holding times (24 - 48 hours). Client has been notified and authority to proceed with analysis given.

Suffix (PT) = potential toxin producer

Suffix (t) = trichome/filament

Suffix (unknown) = unidentifiable to genus level

Where (PT) is indicated next to a genus, it should be noted that not all (and, in most cases, only a few) species within that genus are responsible for producing these compounds.

No exceedances of WASQAP (2020)/MBMMP (2020) Trigger Values.

OTHER COMMENTS

PO Number: AU0144208167

Sample Description:

DE03386.1 - DE03386.3: Sample clear and colourless.

Sample Notes:

DE Sample Number	DE03386.1	DE03386.2	DE03386.3
Sample Type	Marine	Marine	Marine
Client Sample Desc.	SBM1	SBM2	REF4
Sample Date	16/02/2025	16/02/2025	16/02/2025

Analysis Date	4/03/2025	4/03/2025	4/03/2025
Chamber Type	SRC	SRC	SRC
Chamber Volume	1ml	1ml	1ml
Concentration Factor	100x	100x	100x
Units	cells L ⁻¹	cells L ⁻¹	cells L ⁻¹
LOR	100 cell L ⁻¹	100 cell L ⁻¹	100 cell L ⁻¹

[illegible]



**Marine and Freshwater
Research Laboratory**

Tel: 08 93602907 Address: 90 South St, Murdoch, WA, 6150



Accreditation Number: 10603
Accredited for compliance with ISO/IEC 17025 - Testing.



Contact: Russell Stevens
Customer: O2 Marine
Address: 20 Mews Rd Fremantle WA 6160

Date of Issue: 12/03/2025
Date Received: 10/02/2025
Our Reference: O2M25-1
Your Reference: 24ENV368

WATER QUALITY DATA

METHOD SAMPLE CODE	Sampling Date	Sample Type	MS001 Filtered Zn µg/L	MS001 Filtered Ag µg/L
Reporting Limit			<1	<0.1
Analysis Date File			11/03/2025 25031101	11/03/2025 25031101
SBM1		Marine	6	<0.1
SBM2		Marine	5	<0.1
REF4 SB		Marine	6	<0.1
DUP1 SBM		Marine	5	<0.1
DUP1 MEQSAP		Marine	6	<0.1

Note: For results for compliance purposes uncertainty of measurement (MU) will sometimes affect the interpretation whether the result passes or fails the compliance limit.
Tables for measurement uncertainty are available online at www.mafri.murdoch.edu.au

Signatory: Lirong Han
Date: 12/03/2025

The results only apply to the sample as received and to the sample tested.
Spare test items will be held for two months unless otherwise requested.

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rpt_304501863_a01

Appendix C Spoilbank Marina MEWQMP Summary Report Q3



Subject	DoT Spoilbank Marina Water Quality Q3 Summary Report		
Date	05/08/2025	Reference	24ENV368 / T250280
To	Pearl Delima	Email	Pearl.Delima@transport.wa.gov.au
From	Andrew Fung Cameron Holder	Email	andrew.fung@o2marine.com.au cameron.holder@o2marine.com.au
From	Russell Stevens	Email	russell.stevens@o2marine.com.au

1. Introduction

The Spoilbank Marina (the Marina) is located on Lot 5751 and Lot 5550 on a site commonly known as the 'Spoilbank' which is an artificial coastal landform created in the late-1960s/early-1970s from the disposal of material dredged from Port Hedland's inner harbour and shipping channel. The Spoilbank Marina will replace the existing Richardson Street boat ramp (which will be closed) and redirect boating activities away from the commercial operations of Port Hedland's inner harbour and navigation channel (Town of Port Hedland 2019). The Marina development plans included a four-lane boat ramp, 80 boat pens, 208 trailer and 86 car parking bays, dry dock area for commercial vessels, public and pen holder amenities, public open space, and recreation and event space (Figure 1).

Federal environmental approval for the construction of the Marina was granted by the Department of Climate Change, Energy, the Environment and Water (DCCEEW) under the Environmental Protection and Biodiversity Conservation Act 1999 (Cth) (EPBC Act) on 19 February 2021 via EPBC 2019/8520. As part of the approval Conditions, the proponent was required to:

- Condition 5: submit an Operational Environment Management Plan (OEMP), at least three months prior to the anticipated commencement of the operation of the marina, for the Minister's approval to ensure that the operation of the marina does not significantly impact protected matters. The OEMP must:
 - Condition 5 part c): include a Marine Environment and Water Quality Management Plan (MEQMP) that addresses how marine water quality, sediment quality and accumulation of marine debris will be monitored and managed to prevent impacts to protected matters from the operation of the marina.

1.1. Approach

The approach detailed within the MEQMP was developed in the context of the Environmental Quality Management Framework (EQMF). The approach to establishing an EQMF, including identification of Environmental Values (EVs), EQOs, levels of ecological protection (LEP) and EQC is clearly described in EPA (2016), and is based on the principles and guidelines of the National Water Quality Management Strategy (NWQMS), with regard to the Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZG 2018). The focus of the approach is on maintaining existing environmental quality and identifying where management and/or remediation may be required and to measure its effectiveness. The EQMF can also be used to provide measurable performance objectives for unplanned events or discharges (EPA 2016). The MEQMP forms the basis of this report and will be referred to consistently throughout.

1.2. Purpose

The purpose of this report is to present a summary of sampling results in accordance with the MEQMP for the third implementation round conducted on the 16 of May 2025.

2. Methodology

The MEQMP prescribes marine environmental quality sampling over an annual period (Table 1). This report presents results from the third quarterly sampling event (Q3).

Field logs for this sampling event are presented in Appendix A. All sampling methods were conducted in accordance with the MEQMP (O2M 2024).

Table 1: Overview of sampling events to be undertaken during the annual reporting period.

Sampling Event	Water	Sediment	Season	Month
Q1	X	-	Summer	26-27/10/2024
Q2	X	-	Autumn	04-06/02/2025
Q3	X	X	Winter	16/05/2025
Q4	X	-	Spring	TBC

2.1. Sampling Locations

A summary of the sampling locations and tasks conducted is presented in Table 2.

Table 2: Spoilbank Marina sample sites, parameters, and location.

Site Name	Ecological Protection Area	Site Type	Easting	Northing	Sampling Tasks Conducted					
					Aesthetic Observations	Physico-chemical Water Column Profiling	Water Sample Collection			Sediment Sample Analysis
							General Water Sample Analysis	Bacterial Sample Analysis	Phytoplankton Sample Analysis	
SBM1	Moderate	Impact	666047	7753746	✓	✓	✓	✓	✓	✓
SBM2	High	Impact	665686	7754176	✓	✓	✓	✓	✓	✓
REF4	High	Reference	658166	7755976	✓	✓	✓	✓	✓	✓



Figure 1: Water quality sampling locations

2.2. Data Analysis and QA/QC

The following data analysis and QA/QC was conducted during the reporting period:

- Physiochemical profile data analysis and QA/QC included:
 - data trimming was conducted to remove data points occurring outside the range of 0.5 m below the surface and 0.5 m above the seafloor;
 - manual and automated QC checks were conducted to remove erroneous entries;
 - Data smoothing and bias reduction through applying a gaussian depth weighted average to each profile;
 - Calculation of a median value for each parameter for each profile; and
 - Comparison of the median value against interim EQGs.
- Laboratory reported water quality results have been compared against relevant EQCs.
- Aesthetic observations have been compared to relevant EQCs.

Field QA/QC sampling included collection of one rinsate sample.

All laboratory analysis were completed in accordance with the relevant NATA accreditation¹. Comprehensive QA/QC testing of samples will be undertaken in accordance with their respective NATA accreditation and include testing of laboratory control samples, method blanks, matrix spikes, laboratory duplicates and surrogate recovery outliers (where applicable).

¹ LORs for metals Cr (VI) and Cu reported are not sufficient to provide suitable assessment against the EQGs for the High Ecological Protection Area due to limitations of laboratory testing NATA accreditation.

3. Results

3.1. General Observations

During sampling weather conditions were moderate breeze (Table 3). Sample collection times, sample depths and tidal regimes are outlined in Table 4.

Table 3: General observations made during sampling event.

Weather Observations & Sea State				General Observations
16 May 2025				
General Conditions	Moderate breeze	Wave Height (metres)	2m	Moderate breeze Low Tide: 0627 / 1.9m High Tide: 1239 / 6.6m
Air Temp (°C)	~30 °C	Wave Direction	E	
Wind Speed (knots)	10knts			
Wind Direction	E			

Table 4: Sample timing and depth – note samples are presented in chronological order of sampling event.

Site	Date	Depth (m)	Tide Time and Height (m) ↓ (outgoing) ↑ (incoming)	Sample Time (24hr)
SBM1	16/05/2025	7.2	4.6m ↓	1420
SBM2	16/05/2025	3.0	4.4m ↓	1500
REF4	16/05/2025	8.0	6.5m ↑	1240

3.2. EQO1: Ecosystem Health – Water Quality

3.2.1. Physical and Chemical Stressors

Chlorophyll- α and physicochemical profile results for the reporting period are presented in Table 5. Water column profiles are displayed in Figure 2. In summary:

- Temperature values ranged between 23.8 °C and 24.2 °C. Values exceeded the EQGs at REF4.
- DO values ranged between 84.8 % and 87.2 %. Values exceeded the EQGs at SBM1, SBM2 and REF4.
- EC values ranged between 55,905.1 mS/cm and 56,228.7 mS/cm
- Salinity is 38.1 ppt for all sites.
- pH is 8.36 for all sites. Values exceeded the EQGs at SBM1, SBM2 and REF4.
- Turbidity values ranged between 5.3 NTU and 6.2 NTU.
- Chlorophyll- α concentration is below 0.001 mg/L for all sites.

Table 5: Median values for physical and chemical stressors. Exceedances of numerical EQGs indicated by highlighted cells.

Site ID	LEP Area	Temp °C	DO % Saturation	EC mS/cm	Salinity ppt	pH -	Turbidity NTU	Chl α mg/L
Moderate EQG		20.9 – 25.5	>97.3	-	32.8 – 38.9	7.9 – 8.35	9.1	0.001
High EQG		21.4 – 24.0	>99.6	-	32.9 – 38.9	8.17 – 8.35	6.7	0.001
Impact Sites								
SBM1	MEPA	23.9	85.1	55,931.2	38.1	8.36	6.2	<0.001
SBM2	HEPA	23.8	84.8	55,905.1	38.1	8.36	6.2	<0.001
Reference Sites								
REF4	HEPA	24.2	87.2	56,228.7	38.1	8.36	5.3	<0.001

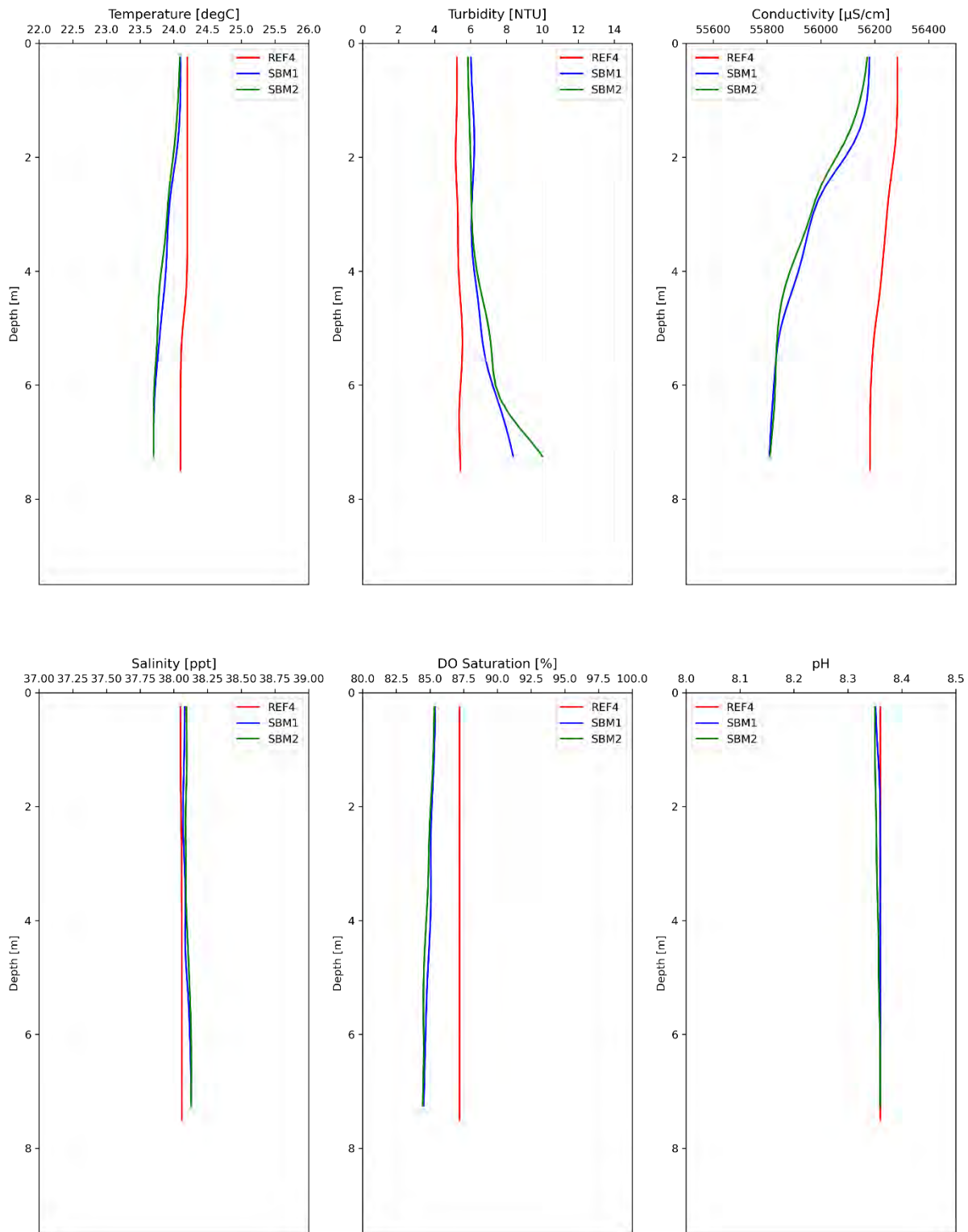


Figure 2: Physico-chemical profiles collected at the Spoilbank Marine during May 2025.

3.2.2. Nutrients

Analytical certificates of analysis and quality control reports for nutrients and chlorophyll- α in water are presented in Appendix C. These are summarised in Table 6 and below:

- Total nitrogen (TN) concentrations ranged between 4.9 mg/L (SBM1), and 0.7 mg/L (SBM2).
- Total phosphorus (TP) concentrations ranged between 0.007 mg/L (SBM1), and 0.01 (REF4).

Table 6: Nutrient concentrations in marine water samples.

Site ID	LEP Area	Total Nitrogen (TN)	Total Kjeldahl Nitrogen (TKN)	Total Phosphorus (TP)
Units		mg/L		
Moderate EQG		-	-	-
High EQG		-	-	-
Impact Sites				
SBM1	MEPA	4.9	1.8	0.07
SBM2	HEPA	0.7	0.7	0.02
Reference Sites				
REF4	HEPA	1.7	1.7	0.01

3.2.3. Dissolved Metals

Analytical certificates of analysis and quality control reports for toxicants in water are presented in Table 7. A summary of the dissolved metal concentrations is presented in Table 7. In summary:

- Dissolved metals concentrations were generally low or reported below the LOR.
- Copper concentrations exceeded the numerical EQG at REF4.
- Mercury concentrations exceeded the numerical EQG at SBM2.
- Zinc concentrations exceeded the numerical EQG at sites SBM2, and at REF4.

Table 7: Dissolved metals concentrations. EQG exceedances indicated by highlighted cells.

Site ID	LEP Area	Al	As	Cd	Cr (III)	Cr (VI)	Co	Cu	Fe	Pb	Mn	Hg	Ni	Ag	V	Zn ¹
		mg/L														
Moderate EQG		-	-	0.014	0.049	0.020	0.001	0.003	-	0.0066	0.014	0.0007	0.2	0.0018	0.16	0.012
High EQG		-	-	0.0007	0.0077	0.00014	0.001	0.0003	-	0.0022	0.014	0.0001	0.007	0.0008	0.05	0.0033
Impact Sites																
SBM1	MEPA	<0.05	0.004	< 0.0001	< 0.002	< 0.002	< 0.001	0.001	<0.01	< 0.001	< 0.005	<0.0001	< 0.001	<0.0001	0.016	0.008
SBM2	HEPA	<0.05	0.004	< 0.0001	< 0.002	< 0.002	< 0.001	< 0.001	<0.01	< 0.001	< 0.005	0.0003	0.001	<0.0001	0.016	0.005
Reference Sites																
REF4	HEPA	<0.05	0.004	< 0.0001	< 0.002	< 0.002	< 0.001	0.003	<0.01	< 0.001	< 0.005	<0.0001	< 0.001	0.0003	0.013	0.015

¹ EQG for zinc has changed since the OEMP was approved due to an update for this parameter in the Guidelines for Fresh & Marine Water Quality

3.2.4. Hydrocarbons

Hydrocarbons results are presented in Appendix C.

- BTEX is detected at low concentrations at sites SBM2 and REF4.
- Polycyclic aromatic hydrocarbons and total recoverable hydrocarbons concentrations were reported below the LOR.

3.3. EQO1: Ecosystem Health – Sediment Quality

3.3.1. Particle Size Distribution

The particle size distribution (PSD) results are summarised Figure 3. Finer sediments, indicated by higher proportions of clay, silt and fine sand were typically observed at the Spoilbank Marina sites located within and just outside of the marina. Sediments at the reference location REF4 were dominated by a higher proportion of medium and coarse grain sand.

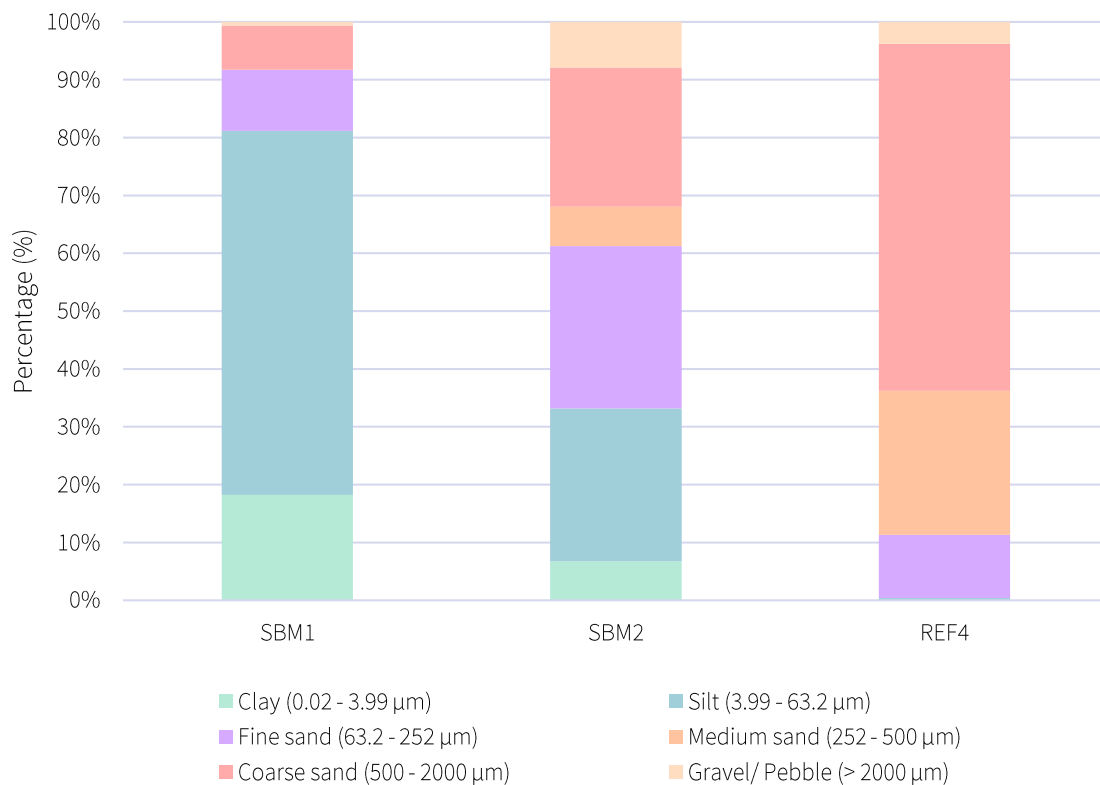


Figure 3: Particle size distribution analysis results

3.3.2. Nutrients

Analytical certificates of analysis and quality control reports for nutrients and chlorophyll- α in water are presented in Appendix C. These are summarised in Table 9 and below:

- Total nitrogen (TN) ranged between 880 mg/kg (SBM1), and 83 mg/kg (REF4).
- Total phosphorus (TP) ranged between 280 mg/kg (SBM1), and 130 mg/kg (REF4).

Table 8 Nutrient concentrations in marine sediment samples.

Site ID	LEP Area	Total Nitrogen (TN)	Total Kjeldahl Nitrogen (TKN)	Total Phosphorus (TP)
Moderate EQG		-	-	-
High EQG		-	-	-
Impact Sites				
SBM1	MEPA	880	880	280
SBM2	HEPA	680	680	170
Reference Sites				
REF4	HEPA	83	83	130

3.3.3. Metals

Analytical certificates of analysis and quality control reports for toxicants in water are presented in Appendix C. A summary of the dissolved metal concentrations is presented in Table 9. In summary:

- Arsenic concentrations exceeded the numerical EQG at sites SBM1 and REF4.
- Nickel concentrations exceeded the numerical EQG at site SBM1.

Table 9: Metals concentrations. EQG exceedances indicated by highlighted cells.

Site ID	LEP Area	Al	As	Cd	Cr	Cu	Fe	Pb	Hg	Ni	Zn
mg/kg											
Moderate EQG		9100	20	1.5	80	65	-	50	0.15	21	200
High EQG		9100	20	1.5	80	65	-	50	0.15	21	200
Impact Sites											
SBM1	MEPA	9100	22	<0.1	62	19	28000	9	0.03	29	31
SBM2	HEPA	3400	9.2	<0.1	32	9.1	15000	3.7	<0.02	12	17
Reference Sites											
REF4	HEPA	850	21	<0.1	17	1.1	5600	1.2	<0.02	4.8	<5

3.3.4. Hydrocarbons

Hydrocarbons results are presented in Appendix C. All hydrocarbons' concentrations were reported below the LOR.

3.4. EQO4/EQO5/EQO6: Recreation and Aesthetics

3.4.1. Recreation and Aesthetics

Assessment of data including aesthetic observations (Appendix A) and laboratory analysis of nuisance organisms and pathogens (Appendix C) are presented in Table 10.

In summary, pathogens, nuisance organisms, water quality and general observations indicate:

- No EQG exceedances for primary or secondary contact (EQO4/EQO5).
- No aesthetics EQG (EQO6) exceedances were reported.
- No Department of Health Western Australia (DOHWA) watch list species were detected.

Table 10: Pathogenic bacteria, nuisance organisms, field observations. EQG exceedances indicated by highlighted cells.

Site ID	LEP Area	Pathogenic Bacteria	Nuisance Organisms			Oil	Debris	Wrack	Odour	Fauna deaths
		Enterococci/100mL	Cells/mL	Public reports	Observation					
EQG – Primary Contact (EQO4)		<200	<10,000	Nil	-	-	-	-	-	-
EQG - Secondary Contact (EQO5)		<2000	<25,000	Nil	-	-	-	-	-	-
EQG – Aesthetics (EQO6)		-	-	-	Minor surface scums ¹	Refer to Section 3.2 of the MEQMP	Refer to Section 3.2 of the MEQMP	Coverage <25%	No objectional odour	-
Impact Sites										
SBM1	MEPA	<1	206.0	Nil	Nil	Nil	Nil	Nil	Nil	No Fauna Deaths
SBM2	HEPA	<1	230.0	Nil	Nil	Nil	Nil	Nil	Nil	No Fauna Deaths
Reference Sites										
REF4	HEPA	4	443.0	Nil	Nil	Nil	Nil	Nil	Nil	No Fauna Deaths

3.5. QA/QC Assessment

3.5.1. Field QA/QC Results

Field QA/QC assessment conducted during Q3 sampling included collection on one duplicate sample and one rinsate sample. Duplicate RPD results are presented in Table 11 and Table 12. In summary:

- RPD exceedances were reported for mercury for water quality samples. RPD exceedances were reported as a result of comparison against low level detections of contaminants, resulting in a proportionally higher RPD value.
- Rinsate sample results were all reported below the LOR during Q3.

Table 11: Duplicate RPD results for water quality samples collected in Q3.

Site	Al	As	Cd	Cr (III)	Cr (VI)	Co	Cu	Fe	Pb	Mn	Hg	Ni	Ag	V	Zn
SBM 1	<0.05	0.004	< 0.0001	< 0.002	< 0.002	< 0.001	0.001	<0.01	< 0.001	< 0.005	<0.0001	< 0.001	<0.0001	0.016	0.008
DUP 1	<0.05	0.004	< 0.0001	<0.002	< 0.002	< 0.001	0.001	<0.01	< 0.001	< 0.005	0.0001	< 0.001	<0.0001	0.017	0.008
RPD	-	0%	-	-	-	-	-	-	-	-	67%	-	-	-	0%

Note:

For results below LOR (highlighted in blue), half the LOR value was used for RPD calculations.

RPD values exceeding (RPD >35%) are highlighted in red text.

Table 12: Duplicate RPD results for sediment quality samples collected in Q3.

Site	Al	As	Cd	Cr	Cu	Fe	Pb	Hg	Ni	Zn
SBM 1	9100	22	<0.1	62	19	28000	9	0.03	29	31
DUP 1	13000	26	<0.1	75	22	35000	12	0.04	37	41
RPD	35%	17%	-	19%	15%	22%	29%	29%	24%	28%

Note:

For results below LOR (highlighted in blue), half the LOR value was used for RPD calculations.

RPD values exceeding (RPD >35%) are highlighted in red text.

3.5.2. Laboratory QA/QC Results

Full laboratory QA/QC reports for Q3 of the Reporting Period are presented in Appendix C. QA/QC results for the Q3 sampling period indicate:

- All laboratory QA/QC tests were within an acceptable range for all analytes in water quality samples.
- Most laboratory QA/QC tests were within an acceptable range for all analytes in sediment quality samples except for zinc and lead result. The matrix spike recovery for these two metals is outside of the recommended acceptance criteria. An acceptable recovery was obtained for the laboratory control sample indicating a sample matrix interference.

4. Discussion and Conclusion

4.1. EQO1: Ecosystem Health – Water Quality

4.1.1. Physical and Chemical Stressors in Water

Physico-chemical parameters recorded results typical of the Pilbara coastal waters with no significant outliers. Data indicates low variance among sites, while there were no trends between sites for physico-chemical parameters.

DO, pH and temperature values slightly exceeded the numerical EQGs presented in MEQMP, however did not represent an EQG exceedance based on comparison against reference site data, which was also elevated with respect to the EQG. These results indicate that DO, pH and temperature values reported during this quarter were representative of natural environmental variability.

Chlorophyll- α was reported below the LOR across all sample sites.

No EQG exceedances were reported for any physical and chemical stressors in water. Based on this assessment, reported results indicate that EQO1 has been achieved and the EVs are not at risk from physical and chemical water quality issues.

4.1.2. Nutrients

Total nitrogen content in marine water samples ranged between 4.9 mg/L at site SBM1 and 0.7 mg/L at site SMB2, while TP concentration ranged between 0.007 mg/L at site SBM1, and 0.01 mg/L at site REF4. Concentrations of TN and TP were generally higher at site SBM1 when compared to SBM2, and the reference location. There are currently no ANZG (2018) SPLs defined for TN or TP in marine or freshwater.

4.1.3. Toxicants in Water

Metal and hydrocarbon toxicant concentrations in water samples were mostly found to be low. However, zinc reported exceedances of the numerical EQG at sites SBM2 and REF4 while mercury reported exceedance of the numerical EQG at site SBM2.

Elevated zinc concentrations in exceedance of the EQG have historically been reported in Port Hedland, both within the Port and in nearby creeks (O2 Marine 2023; Wenziker et al. 2006), indicating that zinc is occurring naturally at these levels. Furthermore, the results for zinc from SBM2 were consistent with levels reported at the reference site (REF4), thus was considered to be representative of natural concentrations. The exceedance of mercury at SBM2 was marginal, with concentrations only slightly above the LOR. This minor elevation may be attributed to natural variability or analytical variability.

Hydrocarbons were reported low concentration or below the LOR across all sample sites.

Based on this assessment, reported results indicate that EQO1 has been achieved and the EVs are not at risk from toxicants in water.

4.2. EQO1: Ecosystem Health – Sediment Quality

4.2.1. Nutrients

Total nitrogen ranged between 880 mg/kg at site SBM1, and 83 mg/kg at reference site REF4, while TP ranged between 280 mg/kg at site SBM1, and 130 mg/kg at the reference site REF4. TN and TP concentrations were the highest at site SBM1, followed by SBM2, and were the lowest at the reference site REF4. TN and TP concentrations were likely correlated with the proportion of fines (<62 µm) in sediment. There are currently no ANZG (2018) DGVs defined for TN or TP in sediments.

4.2.2. Toxicants in Sediment

Metal and hydrocarbon concentrations in sediment samples were generally low. However, exceedances of the numerical EQG were recorded for arsenic (at sites SBM1 and REF4) and nickel (at SBM1). Elevated levels of arsenic and nickel have been historically reported in the Port Hedland region, both within the port and in adjacent creeks (O2 Marine 2023; Wenziker *et al.* 2006), suggesting these concentrations are of natural origin. Additionally, arsenic levels at SBM1 was consistent with that at the reference site (REF4), further supporting the interpretation that they reflect background natural concentrations.

Hydrocarbons were reported low concentration or below the LOR across all sample sites.

Based on this assessment, reported results indicate that EQO1 has been achieved and the EVs are not at risk from toxicants in water.

4.3. EQO4/EQO5/EQO6: Recreation and Aesthetics

4.3.1. EQO4/EQO5 Primary and Secondary Contact

E. coli and *Enterococci* were reported below the LOR at all monitoring locations. Primary and secondary contact results for toxic and nuisance phytoplankton were below the EQG at all sites during Q3.

No DOHWA watchlist species were detected.

4.3.2. EQO6 Aesthetics

During the reporting period no results are considered to represent a decline in marine environmental quality when assessed against the EQGs. No observed incidences of large-scale marine deaths, noticeable visible film or debris on the surface, odour or natural reflectance were recorded above the criteria described within the MEQMP.

5. References

- ANZG (2018). *Australian and New Zealand Guidelines for fresh and Marine Water Quality* - <https://www.waterquality.gov.au/anz-guidelines/guideline-values/default/water-quality-toxicants/search>. Accessed 21/07/2023.
- EPA (2016). Technical Guidance – Protecting the Quality of Western Australia’s Marine Environment. Environmental Protection Authority, December 2016
- O2Marine (2024) Port Hedland Spoilbank Marina Marine Environmental Quality Management Plan. Report prepared for the Department of Transport, July 2024.
- O2 Marine (2023). Port of Port Hedland Baseline Data Analysis Technical Memo. Report prepared for the Pilbara Ports Authority.
- Wenziker K.J., McAlpine, K. W., Apte, S.C. and Masini, R.J. (2006). Background quality for coastal marine waters of the North West Shelf, Western Australia. North West Shelf Joint Environmental Management Study, CSIRO Marine Research, GPO Box 1538, Hobart Tasmania 7001.

Appendix A. Field Sheets

Sediment Sampling Record

Project Details		Sampling Requirements		Weather Observations	
Job Number:	Z3ENV179	Primary Lab		Sampling Dates:	16/05/23
Project Title:	PHM2 Q5AP	ARL		Air Temp. (°C):	~30°C
Client:	Pilbara Ports			Wind Speed (knts):	~10 knts
Field Staff:	CH/AM			Wind Direction:	E
				Sea State:	mod

SITE	GPS	Duplicate (Y/N)	DATE	TIME	ACTUAL DEPTH (m)	Sample requirements	PHYSICAL APPEARANCE	COLOUR	PLASTICITY	GRAIN SIZE	FOREIGN MATERIAL	ORGANIC MATTER	ODOUR	COMMENTS
Ref3	X	N	16/05	1115	2.5	2.5	Mud/silt	Brown	mod	clay/silt	shell/rock	low	N	-
Ref2	X	N	16/05	1145	3.0m	2.5	Mud/silt	Brown / R/Brown	low/mod	fs/silt	rock shell	High	N	high organic content
Ref1	X	N	11	12410	3.0m	2.5	m/c Sand	Brown / Y/R	low	CS/MS	shell CS	low	N	-
Ref4	X	N	11	1245	8m	2.5	m/c Sand	Brown / Y/R	low	CS/MS	shell CS	low	N	-
SBM1	X	Y	11	1420	7.2m	2.5	Mud/Clay	Brown	High	clay	N	N	N	-
SBM2	X	N	11	1500	1m	2.5	mud/clay	Dark Brown	High	clay	N	low	N	-
SR1	X	N	16/05	1600	2m	2.5	Mud/silt	grey Brown	low	MS	Rock/organic	mod	N	-
1H1	X	N	17/05	0815	17m	2.5	CS/MS	Red/Brown	low	MS	Rock	N	N	-
SEC1	X	N	17/05	0850	1m	2.5	CS/MS	11	11	11	shell	N	N	-

SOC1	X	Y	17/05	0920	1.3m	2.5	11	11	11	11	N	N	N	-
SWC1	X	N	11	0950	1.4m	2.5	11	11	11	11	N	N	N	-
WEC1	X	TRIP	11	1015	1.4m	2.5	Mud/Clay	Dark Brown / Black / grey	High	clay	organic roots	Y	N	-
1H2	X	X	17/05	1030	20m	2.5	Coarse Sand	Red/Brown	low	Coarse grains	N	N	N	-

Refusal / mostly gravel

	Date	Time	Dup	Colour	Plast.	Grain size	Moist Mat	Organic	Gravel
1H3	17/05	1120	X	Red/Brown	low	Coarse / Rock	N	N	N
1H4	17/05	1130	X	Brown / DK grey	high/mix	mix silt + ms	N	N	Slight

Time	SBM	Dup	ABCDEF	comment
1240	Ref 4	x	1 1 1 1 1 1	-
1420	SBM1	✓	1 1 1 1 1 1	-
1500	SBM2	x	1 1 1 1 1 1	-

Appendix B. Chain of Custody

[illegible]

NR ~~12/25~~ 26/5/25 13:01

159

#1224509

02M25-16 CoC

Appendix C. Laboratory Certificate of Analysis



**Marine and Freshwater
Research Laboratory**

Tel: 08 93602907 Address: 90 South St, Murdoch, WA, 6150



Accreditation Number: 10603
Accredited for compliance with ISO/IEC 17025 - Testing.



WATER QUALITY DATA

Contact: Russell Stevens
Customer: O2 Marine
Address: 20 Mews Rd, Fremantle WA 6160

Date of Issue: 5/06/2025
Date Received: 22/05/2025
Our Reference: O2M25-16
Your Reference: 24ENV368

METHOD SAMPLE CODE	Sampling Date	Sample Type	MS001 Filtered Zn µg/L	MS001 Filtered Ag µg/L
Reporting Limit			<1	<0.1
Analysis Date File			28/05/2025 25052801	28/05/2025 25052801
SBM1	16/05/2025	Marine	8	<0.1
SBM2	16/05/2025	Marine	5	<0.1
REF4	16/05/2025	Marine	15	0.3
DUP1	16/05/2025	Marine	8	<0.1

Note: For results for compliance purposes uncertainty of measurement (MU) will sometimes affect the interpretation whether the result passes or fails the compliance limit.
Tables for measurement uncertainty are available online at www.mafrl.murdoch.edu.au

Signatory: Lirong Han
Date: 5/06/2025

The results only apply to the sample as received and to the sample tested.
Spare test items will be held for two months unless otherwise requested.

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Client: Eurofins ARL Pty Ltd
Client address: 46 - 48 Banksia Road, Welshpool, WA, 6106
Client ID: 1224509 25-My0075490
Job ID: 25_0954
Lab ID: 25_0954_001
Revision No. : 0

Date received: 27/05/2025
Date analysed: 13/06/2025
Date reported: 17/06/2025

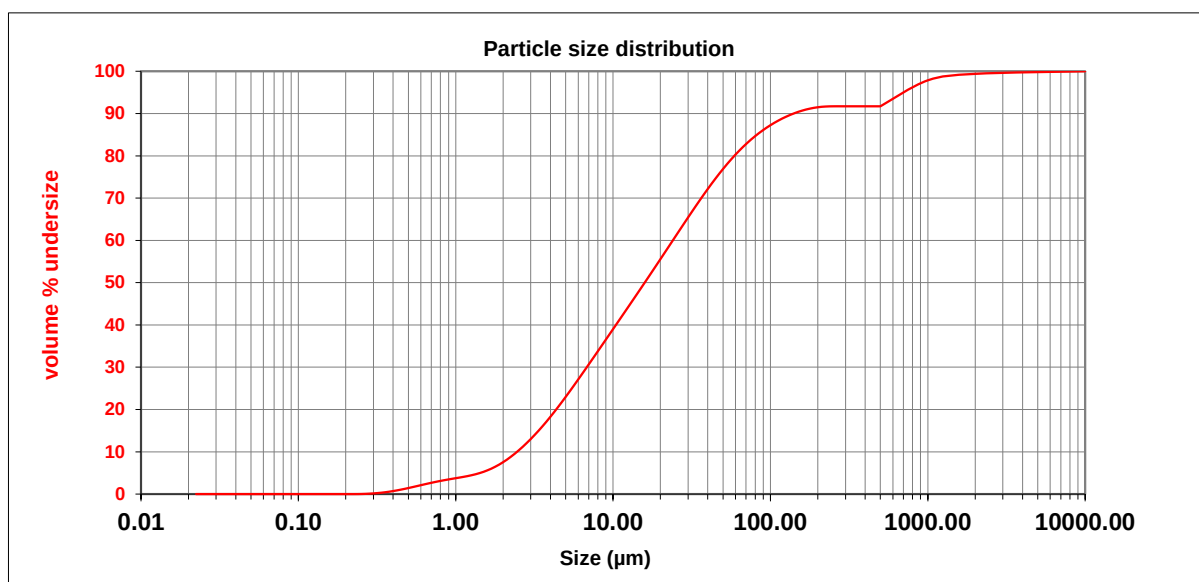
Sample Preparation: The < 500µm portion of the sample was sonicated for 15 minutes prior to being subsampled for analysis, this is to reduce any agglomerations that may have formed.

Comment: None.

Analysis: Laser diffraction size distribution following ISO13320-1:2020
Dispersant/RI: Water/1.33
Additives: 10 millilitres Sodium Hexametaphosphate
Sonication: 15 min sonication
Instrument Name: Malvern Mastersizer 3000

Result units: Volume
Analysis model: General Purpose
RI/ABS: 1.543 / 0.01
Pump/Stirrer speed: 2790
Date Last Qualification: 17/02/2025

Span	8.70 µm	Surface Weighted mean D[3,2]	5.30 µm
		Vol. Weighted mean D[4,3]	117.08 µm
d(0.1)	2.45 µm	d(0.5)	15.88 µm
		d(0.9)	140.58 µm



Wentworth Scale

Size (µm)	Vol In %	Size (µm)	Vol In %	Size (µm)	Vol In %	Size (µm)	Vol In %
0.020	18.25	3.990	62.92	63.200	10.54	252.000	0.00
3.990		63.200		252.000		500.000	
Clay		Silt		Fine sand		Medium sand	

Note 1: Data from 500µm to 10000µm by wet screening, from 0.02µm to 500µm by laser diffraction.

Note 2: The categories for Wentworth scale are solely a statement of size range classification. Unless otherwise stated, there has been no determination made as to whether the particulate assigned to a specific category is sedimentary or non-sedimentary.

Analysed: Jess Kern, Diploma (Laboratory Technology)
Reported: Jess Kern, Diploma (Laboratory Technology)
Approved: Benjamin Rainer, Diploma (Laboratory Technology)

MAQR84 v2.0

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Client: Eurofins ARL Pty Ltd
Client address: 46 - 48 Banksia Road, Welshpool, WA, 6106
Client ID: 1224509 25-My0075491
Job ID: 25_0954
Lab ID: 25_0954_002
Revision No. : 0

Date received: 27/05/2025
Date analysed: 13/06/2025
Date reported: 17/06/2025

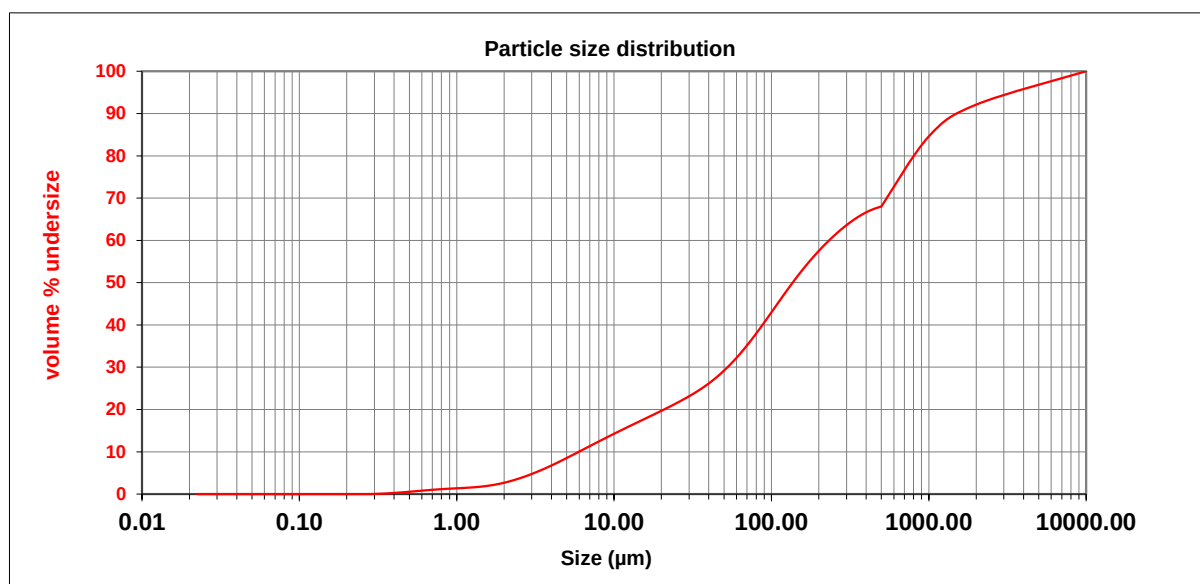
Sample Preparation: The < 500µm portion of the sample was sonicated for 15 minutes prior to being subsampled for analysis, this is to reduce any agglomerations that may have formed.

Comment: None.

Analysis: Laser diffraction size distribution following ISO13320-1:2020
Dispersant/RI: Water/1.33
Additives: 10 millilitres Sodium Hexametaphosphate
Sonication: 15 min sonication
Instrument Name: Malvern Mastersizer 3000

Result units: Volume
Analysis model: General Purpose
RI/ABS: 1.543 / 0.01
Pump/Stirrer speed: 2430
Date Last Qualification: 17/02/2025

Span	12.54 µm	Surface Weighted mean D[3,2]	13.90 µm
		Vol. Weighted mean D[4,3]	643.59 µm
d(0.1)	5.98 µm	d(0.5)	136.67 µm
		d(0.9)	1720.45 µm



Wentworth Scale

Size (µm) 0.020 3.990 Clay	Vol In % 6.74	Size (µm) 3.990 63.200 Silt	Vol In % 26.44	Size (µm) 63.200 252.000 Fine sand	Vol In % 28.04	Size (µm) 252.000 500.000 Medium sand	Vol In % 6.80
Size (µm) 500.000 2000.000 Coarse sand	Vol In % 24.08	Size (µm) 2000.000 10000.000 Gravel/Pebble	Vol In % 7.90				

Note 1: Data from 500µm to 10000µm by wet screening, from 0.02µm to 500µm by laser diffraction.

Note 2: The categories for Wentworth scale are solely a statement of size range classification. Unless otherwise stated, there has been no determination made as to whether the particulate assigned to a specific category is sedimentary or non-sedimentary.

Analysed: Jess Kern, Diploma (Laboratory Technology)
Reported: Jess Kern, Diploma (Laboratory Technology)
Approved: Benjamin Rainer, Diploma (Laboratory Technology)

MAQR84 v2.0

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Be Confident We See More

Client: Eurofins ARL Pty Ltd
Client address: 46 - 48 Banksia Road, Welshpool, WA, 6106
Client ID: 1224509 25-My0075492
Job ID: 25_0954
Lab ID: 25_0954_003
Revision No. : 0

Date received: 27/05/2025
Date analysed: 13/06/2025
Date reported: 17/06/2025

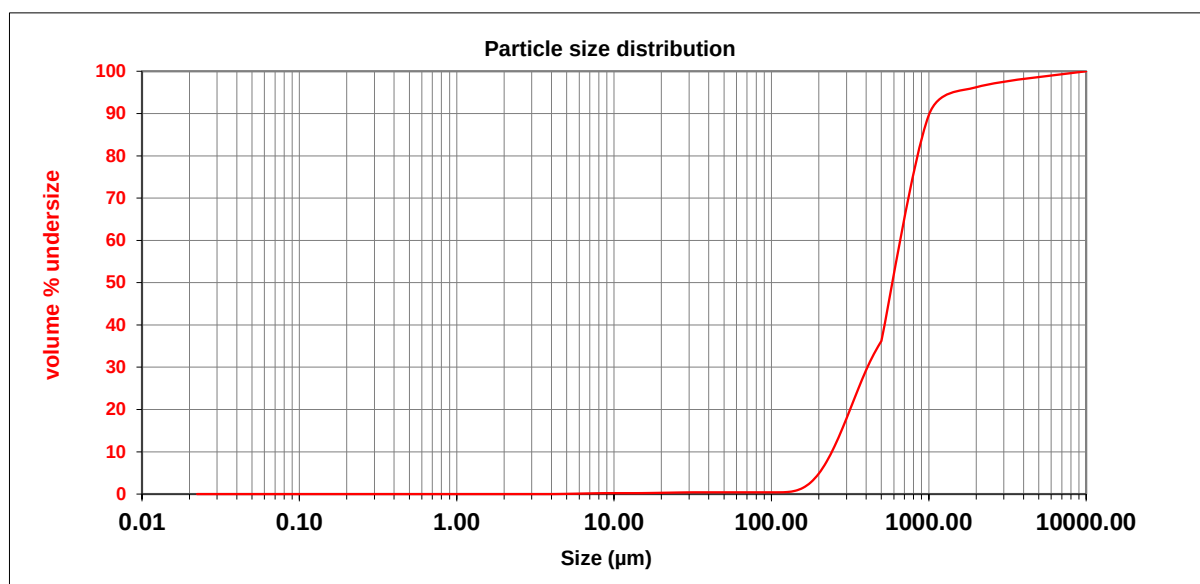
Sample Preparation: The < 500µm portion of the sample was sonicated for 15 minutes prior to being subsampled for analysis, this is to reduce any agglomerations that may have formed.

Comment: None.

Analysis: Laser diffraction size distribution following ISO13320-1:2020
Dispersant/RI: Water/1.33
Additives: 10 millilitres Sodium Hexametaphosphate
Sonication: 15 min sonication
Instrument Name: Malvern Mastersizer 3000

Result units: Volume
Analysis model: General Purpose
RI/ABS: 1.543 / 0.01
Pump/Stirrer speed: 2880
Date Last Qualification: 17/02/2025

Span	1.30 µm	Surface Weighted mean D[3,2]	391.17 µm
		Vol. Weighted mean D[4,3]	751.09 µm
d(0.1)	241.90 µm	d(0.5)	629.04 µm
		d(0.9)	1058.90 µm



Wentworth Scale

Size (µm)	Vol In %	Size (µm)	Vol In %	Size (µm)	Vol In %	Size (µm)	Vol In %
0.020	0.00	3.990	0.42	63.200	10.91	252.000	24.89
3.990		63.200		252.000		500.000	
Clay		Silt		Fine sand		Medium sand	
Size (µm)	Vol In %	Size (µm)	Vol In %	Size (µm)	Vol In %	Size (µm)	Vol In %
500.000	59.99	2000.000	3.79				
2000.000		10000.000					
Coarse sand		Gravel/Pebble					

Note 1: Data from 500µm to 10000µm by wet screening, from 0.02µm to 500µm by laser diffraction.

Note 2: The categories for Wentworth scale are solely a statement of size range classification. Unless otherwise stated, there has been no determination made as to whether the particulate assigned to a specific category is sedimentary or non-sedimentary.

Analysed: Jess Kern, Diploma (Laboratory Technology)
Reported: Jess Kern, Diploma (Laboratory Technology)
Approved: Benjamin Rainer, Diploma (Laboratory Technology)

MAQR84 v2.0

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Project Spoilbank
Samples 3
Date Received 27/05/2025

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Telephone +61 1300 145 562
Email stuart.hellen@dalconenvironmental.com.au

Dalcon Environmental Reference DE03501
Report Number DE03501.R0
Date Reported 30/06/2025

COMMENTS

Accredited for compliance with ISO/IEC 17025 - Testing.
NATA accredited laboratory 20077.

These results apply only to the sample(s) as received and tested.
This report may only be reproduced in full.

SIGNATORY

Dr Stuart Hellen
Principal/Senior Scientist

CLIENT DETAILS

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Project Spoilbank
Samples 3
Date Received 27/05/2025

Principal Laboratory Address**LABORATORY DETAILS**

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Email stuart.hellen@dalconenvironmental.com.au

Dalcon Environmental Reference DE03501
Report Number DE03501.R0
Date Reported 30/06/2025

LABORATORY COMMENTS

Sample received unpreserved and chilled. Sample integrity intact.
Sample filtered (1,000 ml -> 10 ml) upon receipt and preserved with Lugol's Iodine.
Sample analysed using method DE-AM-01. Limit of Reporting = 100 cells L⁻¹

Suffix (PT) = potential toxin producer
Suffix (t) = trichome/filament
Suffix (unknown) = unidentifiable to genus level

Where (PT) is indicated next to a genus, it should be noted that not all (and, in most cases, only a few) species within that genus are responsible for producing these compounds.

No exceedances of WASQAP (2020)/MBMMP (2020) Trigger Values.

OTHER COMMENTS

PO Number: AU0144208167

Sample Description:

DE03501.1 - DE03501.3: Sample clear and colourless.

Sample Notes:

SAMPLE DETAILS

DE Sample Number	DE03501.1	DE03501.2	DE03501.3
Sample Type	Marine	Marine	Marine
Client Sample Desc.	SBM1	SBM2	REF4
Sample Date	26/05/2025	26/05/2025	26/05/2025

Test Method: DE-AM-01

Analysis Date	27/06/2025	27/06/2025	30/06/2025
Chamber Type	SRC	SRC	SRC
Chamber Volume	1ml	1ml	1ml
Concentration Factor	100x	100x	100x
Units	cells L ⁻¹	cells L ⁻¹	cells L ⁻¹
LOR	100 cell L ⁻¹	100 cell L ⁻¹	100 cell L ⁻¹

Analytical Results

Taxon	Abund.	%	Abund.	%	Abund.	%
Bacillariophyceae	20300	98.54	22500	97.83	44000	99.32
Amphora spp	1100	5.34	2100	9.13	6000	13.54
Bacillaria spp	100	0.49			200	0.45
Bacteriastrium spp	200	0.97	100	0.43		
Chaetoceros spp	6000	29.13	6300	27.39	400	0.90
Cocconeis spp	400	1.94	400	1.74	2000	4.51
Coscinodiscus spp	300	1.46	500	2.17	400	0.90
Cylindrotheca closterium	3400	16.50	4900	21.30	14000	31.60
Diploneis spp					100	0.23
Entomoneis spp	100	0.49				
Grammatophora spp					200	0.45
Guinardia spp	1700	8.25	2100	9.13	5000	11.29
Leptocylindrus spp	500	2.43	700	3.04		
Licmophora spp					300	0.68
Mastogloia spp	100	0.49	300	1.30	100	0.23
Navicula spp	1400	6.80	2300	10.00	5000	11.29
Nitzschia longissima	200	0.97	300	1.30	100	0.23
Pleurosigma spp	3600	17.48	500	2.17	9000	20.32
Pseudo-nitzschia "delicatissima" group (PT)	100	0.49	200	0.87		
Pseudo-nitzschia "seriata" group (PT)			300	1.30		
Rhizosolenia spp	700	3.40	1100	4.78	200	0.45
Thalassionema spp	200	0.97				
Thalassiosira spp	100	0.49			300	0.68
Thalassiothrix spp			300	1.30	400	0.90
Toxarium spp	100	0.49	100	0.43	200	0.45
Trieres chinensis					100	0.23
Dinophyceae	300	1.46	500	2.17	300	0.68
Dactyliosolen spp	100	0.49	300	1.30		
Diplopsalis spp	100	0.49				
Heterocapsa spp	100	0.49			200	0.45
Prorocentrum spp			200	0.87		
Protoperdinium spp					100	0.23
TOTAL (All Taxa)	20600	100	23000	100	44300	100

O2 Marine
Suite 2, 4B Mews Rd
Fremantle
WA 6160

Attention: Russell Stevens

Report 1224236-W
Project name SPOILBANK MARINA MEQP
Project ID 24ENV368
Received Date May 26, 2025

Client Sample ID			SBM1	SBM2	REF4	DUP1
Sample Matrix			Water	Water	Water	Water
Eurofins Sample No.			L25-My0073519	L25-My0073520	L25-My0073521	L25-My0073522
Date Sampled			May 16, 2025	May 16, 2025	May 16, 2025	May 16, 2025
Test/Reference	LOR	Unit				
Naphthalene ^{NO2}	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
TRH >C10-C16 after Silica Cleanup less Naphthalene (F2)	0.02	mg/L	< 0.02	< 0.02	< 0.02	< 0.02
Chlorophyll-a	0.001	mg/L	< 0.001	< 0.001	< 0.001	-
Chromium (VI)	0.002	mg/L	< 0.002	< 0.002	< 0.002	< 0.002
NOx (as N)	0.01	mg/L	3.1	< 0.01	< 0.01	-
Total Kjeldahl Nitrogen	0.2	mg/L	1.8	0.7	1.7	-
Total Nitrogen	0.2	mg/L	4.9	0.7	1.7	-
Total Phosphorus	0.01	mg/L	0.07	0.02	0.01	-
Chromium (III) (filtered)*	0.002	mg/L	< 0.002	< 0.002	< 0.002	< 0.002
E. Coli	1	CFU/100mL	< 1	< 1	< 1	-
Enterococci	1	CFU/100mL	< 1	< 1	4.0	-
Faecal (Thermotolerant) Coliforms	1	CFU/100mL	M23a3(Estimated)	< 1	< 1	-
BTEX						
Benzene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Toluene	0.001	mg/L	< 0.001	0.008	0.008	0.011
Ethylbenzene	0.001	mg/L	< 0.001	0.002	0.001	0.002
m&p-Xylenes	0.002	mg/L	< 0.002	0.002	0.002	0.003
o-Xylene	0.001	mg/L	< 0.001	0.001	0.001	0.002
Xylenes - Total*	0.003	mg/L	< 0.003	0.004	0.004	0.005
4-Bromofluorobenzene (surr.)	1	%	106	97	88	106
Polycyclic Aromatic Hydrocarbons						
Benzo(a)pyrene TEQ (lower bound) *	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Acenaphthene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Acenaphthylene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Anthracene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Benz(a)anthracene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Benzo(a)pyrene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Benzo(b&j)fluoranthene ^{NO7}	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Benzo(g,h,i)perylene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Benzo(k)fluoranthene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Chrysene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Dibenz(a,h)anthracene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Fluoranthene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Fluorene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001

Client Sample ID Sample Matrix Eurofins Sample No. Date Sampled Test/Reference	LOR	Unit	SBM1 Water L25- My0073519 May 16, 2025	SBM2 Water L25- My0073520 May 16, 2025	REF4 Water L25- My0073521 May 16, 2025	DUP1 Water L25- My0073522 May 16, 2025
Polycyclic Aromatic Hydrocarbons						
Indeno(1.2.3-cd)pyrene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Naphthalene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Phenanthrene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Pyrene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Total PAH*	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
2-Fluorobiphenyl (surr.)	1	%	107	118	68	89
p-Terphenyl-d14 (surr.)	1	%	97	57	75	89
TRH - 2013 NEPM Fractions (after silica gel clean-up)						
TRH >C10-C16 (after silica gel clean-up)	0.02	mg/L	< 0.02	< 0.02	< 0.02	< 0.02
TRH >C16-C34 (after silica gel clean-up)	0.05	mg/L	< 0.05	< 0.05	< 0.05	< 0.05
TRH >C34-C40 (after silica gel clean-up)	0.05	mg/L	< 0.05	< 0.05	< 0.05	< 0.05
TRH >C10-C40 (total) (after silica-gel clean up)*	0.05	mg/L	< 0.05	< 0.05	< 0.05	< 0.05
TRH - 1999 NEPM Fractions (after silica gel clean-up)						
TRH C10-C14 (after silica gel clean-up)	0.02	mg/L	< 0.02	< 0.02	< 0.02	< 0.02
TRH C15-C28 (after silica gel clean-up)	0.04	mg/L	< 0.04	< 0.04	< 0.04	< 0.04
TRH C29-C36 (after silica gel clean-up)	0.04	mg/L	< 0.04	< 0.04	< 0.04	< 0.04
TRH C10-C36 (Total) (after silica gel clean-up)	0.04	mg/L	< 0.04	< 0.04	< 0.04	< 0.04
Heavy Metals (filtered)						
Aluminium (filtered)	0.05	mg/L	< 0.05	< 0.05	< 0.05	< 0.05
Arsenic (filtered)	0.001	mg/L	0.004	0.004	0.004	0.004
Cadmium (filtered)	0.0001	mg/L	< 0.0001	< 0.0001	< 0.0001	< 0.0001
Chromium (filtered)	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Cobalt (filtered)	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Copper (filtered)	0.001	mg/L	0.001	< 0.001	0.003	0.001
Iron (filtered)	0.01	mg/L	< 0.01	< 0.01	< 0.01	< 0.01
Lead (filtered)	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Manganese (filtered)	0.005	mg/L	< 0.005	< 0.005	< 0.005	< 0.005
Mercury (filtered)	0.0001	mg/L	< 0.0001	0.0003	< 0.0001	0.0001
Nickel (filtered)	0.001	mg/L	< 0.001	0.001	< 0.001	< 0.001
Vanadium (filtered)	0.005	mg/L	0.016	0.016	0.013	0.017

Sample History

Where samples are submitted/analysed over several days, the last date of extraction is reported.

If the date and time of sampling are not provided, the Laboratory will not be responsible for compromised results should testing be performed outside the recommended holding time.

Description	Testing Site	Extracted	Holding Time
Naphthalene	Welshpool	May 27, 2025	14 Days
- Method: LTM-ORG-2010 TRH C6-C40			
BTEX	Welshpool	May 27, 2025	14 Days
- Method: LTM-ORG-2010 TRH C6-C40			
TRH - 2013 NEPM Fractions (after silica gel clean-up)	Welshpool	May 27, 2025	7 Days
- Method: LTM-ORG-2010 TRH C6-C40			
TRH - 1999 NEPM Fractions (after silica gel clean-up)	Welshpool	May 27, 2025	7 Days
- Method: LTM-ORG-2010 TRH C6-C40			
Chlorophyll-a	Welshpool	May 27, 2025	28 Days
- Method: ARL141 - Chlorophyll-a and Pheophytin-a in Water			
Chromium (VI)	Welshpool	May 27, 2025	1 Day
- Method: ARL316 - Hexavalent Chromium in Water by Discrete Analyser			
Chromium (III) (filtered)*	Welshpool	May 27, 2025	180 Days
- Method: ARL402/403 - Metals in Water by ICPOES/ICPMS			
E. Coli	MicWA	May 27, 2025	24 Hours
- Method: PM 4.2A - Total Coliforms, E.coli and Thermotolerant Coliforms by Membrane Filtration			
Enterococci	MicWA	May 27, 2025	24 Hours
- Method: PM 4.4 - Faecal Streptococci (Enterococci) by Membrane Filtration			
Faecal (Thermotolerant) Coliforms	MicWA	May 27, 2025	24 Hours
- Method: PM 4.2A - Total Coliforms, E.coli and Thermotolerant Coliforms by Membrane Filtration			
Polycyclic Aromatic Hydrocarbons	Welshpool	May 27, 2025	7 Days
- Method: LTM-ORG-2130 PAH and Phenols in Soil and Water			
Heavy Metals (filtered)	Welshpool	May 28, 2025	28 Days
- Method: LTM-MET-3040 Metals in Waters, Soils & Sediments by ICP-MS			
NOx (as N)	Welshpool	May 27, 2025	28 Days
- Method: ARL313/319 - NOx in Water by Discrete Analyser			
Total Kjeldahl Nitrogen	Welshpool	May 27, 2025	28 Day
- Method: ARL No. 330 - Persulfate Method for Simultaneous Determination of TN & TP			
Total Nitrogen	Welshpool	May 27, 2025	28 Days
- Method: ARL No. 330 - Persulfate Method for Simultaneous Determination of TN & TP			
Total Phosphorus	Welshpool	May 27, 2025	28 Days
- Method: ARL308 - Total Phosphorus in Water by Discrete Analyser			



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Company Name: O2 Marine
Address: Suite 2, 4B Mews Rd
Fremantle
WA 6160

Project Name: SPOILBANK MARINA MEQP
Project ID: 24ENV368

Order No.:
Report #: 1224236
Phone: 1300 219 801
Fax:

Received: May 26, 2025 1:01 PM
Due: Jun 3, 2025
Priority: 5 Day
Contact Name: Russell Stevens

Eurofins Analytical Services Manager : Elden Garrett

Sample Detail						Aluminium	Antimony	Iron	Lithium	Manganese	Particle Size Distribution*	Silver	Total Organic Carbon	Total Phosphorus	Vanadium	Polycyclic Aromatic Hydrocarbons	Metals M8	Eurofins Suite B1SG: TRH (With Silica Gel Clean up), BTEXN	Total Nitrogen
Perth Laboratory - NATA # 2377 Site # 2370 & 2554						X	X	X	X	X		X		X	X	X	X	X	X
Melbourne Laboratory - NATA # 1261 Site # 1254													X						
External Laboratory											X								
No	Sample ID	Sample Date	Sampling Time	Matrix	LAB ID														
1	SBM1	May 16, 2025	2:20PM	Water	L25-My0073519	X	X	X	X	X	X	X	X	X	X	X	X	X	X
2	SBM2	May 16, 2025	3:00PM	Water	L25-My0073520	X	X	X	X	X	X	X	X	X	X	X	X	X	X
3	REF4	May 16, 2025	12:40PM	Water	L25-My0073521	X	X	X	X	X	X	X	X	X	X	X	X	X	X
4	DUP1	May 16, 2025		Water	L25-My0073522	X	X	X	X	X		X	X		X	X	X	X	
Test Counts						4	4	4	4	4	3	4	4	3	4	4	4	4	3

Internal Quality Control Review and Glossary

General

1. Laboratory QC results for Method Blanks, Duplicates, Matrix Spikes, and Laboratory Control Samples follow guidelines delineated in the National Environment Protection (Assessment of Site Contamination) Measure 1999, as amended May 2013. They are included in this QC report where applicable. Additional QC data may be available on request.
2. Unless otherwise stated, all soil/sediment/solid results are reported on a dry weight basis.
3. Unless otherwise stated, all biota/food results are reported on a wet weight basis on the edible portion.
4. For CEC results where the sample's origin is unknown or environmentally contaminated, the results should be used advisedly.
5. Actual LORs are matrix dependent. Quoted LORs may be raised where sample extracts are diluted due to interferences.
6. Results are uncorrected for matrix spikes or surrogate recoveries except for PFAS compounds where annotated.
7. SVOC analysis on waters is performed on homogenised, unfiltered samples unless noted otherwise.
8. Samples were analysed on an 'as received' basis.
9. Information identified in this report with **blue** colour indicates data provided by customers that may have an impact on the results.
10. This report replaces any interim results previously issued.

Holding Times

Please refer to the 'Sample Preservation and Container Guide' for holding times (QS3001).

For samples received on the last day of holding time, notification of testing requirements should have been received at least 6 hours before sample receipt deadlines as stated on the SRA.

If the Laboratory did not receive the information in the required timeframe, and despite any other integrity issues, suitably qualified results may still be reported.

Holding times apply from the sampling date; therefore, compliance with these may be outside the laboratory's control.

For VOCs containing vinyl chloride, styrene and 2-chloroethyl vinyl ether, the holding time is seven days; however, for all other VOCs, such as BTEX or C6-10 TRH, the holding time is 14 days.

Units

mg/kg: milligrams per kilogram	mg/L: milligrams per litre	ppm: parts per million
µg/L: micrograms per litre	ppb: parts per billion	%: Percentage
org/100 mL: Organisms per 100 millilitres	NTU: Nephelometric Turbidity Units	MPN/100 mL: Most Probable Number of organisms per 100 millilitres
CFU: Colony Forming Unit	Colour: Pt-Co Units (CU)	

Terms

APHA	American Public Health Association
CEC	Cation Exchange Capacity
COC	Chain of Custody
CP	Client Parent - QC was performed on samples pertaining to this report
CRM	Certified Reference Material (ISO17034) - reported as percent recovery.
Dry	Where moisture has been determined on a solid sample, the result is expressed on a dry weight basis.
Duplicate	A second piece of analysis from the same sample and reported in the same units as the result to show comparison.
LOR	Limit of Reporting.
LCS	Laboratory Control Sample - reported as percent recovery.
Method Blank	In the case of solid samples, these are performed on laboratory-certified clean sands and in the case of water samples, these are performed on de-ionised water.
NCP	Non-Client Parent - QC performed on samples not pertaining to this report, QC represents the sequence or batch that client samples were analysed within.
RPD	Relative Percent Difference between two Duplicate pieces of analysis.
SPIKE	Addition of the analyte to the sample and reported as percentage recovery.
SRA	Sample Receipt Advice
Surr - Surrogate	The addition of a similar compound to the analyte target is reported as percentage recovery. See below for acceptance criteria.
TBTO	Tributyltin oxide (<i>bis</i> -tributyltin oxide) - individual tributyltin compounds cannot be identified separately in the environment; however, free tributyltin was measured, and its values were converted stoichiometrically into tributyltin oxide for comparison with regulatory limits.
TCLP	Toxicity Characteristic Leaching Procedure
TEQ	Toxic Equivalency Quotient or Total Equivalence
QSM	US Department of Defense Quality Systems Manual Version 6.0
US EPA	United States Environmental Protection Agency
WA DWER	Sum of PFBA, PFPeA, PFHxA, PFHpA, PFOA, PFBS, PFHxS, PFOS, 6:2 FTSA, 8:2 FTSA

QC - Acceptance Criteria

The acceptance criteria should only be used as a guide and may be different when site-specific Sampling Analysis and Quality Plan (SAQP) have been implemented.

RPD Duplicates: Global RPD Duplicates Acceptance Criteria is ≤30%; however, the following acceptance guidelines are equally applicable:

Results <10 times the LOR:	No Limit
Results between 10-20 times the LOR:	RPD must lie between 0-50%
Results >20 times the LOR:	RPD must lie between 0-30%

NOTE: pH duplicates are reported as a range, not as RPD

Surrogate Recoveries: Recoveries must lie between 20-130% for Speciated Phenols & 50-150% for PFAS. SVOCs recoveries 20 – 150%, VOC recoveries 50 – 150%

PFAS field samples containing surrogate recoveries above the QC limit designated in QSM 6.0, where no positive PFAS results have been reported or reviewed, and no data was affected.

QC Data General Comments

1. Where a result is reported as less than (<), higher than the nominated LOR, this is due to either matrix interference, extract dilution required due to interferences or contaminant levels within the sample, high moisture content or insufficient sample provided.
2. Duplicate data shown within this report that states the word "BATCH" is a Batch Duplicate from outside of your sample batch but within the laboratory sample batch at a 1:10 ratio. The Parent and Duplicate data shown are not data from your samples.
3. pH and Free Chlorine analysed in the laboratory - Analysis on this test must begin within 30 minutes of sampling. Therefore, laboratory analysis is unlikely to be completed within holding time. Analysis will begin as soon as possible after sample receipt.
4. Recovery Data (Spikes & Surrogates) - where chromatographic interference does not allow the determination of recovery, the term "INT" appears against that analyte.
5. For Matrix Spikes and LCS results, a dash "-" in the report means that the specific analyte was not added to the QC sample.
6. Duplicate RPDs are calculated from raw analytical data; thus, it is possible to have two sets of data.

Quality Control Results

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Method Blank							
Naphthalene	mg/L	< 0.001			0.001	Pass	
Chromium (VI)	mg/L	< 0.002			0.002	Pass	
NOx (as N)	mg/L	< 0.01			0.01	Pass	
Total Nitrogen	mg/L	< 0.2			0.2	Pass	
Total Phosphorus	mg/L	< 0.01			0.01	Pass	
Method Blank							
BTEX							
Benzene	mg/L	< 0.001			0.001	Pass	
Toluene	mg/L	< 0.001			0.001	Pass	
Ethylbenzene	mg/L	< 0.001			0.001	Pass	
m&p-Xylenes	mg/L	< 0.002			0.002	Pass	
o-Xylene	mg/L	< 0.001			0.001	Pass	
Xylenes - Total*	mg/L	< 0.003			0.003	Pass	
Method Blank							
Polycyclic Aromatic Hydrocarbons							
Acenaphthene	mg/L	< 0.001			0.001	Pass	
Acenaphthylene	mg/L	< 0.001			0.001	Pass	
Anthracene	mg/L	< 0.001			0.001	Pass	
Benz(a)anthracene	mg/L	< 0.001			0.001	Pass	
Benzo(a)pyrene	mg/L	< 0.001			0.001	Pass	
Benzo(b&j)fluoranthene	mg/L	< 0.001			0.001	Pass	
Benzo(g,h,i)perylene	mg/L	< 0.001			0.001	Pass	
Benzo(k)fluoranthene	mg/L	< 0.001			0.001	Pass	
Chrysene	mg/L	< 0.001			0.001	Pass	
Dibenz(a,h)anthracene	mg/L	< 0.001			0.001	Pass	
Fluoranthene	mg/L	< 0.001			0.001	Pass	
Fluorene	mg/L	< 0.001			0.001	Pass	
Indeno(1,2,3-cd)pyrene	mg/L	< 0.001			0.001	Pass	
Naphthalene	mg/L	< 0.001			0.001	Pass	
Phenanthrene	mg/L	< 0.001			0.001	Pass	
Pyrene	mg/L	< 0.001			0.001	Pass	
Method Blank							
TRH - 2013 NEPM Fractions (after silica gel clean-up)							
TRH >C10-C16 (after silica gel clean-up)	mg/L	< 0.02			0.02	Pass	
TRH >C16-C34 (after silica gel clean-up)	mg/L	< 0.05			0.05	Pass	
TRH >C34-C40 (after silica gel clean-up)	mg/L	< 0.05			0.05	Pass	
Method Blank							
TRH - 1999 NEPM Fractions (after silica gel clean-up)							
TRH C10-C14 (after silica gel clean-up)	mg/L	< 0.02			0.02	Pass	
TRH C15-C28 (after silica gel clean-up)	mg/L	< 0.04			0.04	Pass	
TRH C29-C36 (after silica gel clean-up)	mg/L	< 0.04			0.04	Pass	
Method Blank							
Heavy Metals (filtered)							
Aluminium (filtered)	mg/L	< 0.05			0.05	Pass	
Arsenic (filtered)	mg/L	< 0.001			0.001	Pass	
Cadmium (filtered)	mg/L	< 0.0001			0.0001	Pass	
Chromium (filtered)	mg/L	< 0.001			0.001	Pass	
Cobalt (filtered)	mg/L	< 0.001			0.001	Pass	
Copper (filtered)	mg/L	< 0.001			0.001	Pass	
Iron (filtered)	mg/L	< 0.01			0.01	Pass	
Lead (filtered)	mg/L	< 0.001			0.001	Pass	

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Manganese (filtered)	mg/L	< 0.005			0.005	Pass	
Mercury (filtered)	mg/L	< 0.0001			0.0001	Pass	
Nickel (filtered)	mg/L	< 0.001			0.001	Pass	
Vanadium (filtered)	mg/L	< 0.005			0.005	Pass	
LCS - % Recovery							
Naphthalene	%	84			70-130	Pass	
LCS - % Recovery							
BTEX							
Benzene	%	91			70-130	Pass	
Toluene	%	94			70-130	Pass	
Ethylbenzene	%	95			70-130	Pass	
m&p-Xylenes	%	93			70-130	Pass	
o-Xylene	%	95			70-130	Pass	
Xylenes - Total*	%	94			70-130	Pass	
LCS - % Recovery							
Polycyclic Aromatic Hydrocarbons							
Acenaphthene	%	100			70-130	Pass	
Acenaphthylene	%	100			70-130	Pass	
Anthracene	%	101			70-130	Pass	
Benz(a)anthracene	%	100			70-130	Pass	
Benzo(a)pyrene	%	100			70-130	Pass	
Benzo(b&j)fluoranthene	%	102			70-130	Pass	
Benzo(g,h,i)perylene	%	98			70-130	Pass	
Benzo(k)fluoranthene	%	102			70-130	Pass	
Chrysene	%	103			70-130	Pass	
Dibenz(a,h)anthracene	%	97			70-130	Pass	
Fluoranthene	%	102			70-130	Pass	
Fluorene	%	99			70-130	Pass	
Indeno(1,2,3-cd)pyrene	%	98			70-130	Pass	
Naphthalene	%	100			70-130	Pass	
Phenanthrene	%	99			70-130	Pass	
Pyrene	%	102			70-130	Pass	
LCS - % Recovery							
TRH - 2013 NEPM Fractions (after silica gel clean-up)							
TRH >C10-C16 (after silica gel clean-up)	%	92			70-130	Pass	
LCS - % Recovery							
TRH - 1999 NEPM Fractions (after silica gel clean-up)							
TRH C10-C14 (after silica gel clean-up)	%	99			70-130	Pass	
LCS - % Recovery							
Heavy Metals (filtered)							
Aluminium (filtered)	%	104			80-120	Pass	
Arsenic (filtered)	%	114			80-120	Pass	
Cadmium (filtered)	%	104			80-120	Pass	
Chromium (filtered)	%	97			80-120	Pass	
Cobalt (filtered)	%	93			80-120	Pass	
Copper (filtered)	%	89			80-120	Pass	
Iron (filtered)	%	100			80-120	Pass	
Lead (filtered)	%	97			80-120	Pass	
Manganese (filtered)	%	97			80-120	Pass	
Mercury (filtered)	%	100			80-120	Pass	
Nickel (filtered)	%	91			80-120	Pass	
Vanadium (filtered)	%	97			80-120	Pass	

Test	Lab Sample ID	QA Source	Units	Result 1		Acceptance Limits	Pass Limits	Qualifying Code
Spike - % Recovery								
				Result 1				
Chromium (VI)	L25-My0069081	NCP	%	103		80-120	Pass	
NOx (as N)	L25-My0070974	NCP	%	112		80-120	Pass	
Total Nitrogen	L25-My0071001	NCP	%	122		70-130	Pass	
Total Phosphorus	L25-My0071001	NCP	%	109		80-120	Pass	
Spike - % Recovery								
Polycyclic Aromatic Hydrocarbons				Result 1				
Acenaphthene	L25-My0070748	NCP	%	102		70-130	Pass	
Acenaphthylene	L25-My0070748	NCP	%	101		70-130	Pass	
Anthracene	L25-My0070748	NCP	%	103		70-130	Pass	
Benz(a)anthracene	L25-My0070748	NCP	%	101		70-130	Pass	
Benzo(a)pyrene	L25-My0070748	NCP	%	101		70-130	Pass	
Benzo(b&j)fluoranthene	L25-My0070748	NCP	%	103		70-130	Pass	
Benzo(g,h,i)perylene	L25-My0070748	NCP	%	103		70-130	Pass	
Benzo(k)fluoranthene	L25-My0070748	NCP	%	101		70-130	Pass	
Chrysene	L25-My0070748	NCP	%	102		70-130	Pass	
Dibenz(a,h)anthracene	L25-My0070748	NCP	%	101		70-130	Pass	
Fluoranthene	L25-My0070748	NCP	%	106		70-130	Pass	
Fluorene	L25-My0070748	NCP	%	104		70-130	Pass	
Indeno(1,2,3-cd)pyrene	L25-My0070748	NCP	%	102		70-130	Pass	
Naphthalene	L25-My0070748	NCP	%	103		70-130	Pass	
Phenanthrene	L25-My0070748	NCP	%	104		70-130	Pass	
Pyrene	L25-My0070748	NCP	%	102		70-130	Pass	
Spike - % Recovery								
TRH - 2013 NEPM Fractions (after silica gel clean-up)				Result 1				
TRH >C10-C16 (after silica gel clean-up)	L25-My0069069	NCP	%	90		70-130	Pass	
Spike - % Recovery								
TRH - 1999 NEPM Fractions (after silica gel clean-up)				Result 1				
TRH C10-C14 (after silica gel clean-up)	L25-My0069069	NCP	%	96		70-130	Pass	
Spike - % Recovery								
Heavy Metals (filtered)				Result 1				
Aluminium (filtered)	L25-My0073519	CP	%	94		75-125	Pass	
Arsenic (filtered)	L25-My0073519	CP	%	107		75-125	Pass	
Cadmium (filtered)	L25-My0073519	CP	%	99		75-125	Pass	
Chromium (filtered)	L25-My0073519	CP	%	91		75-125	Pass	
Cobalt (filtered)	L25-My0073519	CP	%	87		75-125	Pass	
Copper (filtered)	L25-My0073519	CP	%	83		75-125	Pass	
Iron (filtered)	L25-My0073519	CP	%	93		75-125	Pass	
Lead (filtered)	L25-My0073519	CP	%	90		75-125	Pass	
Manganese (filtered)	L25-My0073519	CP	%	90		75-125	Pass	
Mercury (filtered)	L25-My0073519	CP	%	92		75-125	Pass	
Nickel (filtered)	L25-My0073519	CP	%	86		75-125	Pass	
Vanadium (filtered)	L25-My0073519	CP	%	95		75-125	Pass	
Spike - % Recovery								
				Result 1				
Naphthalene	L25-My0073521	CP	%	102		70-130	Pass	
Spike - % Recovery								
BTEX				Result 1				
Benzene	L25-My0073521	CP	%	111		70-130	Pass	
Toluene	L25-My0073521	CP	%	129		70-130	Pass	
Ethylbenzene	L25-My0073521	CP	%	101		70-130	Pass	
m&p-Xylenes	L25-My0073521	CP	%	109		70-130	Pass	

Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
o-Xylene	L25-My0073521	CP	%	108			70-130	Pass	
Xylenes - Total*	L25-My0073521	CP	%	108			70-130	Pass	
Spike - % Recovery									
				Result 1					
Naphthalene	L25-My0073522	CP	%	81			70-130	Pass	
Spike - % Recovery									
BTEX									
				Result 1					
Benzene	L25-My0073522	CP	%	109			70-130	Pass	
Toluene	L25-My0073522	CP	%	114			70-130	Pass	
Ethylbenzene	L25-My0073522	CP	%	106			70-130	Pass	
m&p-Xylenes	L25-My0073522	CP	%	115			70-130	Pass	
o-Xylene	L25-My0073522	CP	%	107			70-130	Pass	
Xylenes - Total*	L25-My0073522	CP	%	112			70-130	Pass	
Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Duplicate									
				Result 1	Result 2	RPD			
Naphthalene	L25-My0086670	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Chromium (VI)	L25-My0069080	NCP	mg/L	< 0.002	< 0.002	<1	20%	Pass	
NOx (as N)	L25-My0068541	NCP	mg/L	0.23	0.23	<1	20%	Pass	
Total Nitrogen	L25-My0072772	NCP	mg/L	8.9	8.5	4.0	30%	Pass	
Total Phosphorus	L25-My0072772	NCP	mg/L	5.2	5.2	1.0	20%	Pass	
Duplicate									
BTEX									
				Result 1	Result 2	RPD			
Benzene	L25-My0086670	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Toluene	L25-My0086670	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Ethylbenzene	L25-My0086670	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
m&p-Xylenes	L25-My0086670	NCP	mg/L	< 0.002	< 0.002	<1	30%	Pass	
o-Xylene	L25-My0086670	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Xylenes - Total*	L25-My0086670	NCP	mg/L	< 0.003	< 0.003	<1	30%	Pass	
Duplicate									
Polycyclic Aromatic Hydrocarbons									
				Result 1	Result 2	RPD			
Acenaphthene	L25-My0070751	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Acenaphthylene	L25-My0070751	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Anthracene	L25-My0070751	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Benz(a)anthracene	L25-My0070751	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Benzo(a)pyrene	L25-My0070751	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Benzo(b&j)fluoranthene	L25-My0070751	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Benzo(g,h,i)perylene	L25-My0070751	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Benzo(k)fluoranthene	L25-My0070751	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Chrysene	L25-My0070751	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Dibenz(a,h)anthracene	L25-My0070751	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Fluoranthene	L25-My0070751	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Fluorene	L25-My0070751	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Indeno(1,2,3-cd)pyrene	L25-My0070751	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Naphthalene	L25-My0070751	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Phenanthrene	L25-My0070751	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Pyrene	L25-My0070751	NCP	mg/L	< 0.001	< 0.001	<1	30%	Pass	
Duplicate									
TRH - 2013 NEPM Fractions (after silica gel clean-up)									
				Result 1	Result 2	RPD			
TRH >C10-C16 (after silica gel clean-up)	L25-My0069078	NCP	mg/L	< 0.02	< 0.02	<1	30%	Pass	
TRH >C16-C34 (after silica gel clean-up)	L25-My0069078	NCP	mg/L	< 0.05	< 0.05	<1	30%	Pass	
TRH >C34-C40 (after silica gel clean-up)	L25-My0069078	NCP	mg/L	< 0.05	< 0.05	<1	30%	Pass	

Duplicate								
TRH - 1999 NEPM Fractions (after silica gel clean-up)				Result 1	Result 2	RPD		
TRH C10-C14 (after silica gel clean-up)	L25-My0069078	NCP	mg/L	< 0.02	< 0.02	<1	30%	Pass
TRH C15-C28 (after silica gel clean-up)	L25-My0069078	NCP	mg/L	< 0.04	< 0.04	<1	30%	Pass
TRH C29-C36 (after silica gel clean-up)	L25-My0069078	NCP	mg/L	< 0.04	< 0.04	<1	30%	Pass
TRH C10-C36 (Total) (after silica gel clean-up)	L25-My0069078	NCP	mg/L	< 0.04	< 0.04	<1	30%	Pass
Duplicate								
Heavy Metals (filtered)				Result 1	Result 2	RPD		
Aluminium (filtered)	L25-My0073521	CP	mg/L	< 0.05	< 0.05	<1	30%	Pass
Arsenic (filtered)	L25-My0073521	CP	mg/L	0.004	0.004	11	30%	Pass
Cadmium (filtered)	L25-My0073521	CP	mg/L	< 0.0001	< 0.0001	<1	30%	Pass
Chromium (filtered)	L25-My0073521	CP	mg/L	< 0.001	< 0.001	<1	30%	Pass
Cobalt (filtered)	L25-My0073521	CP	mg/L	< 0.001	< 0.001	<1	30%	Pass
Copper (filtered)	L25-My0073521	CP	mg/L	0.003	0.003	12	30%	Pass
Iron (filtered)	L25-My0073521	CP	mg/L	< 0.01	< 0.01	<1	30%	Pass
Lead (filtered)	L25-My0073521	CP	mg/L	< 0.001	< 0.001	<1	30%	Pass
Manganese (filtered)	L25-My0073521	CP	mg/L	< 0.005	< 0.005	<1	30%	Pass
Mercury (filtered)	L25-My0073521	CP	mg/L	< 0.0001	< 0.0001	<1	30%	Pass
Vanadium (filtered)	L25-My0073521	CP	mg/L	0.013	0.015	13	30%	Pass

LABORATORY

Comments

Sample Integrity

Custody Seals Intact (if used)	N/A
Attempt to Chill was evident	Yes
Sample correctly preserved	Yes
Appropriate sample containers have been used	Yes
Sample containers for volatile analysis received with minimal headspace	Yes
Samples received within HoldingTime	Yes
Some samples have been subcontracted	No

Qualifier Codes/Comments

Code	Description
M23a	AS 4276.1:2021 Water microbiology, Method 1: Water quality - General requirements and guidance for microbiological examinations by culture. For 1 or 2 colonies the result is reported as "Presence"
N02	Where we have reported both volatile (P&T GCMS) and semivolatile (GCMS) naphthalene data, results may not be identical. Provided correct sample handling protocols have been followed, any observed differences in results are likely to be due to procedural differences within each methodology. Results determined by both techniques have passed all QAQC acceptance criteria, and are entirely technically valid.
N07	Please note:- These two PAH isomers closely co-elute using the most contemporary analytical methods and both the reported concentration (and the TEQ) apply specifically to the total of the two co-eluting PAHs
Q05	The matrix spike concentration is less than five times the background concentration in the sample - therefore the spike recovery cannot be determined

Authorised by:

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Lolita Kusnandar	Senior Analyst-Microbiology
Patrick Patfield	Senior Analyst-Organic
Patrick Patfield	Senior Analyst-Volatile
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Sean Sangster	Senior Analyst-Metal
Wafa Hanna	Senior Analyst-Microbiology

Kim Rodgers

General Manager

- Indicates Not Requested

* Indicates NATA accreditation does not cover the performance of this service

Measurement uncertainty of test data is available on request

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Report 1224509-S
Project name SPOILBANK MARINA MEQP
Project ID 24ENV368
Received Date May 26, 2025

Client Sample ID			SBM1	SBM2	REF4	DUP1
Sample Matrix			Sediment	Sediment	Sediment	Sediment
Eurofins Sample No.			L25-My0075490	L25-My0075491	L25-My0075492	L25-My0075493
Date Sampled			May 16, 2025	May 16, 2025	May 16, 2025	May 16, 2025
Test/Reference	LOR	Unit				
Naphthalene ^{NO2}	0.5	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5
TRH >C10-C16 after Silica Cleanup less Naphthalene (F2)	50	mg/kg	< 50	< 50	< 50	< 50
Nitrate & Nitrite (as N)	5	mg/kg	< 5	< 5	< 5	-
Nitrate (as N)	5	mg/kg	< 5	< 5	< 5	-
Nitrite (as N)	5	mg/kg	< 5	< 5	< 5	-
Total Kjeldahl Nitrogen (as N)	10	mg/kg	880	680	83	-
Total Nitrogen (as N)*	10	mg/kg	880	680	83	-
Total Organic Carbon	0.1	%	< 0.1	0.5	6.4	-
Lithium	5	mg/kg	9.1	< 5	< 5	12
Phosphorus	1	mg/kg	280	170	130	-
% Moisture	1	%	54	36	18	53
Particle Size Distribution						-
BTEX						
Benzene	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1
Toluene	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1
Ethylbenzene	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1
m&p-Xylenes	0.2	mg/kg	< 0.2	< 0.2	< 0.2	< 0.2
o-Xylene	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1
Xylenes - Total*	0.3	mg/kg	< 0.3	< 0.3	< 0.3	< 0.3
4-Bromofluorobenzene (surr.)	1	%	77	74	78	100
Polycyclic Aromatic Hydrocarbons						
Benzo(a)pyrene TEQ (lower bound) *	0.5	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5
Benzo(a)pyrene TEQ (medium bound) *	0.5	mg/kg	0.6	0.6	0.6	0.6
Benzo(a)pyrene TEQ (upper bound) *	0.5	mg/kg	1.2	1.2	1.2	1.2
Acenaphthene	0.5	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5
Acenaphthylene	0.5	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5
Anthracene	0.5	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5
Benz(a)anthracene	0.5	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5
Benzo(a)pyrene	0.5	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5
Benzo(b&j)fluoranthene ^{NO7}	0.5	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5
Benzo(g,h,i)perylene	0.5	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5
Benzo(k)fluoranthene	0.5	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5
Chrysene	0.5	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5
Dibenz(a,h)anthracene	0.5	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5

Client Sample ID Sample Matrix Eurofins Sample No. Date Sampled Test/Reference	LOR	Unit	SBM1 Sediment L25- My0075490 May 16, 2025	SBM2 Sediment L25- My0075491 May 16, 2025	REF4 Sediment L25- My0075492 May 16, 2025	DUP1 Sediment L25- My0075493 May 16, 2025
Polycyclic Aromatic Hydrocarbons						
Fluoranthene	0.5	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5
Fluorene	0.5	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5
Indeno(1.2.3-cd)pyrene	0.5	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5
Naphthalene	0.5	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5
Phenanthrene	0.5	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5
Pyrene	0.5	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5
Total PAH*	0.5	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5
2-Fluorobiphenyl (surr.)	1	%	76	139	65	73
p-Terphenyl-d14 (surr.)	1	%	136	73	66	83
TRH - 2013 NEPM Fractions (after silica gel clean-up)						
TRH >C10-C16 (after silica gel clean-up)	50	mg/kg	< 50	< 50	< 50	< 50
TRH >C16-C34 (after silica gel clean-up)	100	mg/kg	< 100	< 100	< 100	< 100
TRH >C34-C40 (after silica gel clean-up)	100	mg/kg	< 100	< 100	< 100	< 100
TRH >C10-C40 (total) (after silica-gel clean up)*	100	mg/kg	< 100	< 100	< 100	< 100
TRH - 1999 NEPM Fractions (after silica gel clean-up)						
TRH C10-C14 (after silica gel clean-up)	20	mg/kg	< 20	< 20	< 20	< 20
TRH C15-C28 (after silica gel clean-up)	50	mg/kg	< 50	< 50	< 50	< 50
TRH C29-C36 (after silica gel clean-up)	50	mg/kg	< 50	< 50	< 50	< 50
TRH C10-C36 (Total) (after silica gel clean-up)	50	mg/kg	< 50	< 50	< 50	< 50
Heavy Metals						
Aluminium	20	mg/kg	8100	3400	850	13000
Antimony	1	mg/kg	< 1	< 1	< 1	< 1
Iron	20	mg/kg	28000	15000	5600	35000
Manganese	5	mg/kg	230	150	180	260
Silver	2	mg/kg	< 2	< 2	< 2	< 2
Vanadium	10	mg/kg	51	22	19	60
Metals M8						
Arsenic	2	mg/kg	22	9.2	21	26
Cadmium	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1
Chromium	1	mg/kg	62	32	17	75
Copper	1	mg/kg	19	9.1	1.1	22
Lead	1	mg/kg	9.0	3.7	1.2	12
Mercury	0.02	mg/kg	0.03	< 0.02	< 0.02	0.04
Nickel	1	mg/kg	29	12	4.8	37
Zinc	5	mg/kg	31	17	< 5	41

Sample History

Where samples are submitted/analysed over several days, the last date of extraction is reported.

If the date and time of sampling are not provided, the Laboratory will not be responsible for compromised results should testing be performed outside the recommended holding time.

Description	Testing Site	Extracted	Holding Time
Naphthalene	Welshpool	May 27, 2025	14 Days
- Method: LTM-ORG-2010 TRH C6-C40			
BTEX	Welshpool	May 27, 2025	14 Days
- Method: LTM-ORG-2010 TRH C6-C40			
TRH - 2013 NEPM Fractions (after silica gel clean-up)	Welshpool	May 27, 2025	14 Days
- Method: LTM-ORG-2010 TRH C6-C40			
TRH - 1999 NEPM Fractions (after silica gel clean-up)	Welshpool	May 27, 2025	14 Days
- Method: LTM-ORG-2010 TRH C6-C40			
Total Nitrogen Set (as N)			
Nitrate & Nitrite (as N)	Melbourne	May 28, 2025	28 Days
- Method: LTM-INO-4450 Nitrogens by Discrete Analyser			
Nitrate (as N)	Melbourne	May 28, 2025	28 Days
- Method: LTM-INO-4450 Nitrogens by Discrete Analyser			
Nitrite (as N)	Melbourne	May 28, 2025	28 Days
- Method: LTM-INO-4450 Nitrogens by Discrete Analyser			
Total Kjeldahl Nitrogen (as N)	Melbourne	May 28, 2025	28 Days
- Method: APHA 4500-Norg B,D Total Kjeldahl Nitrogen by FIA			
Total Organic Carbon	Melbourne	May 28, 2025	28 Days
- Method: LTM-INO-4060 Total Organic Carbon in water and soil			
Lithium	Welshpool	May 27, 2025	180 Days
- Method: LTM-MET-3040 Metals in Waters, Soils & Sediments by ICP-MS			
Phosphorus	Welshpool	May 27, 2025	7 Days
- Method: ARL401/403 - Metals in Soil and Sediment by ICPOES/MS			
Polycyclic Aromatic Hydrocarbons	Welshpool	May 27, 2025	14 Days
- Method: LTM-ORG-2130 PAH and Phenols in Soil and Water			
Heavy Metals	Welshpool	May 27, 2025	28 Days
- Method: LTM-MET-3040 Metals in Waters, Soils & Sediments by ICP-MS			
Metals M8	Welshpool	May 27, 2025	28 Days
- Method: LTM-MET-3040 Metals in Waters, Soils & Sediments by ICP-MS			
% Moisture	Welshpool	May 26, 2025	14 Days
- Method: ARL135 Moisture in Solids			



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Order No.:
Report #: 1224509
Phone: 1300 219 801
Fax:

Received: May 26, 2025 1:01 PM
Due: Jun 3, 2025
Priority: 5 Day
Contact Name: Russell Stevens

Project Name: SPOILBANK MARINA MEQP
Project ID: 24ENV368

Eurofins Analytical Services Manager : Elden Garrett

Sample Detail						Aluminium	Antimony	Iron	Lithium	Manganese	Particle Size Distribution*	Phosphorus	Silver	Total Organic Carbon	Vanadium	Polycyclic Aromatic Hydrocarbons	Metals M8	Total Nitrogen Set (as N)	Moisture Set	Eurofins Suite B1SG: TRH (With Silica Gel Clean up), BTEXN
Perth Laboratory - NATA # 2377 Site # 2370 & 2554						X	X	X	X	X		X	X		X	X	X		X	X
Melbourne Laboratory - NATA # 1261 Site # 1254														X				X		
External Laboratory											X									
No	Sample ID	Sample Date	Sampling Time	Matrix	LAB ID															
1	SBM1	May 16, 2025	2:20PM	Sediment	L25-My0075490	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
2	SBM2	May 16, 2025	3:00PM	Sediment	L25-My0075491	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
3	REF4	May 16, 2025	12:40PM	Sediment	L25-My0075492	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
4	DUP1	May 16, 2025		Sediment	L25-My0075493	X	X	X	X	X			X		X	X	X		X	X
Test Counts						4	4	4	4	4	3	3	4	3	4	4	4	3	4	4

Internal Quality Control Review and Glossary

General

1. Laboratory QC results for Method Blanks, Duplicates, Matrix Spikes, and Laboratory Control Samples follow guidelines delineated in the National Environment Protection (Assessment of Site Contamination) Measure 1999, as amended May 2013. They are included in this QC report where applicable. Additional QC data may be available on request.
2. Unless otherwise stated, all soil/sediment/solid results are reported on a dry weight basis.
3. Unless otherwise stated, all biota/food results are reported on a wet weight basis on the edible portion.
4. For CEC results where the sample's origin is unknown or environmentally contaminated, the results should be used advisedly.
5. Actual LORs are matrix dependent. Quoted LORs may be raised where sample extracts are diluted due to interferences.
6. Results are uncorrected for matrix spikes or surrogate recoveries except for PFAS compounds where annotated.
7. SVOC analysis on waters is performed on homogenised, unfiltered samples unless noted otherwise.
8. Samples were analysed on an 'as received' basis.
9. Information identified in this report with **blue** colour indicates data provided by customers that may have an impact on the results.
10. This report replaces any interim results previously issued.

Holding Times

Please refer to the 'Sample Preservation and Container Guide' for holding times (QS3001).

For samples received on the last day of holding time, notification of testing requirements should have been received at least 6 hours before sample receipt deadlines as stated on the SRA.

If the Laboratory did not receive the information in the required timeframe, and despite any other integrity issues, suitably qualified results may still be reported.

Holding times apply from the sampling date; therefore, compliance with these may be outside the laboratory's control.

For VOCs containing vinyl chloride, styrene and 2-chloroethyl vinyl ether, the holding time is seven days; however, for all other VOCs, such as BTEX or C6-10 TRH, the holding time is 14 days.

Units

mg/kg: milligrams per kilogram	mg/L: milligrams per litre	ppm: parts per million
µg/L: micrograms per litre	ppb: parts per billion	%: Percentage
org/100 mL: Organisms per 100 millilitres	NTU: Nephelometric Turbidity Units	MPN/100 mL: Most Probable Number of organisms per 100 millilitres
CFU: Colony Forming Unit	Colour: Pt-Co Units (CU)	

Terms

APHA	American Public Health Association
CEC	Cation Exchange Capacity
COC	Chain of Custody
CP	Client Parent - QC was performed on samples pertaining to this report
CRM	Certified Reference Material (ISO17034) - reported as percent recovery.
Dry	Where moisture has been determined on a solid sample, the result is expressed on a dry weight basis.
Duplicate	A second piece of analysis from the same sample and reported in the same units as the result to show comparison.
LOR	Limit of Reporting.
LCS	Laboratory Control Sample - reported as percent recovery.
Method Blank	In the case of solid samples, these are performed on laboratory-certified clean sands and in the case of water samples, these are performed on de-ionised water.
NCP	Non-Client Parent - QC performed on samples not pertaining to this report, QC represents the sequence or batch that client samples were analysed within.
RPD	Relative Percent Difference between two Duplicate pieces of analysis.
SPIKE	Addition of the analyte to the sample and reported as percentage recovery.
SRA	Sample Receipt Advice
Surr - Surrogate	The addition of a similar compound to the analyte target is reported as percentage recovery. See below for acceptance criteria.
TBTO	Tributyltin oxide (<i>bis</i> -tributyltin oxide) - individual tributyltin compounds cannot be identified separately in the environment; however, free tributyltin was measured, and its values were converted stoichiometrically into tributyltin oxide for comparison with regulatory limits.
TCLP	Toxicity Characteristic Leaching Procedure
TEQ	Toxic Equivalency Quotient or Total Equivalence
QSM	US Department of Defense Quality Systems Manual Version 6.0
US EPA	United States Environmental Protection Agency
WA DWER	Sum of PFBA, PFPeA, PFHxA, PFHpA, PFOA, PFBS, PFHxS, PFOS, 6:2 FTSA, 8:2 FTSA

QC - Acceptance Criteria

The acceptance criteria should only be used as a guide and may be different when site-specific Sampling Analysis and Quality Plan (SAQP) have been implemented.

RPD Duplicates: Global RPD Duplicates Acceptance Criteria is ≤30%; however, the following acceptance guidelines are equally applicable:

Results <10 times the LOR:	No Limit
Results between 10-20 times the LOR:	RPD must lie between 0-50%
Results >20 times the LOR:	RPD must lie between 0-30%

NOTE: pH duplicates are reported as a range, not as RPD

Surrogate Recoveries: Recoveries must lie between 20-130% for Speciated Phenols & 50-150% for PFAS. SVOCs recoveries 20 – 150%, VOC recoveries 50 – 150%

PFAS field samples containing surrogate recoveries above the QC limit designated in QSM 6.0, where no positive PFAS results have been reported or reviewed, and no data was affected.

QC Data General Comments

1. Where a result is reported as less than (<), higher than the nominated LOR, this is due to either matrix interference, extract dilution required due to interferences or contaminant levels within the sample, high moisture content or insufficient sample provided.
2. Duplicate data shown within this report that states the word "BATCH" is a Batch Duplicate from outside of your sample batch but within the laboratory sample batch at a 1:10 ratio. The Parent and Duplicate data shown are not data from your samples.
3. pH and Free Chlorine analysed in the laboratory - Analysis on this test must begin within 30 minutes of sampling. Therefore, laboratory analysis is unlikely to be completed within holding time. Analysis will begin as soon as possible after sample receipt.
4. Recovery Data (Spikes & Surrogates) - where chromatographic interference does not allow the determination of recovery, the term "INT" appears against that analyte.
5. For Matrix Spikes and LCS results, a dash "-" in the report means that the specific analyte was not added to the QC sample.
6. Duplicate RPDs are calculated from raw analytical data; thus, it is possible to have two sets of data.

Quality Control Results

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Method Blank							
Naphthalene	mg/kg	< 0.5			0.5	Pass	
Nitrate & Nitrite (as N)	mg/kg	< 5			5	Pass	
Nitrate (as N)	mg/kg	< 5			5	Pass	
Nitrite (as N)	mg/kg	< 5			5	Pass	
Total Kjeldahl Nitrogen (as N)	mg/kg	< 10			10	Pass	
Total Organic Carbon	%	< 0.1			0.1	Pass	
Lithium	mg/kg	< 5			5	Pass	
Phosphorus	mg/kg	< 1			1	Pass	
Method Blank							
BTEX							
Benzene	mg/kg	< 0.1			0.1	Pass	
Toluene	mg/kg	< 0.1			0.1	Pass	
Ethylbenzene	mg/kg	< 0.1			0.1	Pass	
m&p-Xylenes	mg/kg	< 0.2			0.2	Pass	
o-Xylene	mg/kg	< 0.1			0.1	Pass	
Xylenes - Total*	mg/kg	< 0.3			0.3	Pass	
Method Blank							
Polycyclic Aromatic Hydrocarbons							
Acenaphthene	mg/kg	< 0.5			0.5	Pass	
Acenaphthylene	mg/kg	< 0.5			0.5	Pass	
Anthracene	mg/kg	< 0.5			0.5	Pass	
Benz(a)anthracene	mg/kg	< 0.5			0.5	Pass	
Benzo(a)pyrene	mg/kg	< 0.5			0.5	Pass	
Benzo(b&j)fluoranthene	mg/kg	< 0.5			0.5	Pass	
Benzo(g,h,i)perylene	mg/kg	< 0.5			0.5	Pass	
Benzo(k)fluoranthene	mg/kg	< 0.5			0.5	Pass	
Chrysene	mg/kg	< 0.5			0.5	Pass	
Dibenz(a,h)anthracene	mg/kg	< 0.5			0.5	Pass	
Fluoranthene	mg/kg	< 0.5			0.5	Pass	
Fluorene	mg/kg	< 0.5			0.5	Pass	
Indeno(1,2,3-cd)pyrene	mg/kg	< 0.5			0.5	Pass	
Naphthalene	mg/kg	< 0.5			0.5	Pass	
Phenanthrene	mg/kg	< 0.5			0.5	Pass	
Pyrene	mg/kg	< 0.5			0.5	Pass	
Method Blank							
TRH - 2013 NEPM Fractions (after silica gel clean-up)							
TRH >C10-C16 (after silica gel clean-up)	mg/kg	< 50			50	Pass	
TRH >C16-C34 (after silica gel clean-up)	mg/kg	< 100			100	Pass	
TRH >C34-C40 (after silica gel clean-up)	mg/kg	< 100			100	Pass	
Method Blank							
TRH - 1999 NEPM Fractions (after silica gel clean-up)							
TRH C10-C14 (after silica gel clean-up)	mg/kg	< 20			20	Pass	
TRH C15-C28 (after silica gel clean-up)	mg/kg	< 50			50	Pass	
TRH C29-C36 (after silica gel clean-up)	mg/kg	< 50			50	Pass	
Method Blank							
Heavy Metals							
Aluminium	mg/kg	< 20			20	Pass	
Antimony	mg/kg	< 1			1	Pass	
Iron	mg/kg	< 20			20	Pass	
Manganese	mg/kg	< 5			5	Pass	
Silver	mg/kg	< 2			2	Pass	

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Vanadium	mg/kg	< 10			10	Pass	
Method Blank							
Metals M8							
Arsenic	mg/kg	< 2			2	Pass	
Cadmium	mg/kg	< 0.1			0.1	Pass	
Chromium	mg/kg	< 1			1	Pass	
Copper	mg/kg	< 1			1	Pass	
Lead	mg/kg	< 1			1	Pass	
Mercury	mg/kg	< 0.02			0.02	Pass	
Nickel	mg/kg	< 1			1	Pass	
Zinc	mg/kg	< 5			5	Pass	
LCS - % Recovery							
Naphthalene	%	78			70-130	Pass	
Total Kjeldahl Nitrogen (as N)	%	84			70-130	Pass	
Total Organic Carbon	%	85			70-130	Pass	
Lithium	%	104			80-120	Pass	
Phosphorus	%	93			80-120	Pass	
LCS - % Recovery							
BTEX							
Benzene	%	83			70-130	Pass	
Toluene	%	88			70-130	Pass	
Ethylbenzene	%	92			70-130	Pass	
m&p-Xylenes	%	97			70-130	Pass	
o-Xylene	%	91			70-130	Pass	
Xylenes - Total*	%	95			70-130	Pass	
LCS - % Recovery							
Polycyclic Aromatic Hydrocarbons							
Acenaphthene	%	105			70-130	Pass	
Acenaphthylene	%	100			70-130	Pass	
Anthracene	%	102			70-130	Pass	
Benz(a)anthracene	%	103			70-130	Pass	
Benzo(a)pyrene	%	99			70-130	Pass	
Benzo(b&j)fluoranthene	%	100			70-130	Pass	
Benzo(g,h,i)perylene	%	104			70-130	Pass	
Benzo(k)fluoranthene	%	102			70-130	Pass	
Chrysene	%	100			70-130	Pass	
Dibenz(a,h)anthracene	%	101			70-130	Pass	
Fluoranthene	%	104			70-130	Pass	
Fluorene	%	101			70-130	Pass	
Indeno(1,2,3-cd)pyrene	%	97			70-130	Pass	
Naphthalene	%	105			70-130	Pass	
Phenanthrene	%	101			70-130	Pass	
Pyrene	%	102			70-130	Pass	
LCS - % Recovery							
TRH - 2013 NEPM Fractions (after silica gel clean-up)							
TRH >C10-C16 (after silica gel clean-up)	%	115			70-130	Pass	
LCS - % Recovery							
TRH - 1999 NEPM Fractions (after silica gel clean-up)							
TRH C10-C14 (after silica gel clean-up)	%	122			70-130	Pass	
LCS - % Recovery							
Heavy Metals							
Aluminium	%	101			80-120	Pass	
Antimony	%	96			80-120	Pass	
Iron	%	103			80-120	Pass	

Test			Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Manganese			%	103			80-120	Pass	
Silver			%	97			80-120	Pass	
Vanadium			%	108			80-120	Pass	
LCS - % Recovery									
Metals M8									
Arsenic			%	98			80-120	Pass	
Cadmium			%	96			80-120	Pass	
Chromium			%	103			80-120	Pass	
Copper			%	101			80-120	Pass	
Lead			%	94			80-120	Pass	
Mercury			%	96			80-120	Pass	
Nickel			%	100			80-120	Pass	
Zinc			%	98			80-120	Pass	
LCS - % Recovery									
Phosphorus			%	108			80-120	Pass	
Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Spike - % Recovery									
				Result 1					
Naphthalene	L25-My0074483	NCP	%	82			70-130	Pass	
Nitrate & Nitrite (as N)	M25-My0078726	NCP	%	97			70-130	Pass	
Nitrite (as N)	M25-My0078726	NCP	%	90			70-130	Pass	
Lithium	L25-My0075490	CP	%	96			75-125	Pass	
Phosphorus	L25-My0075490	CP	%	95			80-120	Pass	
Spike - % Recovery									
				Result 1					
BTEX	L25-My0074483	NCP	%	77			70-130	Pass	
Benzene	L25-My0074483	NCP	%	78			70-130	Pass	
Toluene	L25-My0074483	NCP	%	79			70-130	Pass	
Ethylbenzene	L25-My0074483	NCP	%	84			70-130	Pass	
m&p-Xylenes	L25-My0074483	NCP	%	79			70-130	Pass	
o-Xylene	L25-My0074483	NCP	%	83			70-130	Pass	
Xylenes - Total*	L25-My0074483	NCP	%						
Spike - % Recovery									
				Result 1					
Polycyclic Aromatic Hydrocarbons									
Acenaphthene	L25-My0074483	NCP	%	96			70-130	Pass	
Acenaphthylene	L25-My0074483	NCP	%	95			70-130	Pass	
Anthracene	L25-My0074483	NCP	%	101			70-130	Pass	
Benz(a)anthracene	L25-My0074483	NCP	%	98			70-130	Pass	
Benzo(a)pyrene	L25-My0074483	NCP	%	104			70-130	Pass	
Benzo(b&j)fluoranthene	L25-My0074483	NCP	%	101			70-130	Pass	
Benzo(g,h,i)perylene	L25-My0074483	NCP	%	100			70-130	Pass	
Benzo(k)fluoranthene	L25-My0074483	NCP	%	104			70-130	Pass	
Chrysene	L25-My0074483	NCP	%	95			70-130	Pass	
Dibenz(a,h)anthracene	L25-My0074483	NCP	%	100			70-130	Pass	
Fluoranthene	L25-My0074483	NCP	%	103			70-130	Pass	
Fluorene	L25-My0074483	NCP	%	101			70-130	Pass	
Indeno(1,2,3-cd)pyrene	L25-My0074483	NCP	%	104			70-130	Pass	
Naphthalene	L25-My0074483	NCP	%	102			70-130	Pass	
Phenanthrene	L25-My0074483	NCP	%	101			70-130	Pass	
Pyrene	L25-My0074483	NCP	%	101			70-130	Pass	
Spike - % Recovery									
				Result 1					
Heavy Metals									
Antimony	L25-My0075490	CP	%	91			75-125	Pass	
Manganese	L25-My0075490	CP	%	90			75-125	Pass	
Silver	L25-My0068930	NCP	%	102			75-125	Pass	

Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Vanadium	L25-My0075490	CP	%	101			75-125	Pass	
Spike - % Recovery									
Metals M8				Result 1					
Arsenic	L25-My0068930	NCP	%	102			75-125	Pass	
Cadmium	L25-My0068930	NCP	%	102			75-125	Pass	
Chromium	L25-My0068930	NCP	%	108			75-125	Pass	
Copper	L25-My0068930	NCP	%	117			75-125	Pass	
Lead	L25-My0075490	CP	%	91			75-125	Pass	Q08
Mercury	L25-My0068930	NCP	%	102			75-125	Pass	
Nickel	L25-My0068930	NCP	%	107			75-125	Pass	
Zinc	L25-My0075490	CP	%	96			75-125	Pass	Q08
Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Duplicate									
				Result 1	Result 2	RPD			
Naphthalene	L25-My0074197	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Nitrate & Nitrite (as N)	M25-My0083577	NCP	mg/kg	18	22	17	30%	Pass	
Nitrite (as N)	M25-My0083577	NCP	mg/kg	< 5	< 5	<1	30%	Pass	
Total Kjeldahl Nitrogen (as N)	B25-My0085438	NCP	mg/kg	41	41	2.0	30%	Pass	
Total Organic Carbon	M25-My0078512	NCP	%	3.6	3.5	4.3	30%	Pass	
Lithium	L25-My0070922	NCP	mg/kg	< 5	< 5	<1	30%	Pass	
Phosphorus	L25-My0070922	NCP	mg/kg	1700	1600	5.0	20%	Pass	
% Moisture	L25-My0075490	CP	%	54	57	5.0	30%	Pass	
Duplicate									
BTEX				Result 1	Result 2	RPD			
Benzene	L25-My0074197	NCP	mg/kg	< 0.1	< 0.1	<1	30%	Pass	
Toluene	L25-My0074197	NCP	mg/kg	< 0.1	< 0.1	<1	30%	Pass	
Ethylbenzene	L25-My0074197	NCP	mg/kg	< 0.1	< 0.1	<1	30%	Pass	
m&p-Xylenes	L25-My0074197	NCP	mg/kg	< 0.2	< 0.2	<1	30%	Pass	
o-Xylene	L25-My0074197	NCP	mg/kg	< 0.1	< 0.1	<1	30%	Pass	
Xylenes - Total*	L25-My0074197	NCP	mg/kg	< 0.3	< 0.3	<1	30%	Pass	
Duplicate									
Polycyclic Aromatic Hydrocarbons				Result 1	Result 2	RPD			
Acenaphthene	L25-My0067249	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Acenaphthylene	L25-My0067249	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Anthracene	L25-My0067249	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Benz(a)anthracene	L25-My0067249	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Benzo(a)pyrene	L25-My0067249	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Benzo(b&j)fluoranthene	L25-My0067249	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Benzo(g,h,i)perylene	L25-My0067249	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Benzo(k)fluoranthene	L25-My0067249	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Chrysene	L25-My0067249	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Dibenz(a,h)anthracene	L25-My0067249	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Fluoranthene	L25-My0067249	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Fluorene	L25-My0067249	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Indeno(1,2,3-cd)pyrene	L25-My0067249	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Naphthalene	L25-My0067249	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Phenanthrene	L25-My0067249	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Pyrene	L25-My0067249	NCP	mg/kg	< 0.5	< 0.5	<1	30%	Pass	
Duplicate									
TRH - 2013 NEPM Fractions (after silica gel clean-up)				Result 1	Result 2	RPD			
TRH >C10-C16 (after silica gel clean-up)	L25-My0075490	CP	mg/kg	< 50	< 50	<1	30%	Pass	
TRH >C16-C34 (after silica gel clean-up)	L25-My0075490	CP	mg/kg	< 100	< 100	<1	30%	Pass	
TRH >C34-C40 (after silica gel clean-up)	L25-My0075490	CP	mg/kg	< 100	< 100	<1	30%	Pass	

Duplicate								
TRH - 1999 NEPM Fractions (after silica gel clean-up)				Result 1	Result 2	RPD		
TRH C10-C14 (after silica gel clean-up)	L25-My0075490	CP	mg/kg	< 20	< 20	<1	30%	Pass
TRH C15-C28 (after silica gel clean-up)	L25-My0075490	CP	mg/kg	< 50	< 50	<1	30%	Pass
TRH C29-C36 (after silica gel clean-up)	L25-My0075490	CP	mg/kg	< 50	< 50	<1	30%	Pass
TRH C10-C36 (Total) (after silica gel clean-up)	L25-My0075490	CP	mg/kg	< 50	< 50	<1	30%	Pass
Duplicate								
Heavy Metals				Result 1	Result 2	RPD		
Aluminium	L25-My0070922	NCP	mg/kg	4000	3200	3.0	30%	Pass
Antimony	L25-My0070922	NCP	mg/kg	< 1	< 1	<1	30%	Pass
Iron	L25-My0070922	NCP	mg/kg	18000	21000	3.0	30%	Pass
Manganese	L25-My0070922	NCP	mg/kg	2800	3000	2.0	30%	Pass
Silver	L25-My0070922	NCP	mg/kg	< 2	< 2	<1	30%	Pass
Vanadium	L25-My0070922	NCP	mg/kg	12	15	1.0	30%	Pass
Duplicate								
Metals M8				Result 1	Result 2	RPD		
Arsenic	L25-My0070922	NCP	mg/kg	2.7	2.1	2.0	30%	Pass
Cadmium	L25-My0070922	NCP	mg/kg	< 0.1	< 0.1	<1	30%	Pass
Chromium	L25-My0070922	NCP	mg/kg	15	17	2.0	30%	Pass
Copper	L25-My0070922	NCP	mg/kg	33	30	2.0	30%	Pass
Lead	L25-My0070922	NCP	mg/kg	8.2	8.9	3.0	30%	Pass
Mercury	L25-My0070922	NCP	mg/kg	< 0.02	< 0.02	<1	30%	Pass
Nickel	L25-My0070922	NCP	mg/kg	16	15	2.0	30%	Pass
Zinc	L25-My0070922	NCP	mg/kg	73	66	2.0	30%	Pass

A
 R
 D

Comments

Sample Integrity

Custody Seals Intact (if used)	N/A
Attempt to Chill was evident	Yes
Sample correctly preserved	Yes
Appropriate sample containers have been used	Yes
Sample containers for volatile analysis received with minimal headspace	Yes
Samples received within HoldingTime	Yes
Some samples have been subcontracted	No

Qualifier Codes/Comments

Code	Description
N02	Where we have reported both volatile (P&T GCMS) and semivolatile (GCMS) naphthalene data, results may not be identical. Provided correct sample handling protocols have been followed, any observed differences in results are likely to be due to procedural differences within each methodology. Results determined by both techniques have passed all QAQC acceptance criteria, and are entirely technically valid.
N07	Please note:- These two PAH isomers closely co-elute using the most contemporary analytical methods and both the reported concentration (and the TEQ) apply specifically to the total of the two co-eluting PAHs
Q05	The matrix spike concentration is less than five times the background concentration in the sample - therefore the spike recovery cannot be determined
Q08	The matrix spike recovery is outside of the recommended acceptance criteria. An acceptable recovery was obtained for the laboratory control sample indicating a sample matrix interference.

Authorised by:

Douglas Todd	Senior Analyst-Sample Properties
Luke Holt	Senior Analyst-Inorganic
Mary Makarios	Senior Analyst-Inorganic
Patrick Patfield	Senior Analyst-Organic
Patrick Patfield	Senior Analyst-Volatile
Sean Sangster	Senior Analyst-Metal

Kim Rodgers

General Manager

- Indicates Not Requested

* Indicates NATA accreditation does not cover the performance of this service

Measurement uncertainty of test data is available on request

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Appendix D Spoilbank Marina MEWQMP Summary Report Q4



Port Hedland Spoilbank Marina Project: MEWQMP Summary Report - Q4

Prepared for: Department of Transport

Date: 21/08/2025

Prepared by: Jack Munns

Project: 304501863



Revision Schedule

Revision No.	Date	Description	Prepared by	Quality Reviewer	Independent Reviewer	Project Manager Final Approval
A01	21/08/2025	Q4 Report	JM	JD	GS	TS

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1 Introduction

1.1 Background

The Spoilbank Marina, located on the western extent of the spoil bank sand formation in Port Hedland, was developed to replace the Richardson Street boat ramp and to redirect recreational boating traffic away from the commercial shipping channel within the inner harbour. Federal environmental approval for the project was granted by the Department of Climate Change, Energy, the Environment and Water (DCCEEW) under the *Environment Protection and Biodiversity Conservation Act 1999* (Cth) (EPBC Act) on 19 February 2021 (EPBC 2019/8520).

On 9 July 2024, DCCEEW approved the transfer of proponent responsibilities from Pilbara Ports (PP) to the Department of Transport and Major Infrastructure (DoTMI) (Previously Department of Transport (DoT)). As the new proponent, DoTMI has assumed full operational responsibility for the Spoilbank Marina, including ongoing environmental management, monitoring, and maintenance in accordance with the approved Operational Environmental Management Plan (OEMP).

Within the OEMP a Marine Environment and Water Quality Management Plan (MEWQMP) outlines how the new proponent (DoTMI) will monitor marine water quality, sediment quality and accumulation of marine debris and how impacts to protected matters via the operation of the marina will be managed (O2Marine 2024).

1.2 Objectives

This report is submitted in partial fulfillment of Condition C6 of the Approval Decision Notice (2019/8520), that states: “If the Minister approves the OEMP then the approved OEMP must be implemented”. It provides a summary of the water sampling outcomes conducted in alignment with the MEWQMP during the fourth round of implementation completed on 28 July 2025.



2 Methods

2.1 Sample Collection and Locations

Water quality samples for the targeted testing of dissolved metals, hydrocarbons and chlorophyll-a, and physiochemical profiling of the water column were taken in accordance with the MEWQMP and completed on 28 July 2025. Sampling was undertaken at one site in the Moderate Ecological Protection Area (MEPA), one site at the boundary of the MEPA and High Ecological Protection Area, and four Reference sites: three located approximately 100 to 1500 m north of the marina, and one (a legacy site) located several kilometers to the west. Reference sites 1, 2 and 3 are new to the program in Q4 2025.

Sampling locations are presented in **Figure 1** with corresponding coordinates in **Table 1**.

Table 1. Water quality sampling conducted at the Port Hedland Spoilbank Marina.

Site	Site Type	Latitude	Longitude	Metals (As, Cr, Cu, Pb, Ni, Cd, Hg, Zn, Al)	Chromium speciation (III, VI)	Chlorophyll-a	TPH aliphatic/aromatic (>C16-C35)	TRH - Silica gel clean up (NEPM Fractions) + BTEXN	Inorganics (NH ₃ , NO _x , FRP, NO ₂ , TN, TP, TN)
SBM1	Impact (MEPA)	20° 18'25.19"S	118° 35'25.15"E	✓	✓	✓	✓	✓	✓
SBM2	Impact (HEPA)	20° 18'11.32"S	118° 35'12.56"E	✓	✓	✓	✓	✓	✓
REF1	Reference	20° 17'56.44"S	118° 35'11.69"E	✓	✓	✓	✓	✓	✓
REF2	Reference	20° 17'50.52"S	118° 35'14.20"E	✓	✓	✓	✓	✓	✓
REF3	Reference	20° 17'44.51"S	118° 35'16.75"E	✓	✓	✓	✓	✓	✓
REF4	Reference	20° 17'15.08"S	118° 30'52.82"E	✓	✓	✓	✓	✓	✓



Methods



Figure 1. Water quality sampling sites at the Port Hedland Spoilbank Marina.



2.2 Data Analysis

Data collected during the Q4 sampling event were cleaned and analysed as follows:

- Profile data were first cleaned to remove spurious measurements in the top 0.5 and the lower 0.5 of the water column. Data at these levels were affected by microbubbles in the turbulent surface layers, and the contact with sediments in the lower strata of the water column.
- Temperature, Turbidity, Conductivity, Salinity, Dissolved Oxygen and pH data were fitted to depth profile plots in MATLAB, to check for the presence of gradients.
- Median values for each profile were calculated and compared against the numerical EQGs in EPA (2017) and the EQGs in Table 9 of Appendix A of the OEMP where appropriate.
- Laboratory water quality results were tabulated and compared against the numerical EQGs in EPA (2017).

2.3 QA/QC

- Manual QA/QC checks were completed on the physiochemical data refinement and outlier removal process.
- Field sampling included duplicate samples and met sample holding time requirements.
- All laboratory water quality analysis was completed at a NATA accredited laboratory and abides by QA/QC requirements as part of the accreditation.



3 Results

3.1 EQO1: Ecosystem Health

3.1.1 Physicochemical Stressors

Results of the physico-chemical profiling and chlorophyll-a sampling events on the 28 July 2025 are detailed in **Table 2** and summarised briefly below.

- Chlorophyll-a concentrations were consistently below the LOR and met the EQGs (both those listed in Table 9 of Appendix A of the OEMP (O2Marine 2023) and EPA (2017).
- Median temperature readings exceeded the winter EQGs as listed in Table 9 of Appendix A of the OEMP, and marginally exceeded the EPA EQGs. While water temperatures were between 0.2 to 0.6°C lower than the Reference sites, they were not considered unusual for the Pilbara in July and were not considered to pose a risk to marine wildlife or broader ecosystem processes.
- DO concentrations exceeded the EQGs as listed in Table 9 of Appendix A of the OEMP, but met the EPAs EQG for a high level of ecosystem protection.
- pH values of 8.0 to 8.05 are within the normal range for Pilbara waters. The pH of 8.0 recorded at MEPA site was sufficient to exceed the EPA EQG for a moderate level of ecosystem protection, but met the legacy OEMP EQG trigger.
- The measured values for salinity and turbidity on the 28 July 2025 met the respective OEMP and EPA EQG trigger values.

The EQGs for physicochemical stressors were not met. See Section 4 for comments on the need for contingency monitoring against the EQS.



Results

Table 2. Median physico-chemical measurements obtained on the 28 July 2025 against the respective OEMP (O2 Marine 2024) and EPA (2017) environmental quality guidelines.

	OEMP EQG (MEPA) ¹	OEMP EQG (HEPA) ¹	EPA EQG (MEPA) ²	EPA EQG (HEPA) ²	LOR	Unit	SBM1 (MEPA)	SBM2 (HEPA)	REF1	REF2	REF3	REF4
Chlorophyll-a	0.001	0.001	< 0.001	< 0.001	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Temperature	20.9 - 25.5	21.4 - 24.0	18.8-19.0	18.9-19.0	-	°C	18.6*	18.5*	19	19	19.1	18.8
DO	>97.3	>99.6	80	90	-	%	96.5	95.3	96.5	97.7	96.9	95.4
EC	N/A	N/A	54999-55312	55134-55297	-	uS/cm	55310	55184	55254	55284	55317	54955
Salinity	32.8 – 38.9	32.9 – 38.9	36.5-36.7	36.6-36.7	-	PPT	36.64	36.7	36.7	36.7	36.7	36.4
pH	7.9 – 8.35	8.17 – 8.35	8.05-8.06	8.05-8.06	-	pH	8.0*	8.03	8.05	8.06	8.05	8.06
Turbidity	9.1	6.7	4.67	4.64	-	NTU	2.9	5.8	4.2	4.6	4.6	3.6
Max Depth*	-	-	-	-	-	m	2.8	3.5	6.0	5.6	4.1	4.7

Notes: 1. Interim EQGs calculated from three-year data base from PHMEQSAP (O2 Marine 2023).; 2. EQGs as per the EPAs guidance (EPA 2017). The EPA EQGs for temperature, EC, salinity, pH and turbidity are the 80th percentile values of the combined reference sites (n=4). Orange and blue cells represent exceedances of the legacy OEMP HEPA and MEPA EQG triggers respectively, and bold highlighted text represent exceedances of the EPA EQG trigger values (of which there are none). The EPAs trigger values are considered more appropriate than the legacy OEMP triggers and are less likely to yield false positive results.



Results

Results of the water profiling for temperature, turbidity, conductivity, salinity, pH and dissolved oxygen, are plotted in **Figure 2** and summarised briefly below:

- Temperature profiles throughout the water column were consistent across all sites and both profile casts with no variation with depth.
- Turbidity increased with depth in both water column profiles at site SBM2 while a sharp increase in turbidity was observed at site REF1.
- Conductivity, salinity and pH water column profiles remained consistent across depth at all sites and in both depth profiles.
- Dissolved oxygen water column profiles remained consistent across depth at all sites. REF4 recorded differences in DO% between profile casts however both casts remained consistent with all other sites.



Results

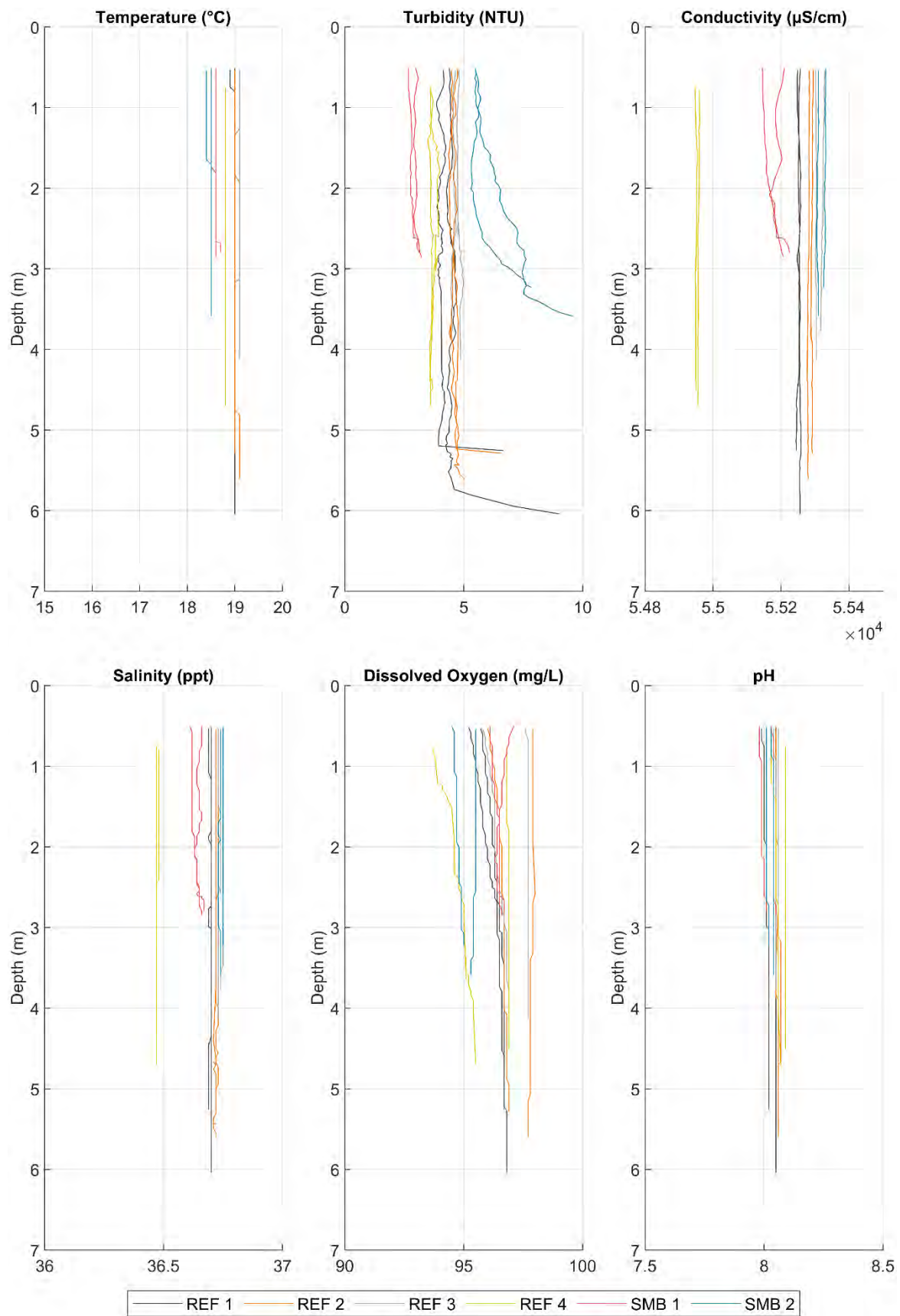


Figure 2. Physicochemical water column profiles displaying two casts from each site.



3.2 Toxicants in Water

3.2.1 Dissolved Metals

Results of the water quality sampling for heavy metals are detailed in **Table 3** and summarised briefly below. The laboratory certificate for the analysis is provided in **Appendix A**.

- Measurements of heavy metals at SBM 1, located inside the Marina, and SBM 2 located at the boundaries of the high and moderate ecological protection areas, met their respective EQGs.
- The EQGs for As and Zn were exceeded at one of the reference sites, but no further exceedances were recorded.

The EQGs for dissolved metals were met. There was therefore no requirement to conduct further monitoring against the EQS.

3.2.2 Hydrocarbons

Results of the water quality sampling for hydrocarbons are detailed in **Table 4** and summarised briefly below. Laboratory certificate for analysis is provided in **Appendix A**.

- None of the measured hydrocarbon concentrations measured on the 28 July 2025 exceeded the EQGs listed in Table 9 of Appendix A of the OEMP.
- With the exception of 4-bromofluorobenzene (surr.), all other measurements were below the laboratory limit of reporting (LOR).
- There were no differences in 4-bromofluorobenzene (surr.) between the marina and the reference sites indicating the measured concentrations were of natural origin.

The EQGs for hydrocarbons were met. There was therefore no requirement to conduct further monitoring against the EQS.



Results

Table 3. Heavy metal concentrations recorded on the 28 July 2025 compared against the respective OEMP (O2 Marine 2024) environmental quality guidelines.

Metal	EQG (MEPA)	EQG (HEPA)	LOR	Unit	SBM1	SBM1 Duplicate	SBM2	REF1	REF2	REF3	REF4
Aluminium	-	-	0.05	mg/L	< 0.05	< 0.05	< 0.05	< 0.05	< 0.5	< 0.05	< 0.05
Arsenic	0.003^	0.003^	0.001	mg/L	0.002	0.003	0.002	0.003	0.015	0.002	0.002
Cadmium	0.014	0.0007	0.0001	mg/L	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.002	< 0.0001	< 0.0001
Chromium (VI)	0.049	0.0077	0.002	mg/L	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002
Chromium (III)	0.02	0.00014	0.002	mg/L	< 0.002	< 0.002	< 0.002	< 0.002	< 0.01	< 0.002	< 0.002
Copper	0.003	0.0003	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001	< 0.01	< 0.001	< 0.001
Lead	0.0066	0.0022	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001	< 0.01	< 0.001	< 0.001
Mercury	0.0007	0.0001	0.0001	mg/L	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.001	< 0.0001	< 0.0001
Nickel	0.2	0.007	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001	< 0.01	< 0.001	< 0.001
Zinc*	0.012	0.0033	0.005	mg/L	< 0.005	< 0.005	< 0.005	< 0.005	0.066	< 0.005	< 0.005

Notes: 1. EQGs as per the OEMP (O2 Marine 2024). Orange and blue cells represent exceedances of the OEMP HEPA and MEPA EQG triggers respectively.



Results

Table 4. Hydrocarbon concentrations recorded on the 28 July 2025 compared against the respective OEMP (O2 Marine 2024) environmental quality guidelines.

Hydrocarbon	EQG (MEPA)	EQG (HEPA)	LOR	Unit	SBM1	SBM1 Duplicate	SBM2	REF1	REF2	REF3	REF4
TRH - 1999 NEPM Fractions											
TRH C6-C9	-	-	0.02	mg/L	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
TRH C10-C14	-	-	0.02	mg/L	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
TRH C15-C28	-	-	0.04	mg/L	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04
TRH C29-C36	-	-	0.04	mg/L	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04
TRH C10-C36	-	-	0.04	mg/L	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04
BTEX											
Benzene	0.9	0.5	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Toluene	0.23	0.11	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Ethylbenzene	0.11	0.05	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
m&p-Xylenes	-	-	0.002	mg/L	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002
o-Xylene	-	-	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Xylenes - Total	0.1	0.05	0.003	mg/L	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003
4-Bromofluorobenzene (surr.)	-	-	1	%	85	83	86	84	80	86	84
TRH - 2013 NEPM Fractions											
Naphthalene ^(N02)	0.09	0.05	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
TRH >C10-C16 less Naphthalene ^(F2)	-	-	0.02	mg/L	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
TRH C6-C36 (Total)	-	-	0.1	mg/L	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
TRH C6-C10 less BTEX ^{(F1)^(N04)}	-	-	0.02	mg/L	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
TRH >C10-C16	-	-	0.02	mg/L	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
TRH >C16-C34	-	-	0.05	mg/L	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
TRH >C34-C40	-	-	0.05	mg/L	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
TRH >C10-C40 (total)	-	-	0.05	mg/L	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Aro/Alk Split of TPH Water											



Results

Hydrocarbon	EQG (MEPA)	EQG (HEPA)	LOR	Unit	SBM1	SBM1 Duplicate	SBM2	REF1	REF2	REF3	REF4
Aliphatic >C16-C35	-	-	0.04	mg/L	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04
Aromatic >C16-C35	-	-	0.04	mg/L	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04

Notes: 1. EQGs as per the OEMP (O2 Marine 2024). Orange and blue cells represent exceedances of the OEMP HEPA and MEPA EQG triggers respectively.



3.3 Nutrients in Water

Results of the water quality sampling for nutrients are **Table 5** and summarised briefly below.

- With the exception of ammonia, all nutrient concentrations met their respective EQGs.
- Ammonia concentrations on the 28 July 2025 ranged between 0.16 and 0.19 ug/L.
- Of the two samples obtained at SBM1, one of the samples exceeded the EQG.
- The exceedance in this case however was marginal, at just 0.01 ug/L above the trigger, and within the range of the other reference sites.
- Based on this, the exceedance in this instance was not considered of ecological significance.

The EQGs for nutrients were met with the exception of ammonia. The EQG for ammonia was exceeded at SBM1 following comparison with the EQG for moderate ecosystem protection. See Section 4 for comments on the need for contingency monitoring against the EQS.



Results

Table 5. Nutrient concentrations recorded on the 28 July 2025 compared against the respective EPA (EPA 2017) environmental quality guidelines.

Nutrient	EPA EQG (MEPA)	EPA EQG (HEPA)	LOR	Unit	SBM1	SBM1 Duplicate	SBM2	REF1	REF2	REF3	REF4
Ammonia (as N)	0.18	0.17	0.02	mg/L	0.19	0.17	0.16	0.17	0.19	0.17	0.16
Nitrate (as N)	-	-	0.01	mg/L	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Nitrite (as N)	-	-	0.01	mg/L	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
NOx (as N)	-	-	0.01	mg/L	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Total Kjeldahl Nitrogen	1.46	0.74	0.2	mg/L	0.9	0.9	0.6	< 0.2	< 0.2	< 0.2	1.7
Total Nitrogen	1.46	0.74	0.2	mg/L	0.9	0.9	0.6	< 0.2	< 0.2	< 0.2	1.7
Total Phosphorus	-	-	0.01	mg/L	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Filterable Reactive Phosphorus	-	-	0.01	mg/L	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01

Notes: 1. EQGs as per the EPAs guidance (EPA 2017). The EPA EQGs nutrients are the 80th percentile values of the combined reference sites (n=4). Orange and blue cells represent exceedances of the OEMP HEPA and MEPA EQG triggers respectively.



4 Discussion

4.1 Physicochemical Stressors in Water

Water temperatures at the MEPA (SBM1) and HEPA (SBM2) sites (18.5-18.8°C) were between 0.0-0.6°C lower relative to the reference sites (18.8-19.1°C). While these differences were sufficient to exceed the winter EQGs as listed in the OEMP and the EPA EQGs, the differences were marginal and well within the range expected of Pilbara near-shore waters in late July (EPA 2019). The observed exceedances in water temperatures are likely false positives, and an artefact of the timing of sampling, which at SBM1 and 2 commenced in the early morning, relative to the other sites, which were sampled later in the day.

DO values at the MEPA (SBM1) and HEPA (SBM2) sites (96.5-95.3%) were between 0.1-1.2% lower than the reference sites (95.4-97.7%). Based on these results, DO at SBM1 and SBM2 were sufficient to exceed the EQGs for a moderate and high level of ecological protection respectively. However, as in the results for water temperature, DO values of between 94.5 and 97.7 are well within the tolerance limits of flora and fauna endemic to the Pilbara waters, and are therefore not of ecological significance (EPA 2019).

While reduced hydrodynamic mixing in semi-enclosed marinas may result in lower DO values relative to external, more exposed waters, the results in this case are more like a reflection of natural variability or instrument drift. Further sampling in time is expected to improve the understanding of the spatiotemporal variability and therefore reduce the probability of making Type I inference errors (falsely concluding there has been an exceedance).

Based on these observations, there was no requirement to conduct further monitoring, nor was there a requirement to conduct further assessment against the EQGs.

4.2 Toxicants in Water

Measurements of heavy metals at SBM 1, located inside the Marina, and SBM 2 located at the boundaries of the high and moderate ecological protection areas, met their respective EQGs. Only reference sites 2 (REF2) recorded metal concentrations above the LOR. Metal concentrations in water were otherwise below the laboratory limit of reporting.

None of the measured hydrocarbon concentrations measured on the 28 July 2025 exceeded the EQGs listed in Table 9 of Appendix A of the OEMP. With the exception of 4-bromofluorobenzene (surr.), all other measurements were below the laboratory limit of reporting (LOR).

Based on these observations, there was no requirement to conduct further monitoring, nor was there a requirement to conduct further assessment against the EQGs.

4.3 Nutrient in Water

Commencing in Q3 2025, nutrient monitoring is a relatively new addition to the Spoilbank Marina OEMP. The EQGs for nutrients were developed using the EPA (2017) guidance which advocates the use of the 80th and 95th percentiles of the reference sites as the triggers for a moderate and high level of ecosystem protection respectively.



5 Conclusion

Except for ammonia, nutrient levels SBM1 and 2 met their respective EQGs. Ammonia values at SBM1 and SBM2 were marginally elevated relative to the reference sites, which in the case of SBM1 was sufficient to exceed the EQG. The exceedance in this case however was marginal, at just 0.01 ug/L above the trigger, and within the range of the other reference sites.

While the EQGs for nutrients have been set based on the 80th and 95th percentile of reference sites, we note that the EPAs triggers for nutrient enrichment are based on chlorophyll-a, which in Q4 were consistently below detection limit. Based on these results, water quality within the marina met the EPAs criteria for a high level of ecosystem protection.

Based on these observations, there was no requirement to conduct further monitoring, nor was there a requirement to conduct further assessment against the EQSs.

5 Conclusion

Water quality within the marina is of an acceptable quality and within the range expected for Pilbara waters in the Australia winter. Based on these results, there was no requirement to conduct further monitoring against the EQS. EQO1 was achieved.



Appendices



Appendix A Laboratory Results Certificate



Stantec Australia Pty Limited
6F 226, Adelaide Terrace
Perth
WA 6000



NATA Accredited
Accreditation Number 2377
Site Number 2370 & 2554

Accredited for compliance with ISO/IEC 17025 – Testing
NATA is a signatory to the ILAC Mutual Recognition
Arrangement for the mutual recognition of the
equivalence of testing, medical testing, calibration,
inspection, proficiency testing scheme providers and
reference materials producers reports and certificates.

Attention: ALL INVOICES

Report 1249689-W
Project name DOT
Project ID 304501863
Received Date Jul 29, 2025

Client Sample ID			SMB1	SMB1 DUP	SMB2	REF1
Sample Matrix			Water	Water	Water	Water
Eurofins Sample No.			L25-JI0076849	L25-JI0076850	L25-JI0076851	L25-JI0076852
Date Sampled			Jul 28, 2025	Jul 28, 2025	Jul 28, 2025	Jul 28, 2025
Test/Reference	LOR	Unit				
Naphthalene ^{NO2}	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
TRH >C10-C16 after Silica Cleanup less Naphthalene (F2)	0.02	mg/L	< 0.02	< 0.02	< 0.02	< 0.02
TRH C6-C36 (Total) (after silica-gel clean up)	0.1	mg/L	< 0.1	< 0.1	< 0.1	< 0.1
Ammonia (as N)	0.02	mg/L	0.19	0.17	0.16	0.17
Chlorophyll-a	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Chromium (VI)	0.002	mg/L	< 0.002	< 0.002	< 0.002	< 0.002
Filterable Reactive Phosphorus	0.01	mg/L	< 0.01	< 0.01	< 0.01	< 0.01
Nitrate (as N)	0.01	mg/L	< 0.01	< 0.01	< 0.01	< 0.01
Nitrite (as N)	0.01	mg/L	< 0.01	< 0.01	< 0.01	< 0.01
NOx (as N)	0.01	mg/L	< 0.01	< 0.01	< 0.01	< 0.01
Total Kjeldahl Nitrogen	0.2	mg/L	0.9	0.9	0.6	< 0.2
Total Nitrogen	0.2	mg/L	0.9	0.9	0.6	< 0.2
Total Phosphorus	0.01	mg/L	< 0.01	< 0.01	< 0.01	< 0.01
Chromium (III) (filtered)*	0.002	mg/L	< 0.002	< 0.002	< 0.002	< 0.002
Total Recoverable Hydrocarbons - 1999 NEPM Fractions						
TRH C6-C9	0.02	mg/L	< 0.02	< 0.02	< 0.02	< 0.02
BTEX						
Benzene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Toluene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Ethylbenzene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
m&p-Xylenes	0.002	mg/L	< 0.002	< 0.002	< 0.002	< 0.002
o-Xylene	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Xylenes - Total*	0.003	mg/L	< 0.003	< 0.003	< 0.003	< 0.003
4-Bromofluorobenzene (surr.)	1	%	85	83	86	84
Total Recoverable Hydrocarbons						
TRH C6-C10 less BTEX (F1) ^{NO4}	0.02	mg/L	< 0.02	< 0.02	< 0.02	< 0.02
TRH - 2013 NEPM Fractions (after silica gel clean-up)						
TRH >C10-C16 (after silica gel clean-up)	0.02	mg/L	< 0.02	< 0.02	< 0.02	< 0.02
TRH >C16-C34 (after silica gel clean-up)	0.05	mg/L	< 0.05	< 0.05	< 0.05	< 0.05
TRH >C34-C40 (after silica gel clean-up)	0.05	mg/L	< 0.05	< 0.05	< 0.05	< 0.05
TRH >C10-C40 (total) (after silica-gel clean up)*	0.05	mg/L	< 0.05	< 0.05	< 0.05	< 0.05

Client Sample ID			SMB1 Water	SMB1 DUP Water	SMB2 Water	REF1 Water
Sample Matrix			L25-JI0076849	L25-JI0076850	L25-JI0076851	L25-JI0076852
Eurofins Sample No.			Jul 28, 2025	Jul 28, 2025	Jul 28, 2025	Jul 28, 2025
Date Sampled						
Test/Reference	LOR	Unit				
TRH - 1999 NEPM Fractions (after silica gel clean-up)						
TRH C10-C14 (after silica gel clean-up)	0.02	mg/L	< 0.02	< 0.02	< 0.02	< 0.02
TRH C15-C28 (after silica gel clean-up)	0.04	mg/L	< 0.04	< 0.04	< 0.04	< 0.04
TRH C29-C36 (after silica gel clean-up)	0.04	mg/L	< 0.04	< 0.04	< 0.04	< 0.04
TRH C10-C36 (Total) (after silica gel clean-up)	0.04	mg/L	< 0.04	< 0.04	< 0.04	< 0.04
Aro/Alc Split of TPH Water						
Aliphatic >C16-C35	0.04	mg/L	< 0.04	< 0.04	< 0.04	< 0.04
Aromatic >C16-C35	0.04	mg/L	< 0.04	< 0.04	< 0.04	< 0.04
Heavy Metals						
Aluminium	0.05	mg/L	< 0.05	< 0.05	< 0.05	< 0.05
Metals M8						
Arsenic	0.001	mg/L	0.002	0.003	0.002	0.003
Cadmium	0.0001	mg/L	< 0.0001	< 0.0001	< 0.0001	< 0.0001
Chromium	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Copper	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Lead	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Mercury	0.0001	mg/L	< 0.0001	< 0.0001	< 0.0001	< 0.0001
Nickel	0.001	mg/L	< 0.001	< 0.001	< 0.001	< 0.001
Zinc	0.005	mg/L	< 0.005	< 0.005	< 0.005	< 0.005

Client Sample ID			REF2 Water	REF3 Water	REF4 Water
Sample Matrix			L25-JI0076853	L25-JI0076854	L25-JI0076855
Eurofins Sample No.			Jul 28, 2025	Jul 28, 2025	Jul 28, 2025
Date Sampled					
Test/Reference	LOR	Unit			
Naphthalene ^{N02}	0.001	mg/L	< 0.001	< 0.001	< 0.001
TRH >C10-C16 after Silica Cleanup less Naphthalene (F2)	0.02	mg/L	< 0.02	< 0.02	< 0.02
TRH C6-C36 (Total) (after silica-gel clean up)	0.1	mg/L	< 0.1	< 0.1	< 0.1
Ammonia (as N)	0.02	mg/L	0.19	0.17	0.16
Chlorophyll-a	0.001	mg/L	< 0.001	< 0.001	< 0.001
Chromium (VI)	0.002	mg/L	< 0.002	< 0.002	< 0.002
Filterable Reactive Phosphorus	0.01	mg/L	< 0.01	< 0.01	< 0.01
Nitrate (as N)	0.01	mg/L	< 0.01	< 0.01	< 0.01
Nitrite (as N)	0.01	mg/L	< 0.01	< 0.01	< 0.01
NOx (as N)	0.01	mg/L	< 0.01	< 0.01	< 0.01
Total Kjeldahl Nitrogen	0.2	mg/L	< 0.2	< 0.2	1.7
Total Nitrogen	0.2	mg/L	< 0.2	< 0.2	1.7
Total Phosphorus	0.01	mg/L	< 0.01	< 0.01	< 0.01
Chromium (III) (filtered)*	0.002	mg/L	G01< 0.01	< 0.002	< 0.002
Total Recoverable Hydrocarbons - 1999 NEPM Fractions					
TRH C6-C9	0.02	mg/L	< 0.02	< 0.02	< 0.02
BTEX					
Benzene	0.001	mg/L	< 0.001	< 0.001	< 0.001
Toluene	0.001	mg/L	< 0.001	< 0.001	< 0.001
Ethylbenzene	0.001	mg/L	< 0.001	< 0.001	< 0.001
m&p-Xylenes	0.002	mg/L	< 0.002	< 0.002	< 0.002
o-Xylene	0.001	mg/L	< 0.001	< 0.001	< 0.001

Client Sample ID			REF2	REF3	REF4
Sample Matrix			Water	Water	Water
Eurofins Sample No.			L25-JI0076853	L25-JI0076854	L25-JI0076855
Date Sampled			Jul 28, 2025	Jul 28, 2025	Jul 28, 2025
Test/Reference	LOR	Unit			
BTEX					
Xylenes - Total*	0.003	mg/L	< 0.003	< 0.003	< 0.003
4-Bromofluorobenzene (surr.)	1	%	80	86	84
Total Recoverable Hydrocarbons					
TRH C6-C10 less BTEX (F1) ^{N04}	0.02	mg/L	< 0.02	< 0.02	< 0.02
TRH - 2013 NEPM Fractions (after silica gel clean-up)					
TRH >C10-C16 (after silica gel clean-up)	0.02	mg/L	< 0.02	< 0.02	< 0.02
TRH >C16-C34 (after silica gel clean-up)	0.05	mg/L	< 0.05	< 0.05	< 0.05
TRH >C34-C40 (after silica gel clean-up)	0.05	mg/L	< 0.05	< 0.05	< 0.05
TRH >C10-C40 (total) (after silica-gel clean up)*	0.05	mg/L	< 0.05	< 0.05	< 0.05
TRH - 1999 NEPM Fractions (after silica gel clean-up)					
TRH C10-C14 (after silica gel clean-up)	0.02	mg/L	< 0.02	< 0.02	< 0.02
TRH C15-C28 (after silica gel clean-up)	0.04	mg/L	< 0.04	< 0.04	< 0.04
TRH C29-C36 (after silica gel clean-up)	0.04	mg/L	< 0.04	< 0.04	< 0.04
TRH C10-C36 (Total) (after silica gel clean-up)	0.04	mg/L	< 0.04	< 0.04	< 0.04
Aro/Alk Split of TPH Water					
Aliphatic >C16-C35	0.04	mg/L	< 0.04	< 0.04	< 0.04
Aromatic >C16-C35	0.04	mg/L	< 0.04	< 0.04	< 0.04
Heavy Metals					
Aluminium	0.05	mg/L	< 0.5	< 0.05	< 0.05
Metals M8					
Arsenic	0.001	mg/L	0.015	0.002	0.002
Cadmium	0.0001	mg/L	< 0.002	< 0.0001	< 0.0001
Chromium	0.001	mg/L	^{G01} < 0.01	0.001	< 0.001
Copper	0.001	mg/L	< 0.01	< 0.001	< 0.001
Lead	0.001	mg/L	< 0.01	< 0.001	< 0.001
Mercury	0.0001	mg/L	< 0.001	< 0.0001	< 0.0001
Nickel	0.001	mg/L	< 0.01	< 0.001	< 0.001
Zinc	0.005	mg/L	0.066	< 0.005	< 0.005

Sample History

Where samples are submitted/analysed over several days, the last date of extraction is reported.

If the date and time of sampling are not provided, the Laboratory will not be responsible for compromised results should testing be performed outside the recommended holding time.

Description	Testing Site	Extracted	Holding Time
Naphthalene	Welshpool	Jul 29, 2025	14 Days
- Method: LTM-ORG-2010 TRH C6-C40			
BTEX	Welshpool	Jul 29, 2025	14 Days
- Method: LTM-ORG-2010 TRH C6-C40			
TRH - 2013 NEPM Fractions (after silica gel clean-up)	Welshpool	Jul 29, 2025	7 Days
- Method: LTM-ORG-2010 TRH C6-C40			
TRH - 1999 NEPM Fractions (after silica gel clean-up)	Welshpool	Jul 29, 2025	7 Days
- Method: LTM-ORG-2010 TRH C6-C40			
Ammonia (as N)	Welshpool	Jul 29, 2025	28 Days
- Method: ARL303 - Ammonia in Water by Discrete Analyser			
Filterable Reactive Phosphorus	Welshpool	Jul 29, 2025	28 Days
- Method: ARL309 - Filterable Reactive Phosphorus in Water by Discrete Analyser			
Nitrate (as N)	Welshpool	Jul 29, 2025	28 Days
- Method: ARL313/319 - NOx in Water by Discrete Analyser			
Nitrite (as N)	Welshpool	Jul 29, 2025	2 Days
- Method: ARL311 - Nitrite in Water by Discrete Analyser			
NOx (as N)	Welshpool	Jul 29, 2025	28 Days
- Method: ARL313/319 - NOx in Water by Discrete Analyser			
Total Kjeldahl Nitrogen	Welshpool	Jul 29, 2025	28 Day
- Method: ARL No. 330 - Persulfate Method for Simultaneous Determination of TN & TP			
Total Nitrogen	Welshpool	Jul 29, 2025	28 Days
- Method: ARL No. 330 - Persulfate Method for Simultaneous Determination of TN & TP			
Total Phosphorus	Welshpool	Jul 29, 2025	28 Days
- Method: ARL308 - Total Phosphorus in Water by Discrete Analyser			
Chlorophyll-a	Welshpool	Jul 29, 2025	28 Days
- Method: ARL141 - Chlorophyll-a and Pheophytin-a in Water			
Chromium (VI)	Welshpool	Jul 29, 2025	1 Day
- Method: ARL316 - Hexavalent Chromium in Water by Discrete Analyser			
Chromium (III) (filtered)*	Welshpool	Jul 29, 2025	180 Days
- Method: ARL402/403 - Metals in Water by ICPOES/ICPMS			
Aro/Alk Split of TPH Water	Welshpool	Jul 29, 2025	7 Days
- Method: ARL111 - Aliphatic/Aromatic Split of TPH			
Heavy Metals	Welshpool	Jul 30, 2025	28 Days
- Method: LTM-MET-3040 Metals in Waters, Soils & Sediments by ICP-MS			
Metals M8	Welshpool	Jul 29, 2025	28 Days
- Method: LTM-MET-3040 Metals in Waters, Soils & Sediments by ICP-MS			



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Project Name: DOT
Project ID: 304501863

Order No.: 304501863
Report #: 1249689
Phone: 0458 839 200
Fax:

Received: Jul 29, 2025 10:20 AM
Due: Aug 5, 2025
Priority: 5 Day
Contact Name: ALL INVOICES

Eurofins Analytical Services Manager : Elden Garrett

Sample Detail						Chlorophyll-a	Chromium (III) (filtered)*	Chromium (VI)	Metals M8	Aro/Ali Split of TPH Water	Eurofins Suite B19E	Eurofins Suite B1SG: TPH (With Silica Gel Clean up), BTEXN
Perth Laboratory - NATA # 2377 Site # 2370 & 2554						X	X	X	X	X	X	X
External Laboratory												
No	Sample ID	Sample Date	Sampling Time	Matrix	LAB ID							
1	SMB1	Jul 28, 2025		Water	L25-JI0076849	X	X	X	X	X	X	X
2	SMB1 DUP	Jul 28, 2025		Water	L25-JI0076850	X	X	X	X	X	X	X
3	SMB2	Jul 28, 2025		Water	L25-JI0076851	X	X	X	X	X	X	X
4	REF1	Jul 28, 2025		Water	L25-JI0076852	X	X	X	X	X	X	X
5	REF2	Jul 28, 2025		Water	L25-JI0076853	X	X	X	X	X	X	X
6	REF3	Jul 28, 2025		Water	L25-JI0076854	X	X	X	X	X	X	X
7	REF4	Jul 28, 2025		Water	L25-JI0076855	X	X	X	X	X	X	X
Test Counts						7	7	7	7	7	7	7

Internal Quality Control Review and Glossary

General

1. Laboratory QC results for Method Blanks, Duplicates, Matrix Spikes, and Laboratory Control Samples follow guidelines delineated in the National Environment Protection (Assessment of Site Contamination) Measure 1999, as amended May 2013. They are included in this QC report where applicable. Additional QC data may be available on request.
2. Unless otherwise stated, all soil/sediment/solid results are reported on a dry weight basis.
3. Unless otherwise stated, all biota/food results are reported on a wet weight basis on the edible portion.
4. For CEC results where the sample's origin is unknown or environmentally contaminated, the results should be used advisedly.
5. Actual LORs are matrix dependent. Quoted LORs may be raised where sample extracts are diluted due to interferences.
6. Results are uncorrected for matrix spikes or surrogate recoveries except for PFAS compounds where annotated.
7. SVOC analysis on waters is performed on homogenised, unfiltered samples unless noted otherwise.
8. Samples were analysed on an 'as received' basis.
9. Information identified in this report with **blue** colour indicates data provided by customers that may have an impact on the results.
10. This report replaces any interim results previously issued.

Holding Times

Please refer to the 'Sample Preservation and Container Guide' for holding times (QS3001).

For samples received on the last day of holding time, notification of testing requirements should have been received at least 6 hours before sample receipt deadlines as stated on the SRA.

If the Laboratory did not receive the information in the required timeframe, and despite any other integrity issues, suitably qualified results may still be reported.

Holding times apply from the sampling date; therefore, compliance with these may be outside the laboratory's control.

For VOCs containing vinyl chloride, styrene and 2-chloroethyl vinyl ether, the holding time is seven days; however, for all other VOCs, such as BTEX or C6-10 TRH, the holding time is 14 days.

Units

mg/kg: milligrams per kilogram	mg/L: milligrams per litre	ppm: parts per million
µg/L: micrograms per litre	ppb: parts per billion	%: Percentage
org/100 mL: Organisms per 100 millilitres	NTU: Nephelometric Turbidity Units	MPN/100 mL: Most Probable Number of organisms per 100 millilitres
CFU: Colony Forming Unit	Colour: Pt-Co Units (CU)	

Terms

APHA	American Public Health Association
CEC	Cation Exchange Capacity
COC	Chain of Custody
CP	Client Parent - QC was performed on samples pertaining to this report
CRM	Certified Reference Material (ISO17034) - reported as percent recovery.
Dry	Where moisture has been determined on a solid sample, the result is expressed on a dry weight basis.
Duplicate	A second piece of analysis from the same sample and reported in the same units as the result to show comparison.
LOR	Limit of Reporting.
LCS	Laboratory Control Sample - reported as percent recovery.
Method Blank	In the case of solid samples, these are performed on laboratory-certified clean sands and in the case of water samples, these are performed on de-ionised water.
NCP	Non-Client Parent - QC performed on samples not pertaining to this report, QC represents the sequence or batch that client samples were analysed within.
RPD	Relative Percent Difference between two Duplicate pieces of analysis.
SPIKE	Addition of the analyte to the sample and reported as percentage recovery.
SRA	Sample Receipt Advice
Surr - Surrogate	The addition of a similar compound to the analyte target is reported as percentage recovery. See below for acceptance criteria.
TBTO	Tributyltin oxide (<i>bis</i> -tributyltin oxide) - individual tributyltin compounds cannot be identified separately in the environment; however, free tributyltin was measured, and its values were converted stoichiometrically into tributyltin oxide for comparison with regulatory limits.
TCLP	Toxicity Characteristic Leaching Procedure
TEQ	Toxic Equivalency Quotient or Total Equivalence
QSM	US Department of Defense Quality Systems Manual Version 6.0
US EPA	United States Environmental Protection Agency
WA DWER	Sum of PFBA, PFPeA, PFHxA, PFHpA, PFOA, PFBS, PFHxS, PFOS, 6:2 FTSA, 8:2 FTSA

QC - Acceptance Criteria

The acceptance criteria should only be used as a guide and may be different when site-specific Sampling Analysis and Quality Plan (SAQP) have been implemented.

RPD Duplicates: Global RPD Duplicates Acceptance Criteria is ≤30%; however, the following acceptance guidelines are equally applicable:

Results <10 times the LOR:	No Limit
Results between 10-20 times the LOR:	RPD must lie between 0-50%
Results >20 times the LOR:	RPD must lie between 0-30%

NOTE: pH duplicates are reported as a range, not as RPD

Surrogate Recoveries: Recoveries must lie between 20-130% for Speciated Phenols & 50-150% for PFAS. SVOCs recoveries 20 – 150%, VOC recoveries 50 – 150%

PFAS field samples containing surrogate recoveries above the QC limit designated in QSM 6.0, where no positive PFAS results have been reported or reviewed, and no data was affected.

QC Data General Comments

1. Where a result is reported as less than (<), higher than the nominated LOR, this is due to either matrix interference, extract dilution required due to interferences or contaminant levels within the sample, high moisture content or insufficient sample provided.
2. Duplicate data shown within this report that states the word "BATCH" is a Batch Duplicate from outside of your sample batch but within the laboratory sample batch at a 1:10 ratio. The Parent and Duplicate data shown are not data from your samples.
3. pH and Free Chlorine analysed in the laboratory - Analysis on this test must begin within 30 minutes of sampling. Therefore, laboratory analysis is unlikely to be completed within holding time. Analysis will begin as soon as possible after sample receipt.
4. Recovery Data (Spikes & Surrogates) - where chromatographic interference does not allow the determination of recovery, the term "INT" appears against that analyte.
5. For Matrix Spikes and LCS results, a dash "-" in the report means that the specific analyte was not added to the QC sample.
6. Duplicate RPDs are calculated from raw analytical data; thus, it is possible to have two sets of data.

Quality Control Results

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Method Blank							
Naphthalene	mg/L	< 0.001			0.001	Pass	
Ammonia (as N)	mg/L	< 0.02			0.02	Pass	
Chromium (VI)	mg/L	< 0.002			0.002	Pass	
Filterable Reactive Phosphorus	mg/L	< 0.01			0.01	Pass	
Nitrate (as N)	mg/L	< 0.01			0.01	Pass	
Nitrite (as N)	mg/L	< 0.01			0.01	Pass	
NOx (as N)	mg/L	< 0.01			0.01	Pass	
Method Blank							
Total Recoverable Hydrocarbons - 1999 NEPM Fractions							
TRH C6-C9	mg/L	< 0.02			0.02	Pass	
Method Blank							
BTEX							
Benzene	mg/L	< 0.001			0.001	Pass	
Toluene	mg/L	< 0.001			0.001	Pass	
Ethylbenzene	mg/L	< 0.001			0.001	Pass	
m&p-Xylenes	mg/L	< 0.002			0.002	Pass	
o-Xylene	mg/L	< 0.001			0.001	Pass	
Xylenes - Total*	mg/L	< 0.003			0.003	Pass	
Method Blank							
TRH - 2013 NEPM Fractions (after silica gel clean-up)							
TRH >C10-C16 (after silica gel clean-up)	mg/L	< 0.02			0.02	Pass	
TRH >C16-C34 (after silica gel clean-up)	mg/L	< 0.05			0.05	Pass	
TRH >C34-C40 (after silica gel clean-up)	mg/L	< 0.05			0.05	Pass	
Method Blank							
TRH - 1999 NEPM Fractions (after silica gel clean-up)							
TRH C10-C14 (after silica gel clean-up)	mg/L	< 0.02			0.02	Pass	
TRH C15-C28 (after silica gel clean-up)	mg/L	< 0.04			0.04	Pass	
TRH C29-C36 (after silica gel clean-up)	mg/L	< 0.04			0.04	Pass	
Method Blank							
Aro/Alk Split of TPH Water							
Aliphatic >C16-C35	mg/L	< 0.04			0.04	Pass	
Aromatic >C16-C35	mg/L	< 0.04			0.04	Pass	
Method Blank							
Heavy Metals							
Aluminium	mg/L	< 0.05			0.05	Pass	
Method Blank							
Metals M8							
Arsenic	mg/L	< 0.001			0.001	Pass	
Cadmium	mg/L	< 0.0001			0.0001	Pass	
Chromium	mg/L	< 0.001			0.001	Pass	
Copper	mg/L	< 0.001			0.001	Pass	
Lead	mg/L	< 0.001			0.001	Pass	
Mercury	mg/L	< 0.0001			0.0001	Pass	
Nickel	mg/L	< 0.001			0.001	Pass	
Zinc	mg/L	< 0.005			0.005	Pass	
Method Blank							
Total Nitrogen	mg/L	< 0.2			0.2	Pass	
Method Blank							
Total Nitrogen	mg/L	< 0.2			0.2	Pass	
Method Blank							
Total Phosphorus	mg/L	< 0.01			0.01	Pass	
Method Blank							

Test				Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Total Phosphorus				mg/L	< 0.01			0.01	Pass	
LCS - % Recovery										
Naphthalene				%	75			70-130	Pass	
LCS - % Recovery										
Total Recoverable Hydrocarbons - 1999 NEPM Fractions										
TRH C6-C9				%	108			70-130	Pass	
LCS - % Recovery										
BTEX										
Benzene				%	114			70-130	Pass	
Toluene				%	93			70-130	Pass	
Ethylbenzene				%	86			70-130	Pass	
m&p-Xylenes				%	95			70-130	Pass	
o-Xylene				%	90			70-130	Pass	
Xylenes - Total*				%	93			70-130	Pass	
LCS - % Recovery										
TRH - 2013 NEPM Fractions (after silica gel clean-up)										
TRH >C10-C16 (after silica gel clean-up)				%	83			70-130	Pass	
LCS - % Recovery										
TRH - 1999 NEPM Fractions (after silica gel clean-up)										
TRH C10-C14 (after silica gel clean-up)				%	85			70-130	Pass	
LCS - % Recovery										
Heavy Metals										
Aluminium				%	91			80-120	Pass	
LCS - % Recovery										
Metals M8										
Arsenic				%	102			80-120	Pass	
Cadmium				%	102			80-120	Pass	
Chromium				%	104			80-120	Pass	
Copper				%	103			80-120	Pass	
Lead				%	101			80-120	Pass	
Mercury				%	97			80-120	Pass	
Nickel				%	105			80-120	Pass	
Zinc				%	101			80-120	Pass	
LCS - % Recovery										
Aro/Alk Split of TPH Water										
Aliphatic >C16-C35				%	104			60-120	Pass	
Aromatic >C16-C35				%	108			60-120	Pass	
Test	Lab Sample ID	QA Source	Units	Result 1				Acceptance Limits	Pass Limits	Qualifying Code
Spike - % Recovery										
					Result 1					
Naphthalene	L25-JI0077712	NCP	%	75				70-130	Pass	
Total Nitrogen	L25-JI0075771	NCP	%	95				70-130	Pass	
Spike - % Recovery										
Total Recoverable Hydrocarbons - 1999 NEPM Fractions					Result 1					
TRH C6-C9	L25-JI0077712	NCP	%	102				70-130	Pass	
Spike - % Recovery										
BTEX					Result 1					
Benzene	L25-JI0077712	NCP	%	100				70-130	Pass	
Toluene	L25-JI0077712	NCP	%	91				70-130	Pass	
Ethylbenzene	L25-JI0077712	NCP	%	85				70-130	Pass	
m&p-Xylenes	L25-JI0077712	NCP	%	92				70-130	Pass	
o-Xylene	L25-JI0077712	NCP	%	87				70-130	Pass	
Xylenes - Total*	L25-JI0077712	NCP	%	91				70-130	Pass	
Spike - % Recovery										

Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
TRH - 2013 NEPM Fractions (after silica gel clean-up)				Result 1					
TRH >C10-C16 (after silica gel clean-up)	L25-JI0077712	NCP	%	81			70-130	Pass	
Spike - % Recovery									
TRH - 1999 NEPM Fractions (after silica gel clean-up)				Result 1					
TRH C10-C14 (after silica gel clean-up)	L25-JI0077712	NCP	%	82			70-130	Pass	
Spike - % Recovery									
Heavy Metals				Result 1					
Aluminium	L25-JI0076849	CP	%	98			75-125	Pass	
Spike - % Recovery									
Metals M8				Result 1					
Cadmium	L25-JI0076849	CP	%	92			75-125	Pass	
Chromium	L25-JI0076849	CP	%	80			75-125	Pass	
Lead	L25-JI0076849	CP	%	82			75-125	Pass	
Mercury	L25-JI0076849	CP	%	92			75-125	Pass	
Spike - % Recovery									
				Result 1					
Ammonia (as N)	L25-JI0076850	CP	%	88			80-120	Pass	
Chromium (VI)	L25-JI0076850	CP	%	99			80-120	Pass	
Filterable Reactive Phosphorus	L25-JI0076850	CP	%	113			80-120	Pass	
Nitrate (as N)	L25-JI0076850	CP	%	90			70-130	Pass	
Nitrite (as N)	L25-JI0076850	CP	%	100			80-120	Pass	
NOx (as N)	L25-JI0076850	CP	%	94			80-120	Pass	
Spike - % Recovery									
Heavy Metals				Result 1					
Aluminium	L25-JI0076851	CP	%	78			75-125	Pass	
Spike - % Recovery									
Metals M8				Result 1					
Arsenic	L25-JI0076851	CP	%	106			75-125	Pass	
Cadmium	L25-JI0076851	CP	%	82			75-125	Pass	
Chromium	L25-JI0076851	CP	%	79			75-125	Pass	
Lead	L25-JI0076851	CP	%	77			75-125	Pass	
Mercury	L25-JI0076851	CP	%	80			75-125	Pass	
Nickel	L25-JI0076851	CP	%	77			75-125	Pass	
Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Duplicate									
				Result 1	Result 2	RPD			
Ammonia (as N)	L25-JI0076849	CP	mg/L	0.19	0.19	<1	20%	Pass	
Chromium (VI)	L25-JI0076849	CP	mg/L	< 0.002	< 0.002	<1	20%	Pass	
Filterable Reactive Phosphorus	L25-JI0076849	CP	mg/L	< 0.01	< 0.01	<1	20%	Pass	
Nitrate (as N)	L25-JI0076849	CP	mg/L	< 0.01	< 0.01	<1	30%	Pass	
Nitrite (as N)	L25-JI0076849	CP	mg/L	< 0.01	< 0.01	<1	20%	Pass	
NOx (as N)	L25-JI0076849	CP	mg/L	< 0.01	< 0.01	<1	20%	Pass	
Duplicate									
TRH - 2013 NEPM Fractions (after silica gel clean-up)				Result 1	Result 2	RPD			
TRH >C10-C16 (after silica gel clean-up)	L25-JI0077710	NCP	mg/L	< 0.02	< 0.02	<1	30%	Pass	
TRH >C16-C34 (after silica gel clean-up)	L25-JI0077710	NCP	mg/L	< 0.05	< 0.05	<1	30%	Pass	
TRH >C34-C40 (after silica gel clean-up)	L25-JI0077710	NCP	mg/L	< 0.05	< 0.05	<1	30%	Pass	

Duplicate								
TRH - 1999 NEPM Fractions (after silica gel clean-up)				Result 1	Result 2	RPD		
TRH C10-C14 (after silica gel clean-up)	L25-JI0077710	NCP	mg/L	< 0.02	< 0.02	<1	30%	Pass
TRH C15-C28 (after silica gel clean-up)	L25-JI0077710	NCP	mg/L	< 0.04	< 0.04	<1	30%	Pass
TRH C29-C36 (after silica gel clean-up)	L25-JI0077710	NCP	mg/L	< 0.04	< 0.04	<1	30%	Pass
TRH C10-C36 (Total) (after silica gel clean-up)	L25-JI0077710	NCP	mg/L	< 0.04	< 0.04	<1	30%	Pass
Duplicate								
				Result 1	Result 2	RPD		
Naphthalene	L25-JI0076852	CP	mg/L	< 0.001	< 0.001	<1	30%	Pass
Total Nitrogen	L25-JI0076852	CP	mg/L	< 0.2	< 0.2	<1	30%	Pass
Total Phosphorus	L25-JI0076852	CP	mg/L	< 0.01	< 0.01	<1	20%	Pass
Duplicate								
Total Recoverable Hydrocarbons - 1999 NEPM Fractions				Result 1	Result 2	RPD		
TRH C6-C9	L25-JI0076852	CP	mg/L	< 0.02	< 0.02	<1	30%	Pass
Duplicate								
BTEX				Result 1	Result 2	RPD		
Benzene	L25-JI0076852	CP	mg/L	< 0.001	< 0.001	<1	30%	Pass
Toluene	L25-JI0076852	CP	mg/L	< 0.001	< 0.001	<1	30%	Pass
Ethylbenzene	L25-JI0076852	CP	mg/L	< 0.001	< 0.001	<1	30%	Pass
m&p-Xylenes	L25-JI0076852	CP	mg/L	< 0.002	< 0.002	<1	30%	Pass
o-Xylene	L25-JI0076852	CP	mg/L	< 0.001	< 0.001	<1	30%	Pass
Xylenes - Total*	L25-JI0076852	CP	mg/L	< 0.003	< 0.003	<1	30%	Pass
Duplicate								
Heavy Metals				Result 1	Result 2	RPD		
Aluminium	L25-JI0076852	CP	mg/L	< 0.05	< 0.05	<1	30%	Pass
Duplicate								
Metals M8				Result 1	Result 2	RPD		
Cadmium	L25-JI0076852	CP	mg/L	< 0.0001	< 0.0001	<1	30%	Pass
Chromium	L25-JI0076852	CP	mg/L	< 0.001	< 0.001	<1	30%	Pass
Copper	L25-JI0076852	CP	mg/L	< 0.001	< 0.001	<1	30%	Pass
Lead	L25-JI0076852	CP	mg/L	< 0.001	< 0.001	<1	30%	Pass
Mercury	L25-JI0076852	CP	mg/L	< 0.0001	< 0.0001	<1	30%	Pass
Nickel	L25-JI0076852	CP	mg/L	< 0.001	< 0.001	<1	30%	Pass
Zinc	L25-JI0076852	CP	mg/L	< 0.005	< 0.005	<1	30%	Pass
Duplicate								
Heavy Metals				Result 1	Result 2	RPD		
Aluminium	L25-JI0076853	CP	mg/L	< 0.5	< 0.5	<1	30%	Pass
Duplicate								
Metals M8				Result 1	Result 2	RPD		
Cadmium	L25-JI0076853	CP	mg/L	< 0.002	< 0.002	<1	30%	Pass
Chromium	L25-JI0076853	CP	mg/L	< 0.01	< 0.01	<1	30%	Pass
Copper	L25-JI0076853	CP	mg/L	< 0.01	< 0.01	<1	30%	Pass
Lead	L25-JI0076853	CP	mg/L	< 0.01	< 0.01	<1	30%	Pass
Mercury	L25-JI0076853	CP	mg/L	< 0.001	< 0.001	<1	30%	Pass
Nickel	L25-JI0076853	CP	mg/L	< 0.01	< 0.01	<1	30%	Pass
Zinc	L25-JI0076853	CP	mg/L	0.066	< 0.05	200	30%	Fail

Q15

Comments

Sample Integrity

Custody Seals Intact (if used)	N/A
Attempt to Chill was evident	Yes
Sample correctly preserved	Yes
Appropriate sample containers have been used	Yes
Sample containers for volatile analysis received with minimal headspace	Yes
Samples received within HoldingTime	Yes
Some samples have been subcontracted	No

Qualifier Codes/Comments

Code	Description
G01	The LORs have been raised due to matrix interference
N02	Where we have reported both volatile (P&T GCMS) and semivolatile (GCMS) naphthalene data, results may not be identical. Provided correct sample handling protocols have been followed, any observed differences in results are likely to be due to procedural differences within each methodology. Results determined by both techniques have passed all QAQC acceptance criteria, and are entirely technically valid.
N04	F1 is determined by arithmetically subtracting the "Total BTEX" value from the "C6-C10" value. The "Total BTEX" value is obtained by summing the concentrations of BTEX analytes. The "C6-C10" value is obtained by quantitating against a standard of mixed aromatic/aliphatic analytes.
Q05	The matrix spike concentration is less than five times the background concentration in the sample - therefore the spike recovery cannot be determined
Q08	The matrix spike recovery is outside of the recommended acceptance criteria. An acceptable recovery was obtained for the laboratory control sample indicating a sample matrix interference.
Q15	The RPD reported passes Eurofins Environment Testing's QC - Acceptance Criteria as defined in the Internal Quality Control Review and Glossary page of this report.

Authorised by:

Elden Garrett	Analytical Services Manager
Patrick Patfield	Senior Analyst-Organic
Patrick Patfield	Senior Analyst-Volatile
Sam Becker	Senior Analyst-Inorganic
Sean Sangster	Senior Analyst-Metal



Kim Rodgers
General Manager

Final Report – this report replaces any previously issued Report

- Indicates Not Requested

* Indicates NATA accreditation does not cover the performance of this service

Measurement uncertainty of test data is available on request

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Appendix E Spoilbank Marina Light Audit 2024 Report



PILBARA PORTS

SPOILBANK MARINA LIGHT AUDIT 2024



Prepared by

Pendoley Environmental Pty Ltd

For

Pilbara Ports

22 August 2024



**ARTIFICIAL LIGHT
ASSESSMENT SERVICES**

PENDOLEY ENVIRONMENTAL



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Document History

Revision	Description	Date received	Date issued	Personnel
Draft	Report Draft		08/07/2024	E. Charlton
Rev IA	Internal Review	08/07/2024	13/08/2024	S. Bruzzese
Rev IB	Technical Review	13/08/2024	19/08/2024	K. Pendoley / S. Bruzzese
Rev A	Client Review	19/08/2024	21/08/2024	L. Georgiou
Rev 0	Final Report Issued	21/08/2024	22/08/2024	S. Bruzzese

Printed:	21 August 2024
Last saved:	21 August 2024 07:10 PM
File name:	J11303 Spoilbank Marina Light Audit 2024_Rev0.docx
Author:	E. Charlton / Dr S. Bruzzese / Dr K. Pendoley
Project manager:	Dr S. Bruzzese
Name of organisation:	Pendoley Environmental Pty Ltd
Name of project:	Spoilbank Marina Light Audit 2024
Client	Pilbara Ports
Client representative:	Lucy Georgiou
Report number:	J11303
Cover photo:	Sky42 Image from Cemetery Beach East

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ACRONYMS AND ABBRVIATIONS

ADSA	Australian Dark Sky Alliance
ALMP	Artificial Light Management Plan
CB	Cemetery Beach
CCT	Correlated colour temperature
DBCA	Department of Biodiversity Conservation and Attractions
DCCEEW	Department of Climate Change, Energy, the Environment and Water
DNB	Day/Night Band
DSLR	Digital single-lens reflex
EPBC Act	Environment Protection and Biodiversity Conservation Act 1999
Intensity	A measure of the power of visible light emitted in a particular direction per solid angle.
K	The temperature of the lights are measures in Kelvin (K)
LED	Light emitting diode
Lumen (lm)	The unit for luminous flux, which is a measure of the total quantity of visible light emitted by a source per unit time.
Marina	Port Hedland Spoilbank Marina
PENV	Pendoley Environmental
PC Amber LED	A filtered LED that emits a higher proportion of longer wavelength visible light (red/orange) and limited shorter wavelength light (blue/UV).
Sky glow	The brightening of the night sky, mostly over urban areas, due to reflection and scattering of artificial light at night.
UV	Ultraviolet
VIIRS	Visible Infrared Imaging Radiometer Suite
Vmag/arcsec²	Vmag/arcsec ² unit quantifies light intensity on an inverted logarithmic scale i.e. higher values represent lower intensity light, while lower values represent higher intensity light
WOS	Whole-of-sky

1 INTRODUCTION

1.1 Project Background

The Port Hedland Spoilbank Marina Project ('the Marina') is located on approximately 36,000 hectares of land on the artificial spoil bank in Port Hedland, approximately 1 km east of Port Hedland Town Centre, adjacent to West End and approximately 3 km east of the Port of Port Hedland (**Figure 1**).

The Marina development is described in the Port Hedland Marina and Waterfront Masterplan (Town of Port Hedland 2019) and includes the following components (**Figure 2**):

- Public open spaces, such as the community node and recreation areas
- Toilets, shade structures, barbeque, and picnic facilities
- Parking for cars, caravans, and boat trailers
- Four-lane boat ramp
- Public jetty
- Boat pens
- Two breakwaters
- Roads and footpaths

Pilbara Ports is the proponent responsible for the construction of the Spoilbank Marina Project ('the Marina') in Port Hedland. The project is directly next to a known flatback turtle (*Natator depressus*) nesting site on Cemetery Beach (**Figure 1**).

In August 2023, Pilbara Ports engaged Pendoley Environmental (PENV) to develop an artificial light management plan (ALMP) to meet Environment Protection and Biodiversity Conservation Act 1999 (EPBC) approval conditions to ensure artificial lighting associated with the operation of the Marina does not impact flatback turtle nesting on Cemetery Beach (EPBC2019/8520 condition 5a).

The ALMP includes a comprehensive monitoring and reporting program to meet conditions 5(a)iii and 5(a)iv of the Port Hedland Spoilbank Marina EPBC 2019/8520 approval (PENV 2024). The monitoring and reporting program includes the following:

1. At least one lighting audit of the Marina must be conducted as soon as practicable, following the commencement of full operations, and prior to the commencement of the 2024/25 peak turtle nesting season.
2. At least one artificial light monitoring survey must be undertaken in the first-year post commencement of full operations.

The aim of the lighting audit survey is to identify any problem lighting and to ensure compliance with lighting design and control measures as described in the Spoilbank Marina ALMP (PENV 2024). Upon

the identification of any problem lighting a risk-based approach will be applied to determine if additional control measures, as outlined in the ALMP, need to be implemented.

1.2 Scope of Works

As part of the Spoilbank Marina ALMP (PENV 2024) monitoring program PENV will undertake the following:

1. Lighting audit of the Spoilbank Marina facilities with full operational lighting.
 - a. Artificial light monitoring from two locations on Cemetery Beach.
 - b. Site inspection of the existing operational lighting infrastructure at the Spoilbank Marina.
2. Lighting audit technical report, as described in the Spoilbank Marina ALMP (PENV 2024).
 - a. Description of the lighting audit survey results.
 - b. Compliance with control measures and lighting design.
 - c. Identification of, and measures taken to reduce, impacts of problem lights.
 - d. Identification of any new information regarding potential impact pathways between artificial light associated with the project and biological receptors, and any adaptive management measures that could further reduce potential impacts.
 - e. Audit and implementation of any control measures to be conducted in consultation with Pilbara Ports and the Department of Biodiversity, Conservation and Attractions (DBCA).
3. The ALMP to be updated, as required, to include outcomes from the lighting audit. This may include changes to the risk assessment, control measures, and/or monitoring commitments.





Figure 2: Spoilbank Marina and Waterfront Masterplan. Source: Port Hedland Marina and Waterfront Masterplan (Town of Port Hedland 2019)

METHODOLOGY

1.3 Artificial Light Monitoring

1.3.1 Field Survey

The artificial light monitoring survey took place over four nights between the 1st and 5th of July 2024. Weather conditions were partially cloudy on the nights of the 1st and 2nd of July, and generally clear on the 3rd and 4th of July. The survey was conducted over the new moon period to allow for comparison between benchmark and future surveys with dark sky conditions. The survey captured all-sky imagery from two locations representative of turtle nesting habitat on Cemetery Beach (CB) at the eastern (CB East) and western ends of the beach (CB West). The camera survey locations are listed in **Table 1** and shown in **Figure 1**.

Table 1: Artificial light monitoring locations and GPS positions (datum: WGS84).

Location	Latitude	Longitude
Cemetery Beach East (CB East)	-20.307005	118.61279
Cemetery Beach West (CB West)	-20.307743	118.60879

1.3.2 Lighting Scenarios

To compare the artificial light emissions from the Spoilbank Marina against existing light sources two lighting scenarios were captured during the light monitoring survey, Marina Lights Off and Marina Lights On. All Marina facility lights were turned off on 4th July to capture the existing artificial light environment and emissions, without the contribution of the Spoilbank Marina lightings (benchmark data). The Marina facility lights were activated on the 2nd and 3rd of July to capture the existing artificial light environment including contributions from the Spoilbank Marina. See **Table 2** for schedule of the lighting scenarios.

During the survey, all of the lighting associated with the boat pens and jetty could not be switched on and were therefore not include in the Marina Lights On scenario.

Table 2: Lighting schedule during the survey period and weather conditions.

Date	Lighting Scenario	Weather Conditions
01/07/2024	Marina Lights On	Partially Cloudy
02/07/2024	Marina Lights On	Partially Cloudy
03/07/2024	Marina Lights On	Mostly Clear
04/07/2024	Marina Lights Off	Mostly Clear

1.3.3 Data Capture

Data was captured at each survey location using a Sky42™ light monitoring camera. The camera is a calibrated Canon EOS 700D DSLR combined with a fish-eye lens and custom-built hardware to acquire low-light images of the entire night sky. The cameras are built into a rigid housing with a protective lid that automatically opens during image capture and closes between capture intervals.

The cameras were mounted on a tripod at a height of 60 cm and programmed to take photos in 5-minute intervals. Cameras were deployed overnight at each location and retrieved during the day. Images were downloaded from the cameras each day.

1.3.4 Data Analysis

The quality of an image captured by a Sky42 light monitoring camera can be influenced by atmospheric factors such as the presence of the moon, twilight, cloud, rain, dust, humidity, or physical factors such as accumulation of sand or dust on the lens. Any images affected by physical factors were removed from the analysis, as well as any images that were affected by the moon or twilight.

All suitable images were processed using specialised software to determine “whole-of-sky”, and “horizon” and “sector” sky brightness levels. Whole-of-sky (WOS) is the mean value of sky glow in the entire image (**Figure 3a**), and horizon is the mean value of sky glow within the 60° – 90° outer band (**Figure 3b**). Sector is the mean value of sky glow within the 60° – 90° outer band constrained to the bearings of the Spoilbank Marina as viewed from the Cemetery Beach monitoring locations (**Figure 3c**).

Sky brightness was quantified in units of visual magnitudes/arcsec² (Vmag/arcsec²; a standard unit used in astronomical measurements and emerging as a standard for sky glow monitoring globally). The Vmag/arcsec² unit quantifies light intensity on an inverted logarithmic scale i.e. higher values represent lower intensity light, while lower values represent higher intensity light. For example, a dark sky under natural conditions, and in the absence of moonlight has a zenith darkness value of 22 Vmag/arcsec². A sky impacted by urban artificial lighting has a zenith brightness of < 18.38 magnitudes.

Additionally, for each relevant monitoring location, a set of processed images were generated detailing the raw fisheye image, processed fisheye image, and a “unwrapped” version as a projected all-sky benchmark image allowing horizon light sources to be easily identified (**Figure 4**).

Note that the colour coding used in the processed imagery represents the scale of intensity of light and is not representative of the colour of light as perceived by a human or Sky42 camera.

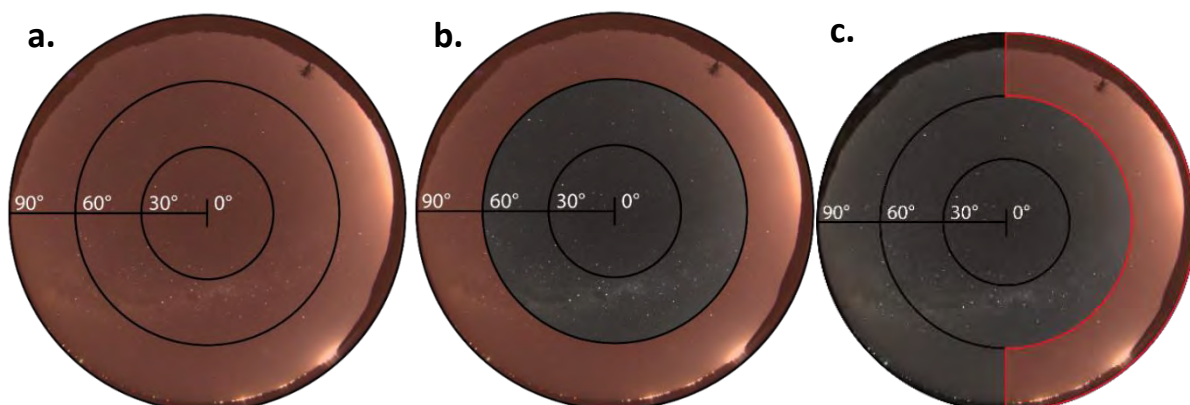


Figure 3: Measurement of mean pixel values; a. Whole-of-sky brightness (full image); b. Horizon brightness (60° – 90°); c. Sector brightness 30° vertically, spanning the bearings of the Spoilbank Marina horizontally. Shaded areas denote the region of the sky being measured.

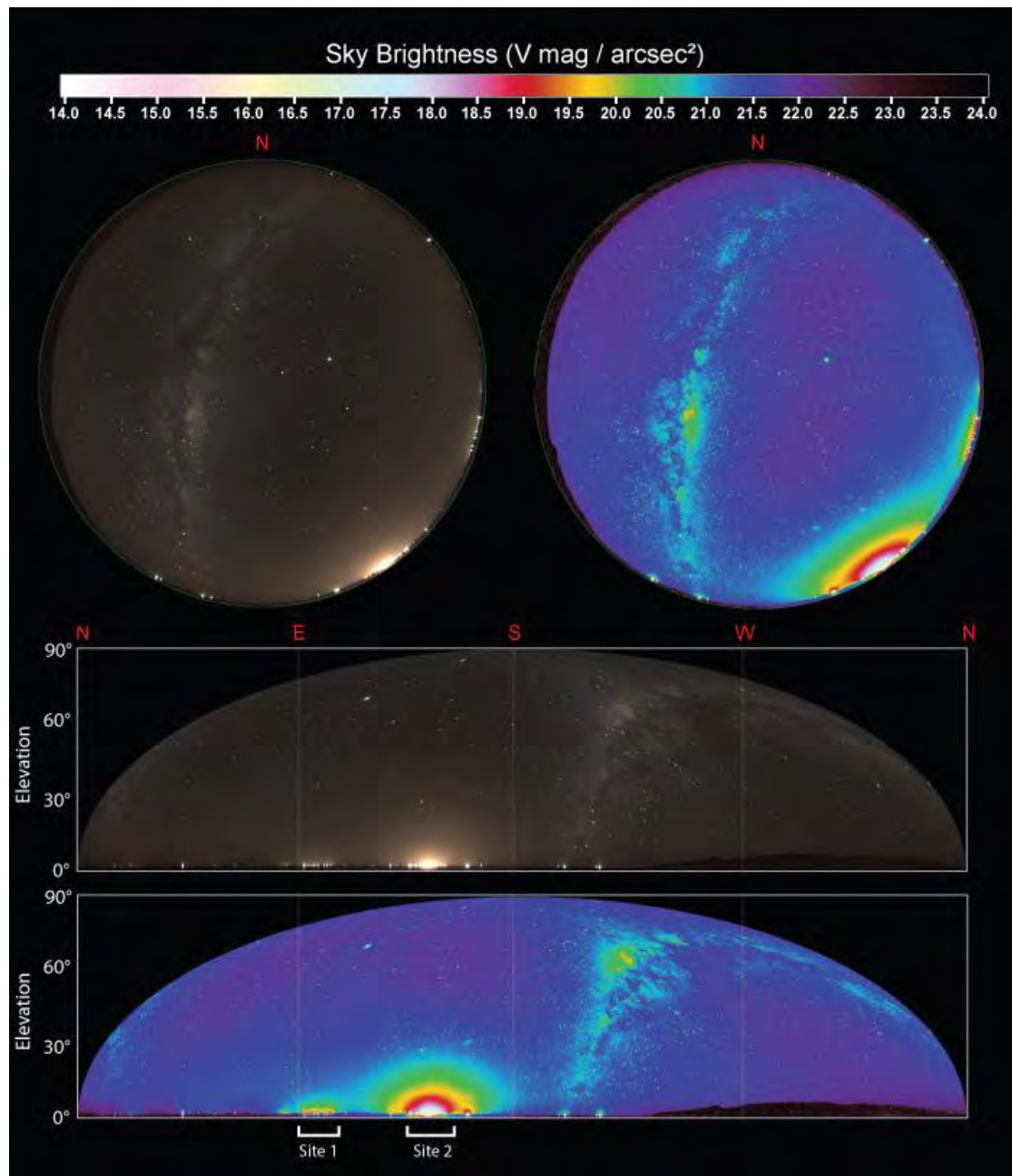


Figure 4: Example outputs from Sky42 camera data analysis: a. Raw circular fisheye image; b. Processed circular image; c. Raw “unwrapped” projected all-sky benchmark image; d. Processed “unwrapped” projected all-sky benchmark image.

1.4 Project Light Audit

On 2nd July 2024, a formal, systematic lighting survey was conducted of all active, external, on-site lighting located at the Spoilbank Marina project site. A review of lighting design drawings to assist with the identification of lights and locations for the survey was performed prior to the survey. The proposed survey included the collection of the following information, where possible:

1. The estimated number and type of lights for each building/area on site. Problems lights will be identified (based on best practice lighting design) and logged.
2. Collection of spectral data using a spectroradiometer (output is a spectral power curve showing relative wavelength intensities and distribution) for each type of light.
3. Identification of light types will be made based on visual observations, spectral data, information from the lighting design drawings and consultations with Pilbara Ports lighting engineers.
4. Identifying the angle of light to determine if the light is appropriately directed and spill minimised.
5. Identifying fitting type, height, and hours of operation, as provided by Pilbara Ports.
6. Identifying additional lighting infrastructure, such as lighting shields/filters or adaptive light controls that can be recommended by the audit team.

1.4.1 Spectrometer

A Sekonic C7000 spectrometer was used to characterise the spectral power distribution of the different light types within the area of interest. For LED type lights the approximate Correlated Colour Temperature (CCT) was provided to the nearest 100 Kelvin (K).

2 RESULTS

2.1 Regional Lighting Environment

The Marina development is located approximately 3 km east of the Port of Port Hedland, which is the largest port for bulk exports globally, facilitating the shipment of commodities such as iron ore, lithium, and salt (Pilbara Ports 2022). The facility operates 24 hours a day and is comprised of 19 operational shipping berths including Finucane Island, Utah Point, East Side, Nelson Point, Stanley Point and Anderson Point (Pilbara Ports 2022). The extensive operations at the port, which include loading, processing, and stockpiling, contribute significantly to the sky glow in the region. The Marina is located adjacent to the Port Hedland Town Centre and West End residential and commercial areas, which also contribute towards visible sky glow as well as directly visible unshielded lights from local streetlights and buildings.

2.1.1 Satellite Imaging

Current satellite imaging of the Port Hedland region derived from the Visible Infrared Imaging Radiometer Suite (VIIRS) Day/Night Band (DNB) detectors can be used to obtain quantitative data about the existing artificial light across the region. The processed images provide yearly, averaged measurements of artificial light, between 500 and 900 nanometers (nm), from space, in terms of radiance (measured in $W/cm^2/sr$; Elvidge et al. 2017). The existing regional light sources within 20 km of the Marina development site, as detected by VIIRS/DNB, are shown in **Figure 5**.

The main sources of artificial light in the region are:

- Port Hedland Port Facilities
 - Utah Point
 - Finucane Island
 - Anderson Point
 - Nelson Point
 - East Side Port
- Port Hedland Town Centre and West End (residential and commercial)

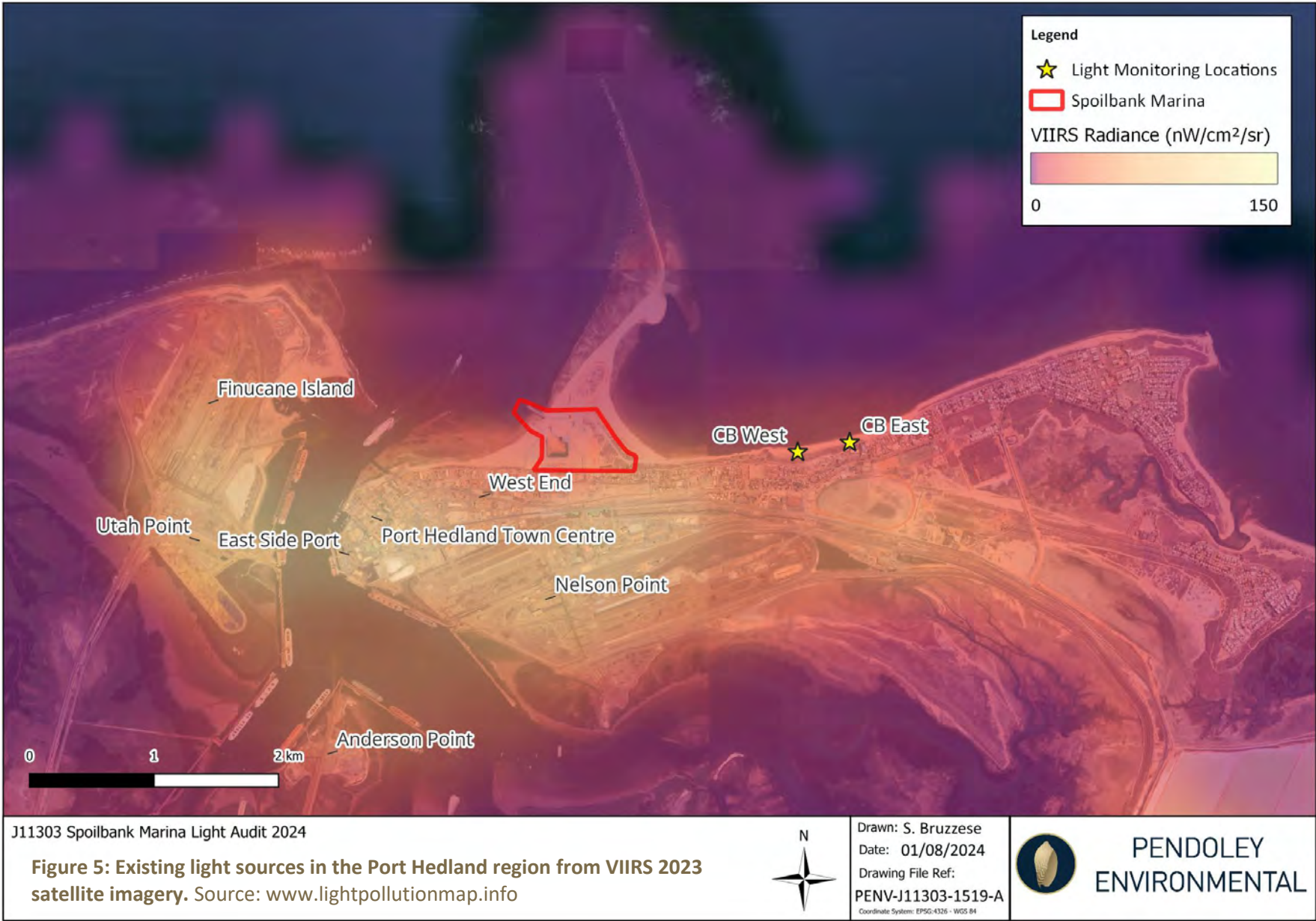
The three brightest sources of existing artificial light in the region are emitted from the Port Hedland Port Facilities at Utah Point, East Side Port and Nelson Point all within 6 km of the turtle nesting areas on Cemetery Beach. The light from Utah Point also merges with light from Finucane Island, which is in the same direction (west) as the Marina development site, as viewed from Cemetery Beach.

2.1.1.1 Satellite Imaging Limitations

The VIIRS/DNB detectors measure light between 500 and 900 nm, which overlaps with human and turtle vision. However, the detectors are not sensitive to light in the blue part of the visible spectrum (< 500 nm) and are sensitive to infrared light (> 700 nm), which is beyond the visible spectrum (Liao et al. 2013). This means that the VIIRS/DNB satellite imagery is less sensitive to light emitted by white

LED lights and more sensitive to heat sources, such as flares and fires (Elvidge et al. 2013; 2015). Therefore, if there is an excess of white LEDs used in the Port Hedland region, the measurements from the VIIR/DNB would underrepresent the true radiance values. It should be noted that marine turtle vision is more sensitive to blue light compared to human vision (DCCEEW 2023).

In addition, the VIIRS/DNB radiance measurements do not account for how the Earth's atmosphere affects light as it travels towards the detector, such as scattering and absorption, reducing the overall radiance values significantly (Horvath 1993; Cinzano et al. 2001). Due to these limitations, the radiance values presented in **Figure 5** are not to be considered an accurate measurement of light intensity. However, **Figure 5** provides the best available regional scale representation of light emissions and is used to identify and quantify the main sources of artificial light in the region.



2.2 Artificial Light Monitoring

Data was successfully captured from the two survey locations during each night of monitoring, with the clearest imagery captured on the 3rd and 4th of July 2024. The Spoilbank Marina lighting was switched off on the 4th of July (Marina Lights Off) and this data was used as a benchmark to analyse the existing artificial lighting environment. The Spoilbank Marina lighting was active on the 3rd of July (Marina Lights On), and this data was used to determine the change in sky brightness from each monitoring location due to the Spoilbank Marina lighting.

The darkest WOS images from each monitoring location for each night have been analysed and presented within this report. The processed results for each monitoring location are shown in **Figure 6**, **Figure 7**, and **Table 4**.

The port facilities are the most dominant source of sky glow in Port Hedland from both monitoring locations. From both locations, the port facilities overlap with the position of the Spoilbank Marina facilities and the lighting from the Spoilbank Marina is indiscernible against the extremely bright existing lighting from the port facilities. Sky glow from residential and other commercial activities is also visible from both locations. Streetlights along Sutherland Street are visible as high intensity point sources of light towards the northeast. Lower-intensity point sources of light corresponding to offshore vessels are visible on the horizon to the northwest from both locations (**Figure 6 – Figure 7**). From Cemetery Beach East, high-intensity, direct light is visible from the water tower and Civic Centre building (**Figure 6**).

Marina Lights OFF

Cemetery Beach East, which is located furthest from the port facilities with higher dunes providing shielding from inland residential and commercial lighting, recorded slightly fainter sky brightness values (WOS: 18.80 Vmag/arcsec², Horizon: 18.48 Vmag/arcsec²; **Table 4**). Cemetery Beach West, which is located closer to the port facilities with lower dunes recorded slightly brighter sky brightness values (WOS: 18.76 Vmag/arcsec², Horizon: 18.41 Vmag/arcsec²; **Table 4**). However, due to the proximity of the two monitoring locations on Cemetery Beach the sky brightness values recorded were similar (within 7 %).

Marina Lights ON

The activation of the Spoilbank Marina lighting resulted in a minor increase in WOS (18.73 Vmag/arcsec²) and horizon (18.41 Vmag/arcsec²) sky brightness values of 3 % and 2 %, respectively from Cemetery Beach East (**Table 4**). Similarly, from Cemetery Beach West there was also a small increase in WOS (18.73 Vmag/arcsec²) and horizon (18.48 Vmag/arcsec²) sky brightness values of 7 % and 8 %, respectively (**Table 4**).

The Spoilbank Marina sector brightness was also analysed from each monitoring location for the bearings of the Spoilbank Marina. When the Marina lights were activated a 0 % change in sky brightness was recorded from Cemetery Beach East and a 2 % increase in sky brightness was recorded from Cemetery Beach West (**Table 4**).

All recorded increases in sky brightness values are less than 10 %, which is within the expected natural variation of sky brightness across a night (see **Section 2.2.1.1** for details). Based on these results,

lighting from the Spoilbank Marina does not have a discernible impact on the existing sky brightness as perceived from the Cemetery Beach monitoring locations. However, this assumes that there were no variations to the existing lighting environment and atmospheric conditions between the survey nights (see **Section 2.2.1.1** for details).

2.2.1 Limitations

2.2.1.1 Variations in sky brightness

The two lighting scenarios described in **Section 1.3.2** were designed to determine the contribution of the Spoilbank Marina to the existing lighting environment from Cemetery Beach. However, there will be variations in atmospheric conditions (e.g., temperature, dust, moisture and aerosol content) across the survey, which affect the scattering of light, and the amount of sky glow received at an observer location. An increase in sky brightness of approximately 10 % is considered within the natural range of sky brightness values observed due to natural variation in atmospheric conditions across a night.

The existing lighting environment in Port Hedland itself is variable and is likely to change throughout one night and across multiple nights. This could be due to changes in nighttime shipping activities at the port or in nighttime commercial and/or residential activities in Port Hedland.

2.2.1.2 Inactive lighting

During the survey some of the Marine facility lighting was inactive. The lighting associated with the boat pens and jetty could not be switched on and were therefore not included in the audit and artificial light monitoring Marina Lights On scenario (95 lights total). Additionally, 15 total lights from the land side of the Marina facility were inactive during the audit and artificial light monitoring Marina Lights On scenario. Five lights were inactive due to electrical issues or faulty fixtures and 10 lights had not been installed at the time of the audit. See **Appendix A** for location of inactive land side Marina lighting.

Based on calculations using the photometric data provided for each light type, the predicted lighting emissions from the jetty and boats pens are 2.31 % of the total lighting emissions power lumens. The other inactive land side lighting emissions are predicted to be 2.94 % of the total lighting emissions power in lumens.

Overall, a total of 110 lights were inactive during the survey which accounted for 5.25 % of the total power in lumens. This minor contribution is not expected to affect the results of the overall survey. See **Table 3** for a summary of the inactive lighting during the survey period.

Table 3: Summary of inactive lighting during the survey.

Location	Total Power (lm)	Inactive Power (lm)	Inactive (% of Total Power)
Boat Pens and Jetty (Marine Side)	568,300	13,506	2.31
Marina Waterfront (Land Side)	17,211	17,211	2.94
Total	585,511	30,717	5.25

Table 4: Comparison of WOS, horizon and Spoilbank Marina sector sky brightness values between Marina Lights Off and Marina Lights On scenarios. Note that the scale is inverse logarithmic, brightness increases with decreasing Vmag/arcsec² values.

Monitoring Location	Sky Brightness (Vmag/arcsec ²)								
	Whole-of- Sky			Horizon			Spoilbank Marina Sector		
	Marina Lights Off	Marina Lights On	Increase in Brightness (%)	Marina Lights Off	Maina Lights On	Increase in Brightness (%)	Marina Lights Off	Maina Lights On	Increase in Brightness (%)
Cemetery Beach East	18.80	18.73	7	18.48	18.40	8	17.81	17.81	0
Cemetery Beach West	18.76	18.73	3	18.41	18.39	2	17.98	17.96	2

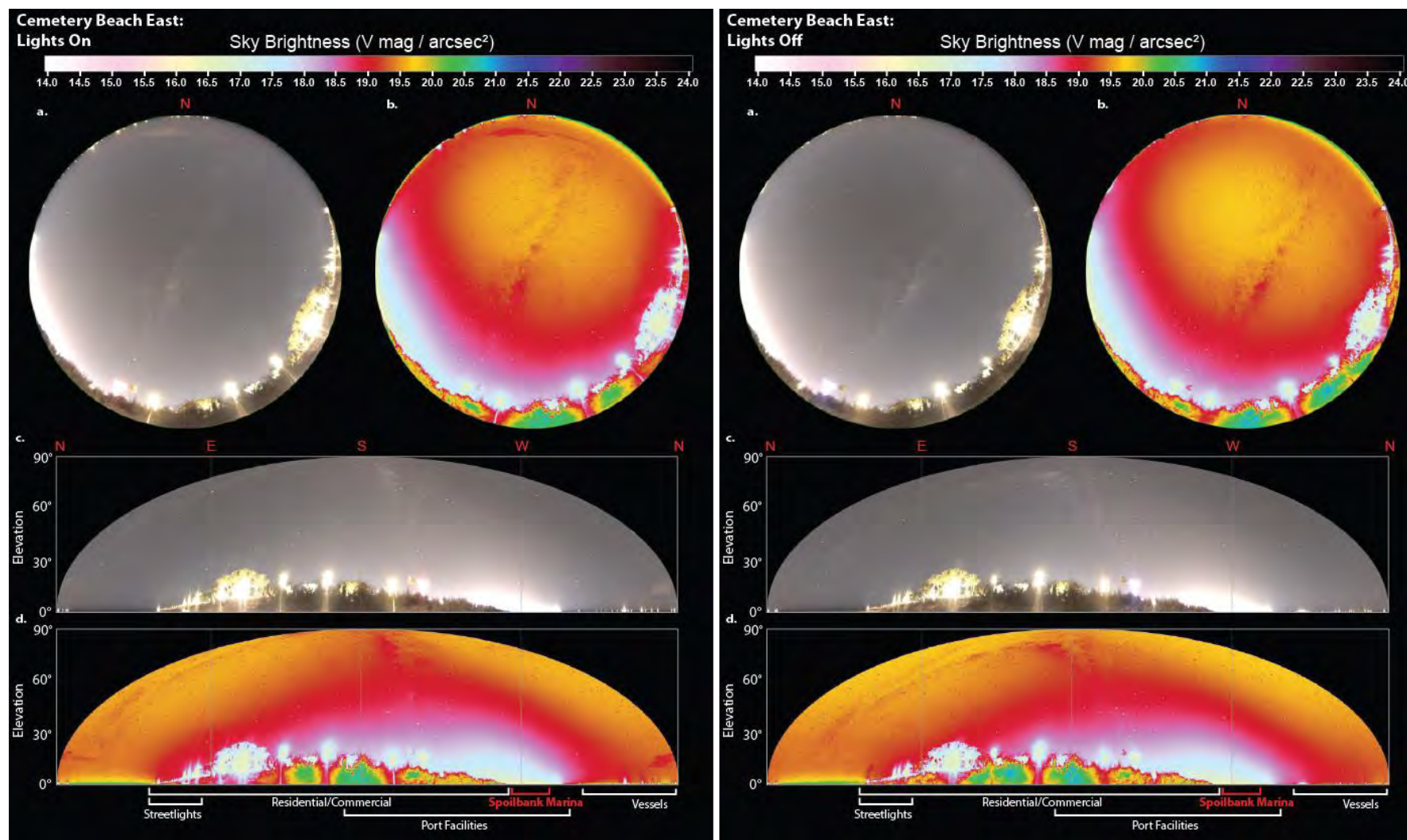


Figure 6: Artificial light monitoring results as observed from Cemetery Beach East for both lighting activated/deactivated scenarios. Left (L): Spoilbank Marina lights are activated, right (R): Spoilbank Marina lights are switched off. Subfigures: a. Raw circular fisheye image; b. Processed circular image; c. Raw “unwrapped” projected all-sky image; d. Processed “unwrapped” projected all-sky image.

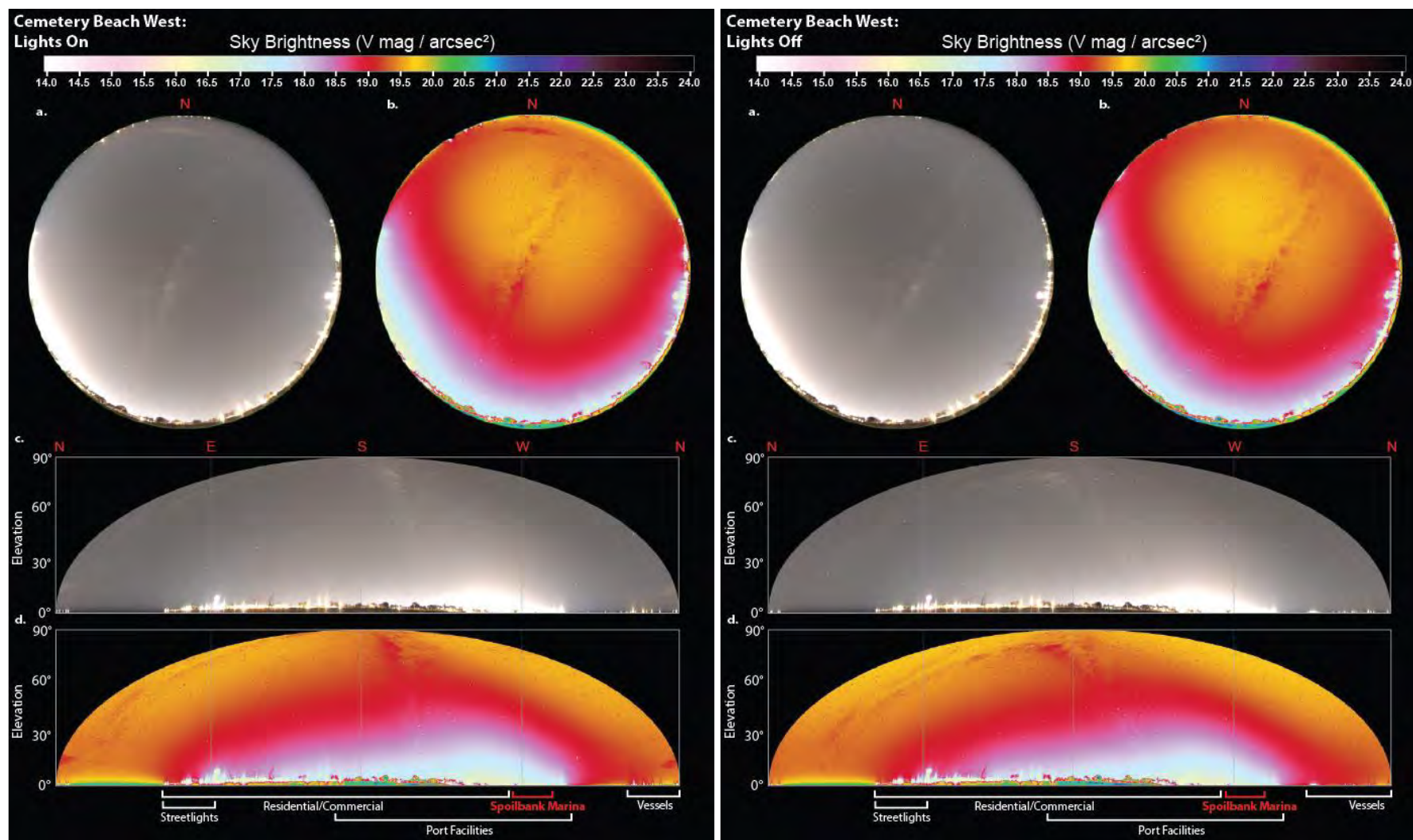


Figure 7: Artificial light monitoring results as observed from Cemetery Beach West for both lighting activated/deactivated scenarios. Left (L): Spoilbank Marina lights are activated, right (R): Spoilbank Marina lights are switched off. Subfigures: a. Raw circular fisheye image; b. Processed circular image; c. Raw “unwrapped” projected all-sky image; d. Processed “unwrapped” projected all-sky image.

2.3 Lighting Audit

The lighting audit of the Spoilbank Marina project site was completed on the 2nd of July 2024. The lighting has been split into two categories: marine side and land side lighting. The marine side lighting includes lighting from the boat pens and jetty. Land side lighting includes lighting for the remaining waterfront facilities including pathways, roads, parking, recreational and community areas.

Prior to the survey the lighting design was reviewed for both land and marine side lighting, to determine the light types, quantity, and mounting style variations, which were recorded and audited against during the survey. See **Appendix B** for the land side Lighting Design and **Appendix C** for the marine side Lighting Design.

2.3.1 Inactive Lighting

During the survey some of the Marina facility lighting was inactive. None of the lighting associated with the boat pens and jetty were switched on and therefore were not included in the audit (95 lights total, 2.31 % of the total lighting emissions power lumens; see **Section 2.2.1.2**). Additionally, 15 total lights from the land side of the Marina facility were inactive during the audit. Five lights were inactive due to electrical issues or faulty fixtures and 10 lights had not been installed at the time of the audit (15 lights total, 2.94 % of the total lighting emissions power in lumens; see **Section 2.2.1.2**). See **Appendix A** for the location of inactive land side Marina lighting.

2.3.2 Lighting Summary

2.3.2.1 Land side Lighting

Review of the land side lighting design prior to the survey identified a total of 273 lights with 7 different light types (Light ID; **Table 5**) and 11 total variations in mounting style and wattage levels (**Table 6**). See **Appendix B** for the land side Lighting Design.

Table 5: Summary of marine side light type and spectral information.

Light ID	Stye/Mounting	CCT (K)	Quantity
ETC320	Floor Uplight	1800	4
FLC121	Pole Uplight	1900	19
KTY234	Bollard	1700	63
PLS420	Linear Light	1700	14
QRI354	Inset Wall Mount	1700	38
VFL530	Pole Mount	1600	59
VFL540	Pole Mount	1600	61

The audit identified the various lights by use case, type of light, the number of lights, mounting type and height, the directionality and shielding of the lights. The directionality of the lights was assessed as either middle (i.e., aimed between the horizontal and 45° towards the ground), downwards (aimed directly towards the ground), or upwards (aimed into the sky). Shielding was assessed as fully shielded or unshielded. See **Appendix D** for examples.

Of the 273 lights identified on the lighting design, 258 were active during the survey with 5 lights not active due to electrical or fixture issues and 10 lights not installed at the time of the audit. This did not

impact the audit as there was a significant quantity of each light type for data to be collected. See **Table 6** for the summary of lights surveyed. Examples of all light types identified in the audit are shown in **Figure 8** and **Figure 9**.

The audit found that the land side lighting was directed correctly and lit the intended target, with no substantial light spill or trespass found. It was noted during the survey that the bollard lighting (KTY234) had a directional emission bias which should be directed towards the intended target once installation is complete.

The spectral characteristics of the lights matched the lighting design, with all light types identified as PC Amber LEDs with CCT ranging from 1600 K to 1900 K (**Table 5**). Selected characteristic spectral outputs for each light type (light ID) are displayed in **Figure 10**. The selected spectra provide an overview of the light types identified throughout the survey, although slight variations may be observed between individual light sources of the same type.

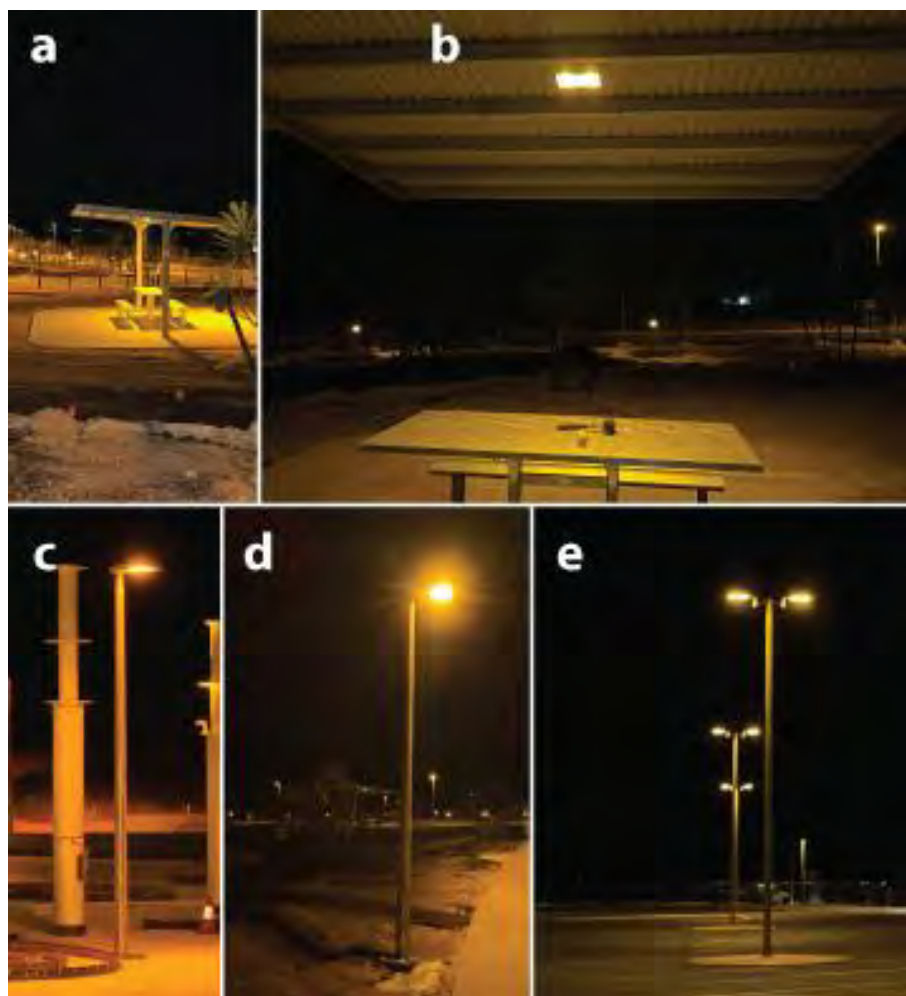


Figure 8: Images of lighting poles and shelters: a. Shelter side view (PLS420); b. Shelter close view (PLS420); c. 4m single headed pole (VL530); d. 6m single headed pole (VL540); e. 8m dual head pole (VLF540-D).

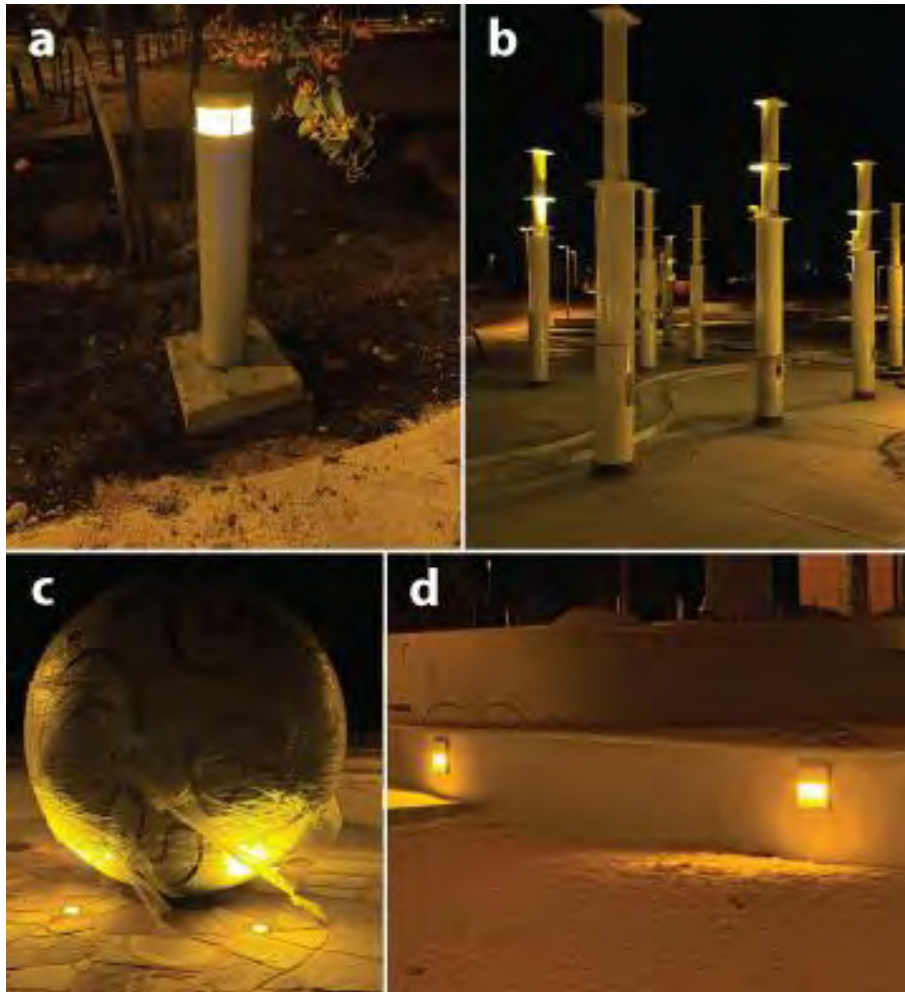


Figure 9: Images of bollard lighting, pole uplights, floor uplights, and inset wall mounted lights:
a. Bollard light (KTY234); b. pole mounted uplight (FLC121); c. floor mounted uplight (ETC320); d. Inset wall mounted lights (QRI354).

Table 6: Summary of land side lighting from audit. Note: *Bollards and pole uplights on underside of shelter were not installed at time of audit.

Lighting Information								Active		Not Active		All	
Light ID	Stye/Mountin g	Type	Directionality/ Shielding	Use Case	Height (m)	Power (W)	Power (lm)	Quantity	Total Power (lm)	Quantity	Total Power (lm)	Quantity	Total Power (lm)
ETC320	Floor Uplight	PC Amber LED	Upwards/ Unshielded	Illuminates decorative sphere	0	15	1,231	4	4,924	-	-	4	4,924
FLC121	Pole Uplight			Illuminates art on underside of shelter	3	84	924	19	17,556	1*	924	20	18,480
KTY234	Bollard		Middle/ Fully shielded	Footpath	1	11	434	63	27,342	9*	3,906	72	31,248
PLS420	Linear Light		Downwards/ Fully shielded	Picnic shelter	3	17	868	14	12,152	-	-	14	12,152
QRI354	Inset Wall Mount			Walkways and stairs	0.5	17	868	38	32,984	2	1,736	40	34720
VFL530- HW	Pole Mount High Wattage			Roads, footpaths, and parking areas	6	57	3,470	23	79,810	1	3,470	24	83,280
VFL530- LW	Pole Mount Low Wattage				4	31	1,735	30	52,050	2	3,470	32	55,520
VFL530- SE	Pole Mount				4	31	1,735	4	6,940	-	-	4	6,940
VFL530- SE-D	Dual Head Pole Mount				4	31	1,735	2	3,470	-	-	2	3,470
VFL540	Pole Mount				6	84	5,206	21	109,326	-	-	21	109,326
VFL540-D	Dual Head Pole Mount				8	84	5,206	40	208,240	-	-	40	208,240
Total								258	554,794	15	13,506	273	568,300

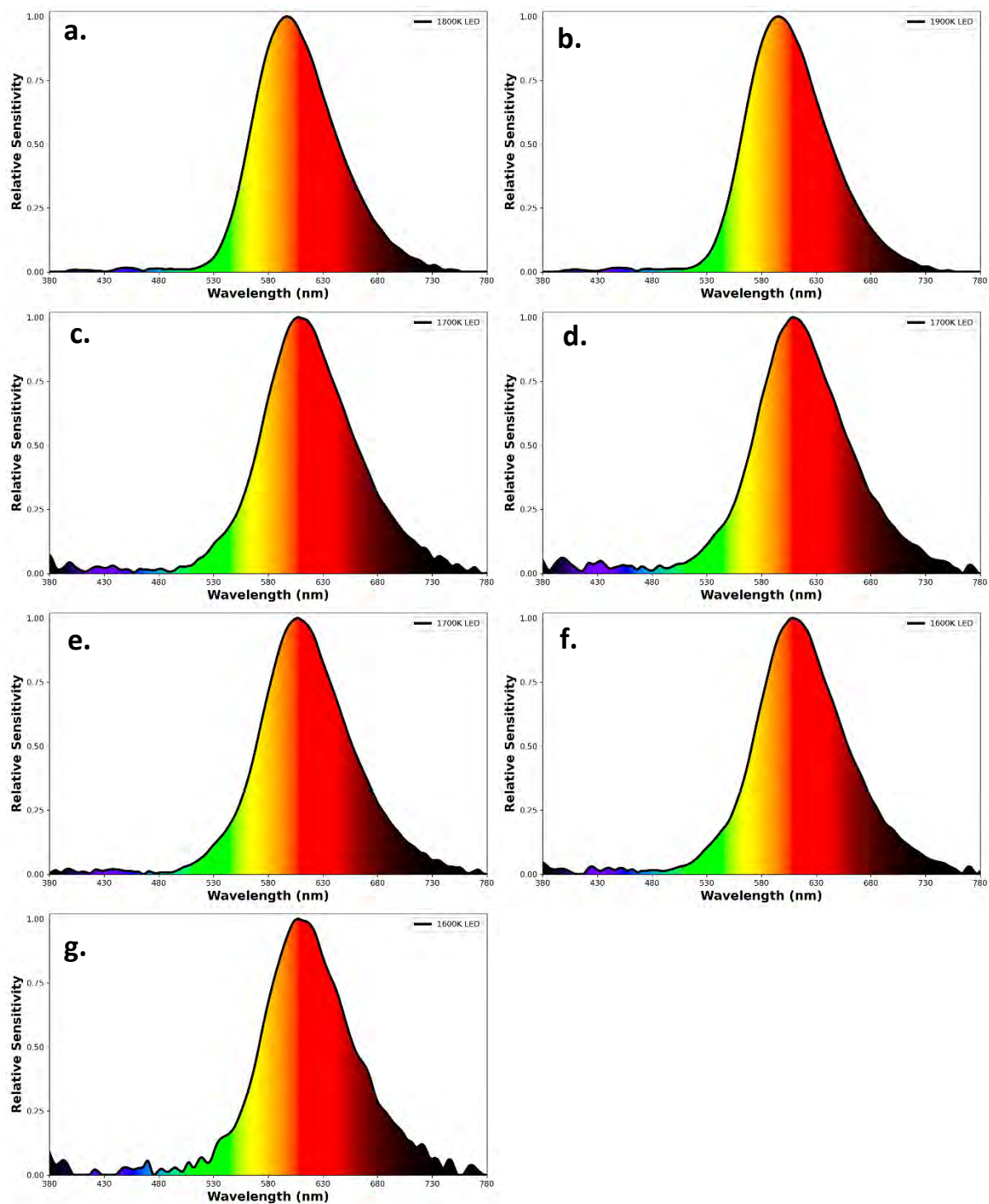


Figure 10: Measured spectral outputs of land side PC Amber LED lighting: a. ECT320; b. FLC121; c. KTY234; d. PLS420; e. QRI354; f. VFL530; g. VFL540.

2.3.2.2 Marine Side Lighting

The marine side lighting consisted of 95 lights total which were divided into 3 light types. At the dates of the survey, the lighting was not activated and therefore not included in the audit. A summary of the marine side lighting based on the lighting design is shown in **Table 7**. See **Appendix C** for the marine side Lighting Design.

Table 7: Summary of the marine side (jetty and boat pens) lighting from lighting design.

Lighting Information						Active		Not Active	
Light ID	Stye/Mounting	Light Type	Mounting Height (m)	Power (W)	Power (lm)	Quantity	Total Power (lm)	Quantity	Total Power (lm)
Klik System	Under Railing	PC	-2.1 to 6.5	11	99	-	-	80	7,920
Dialight Bulkhead	Pole/Downward Facing	Amber LED	5.6/6.5/7.7	31	2145	-	-	3	6,435
Compusec	Pillar Light	Amber LED	-2.3 to 5.1	31	238	-	-	12	2,856
Total						0	0	95	17,211

2.3.3 Compliance with Lighting Design

The lighting audit found that the constructed lighting for the land side of the facility to be compliant with the issued lighting design. However, as the marine side lighting was unable to be activated during the audit, compliance with the lighting design could not be determined.

2.3.4 Best Practise Lighting Design Principles

This section outlines the existing lighting mitigation and control measures as part of the project lighting design along with additional recommended control measures in line with the Best Practice Lighting Design Principles (DCCEEW 2023) specific to this project and flatback turtles. The recommended control measures need to be considered alongside legislated health and safety requirements under the Workforce Health and Safety Act 2020 and subsidiary regulations, such as duty of care and requirements to provide safe operations.

The Best Practice Lighting Design principles for outdoor light sources, summarised in **Figure 11** are modified from the National Light Pollution Guidelines for Wildlife (DCCEEW 2023).

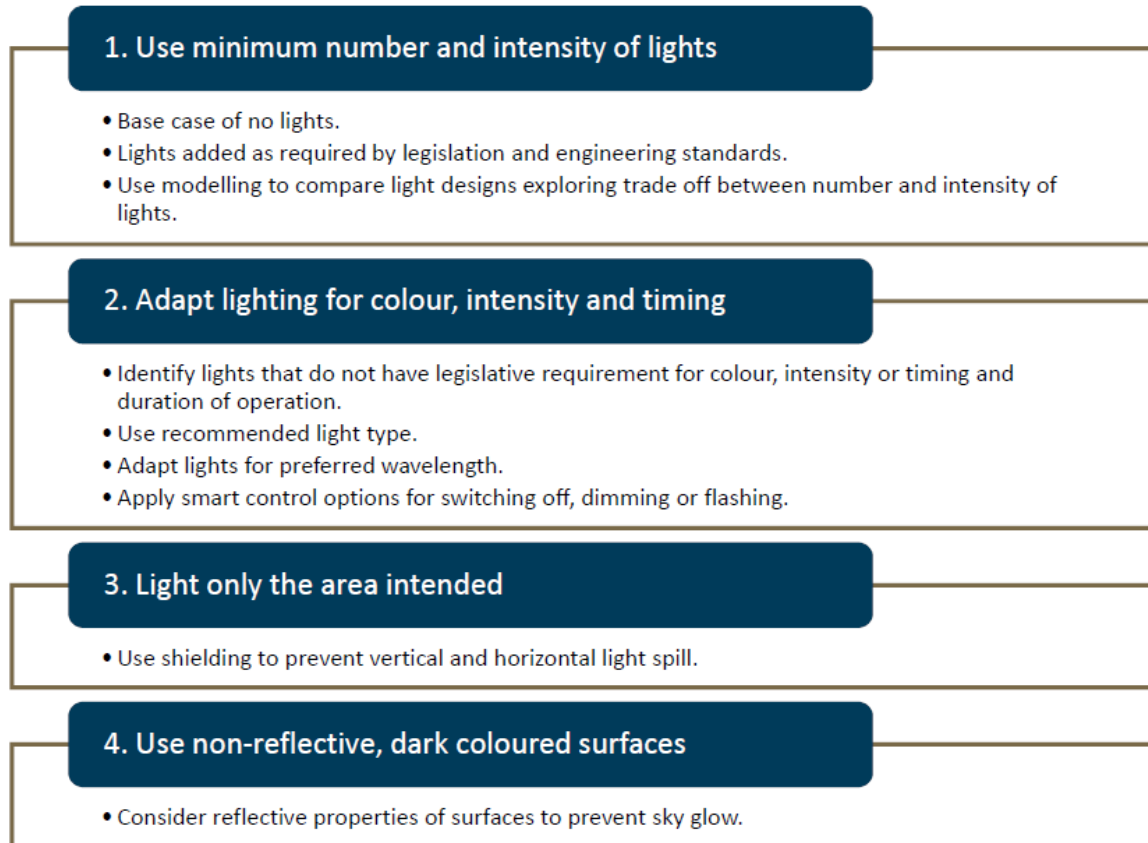


Figure 11: Summary of Best Practice Lighting Design principles.

2.3.4.1 Use minimum number and intensity of lights.

Starting from a base case of no lights, use only the minimum number and intensity of lights needed to provide safe and secure illumination required to meet the lighting objectives and health and safety requirements. Avoiding light fixtures surplus to needs will decrease overall light emissions. Intensity of light should be measured in lumen output, not wattage, when comparing intensity between different lighting design options.

For flatback turtles, the intensity of light is as important as colour (Mrosovsky 1972; Mrosovsky & Shettleworth 1968; Pendoley & Kamrowski 2015). Intensity should be reduced to as low as possible, regardless of the type, colour, and planned operation of the light.

Existing Lighting Design Control Measures:

- Lighting design uses the minimum number and intensity of lights required to meet lighting objectives while addressing safety standards, regulations, and legislation.

Additional Control Measures:

- None

2.3.4.2 Adapt lighting for colour, intensity, and timing.

The potential for biological impacts from white light is universal across fauna groups (DCCEEW 2023). Flatback turtles are most sensitive to short wavelengths of light (UV to blue/green). Therefore, where compliant with health and safety requirements, white lights should be avoided, and amber/orange lights used instead. Because long wavelength light scatters much less than white light and produces less sky glow, the impacts on flatback turtles will be reduced. If white lights are required, filters to block green, blue, violet, and ultra-violet wavelengths should be applied.

For lights that are not required to be continuously lit, smart LED technology should be implemented to allow for switching off when not in use, or the use of intermittent flashing lights. LED lights most suitable for use in protecting wildlife are Amber LED (narrow wavelength peak at 580nm) or PC Amber LED which has a phosphor coating that filter, and therefore minimises, the short wavelength components of the light emissions. See **Table 8** for an overview of the suitability of commercial lights.

Specific LED lights that may be considered suitable for use in protecting wildlife can be found on the Australasian Dark Sky Alliance (ADSA) website. This site lists luminaires that have been certified by an independent lighting engineer as meeting the criteria for ADSA Approved light fittings and includes a list of suppliers. The database for these lights can be accessed via the following link, <https://www.australasiandarkskyalliance.org/certified-luminaires>.

Existing Lighting Design Control Measures:

- PC Amber and Amber LEDs are utilised throughout the Marina.
- Pole-mounted lights WE-EF VFL530 26W are ADSA certified and VFL530-SE 26W are ADSA Prized Wildlife Certified (<https://www.australasiandarkskyalliance.org/adsa-approved>).

Additional Control Measures:

- Identify areas that do not require 24/7 illumination, ensure lights in these areas are on a timer, motion sensor or manual switch, during turtle nesting season.
- Specifically, the car parking lights could utilise smart controls to dim lights during late hours (i.e., 10pm – 4am, when activity is at its lowest) or be activated on a sensor when activity will be at its lowest. This has the disadvantage that no lighting for public safety during this period. However, this strategy has been applied to other roads, parks and other public spaces in Port Hedland.
- Decorative lighting (i.e., the uplights on the decorative sphere and the underside of the art structure) should be switched off during turtle nesting season.

Table 8: Suitability of commercial lights. Source: DCCEEW 2023

Light type	Suitability
Low Pressure Sodium Vapour	Recommended * 'Filtered' means this type of luminaire can be used only if a filter is applied to remove the short wavelength light
High Pressure Sodium Vapour	
Amber/orange LED	
Filtered* LED	
Filtered* metal halide	
Filtered* white LED	
White LED	Not recommended
Metal halide	
White fluorescent	
Halogen	
Mercury Vapour	

2.3.4.3 Light only the area intended.

Light spill is light that falls outside the area that is intended to be lit. Vertical light spill is light that emits above the horizontal plane, contributing directly to artificial sky glow. Light spill that spills into adjacent areas is known as light trespass and can potentially impact the sensitive receptors. To avoid any form of light spill, light fittings should be designed, located, and directed to avoid lighting anything but the target area.

Existing Lighting Design Control Measures:

- All pole-mounted lights in the Marina waterfront (except upward projector lights and upward floor lights to illuminate decorative sphere) are directed downwards to illuminate only the specific areas of need.
- All WE-EF pole-mounted lights in the Marina waterfront area and along access roads have upward waste of 0 %.
- Pole-mounted lights WE-EF VFL530 26W are ADSA certified and VFL530-SE 26W are ADSA Prized Wildlife Certified.
- Majority of the pathways and walkways in the community node and recreational area of the waterfront are illuminated using low-mounted shielded lights, such as the bollards and wall recessed lights.
- Majority of the pole-mounted lights in the Marina waterfront are pointed away from Cemetery Beach to minimise direct visibility of lights.
- Pole-mounted lights along the eastern main access road are facing away from Cemetery Beach.
- Trees have been planted throughout the Marina waterfront and along the eastern access road, which will provide additional shielding. It should be noted that it will take time for these trees to reach a height and cover that will provide sufficient shielding. The amount of shielding

will also depend on the specific line-of-sight of a turtle from Cemetery Beach as trees along the eastern access road are sparsely planted (approximately 10 m apart).

Additional Control Measures:

- Ensure that projector lighting used to illuminate art on the underside of the shade structure does not spill out beyond the structure. This could not be assessed in the audit as the shade structure was not yet installed.
- Bollard lights (KTY234 see **Figure 9a**) have a lighting bias to one direction of the bollard. Ensure that the brighter side of the bollard is directed towards the intended target to be lit (i.e., the path).

2.3.4.4 Use non-reflective, dark-coloured surfaces.

Light reflected from highly polished, shiny, or light-coloured surfaces can increase visible light emissions and further contribute to sky glow. Use of dark, matte surfaces can reduce reflectance and scattering of light.

Existing Lighting Design Control Measures:

- None

Additional Control Measures:

- Paint areas of substantial reflectance. As construction was still underway at time of the audit, some of the final finishes on the buildings and structures could not be assessed, therefore any structure of substantial reflectance (i.e., the shelters see **Figure 8b**) should be painted a dark, matte colour to reduce light reflection.

2.3.5 Summary and Management Actions

The land side lighting design was audited against the best practice lighting design and found to be generally compliant with these principles, with no specific problem lighting identified. However, further recommendations are provided below, which should be reviewed and enacted where practicable, (i.e., while addressing safety standards, regulations, and legislation).

- Identify areas that do not require 24/7 illumination, ensure lights in these areas are on a timer, motion sensor or manual switch, during turtle nesting season. Specifically, the car parking lights could utilise smart controls to dim lights during late hours (i.e., 10 pm – 4 am, when activity is at its lowest) or be activated on a sensor when activity will be at its lowest.
- Painting areas of substantial reflectance. As construction was still underway, some of the final finishes on the buildings and structures could not be assessed, therefore any structure of substantial reflectance (i.e., the shelters see **Figure 8b**) should be painted dark matte colours to reduce light reflection.
- Ensure that projector lighting used to illuminate art on the underside of the shade structure does not spill out beyond the structure. As the shade structure was not installed at the time of the lighting audit.

- Decorative lighting (i.e., the uplights on the decorative sphere and the underside of the art structure) should be switched off during turtle nesting season.
- Ensure, where possible, lights are directed away from sensitive receptors (inward toward the centre of the facility and downward). It was noted during the audit that the Bollard lights (KTY234; **Figure 9a**) had a lighting bias to one direction of the bollard. It should be ensured that brighter side of the bollard is directed towards the intended target to be lit (i.e., the path).

As the marine side lighting was not activated during the time of the audit compliance with the lighting design and Best Practice Lighting Design Principles could not be determined. It is therefore, recommended that a lighting audit of the marine side lighting be conducted during the next artificial light monitoring survey conducted as part of the 2024/25 hatchling orientation survey. As the marine side lighting accounts for 2.31 % of the total lighting emissions power in lumens (**Section 2.2.1.2**) and is below direct line-of-sight to Cemetery Beach (PENV 2024) this survey is not considered urgent.

The Spoilbank Marina ALMP (PENV 2024) recommended the following additional control measures:

- Shielding to be installed on the east facing side (i.e., side facing towards the Cemetery Beach nesting area) of the pole mounted lights along the main access road to assist in reducing the line-of-sight visibility of these lights to hatchlings within the Cemetery Beach nesting area (RPS 2020).
- Shielding to be installed on the eastern facing side of the pole mounted lights located within the parking and hardstand areas to the extent that compliance with AS/NZS 1158.3.1:2018 is not unreasonably compromised (RPS 2020).

However, based on the results of the artificial light monitoring (see **Section 2.2**; **Figure 6** and **Figure 7**) these lights are not visible as direct sources of light from the monitoring locations on Cemetery Beach and are obscured by the existing light emissions from the port facilities along the same line of sight. Therefore, these additional control measures are no longer recommended.

3 CONCLUSIONS AND RECOMMENDATIONS

3.1 Artificial Light Monitoring and Lighting Audit Conclusions

An artificial light monitoring survey was successfully conducted on 3rd and 4th of July 2024. Benchmark data of the existing artificial light environment was captured on the 4th of July 2024 when the Spoilbank Marina lighting was deactivated. To quantify the contribution of artificial light due to the Spoilbank Marina, the land side lighting was activated on the 3rd of July 2024 and compared to the benchmark lighting. A qualitative assessment of the images over the two nights show that the Marina lighting is not detectable against the existing regional lighting sources. The quantified increase in artificial light detected along the bearings of the Marina site from the beach monitoring locations were less than 2 %. This is deemed to be an indiscernible increase to the existing artificial lighting environment and within the expected natural variation in sky brightness across a night.

A light audit was successfully completed of the Spoilbank Marina land side lighting on the 2nd of July 2024. The audit found that the land side lighting had been implemented as designed with sufficient control measures and compliance with the Best Practice Lighting Design Principles. Based on the lighting audit and artificial light monitoring no problem lights were identified. Additional management actions were recommended to be implemented were practicable (i.e., while also addressing safety standards, regulations, and legislation).

3.2 Recommendations

3.2.1 Review of Artificial Light Management Plan

The risk assessment conducted in the Spoilbank Marina ALMP (PENV 2024) was based on the “for construction” lighting design. This required a qualitative interpretation of the intensity and visibility of Marina lighting from Cemetery Beach. The risk assessment, following the Precautionary Principle, overestimated the intensity and visibility of the Marina lighting based on the lighting design. It is therefore recommended that the risk assessment in the Spoilbank Marina ALMP (PENV 2024) be revised and updated based on the artificial light monitoring results presented in this report.

The Spoilbank Marina ALMP (PENV 2024) recommended the following additional control measures:

- Shielding to be installed on the east facing side (i.e., side facing towards the Cemetery Beach nesting area) of the pole mounted lights along the main access road to assist in reducing the line-of-sight visibility of these lights to hatchlings within the Cemetery Beach nesting area (RPS 2020).
- Shielding to be installed on the eastern facing side of the pole mounted lights located within the parking and hardstand areas to the extent that compliance with AS/NZS 1158.3.1:2018 is not unreasonably compromised (RPS 2020).

However, based on the results of the artificial light monitoring these lights are not visible as direct sources of light from the monitoring locations on Cemetery Beach and are obscured by the existing light emissions from the port facilities along the same line of sight. Therefore, these additional control measures are no longer recommended.

3.2.2 Marine Side Lighting Audit

As the marine side lighting was not activated during the time of the audit, compliance with the lighting design and Best Practice Lighting Design Principles could not be determined. It is therefore, recommended that a lighting audit of the marine side lighting be conducted during the next artificial light monitoring survey conducted as part of the 2024/25 hatchling orientation survey. As the marine side lighting accounts for 2.31 % of the total lighting emissions power in lumens and is below direct line-of-sight to Cemetery Beach this survey is not considered urgent.

3.2.3 Management Actions

Based on the light audit and the Best Practice lighting Design Principles, the following recommendations for the lighting design are provided below, and should be reviewed and implemented where practicable, (i.e., while addressing safety standards, regulations, and legislation).

- Identify areas that do not require 24/7 illumination, ensure lights in these areas are on a timer, motion sensor or manual switch, during turtle nesting season. Specifically, the car parking lights could utilise smart controls to dim lights during late hours (i.e., 10 pm – 4 am, when activity is at its lowest) or be activated on a sensor when activity will be at its lowest.
- Painting areas of substantial reflectance. As construction was still underway, some of the final finishes on the buildings and structures could not be assessed, therefore any structure of substantial reflectance (i.e., the shelters) should be painted dark matte colours to reduce light reflection.
- Ensure, where possible, lights are directed away from sensitive receptors (inward toward the centre of the facility and downward). It was noted during the audit that the bollard lights had a lighting bias to one direction. It should be ensured that brighter side of the bollard is directed towards the intended target to be lit (i.e., the path).
- Decorative lighting (i.e., the uplights on the decorative sphere and the underside of the art structure) should be switched off during turtle nesting season.
- Ensure that projector lighting used to illuminate art on the underside of the shade structure does not spill out beyond the structure. As the shade structure was not installed at the time of the lighting audit this could not be assessed.

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Appendix A: Location of inactive land side lighting



LEGEND	
CONDUIT	
POWER - DISTRIBUTION	---
POWER - RETICULATION	---
POWER - LIGHTING	---
POWER - 2x150mm SPARE	---
POWER - 1x150mm SPARE	---
POWER INFRASTRUCTURE	
TRANSFORMER	
SWITCHBOARD	---
ACD CABLEMATE TYPE 44 CABLE PIT	---
ACD CABLEMATE TYPE 99 CABLE PIT	---
LIGHTING	
BOLLARD - WE-EF RTY234 6W	---
4m SINGLE OUTREACH - WE-EF VFL530 28W	---
4m SINGLE OUTREACH - WE-EF VFL530-SE 28W	---
4m DOUBLE OUTREACH - WE-EF VFL530 28W	---
4m SINGLE OUTREACH - WE-EF VFL530 55W	---
4m SINGLE OUTREACH - WE-EF VFL540 84W	---
8m DOUBLE OUTREACH - WE-EF VFL540 84W	---
BATON LIGHT XXXXXXXXXXXXXXXX	---
RECESSED WALL MOUNTED - WE-EF QB034 12W	---
DOWNLIGHT - WE-EF PLE01 12W (DIP CLAMP)	---

- NOTES:
- DRAWING TO BE READ IN CONJUNCTION WITH THE ELECTRICAL SPECIFICATION AND ALL OTHER SERVICES WHICH FORM PART OF THIS PROJECT.
 - PIT SURROUNDS INCLUDING CONCRETE COLLARS, REINFORCING, BACKFILL, CONCRETE ENCASING (SIDE & BASE), BEDDING, ETC. ARE ACCORDANT ONLY AND ARE TO BE PROVIDED AND INSTALLED IN ACCORDANCE WITH THE PIT MANUFACTURERS RECOMMENDATIONS TO ACHIEVE DESIRED PIT LOADINGS/CLASS RATING. ENSURE PIT BASE DRAINS TO LOCATION OF DRAINAGE CONDUIT.
 - POWER PITS SHALL BE OF DEPTH REQUIRED TO SUIT ALL CONDUITS SHOWN ON THE DRAWING AND ALL CONDUIT SPACING REQUIREMENTS SHOWN HEREIN. CONDUIT MINIMUM 500mm BELOW FINISHED GROUND LEVEL TO MEET AS/NZS 3000.

Dimensions and scales to be checked prior to measuring cable lengths.
(Scale bar only valid for sections of drawing that are as per specified scale)

0 5 10 20 30m
SCALE 1:500 @ ORIGINAL SHEET SIZE A1



NO CHANGES TO DESIGN
UNLESS APPROVED BY
DESIGN MANAGER

ISSUED FOR CONSTRUCTION
THIS DRAWING IS NOT TO BE USED FOR
OPERATIONAL PURPOSES.

THIS DRAWING IS NOT TO BE USED TO IDENTIFY EXISTING WESTERN POWER ASSETS
OR INFORMATION FROM APPROPRIATE CONSTRUCTION PLANNER
PLEASE CONTACT JDSI FOR ANY DRAWING CLARIFICATIONS.

FUTURE JETTY DB
(BY WORKS PACKAGE 3
CONTRACTOR)

FAULTY HEAD

INSTALLED & WORKING

DB1-1

DB1-2

FAULTY HEAD

SUTHERLAND STREET

EE	AS	LC	-	LIGHTING UPDATED TO SUIT NEW LOOKOUT PATH ALIGNMENT
LE	AS	LC	-	SHADE STRUCTURE LIGHTING UPDATED TO SUIT UPDATED LANDSCAPE ARCHITECT LAYOUT.
LC	AS	LC	-	DB1-1 LOCATION UPDATED AND PPA COMMENTS ADDRESSED
LC	AS	LC	-	CABLE SCHEDULE UPDATED
LC	AS	LC	-	LIGHT POLES AND CONDUIT ROUTES UPDATED
DC	AS	LC	-	REVISED LIGHTING LOCATIONS AND QTY'S
DC	AS	-	-	NOTE REMOVED FOR CLARITY
LC	AS	NP/NC	NP/NC	ISSUED FOR CONSTRUCTION
LC	BT	NP/NC	NP/NC	ISSUED FOR TENDER
DC	BT	CHECKED	APPROVED	

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NOTE
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CLIENT:

**PILBARA PORTS
AUTHORITY**

PROJECT:
**SPOILBANK MARINA
PACKAGE 4 - CIVIL AND LANDSCAPING**

DRAWING TITLE:
**PRIVATE LIGHTING RETICULATION
DESIGN LAYOUT
SHEET 2 OF 3**

DRAWN LCONTENPRATO	SCALE 1:500
DESIGNED LCONTENPRATO	DATE 20/08/2014
PROJECT MANAGER DJMELLMUTH	JOB PROJECT NO. JDSI4736.0
JDSI PROJECT NO. JDSI4736.0	ISSUED FOR E103



LEGEND

POWER - DISTRIBUTION
 POWER - RETICULATION
 POWER - LIGHTING
 POWER - DAYTIME SPARE
 POWER - NIGHTTIME SPARE

POWER INFRASTRUCTURE

TRANSFORMER

SWITCHGEAR

1. 150V CABLETYPE TYPE 90 CABLE PIT

2. 150V CABLETYPE TYPE 90 CABLE PIT

LIGHTING

1. BOLLARD - WE-42 KTYEEN 6W

2. 150V SINGLE OUTREACH - WE-42 VFL530 25W

3. 150V SINGLE OUTREACH - WE-42 VFL530 25W

4. 150V SINGLE OUTREACH - WE-42 VFL530 25W

5. 150V SINGLE OUTREACH - WE-42 VFL530 25W

6. 150V SINGLE OUTREACH - WE-42 VFL530 25W

7. 150V SINGLE OUTREACH - WE-42 VFL530 25W

8. 150V SINGLE OUTREACH - WE-42 VFL530 25W

9. 150V SINGLE OUTREACH - WE-42 VFL530 25W

10. 150V SINGLE OUTREACH - WE-42 VFL530 25W

11. 150V SINGLE OUTREACH - WE-42 VFL530 25W

12. 150V SINGLE OUTREACH - WE-42 VFL530 25W

13. 150V SINGLE OUTREACH - WE-42 VFL530 25W

14. 150V SINGLE OUTREACH - WE-42 VFL530 25W

15. 150V SINGLE OUTREACH - WE-42 VFL530 25W

16. 150V SINGLE OUTREACH - WE-42 VFL530 25W

17. 150V SINGLE OUTREACH - WE-42 VFL530 25W

18. 150V SINGLE OUTREACH - WE-42 VFL530 25W

19. 150V SINGLE OUTREACH - WE-42 VFL530 25W

20. 150V SINGLE OUTREACH - WE-42 VFL530 25W

21. 150V SINGLE OUTREACH - WE-42 VFL530 25W

22. 150V SINGLE OUTREACH - WE-42 VFL530 25W

23. 150V SINGLE OUTREACH - WE-42 VFL530 25W

24. 150V SINGLE OUTREACH - WE-42 VFL530 25W

25. 150V SINGLE OUTREACH - WE-42 VFL530 25W

26. 150V SINGLE OUTREACH - WE-42 VFL530 25W

27. 150V SINGLE OUTREACH - WE-42 VFL530 25W

28. 150V SINGLE OUTREACH - WE-42 VFL530 25W

29. 150V SINGLE OUTREACH - WE-42 VFL530 25W

30. 150V SINGLE OUTREACH - WE-42 VFL530 25W

31. 150V SINGLE OUTREACH - WE-42 VFL530 25W

32. 150V SINGLE OUTREACH - WE-42 VFL530 25W

33. 150V SINGLE OUTREACH - WE-42 VFL530 25W

34. 150V SINGLE OUTREACH - WE-42 VFL530 25W

35. 150V SINGLE OUTREACH - WE-42 VFL530 25W

36. 150V SINGLE OUTREACH - WE-42 VFL530 25W

37. 150V SINGLE OUTREACH - WE-42 VFL530 25W

38. 150V SINGLE OUTREACH - WE-42 VFL530 25W

39. 150V SINGLE OUTREACH - WE-42 VFL530 25W

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43. 150V SINGLE OUTREACH - WE-42 VFL530 25W

44. 150V SINGLE OUTREACH - WE-42 VFL530 25W

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48. 150V SINGLE OUTREACH - WE-42 VFL530 25W

49. 150V SINGLE OUTREACH - WE-42 VFL530 25W

50. 150V SINGLE OUTREACH - WE-42 VFL530 25W

51. 150V SINGLE OUTREACH - WE-42 VFL530 25W

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53. 150V SINGLE OUTREACH - WE-42 VFL530 25W

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81. 150V SINGLE OUTREACH - WE-42 VFL530 25W

82. 150V SINGLE OUTREACH - WE-42 VFL530 25W

83. 150V SINGLE OUTREACH - WE-42 VFL530 25W

84. 150V SINGLE OUTREACH - WE-42 VFL530 25W

85. 150V SINGLE OUTREACH - WE-42 VFL530 25W

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87. 150V SINGLE OUTREACH - WE-42 VFL530 25W

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89. 150V SINGLE OUTREACH - WE-42 VFL530 25W

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96. 150V SINGLE OUTREACH - WE-42 VFL530 25W

97. 150V SINGLE OUTREACH - WE-42 VFL530 25W

98. 150V SINGLE OUTREACH - WE-42 VFL530 25W

99. 150V SINGLE OUTREACH - WE-42 VFL530 25W

100. 150V SINGLE OUTREACH - WE-42 VFL530 25W

- NOTES:**
- DRAWING TO BE READ IN CONJUNCTION WITH THE ELECTRICAL SPECIFICATION AND ALL OTHER SERVICES WHICH FORM PART OF THIS PROJECT.
 - PIT SUBGROUNDS INCLUDING DIMENSIONS, COLLARS, REMEDIATION BACKFILL, CONCRETE INCLINING, TIES & BASES, SLOTTING, ETC ARE NORMAL. ONLY AND ARE TO BE PROVIDED AND NOT INSTALLED IN ACCORDANCE WITH THE PIT MANUAL. USED RECOMMENDATIONS TO ADVISORY OFFICER PIT LOADING/CLASS RATING. ENSURE PIT BASE DRAINS TO LOCATION OF DRAINAGE CONDUIT.
 - POWER PITS SHALL BE OF DEPTH REQUIRED TO SUIT ALL CONDUITS SHOWN ON THE DRAWING AND ALL CONDUIT SPACING REQUIREMENTS SHOWN HEREIN. CONDUIT MINIMUM 500mm BELOW FINISHED GROUND LEVEL TO MEET AS/NZS 3000.
 - ALL CABLES ARE TO BE CONCEALED WITHIN THE HOLLOW SHADE STRUCTURE. CABLE PATHS ARE TO BE COORDINATED WITH STRUCTURAL CONTRACTOR TO ENSURE PENETRATIONS BETWEEN CROSS MEMBERS ARE MADE AND DRAW WIRE INSTALLED.
 - CABLE AND CONDUIT PENETRATIONS INTO THE SHADE STRUCTURE ARE TO BE SUITABLY GASKETED AND SEALED TO PREVENT MOISTURE INGRESS.

Dimensions and scales to be checked prior to measuring cable lengths.
 Scale bar only valid for sections of drawing that are as per specified scale.



ISSUED FOR CONSTRUCTION
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 THIS DRAWING IS NOT TO BE USED TO VERIFY EXISTING POWER ASSESSMENT. FOR VERIFICATION FROM APPROVED CONSTRUCTION CONTRACTOR. PLEASE CONTACT JDSI FOR ANY DRAWING CLARIFICATION.

MATCHLINE C REFER DRG E103

REV	DATE	DESIGN	PROJECT	CHECKED	APPROVED	REVISION DESCRIPTION
7	19.03.24	LC	AS	LC		LIGHTING UPDATED TO SUIT NEW LOOKOUT PATH ALIGNMENT
6	08.01.24	LC	AS	LC		SHADE STRUCTURE LIGHTING UPDATED TO SUIT UPDATED LANDSCAPE ARCHITECT LAYOUT
5	24.08.23	LC	AS	LC		DB-1 LOCATION UPDATED AND PPA COMMENTS ADDRESSED
4	21.08.23	LC	AS	LC		CABLE SCHEDULE UPDATED
3	11.08.23	LC	AS	LC		LIGHT POLES AND CONDUIT ROUTES UPDATED
2	16.06.23	DC	AS	LC		REVISED LIGHTING LOCATIONS AND QTY'S
1	04.04.23	DC	AS			NOTE REMOVED FOR CLARITY
0	11.03.23	LC	AS	NPK	NPK	ISSUED FOR CONSTRUCTION
0	30.09.22	LC	BT	NPK	NPK	ISSUED FOR TENDER

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 Level 1, 432 Murray Street, Perth WA 6000
 P: (08) 9227 0595 F: (08) 9227 8617

PILBARA PORTS AUTHORITY

PROJECT:
 SPOILBANK MARINA
 PACKAGE 4 - CIVIL AND LANDSCAPING

DRAWING TITLE:
 PRIVATE LIGHTING RETICULATION
 DESIGN LAYOUT
 SHEET 1 OF 3

DESIGN	LC/TEMPERATO	SCALE	1:500
DESIGNED	LC/TEMPERATO	DRAWN/CHKD	AND/PPA
PROJECT MANAGER	D/HELLMUTH	ISSUED FOR CONSTRUCTION	E102
JDSI PROJECT No.	JDSI4736.0		

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Appendix B: Land side lighting design



LEGEND

CONDUIT

POWER - DISTRIBUTION

POWER - RETICULATION

POWER - LIGHTING

POWER - 2x150mm SPARE

POWER - 4x150mm SPARE

POWER INFRASTRUCTURE

TRANSFORMER

SWITCHBOARD

ACO CABLEMATE TYPE 66 CABLE PIT

ACO CABLEMATE TYPE 99 CABLE PIT

LIGHTING

BOLLARD - WE-EF KTY234 6W

4m SINGLE OUTREACH - WE-EF VFL530 28W

4m SINGLE OUTREACH - WE-EF VFL530-SE 28W

4m DOUBLE OUTREACH - WE-EF VFL530 28W

6m SINGLE OUTREACH - WE-EF VFL530 55W

6m SINGLE OUTREACH - WE-EF VFL540 84W

8m DOUBLE OUTREACH - WE-EF VFL540 84W

BATON LIGHT XXXXXXXXXXXXX

RECESSED WALL MOUNTED - WE-EF QRIB54 12W

DOWNLIGHT - WE-EF FLC121 12W (PIPE CLAMP)

- NOTES:
- DRAWING TO BE READ IN CONJUNCTION WITH THE ELECTRICAL SPECIFICATION AND ALL OTHER SERVICES WHICH FORMS PART OF THIS PROJECT.
 - PIT SURROUNDS INCLUDING DIMENSIONS, COLLARS, REINFORCING, BACKFILL, CONCRETE ENCASING (SIDE & BASE), BEDDING, ETC. ARE NOMINAL ONLY AND ARE TO BE PROVED AND INSTALLED IN ACCORDANCE WITH THE PIT MANUFACTURERS RECOMMENDATIONS TO ACHIEVE SPECIFIC PIT LOADING/CLASS RATING. ENSURE PIT BASE DRAINS TO LOCATION OF DRAINAGE CONDUIT.
 - POWER PITS SHALL BE OF DEPTH REQUIRED TO SUIT ALL CONDUITS SHOWN ON THE DRAWING AND ALL CONDUIT SPACING REQUIREMENTS SHOWN HERE IN. CONDUIT MINIMUM 500mm BELOW FINISHED GROUND LEVEL TO MEET AS/NZS 3000.
 - ALL CABLING IS TO BE CONCEALED WITHIN THE HOLLOW SHADE STRUCTURE. CABLE PATHS ARE TO BE COORDINATED WITH STRUCTURAL CONTRACTOR TO ENSURE PENETRATIONS BETWEEN CROSS MEMBERS ARE MADE AND DRAW WIRE INSTALLED.
 - CABLE AND CONDUIT PENETRATIONS INTO THE SHADE STRUCTURE ARE TO BE SUITABLY GLANDED AND SEALED TO PREVENT MOISTURE INGRESS.

Dimensions and scales to be checked prior to measuring cable lengths.
(Scale bar only valid for sections of drawing that are as per specified scale)

0 5 10 20 30m
SCALE 1:500 @ ORIGINAL SHEET SIZE A1

NO DESIGN CHANGES

WITHOUT MANAGER'S APPROVAL

NO CHANGES TO DESIGN UNLESS APPROVED BY DESIGN MANAGER

ISSUED FOR CONSTRUCTION

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H	7	19.03.24	LC	AS	LC	-	LIGHTING UPDATED TO SUIT NEW LOOKOUT PATH ALIGNMENT	COPYRIGHT This drawing is copyright and the property of JDSI Pty Ltd (JDSI). Use without written permission from JDSI constitutes an infringement of copyright. This document and the information are solely for the use of the authorised recipient and may not be used, copied or reproduced in whole or part for any purpose other than that for which it was supplied by JDSI. NOTE This drawing shall be preliminary only until it is issued for Construction. Certified Quality System to ISO 9001	 Level 1, 432 Murray Street, Perth WA 6000 P: (08) 9227 0595 F: (08) 9227 8617		CLIENT:	PROJECT:	DRAWN	WAPC No.
	6	08.01.24	LC	AS	LC	-	SHADE STRUCTURE LIGHTING UPDATED TO SUIT UPDATED LANDSCAPE ARCHITECT LAYOUT.				L.CONTEMPRATO	DESIGNED	SCALE ● A1	
	5	24.08.23	LC	AS	LC	-	DB1-1 LOCATION UPDATED AND PPA COMMENTS ADDRESSED.				L.CONTEMPRATO	1:500		
	4	21.08.23	LC	AS	LC	-	CABLE SCHEDULE UPDATED				PROJECT MANAGER	DATUM/COORD	HP REFERENCE	
	3	11.08.23	LC	AS	LC	-	LIGHT POLES AND CONDUIT ROUTES UPDATED				D.HELLMUTH	AHD/PHG94	NA	
	2	16.06.23	DC	AS	LC	-	REVISED LIGHTING LOCATIONS AND QTY'S				JDSI PROJECT No.	DRAWING No.	REVISION	
	1	04.04.23	DC	AS	-	-	NOTE REMOVED FOR CLARITY				JDS14736.0	E102	7	
	0	31.03.23	LC	AS	NMcK	NMcK	ISSUD FOR CONSTRUCTION							
	G	30.09.22	LC	BT	NMcK	NMcK	ISSUED FOR TENDER							
	REV		DATE	DRAWN	PROJECT REVIEW	CHECKED	APPROVED				REVISION DESCRIPTION			
1						2								
3						4								
5						6								
7						8								
9						10								
11						12								

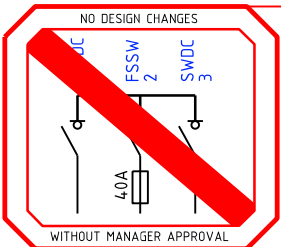
NOTES:

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- POWER PITS SHALL BE OF DEPTH REQUIRED TO SUIT ALL CONDUITS SHOWN ON THE DRAWING AND ALL CONDUIT SPACING REQUIREMENTS SHOWN HERE IN. CONDUIT MINIMUM 500mm BELOW FINISHED GROUND LEVEL TO MEET AS/NZS 3000.

FUTURE JETTY DB
(BY WORKS PACKAGE 3
CONTRACTOR)

LEGEND	
CONDUIT	
POWER - DISTRIBUTION	---
POWER - RETICULATION	---
POWER - LIGHTING	---
POWER - 2x150mm SPARE	---
POWER - 4x150mm SPARE	---
POWER INFRASTRUCTURE	
TRANSFORMER	Ⓣ
SWITCHBOARD	⬢
ACO CABLEMATE TYPE 66 CABLE PIT	□
ACO CABLEMATE TYPE 99 CABLE PIT	⊠
LIGHTING	
BOLLARD - WE-EF KTY234 6W	⊗
4m SINGLE OUTREACH - WE-EF VFL530 28W	Ⓛ
4m SINGLE OUTREACH - WE-EF VFL530-SE 28W	Ⓛ
4m DOUBLE OUTREACH - WE-EF VFL530 28W	Ⓛ
6m SINGLE OUTREACH - WE-EF VFL530 55W	Ⓛ
6m SINGLE OUTREACH - WE-EF VFL540 84W	Ⓛ
8m DOUBLE OUTREACH - WE-EF VFL540 84W	Ⓛ
BATON LIGHT XXXXXXXXXXXXX	◇
RECESSED WALL MOUNTED - WE-EF QRI354 12W	Ⓛ
DOWNLIGHT - WE-EF FLC121 12W (PIPE CLAMP)	Ⓛ

Dimensions and scales to be checked prior to measuring cable lengths.
(Scale bar only valid for sections of drawing that are as per specified scale)



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7	19.03.24	LC	AS	LC	-	LIGHTING UPDATED TO SUIT NEW LOOKOUT PATH ALIGNMENT
6	08.01.24	LC	AS	LC	-	SHADE STRUCTURE LIGHTING UPDATED TO SUIT UPDATED LANDSCAPE ARCHITECT LAYOUT.
5	24.08.23	LC	AS	LC	-	DB1-1 LOCATION UPDATED AND PPA COMMENTS ADDRESSED.
4	21.08.23	LC	AS	LC	-	CABLE SCHEDULE UPDATED
3	11.08.23	LC	AS	LC	-	LIGHT POLES AND CONDUIT ROUTES UPDATED
2	16.06.23	DC	AS	LC	-	REVISED LIGHTING LOCATIONS AND QTY'S
1	04.04.23	DC	AS	-	-	NOTE REMOVED FOR CLARITY
0	31.03.23	LC	AS	NMcK	NMcK	ISSUED FOR CONSTRUCTION
G	30.09.22	LC	BT	NMcK	NMcK	ISSUED FOR TENDER
REV	DATE	DRAWN	PROJECT REVIEW	CHECKED	APPROVED	REVISION DESCRIPTION
1						
2						
3						
4						
5						
6						
7						

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PILBARA PORTS AUTHORITY

PROJECT:
SPOILBANK MARINA
PACKAGE 4 - CIVIL AND LANDSCAPING
DRAWING TITLE:
PRIVATE LIGHTING RETICULATION
DESIGN LAYOUT
SHEET 2 OF 3

DRAWN L.CONTEMPRATO	WAPC No.	
DESIGNED L.CONTEMPRATO	SCALE Ⓢ A1 1:500	
PROJECT MANAGER D.HELLMUTH	DATUM/COORD AHD/PHG94	HP REFERENCE NA
JDSI PROJECT No. JDS14-736.0	DRAWING No. E103	REVISION 7

1	2	3	4	5	6	7	8	9	10	11	12
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- NOTES:



0 5 10 20 30m
SCALE 1:500 @ ORIGINAL SHEET SIZE A1

WITHOUT MANAGER APPROVAL

H	4
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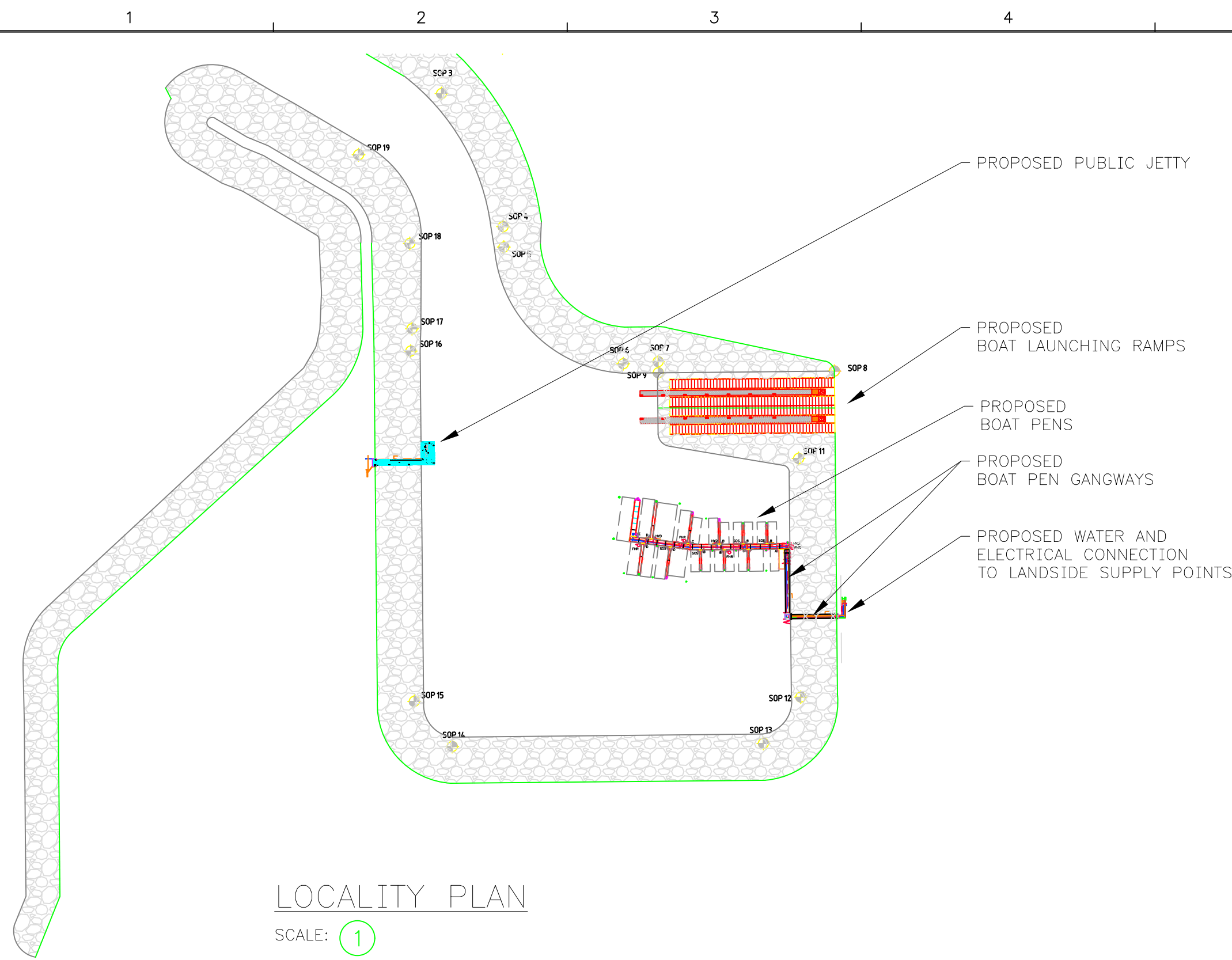


PROJECT: SPOILBANK MARINA
PACKAGE 4 - CIVIL AND LANDSCAPING
DRAWING TITLE: PRIVATE LIGHTING RETICULATION
DESIGN LAYOUT
SHEET 3 OF 3

DRAWN		WAPC No.	
L.CONTEMPRATO			
DESIGNED		SCALE $\text{A} \quad 1$	
L.CONTEMPRATO		1:500	
PROJECT MANAGER		DATUM/COORD	HP REFERENCE
D.HELLMUTH		AHD/PHG94	NA
JDS: PROJECT No.		DRAWING No.	REVISION
JDS14736.0		E104	7

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Appendix C: Marine side lighting design



LOCALITY PLAN

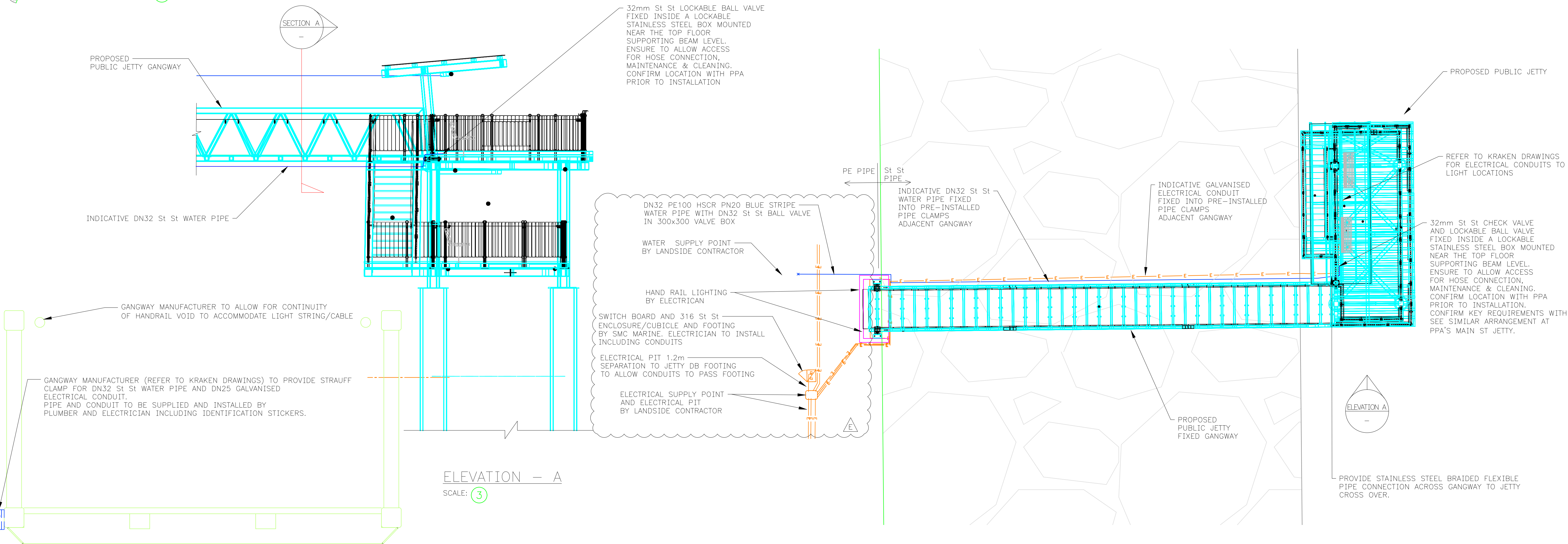
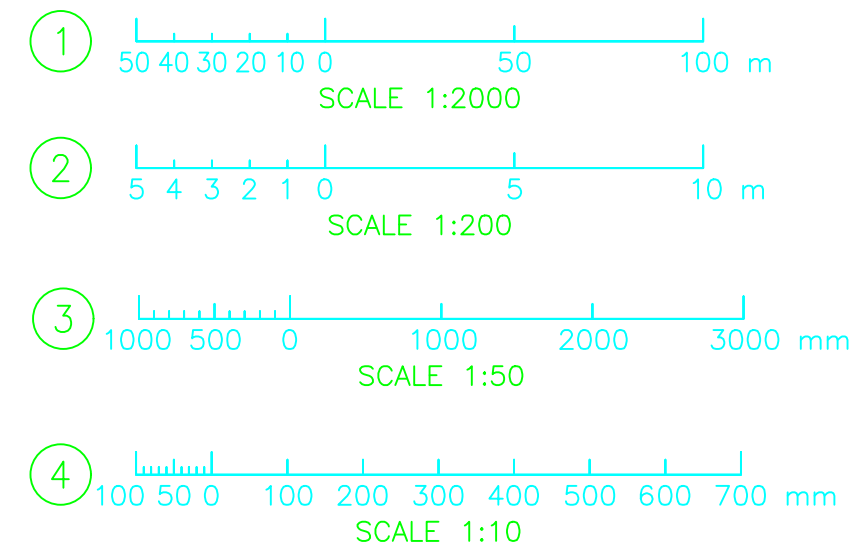
SCALE: ①

- NOTES:
1. SETOUT
 - 1.1. PRIOR TO CONSTRUCTION, CONFIRM THE SETOUT ONSITE.
 - 1.2. REPORT ANOMALIES TO THE SUPERINTENDENT.
 - 1.3. WATER PIPE ALIGNMENTS ARE SHOWN SCHEMATICALLY.
 2. STANDARDS
 - 2.1. ALL WORK SHALL BE UNDERTAKEN IN ACCORDANCE WITH THE PROJECT SPECIFICATIONS AND CURRENT AUSTRALIAN STANDARDS.
 - 2.2. ALL CONTRACTORS WORKING ON THE POTABLE WATER INFRASTRUCTURE SHALL ENSURE THEY OWN OR HAVE ACCESS TO AS/NZS 3500, AS/NZS 3004, AS 2419, AS 2441, AS 3962
 - 2.3. ALL MATERIALS AND COMPONENTS SHALL BE MANUFACTURED IN ACCORDANCE WITH THE RELEVANT AUSTRALIAN STANDARDS.
 - 2.4. COMPONENTS WHICH COME IN CONTACT WITH POTABLE WATER SHALL COMPLY WITH AS/NZS 4020:2018. PROVIDE MSDS AND DATA SHEETS TO SMC FOR DELIVERY TO PPA.
 3. PIPES AND FITTINGS ONSHORE
 - 3.1. POTABLE WATER PIPES ON SHORE BELOW GROUND AND FITTINGS SHALL BE DN32 PE100 HSCR PN20 SDR 9 "BLUE STRIPE" MANUFACTURED IN ACCORDANCE WITH AS/NZS 4130
 - 3.2. BENDS AND JOINTS SHALL BE ELECTROFUSION WELDED JOINTS OF NOT LESS THAN PN16 RATING.
 4. PIPES AND FITTINGS GANGWAYS
 - 4.1. POTABLE WATER PIPES AND FITTINGS SHALL BE STAINLESS STEEL DN32 316L SCH40 PRESSURE RATED PIPE WITH FLANGES TO AS4087 FOR CONNECTION TO OTHER PIPE MATERIALS AND PRESS FITTINGS FOR STRAIGHT JOINTS. STAINLESS STEEL PIPE SHALL COMPLY WITH ASTM A312
 - 4.2. PIPES AND FITTINGS USED FOR WATER CONVEYANCE SHALL HAVE A PREN ≥22
 - 4.3. GASKETS TO BE EPDM IN ACCORDANCE WITH WATER CORPORATION DS38-02
 5. FLEXIBLE PIPE
 - 5.1. PROVIDE FLEXIBLE PIPE AT LOCATIONS WHERE GANGWAYS IMPART MOVEMENT INTO THE PIPES. LOCATIONS ARE INDICATED WITHIN THE DRAWINGS AND ARE TO BE VERIFIED ON SITE.
 - 5.2. IF ADDITIONAL FLEXIBLE JOINTS ARE REQUIRED, INFORM THE SUPERINTENDENT PRIOR TO CONSTRUCTION.
 - 5.3. REFER TO MANUFACTURER'S FLEXIBLE PIPE ARRANGEMENT FOR

- 5.4. INSTALLATION REQUIREMENTS. E.G. PIRTEK 316L St St FLANGES, CIRCULAR CLAMPS, ETC. ARE TO BE UTILISED TO CONNECT BETWEEN FLEXIBLE PIPE AND PE PIPE.
 - 5.5. FLEXIBLE PIPE PRESSURE RATING SHALL BE NOT LESS THAN THE PIPES TO WHICH THEY ARE CONNECTED.
 - 5.6. FLEXIBLE PIPE SHALL HAVE A STAINLESS STEEL BRAIDED SLEEVE.
6. INSTALLATION ADJACENT GANGWAYS
 - 6.1. REFER TO KRAKEN DRAWINGS FOR PRE-INSTALLED STRAUFF CLAMPS.
 - 6.2. ENSURE PIPE CLAMPS PROVIDED BY THE PLUMBER AND ELECTRICIAN ON THE JETTY ARE ACCESSIBLE FOR MAINTENANCE.
 - 6.3. PROVIDE THE SUPERINTENDENT/PPA WITH DETAILS OF PROPOSED BALL VALVES AND LOCKABLE CABINET/BOX PRIOR TO PROCUREMENT AND OBTAIN APPROVAL TO PURCHASE.
 7. DISINFECTION AND PRESSURE TESTING
 - 7.1. THE CONSTRUCTOR SHALL PRODUCE I.T.P.s, SUBMIT TO THE SUPERINTENDENT FOR APPROVAL, AND UNDERTAKE PRESSURE TESTING WITH DISINFECTED WATER IN ACCORDANCE WITH AS/NZS 3500 AND AS 2419 TO PROVE THE INSTALLATION IS FREE OF LEAKS. RELEASE WATER PRESSURE AFTER SUCCESSFUL TESTING.
 - 7.2.
 8. ELECTRICAL CERTIFICATE
 - 8.1. THE ELECTRICAL CERTIFICATE SHALL BE PROVIDED BY THE ELECTRICIAN WHEN WORKS ARE COMPLETED AND READY FOR COMMISSIONING.
 9. LICENSES
 - 9.1. ALL WORKS SHALL BE UNDERTAKEN AND CERTIFIED BY A LICENSED PLUMBER AND ELECTRICIAN.
 10. AVOIDANCE OF CORROSION
 - 10.1. PROVIDE PE SHEET, PE SLEEVE AND ELECTRICAL INSULATION BOLT AND WASHER KITS AS APPROPRIATE BETWEEN DISSIMILAR METALS TO AVOID GALVANIC REACTIONS. E.G. St St AND STEEL, STEEL AND COPPER, STEEL AND ALUMINIUM ETC.
 - 10.2. ALL NUTS, WASHERS, BOLTS AND STEEL FLANGES ARE TO BE HOT DIP GALVANISED WHERE LOCATED ON SHORE.
 - 10.3. ALL NUTS WASHERS, BOLTS AND STEEL FLANGES ARE TO BE 316L St St WHERE LOCATED OFF SHORE.
 - 10.4. ALL NUTS AND BOLTS BELOW GROUND ARE TO BE WRAPPED IN DENSO 4 STEP SYSTEM.



THIS DRAWING HAS BEEN DOCUMENTED IN COLOUR
THIS DRAWING MUST BE PRINTED IN COLOUR
FAILURE TO DO SO MAY RESULT IN LOSS OF INFORMATION
BLACK & WHITE PRINTS MAY ONLY BE USED IF SPECIFIC BLACK & WHITE DOCUMENTS HAVE BEEN OBTAINED FROM THE DESIGN ENGINEER.



ELEVATION - A

SCALE: ③

GANGWAY MANUFACTURER TO ALLOW FOR CONTINUITY OF HANDRAIL VOID TO ACCOMMODATE LIGHT STRING/CABLE

GANGWAY MANUFACTURER (REFER TO KRAKEN DRAWINGS) TO PROVIDE STRAUFF CLAMP FOR DN32 St St WATER PIPE AND DN25 GALVANISED ELECTRICAL CONDUIT. PIPE AND CONDUIT TO BE SUPPLIED AND INSTALLED BY PLUMBER AND ELECTRICIAN INCLUDING IDENTIFICATION STICKERS.

SECTION - A

SCALE: ④

SITE PLAN

SCALE: ②

566	E	10/2023		ADJUSTMENTS TO SUIT PPA LAND SIDE DESIGN & COND'	DK	DK	DK	DESIGN SURVEY —	VERTICAL DATUM AHD	DES CALC —	NORTH POINT 		www.aie-australia.com 18 EDGAR ST, PORT HEADLAND, WA, 6721	RECOMMENDED SEBASTIAN MASSET 22–11–2022 SENIOR ENGINEER	SPOIL BANK MARINA DEVELOPMENT PUBLIC JETTY POTABLE WATER RETICULATION LOCALITY AND SITE PLAN	FILE —	PLAN	CAD	ISSUE	ORIGINAL SHEET SIZE A1			
	D	8/2023		ADJUSTMENTS TO SUIT PPA LANDSIDE DESIGN	DK	DK	DK														ASCON SURVEY —	DES REF —	DRN D.KELLY Q.C. CHD —
	C	12/2022		ADJUSTMENTS TO SUIT PPA FEEDBACK	DK	SM	DK																
	B	11/2022		ADJUSTMENTS TO SUIT PPA FEEDBACK	DK	SM	DK																
	A	5/2022		ORIGINAL ISSUE	DK	SJ	DK																
ISSUE	DATE	GRID	REVISION			DRN	REC	APPD															

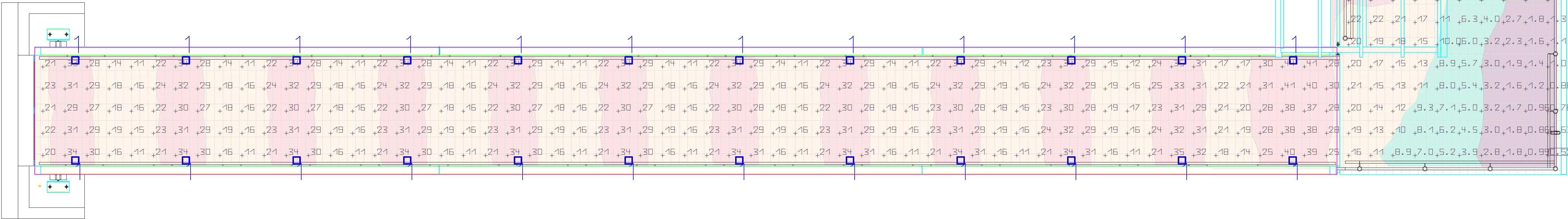
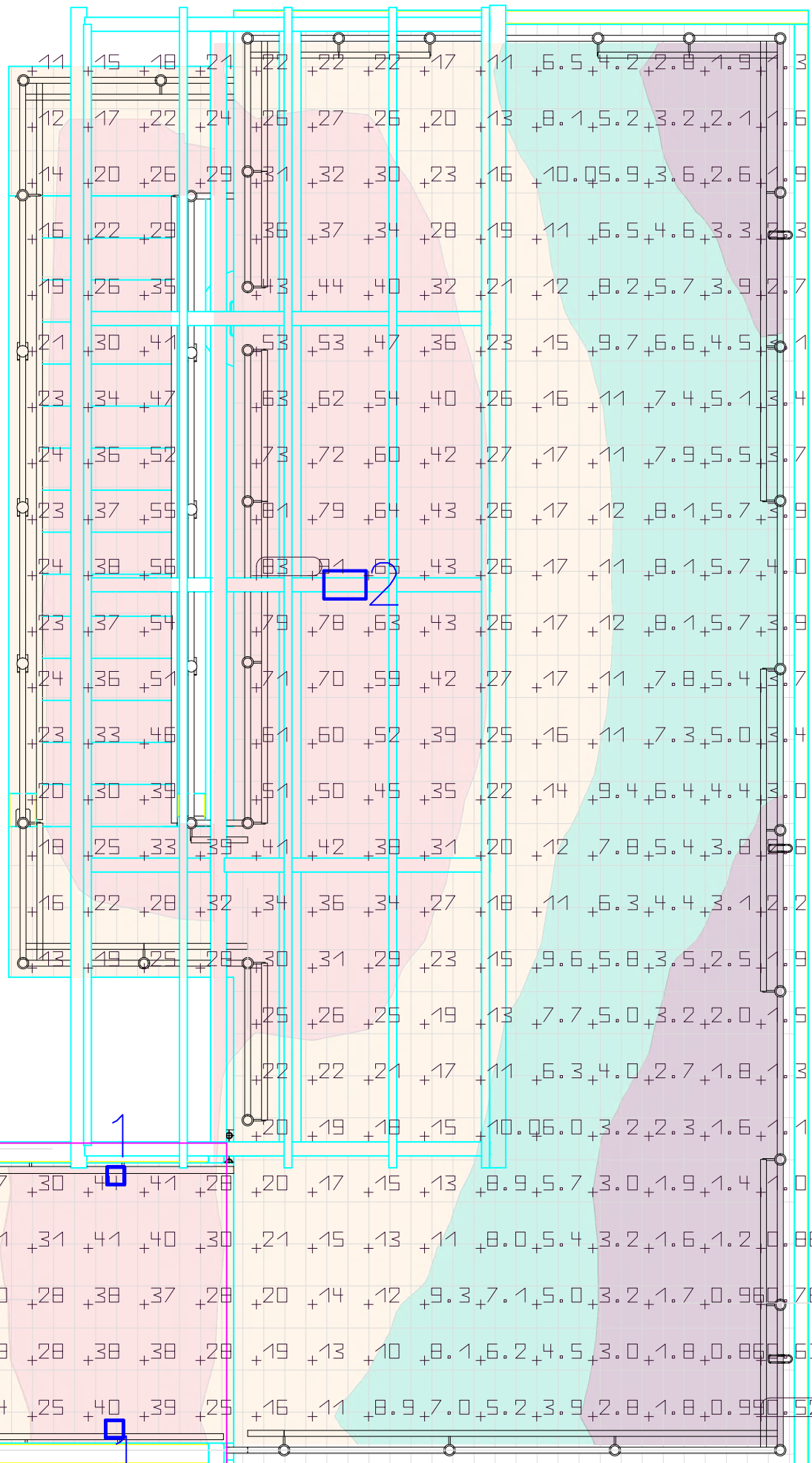
LUX LEGEND	
	30+ LUX
	10–30 LUX
	3–10 LUX
	0.5–3 LUX



- NOTES:
1. THE DESIGN HAS FOLLOWED THE NATIONAL LIGHT POLLUTION GUIDELINES FOR WILDLIFE (DCCCEW)
 2. THE PEDESTRIAN MARINA PATHWAYS ARE ASSESSED IN COMPLIANCE WITH AS/NZS 1158.3.1:2020, PARTICULARLY SUBCATEGORY PP3.
 3. CALCULATIONS ARE SUBJECT TO ACCURACIES AND TOLERANCES NOMINATED IN AUSTRALIAN AND NEW ZEALAND STANDARDS AS/NZS 3827.1:1998 AND AS/NZS 3827.2:1998.
 4. ALL KLIK SYSTEMS HANDRAIL LEDS ARE SPACED 2m APART, UNLESS OTHERWISE SPECIFIED.
 5. REFER TO NEN021-000-ELE-PLN-002 FOR LAYOUT INFORMATION

Light Technical Parameters (Site 1)										
#	Name	Parameter	Min	Max	Average	Min/average	Min/max	Category PP3 Min	Category PP3 Average	Category PP3 Result
1	Calculation Surface 1 – Gangway	Perpendicular illuminance	11.4 lx	44.9 lx	23.9 lx	0.48	0.25	0.5 lx	3 lx	PASS
2	Calculation Surface 2 – Platform	Perpendicular illuminance	0.56 lx	82.9 lx	19.8 lx	0.028	0.007	0.5 lx	3 lx	PASS

Luminaire list (Site 1)								
Index	Manufacturer	Description	Item number	Fitting	Luminous flux	Maintenance factor	Connected load	Quantity
1	Klik Systems	Handrail Lighting – LPOD50–Dir–PCLens–AsymRefW–LP OD–500mA–Amber–PC–0.025m–4 51794–A	LPOD50	1x LPOD–500mA–Amber–PC	99 lm	0.80	1.9 W	24
2	Dialight	Stairway Light – Bulkhead, Clear Lens, Wide, 3klm, Amber, BBU	BxE4UAG3xxxxxN	1x	2145 lm	0.80	27 W	1



A	15/7/22		ORIGINAL DRAWING	RLG	MW	NW	DESIGN SURVEY —	VERTICAL DATUM AHD	DES CALC NEN	NORTH POINT	 ENGINEERING AND CONSTRUCTION MANAGEMENT PTY LTD	WEBSITE: www.aie-australia.com ADDRESS: 18 EDGAR ST, PORT HEADLAND, WA, 6721	RECOMMENDED	RAPH LA GRECA 04—10—2023	SPOIL BANK MARINA DEVELOPMENT FISHING JETTY LIGHTING ASSESSMENT (UPPER LEVEL)	ORIGINAL SHEET SIZE A1	
B	3/10/23		LIGHTING REASSESSED	IN	RLG	NW		COORDINATE SYS MGA2020—50	DES CHD NEN				ELECTRICAL ENGINEER	APPROVED			NERISSA WOOD 04—10—2023
ISSUE	DATE	GRID	REVISION	DRN	REC	APPD	ASCON SURVEY —	DES REF —	DRN NEN Q.C. CHD NEN				PRINCIPAL ENGINEER	PROJECT AU22—049	NEN021—000—ELE—LGT—002	B	

- NOTES:
1.

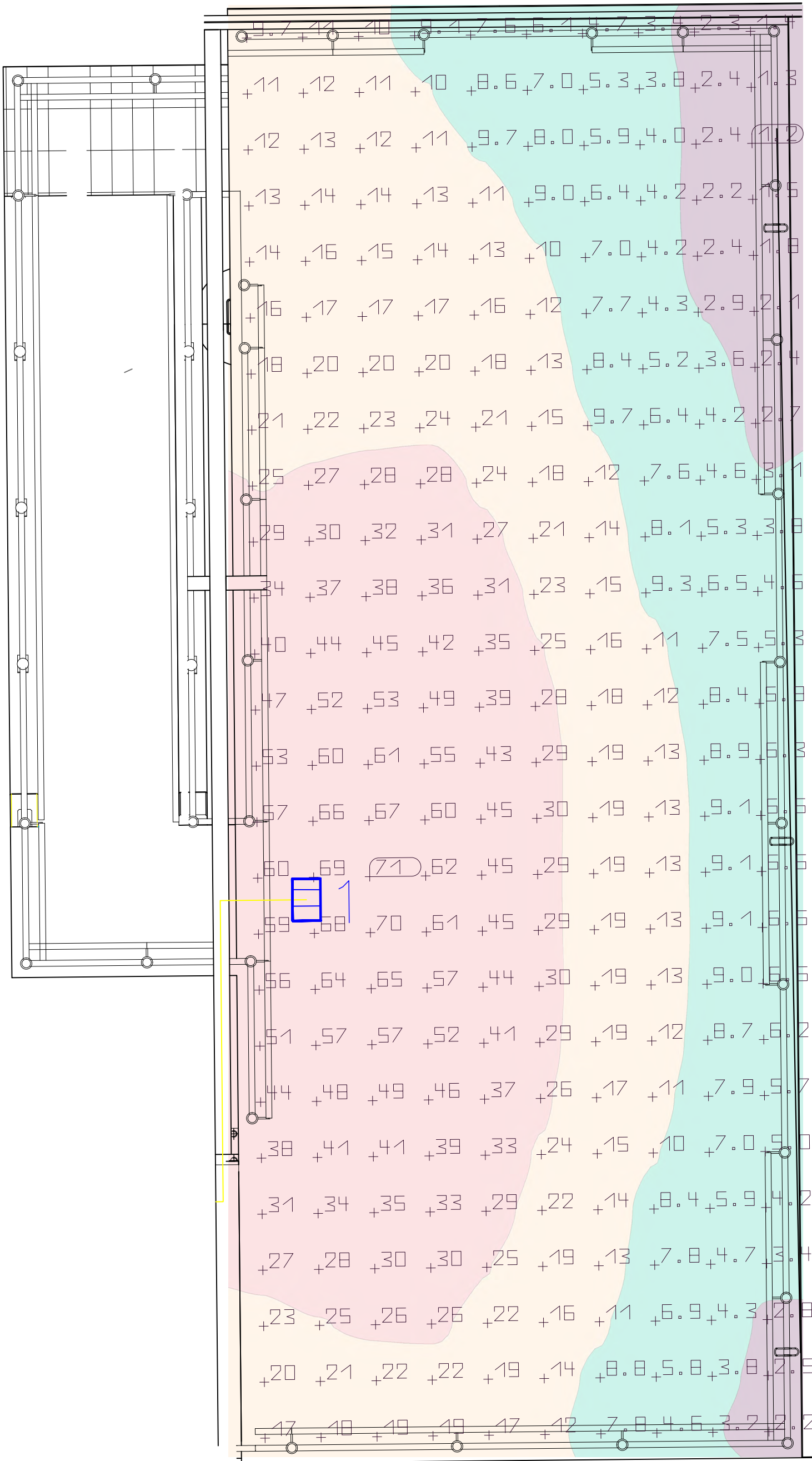
THE DESIGN HAS FOLLOWED THE NATIONAL LIGHT POLLUTION GUIDELINES FOR WILDLIFE (DCCCEW)
2.

THE PEDESTRIAN MARINA PATHWAYS ARE ASSESSED IN COMPLIANCE WITH AS/NZS 1158.3.1:2020, PARTICULARLY SUBCATEGORY PP3.
3.

CALCULATIONS ARE SUBJECT TO ACCURACIES AND TOLERANCES NOMINATED IN AUSTRALIAN AND NEW ZEALAND STANDARDS AS/NZS 3827.1:1998 AND AS/NZS 3827.2:1998.
4.

ALL KLIK SYSTEMS HANDRAIL LEDS ARE SPACED 2m APART, UNLESS OTHERWISE SPECIFIED.
5.

REFER TO NEN021-000-ELE-PLN-002 FOR LAYOUT INFORMATION

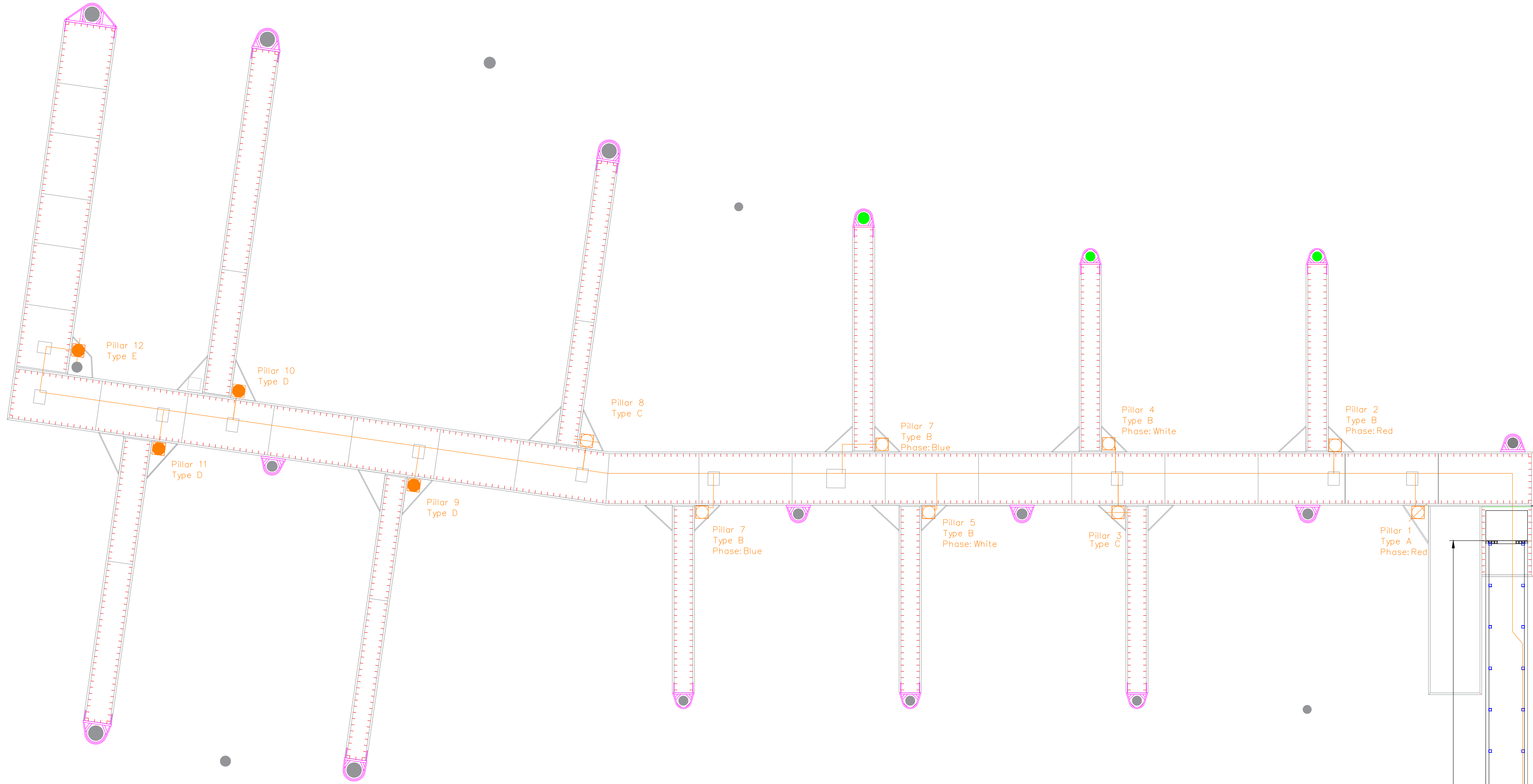


LUX LEGEND	
	30+ LUX
	10-30 LUX
	3-10 LUX
	0.5-3 LUX

Light Technical Parameters (Site 1)										
#	Name	Parameter	Min	Max	Average	Min/average	Min/max	Category PP3 Min	Category PP3 Average	Category PP3 Result
1	Calculation Surface Lower Fishing Jetty	Perpendicular illuminance	1.25 lx	70.9 lx	21.3 lx	0.059	0.018	0.5 lx	3 lx	PASS

Luminaire list (Site 1)								
Index	Manufacturer	Description	Item number	Fitting	Luminous flux	Maintenance factor	Connected load	Quantity
1	Dialight	Stairway Light – Bulkhead, Clear Lens, Wide, 3klm, Amber, BBU	BxE4UAG3xxxxxN	1x	2145 lm	0.80	27 W	1

566	A	15/7/22		ORIGINAL DRAWING		RLG	MW	NW	DESIGN SURVEY —	VERTICAL DATUM AHD	DES CALC NEN	NORTH POINT	 ENGINEERING AND CONSTRUCTION MANAGEMENT PTY LTD WEBSITE: www.aie-australia.com ADDRESS: 18 EDGAR ST, PORT HEADLAND, WA, 6721	RECOMMENDED		SPOIL BANK MARINA DEVELOPMENT FISHING JETTY LIGHTING ASSESSMENT (LOWER LEVEL)			ORIGINAL SHEET SIZE
	B	3/10/23		LIGHTING REASSESSED		IN	RLG	NW		COORDINATE SYS MGA2020—50	DES CHD NEN			RAPH LA GRECA 04—10—2023	SENIOR ENGINEER				
									ASCON SURVEY —	DES REF —	DRN NEN	APPROVED							
											Q.C. CHD NEN	NERISSA WOOD 04—10—2023		PRINCIPAL ENGINEER					
	ISSUE	DATE	GRID	REVISION		DRN	REC	APPD							PROJECT	AU22—049	NEN021—000—ELE—LGT—002	CAD	
																B			



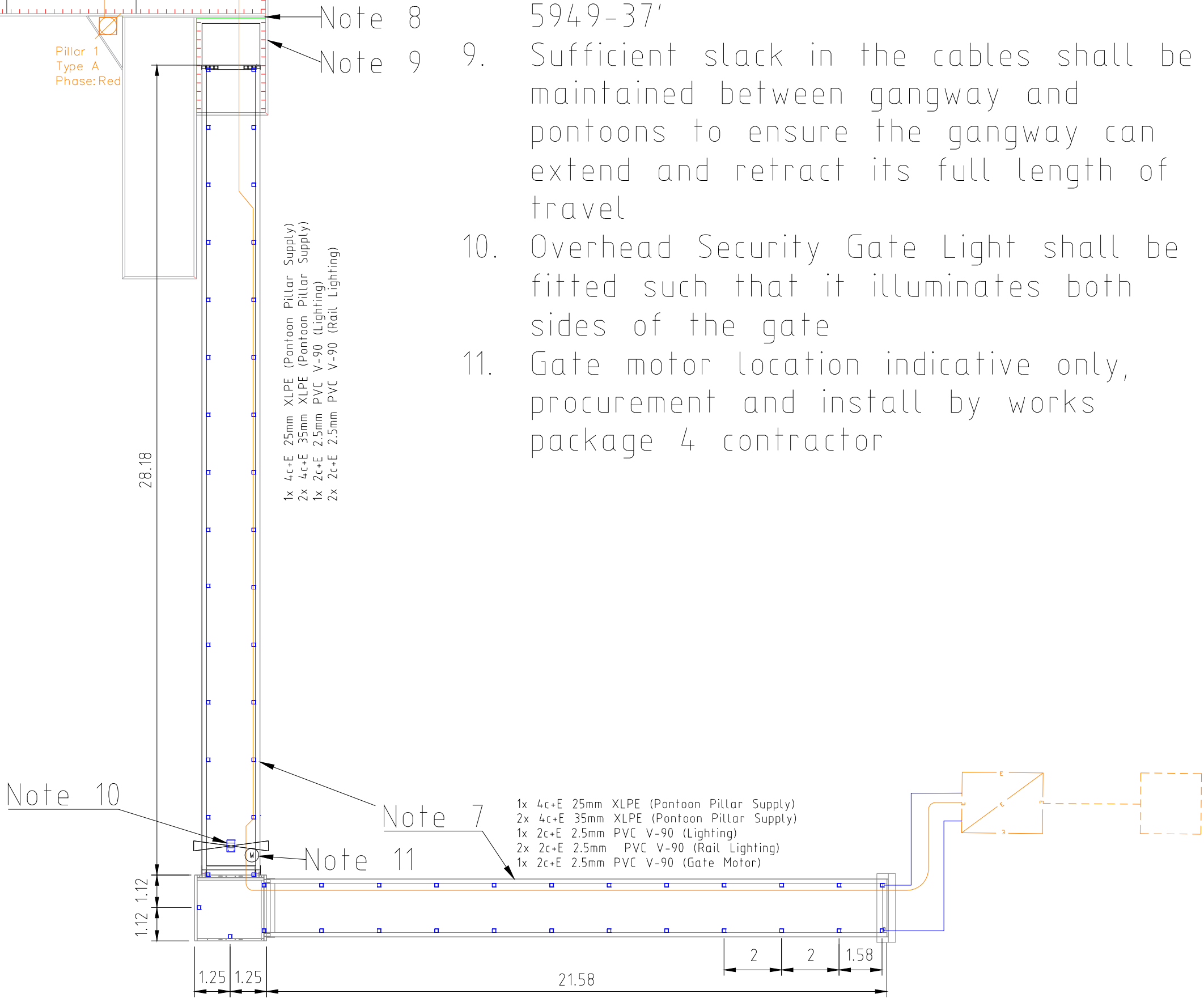
- Note:
- Pillars connected using cable tails supplied by vendor in pillar base.
 - Type A & B Pillars only have single phase connection - follow phase allocation specified in diagram
 - PE cell mounted externally on switchboard
 - Refer to Single Line Diagram NEN021-000-ELE-SLD-001 for Wiring Information
 - Refer to NEN021-000-ELE-LGT-001 for Lighting Assessment
 - Cables shall be selected and enclosed in conduit as per AS 3004 Clause 2.1
 - Conduit shall run on cable tray below gangway
 - Pontoon cables shall run via 150 I.D. PVC Pipe as per 'BOAT MOORING PEN CONCRETE ABUTMENT Drawing No. 5949-37'
 - Sufficient slack in the cables shall be maintained between gangway and pontoons to ensure the gangway can extend and retract its full length of travel
 - Overhead Security Gate Light shall be fitted such that it illuminates both sides of the gate
 - Gate motor location indicative only, procurement and install by works package 4 contractor

Cable Schedule

Cable	Description	Total Length
2c+E 2.5mm PVC V-90	Handrail Lighting Supply Cables	140m
2c+E 2.5mm PVC V-90	Gate Motor Supply Cables	35m
2c+E 2.5mm PVC V-90	Batten and Marine Pillar Lighting Supply Cables	230m
4c+E 25mm XLPE	Pontoon Power Supply Cables	170m
4c+E 35mm XLPE	Pontoon Power Supply Cables	315m

Equipment Schedule

Equipment	Symbol	Description	Quantity
L1		Overhead Security Gate Light	1
L2		Gangway Handrail Light String 1 (28 LEDs)	1
L3		Gangway Handrail Light String 2 (28 LEDs)	1
PILLAR A		1x15A SOCKETS	1
PILLAR B		2x15A SOCKETS	5
PILLAR C		2x15A, 1x32A SOCKETS	2
PILLAR D		2x15A, 2x32A SOCKETS	3
PILLAR E		1x15A, 1x32A SOCKETS	1
GATE MOTOR		Beninca BILL40M (by others)	1

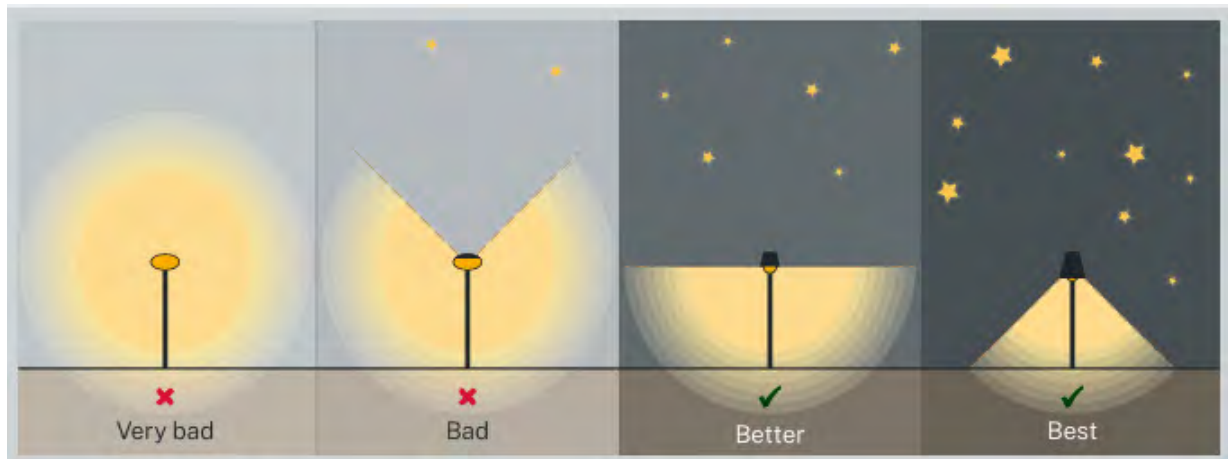


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Appendix D: Lighting terminology and definitions

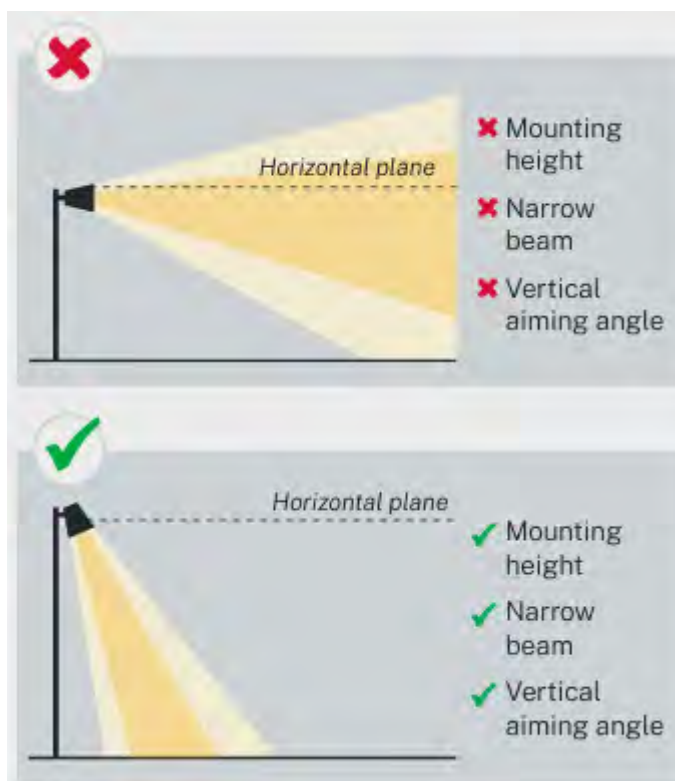
Shielding

Refers to the amount of light contained under an opaque shield. Shielding can range from no shielding (left) where light scatters upwards into the sky, to fully shielded (right) where all light is directed downwards, and no light is lost above the horizontal.



Directionality

Refers to the vertical aiming angle of the light relative to the horizontal plane. Lights should be mounted as low as possible, aimed downwards and use the narrowest beam angle possible.



Correlated Colour Temperature (CCT)

CCT refers to the 'warmth' of a light, generally the higher the CCT the brighter and whiter the light and the more blue content there is. The lower the CCT, the more orange or yellow the light and the less blue content. The temperature of the lights are measures in Kelvin (K).



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Appendix F Spoilbank Marina Cemetery Beach SMP 2025 Report



R2078 Rev 0

July 2025

Department of Transport

**EPBC 2019/8520 Spoilbank Marina Cemetery
Beach SMP 2025 Report**

marinas

boat harbours

canals

breakwaters

jetties

seawalls

dredging

reclamation

climate change

waves

currents

tides

flood levels

water quality

siltation

erosion

rivers

beaches

estuaries

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K2215, Report R2078 Rev 0

Record of Document Revisions

Rev	Purpose of Document	Prepared	Reviewed	Approved	Date
A	Draft for MRA review	M Peterson	J Costin	C Doak	03/07/25
0	Issued to Client	J Costin	C Doak	C Doak	03/07/25
1	Re-issued with minor changes	C Doak		C Doak	10/07/25

Form 035 18/06/2013

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1. Introduction

The Department of Transport (DoT) assumed the role of marina managers for the Spoilbank Marina in Port Hedland in 2024. The Spoilbank Marina is a recreational boating and waterfront precinct constructed on the western shoreline of the Spoilbank. The marina became operational in late 2023. Landscape works finished in mid to late 2024. A layout plan for the marina development is provided in Figure 1.1.

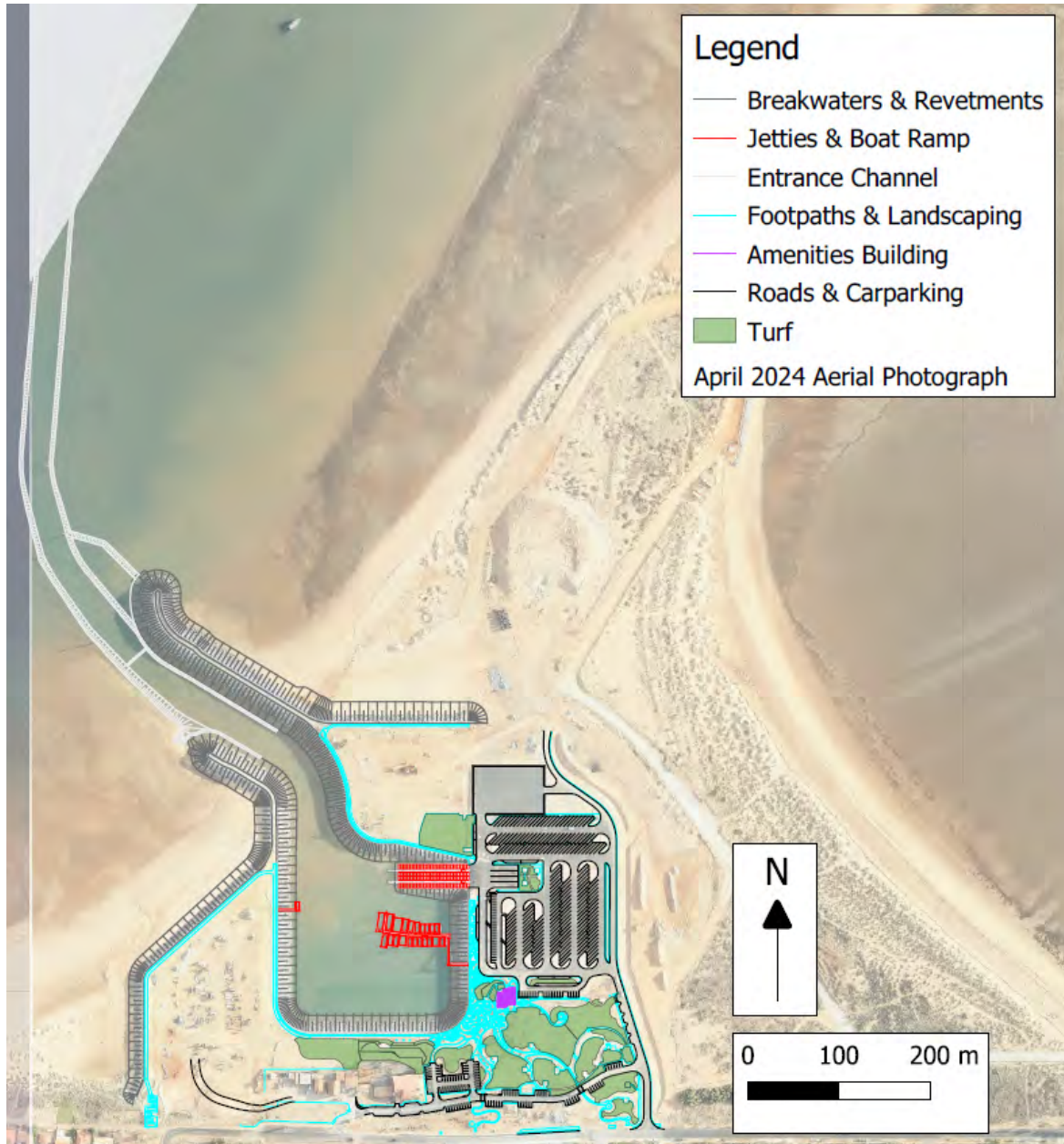


Figure 1.1 Spoilbank Marina Layout

1.1 Environmental Approval

Environmental approval for the project is outlined in the Australian Government, Department of Climate Change, Energy, the Environment and Water approval for the Port Hedland Spoilbank Marina (EPBC 2019/8520).

A number of conditions are included in EPBC 2019/8520, including requirements related to the protection of Flatback Turtle nesting at Cemetery Beach and for the preparation of a Sediment Management Plan (SMP) that ensures anthropogenic activities of the action do not result in, or contribute to, the denuding of Cemetery Beach.

1.2 EPBC 2019/8520 Port Hedland Spoilbank Marina Cemetery Beach Sediment Management Plan

To satisfy the relevant conditions of EPBC 2019/8520 Pilbara Ports Authority, the agency that managed the design and construction of the Marina, engaged M P Rogers & Associates (MRA) to prepare the *EPBC 2019/8520 Port Hedland Spoilbank Marina Cemetery Beach Sediment Management Plan* (MRA 2024a).

This SMP outlined various coastal monitoring requirements and subsequent management actions to ensure that the construction and operation of the Spoilbank Marina would not result in, or contribute to, the denuding of sediment from Cemetery Beach. Importantly, the plan focused on the identification of changes to coastal process and sediment transport pathways that are the result of, or contributed to by, the Spoilbank Marina.

The SMP includes the following elements.

- Aerial topographic surveys of the coastline in the vicinity of the Seawall, Cemetery Beach and Spoilbank.
- Beach profiles 'cut' from the aerial topographic survey.
- Photographic monitoring.
- Shoreline mapping using ortho-rectified aerial photographs.
- Post cyclone monitoring.
- Assessment of shoreline changes against triggers.
 - Trigger 1: Where the observed rate of recession of the shoreline or beach profile on Cemetery Beach is greater than 5 m plus the assessed rate of long term shoreline recession (approximately 0.7 m/yr) as measured from the baseline survey location, or assessed by an experienced coastal engineer, further investigation will be required to ascertain the potential cause of the erosion.
 - Trigger 2: Where the observed shoreline movement outside of Cemetery Beach is significantly different to the expected shoreline changes (approximately greater than 10 m plus the assessed rate of long term approximately 0.7 m/yr rate of shoreline recession as measured from the baseline, or as assessed by an experienced coastal engineer), further investigation will be required to ascertain the potential cause of the difference.

If a trigger is exceeded, further investigation is required by an experienced coastal engineer to determine if the exceedance was the direct result of the Spoilbank Marina and if the shoreline changes have had, or are likely to have, an impact on Cemetery Beach.

- Annual reporting on the monitoring results to the Department of Climate Change, Energy, the Environment and Water (DCCEEW).

Implementation of the SMP commenced in 2023, with the baseline monitoring completed in approximately May and September. The SMP, including details of the coastal monitoring efforts and shoreline change assessments, and the 2023 baseline monitoring is reported in MRA (2024a).

Coastal monitoring was also completed during 2024. This round of monitoring and assessment of shoreline change is reported in MRA (2024b).

2. Monitoring Data

Monitoring data from the May 2025 round of coastal monitoring is discussed below.

Commentary on the annual changes from April/May 2024 to May 2025 is included below.

2.1 Aerial Topographic Surveys

Plans showing the May 2025 aerial topographic survey, along with the April 2024, May 2023 and September 2023 beach profiles, are included in Appendix A.

The key changes between the May 2025 and April 2024 surveys include the following.

- Ongoing movement of the Spoilbank and accumulation of material along the western shoreline, particularly towards the Spoilbank Marina Outer Breakwater Sand Trap.
- A clockwise rotation of the shoreline at Cemetery Beach.
- Erosion of the shoreline at the eastern end of Cemetery Beach, adjacent to the Sutherland St Seawall.

A survey difference plot comparing the April 2024 to May 2025 surveys in the vicinity of Cemetery Beach is shown in Figure 2.1. This plot shows a clockwise rotation at Cemetery Beach, due to net westward transport of sediment has occurred over the past year. This is a reversal of the usual prevailing eastward net sediment transport processes along the Port Hedland coastline. This is likely due to effects from Severe Tropical Cyclone (TC) Zelia. TC Zelia crossed the Pilbara coastline on 14 February 2025 around 100 km east of Port Hedland. This would usually not represent a major concern for the study area coastline in terms of inundation, extreme wave conditions and erosion, as the most severe winds at the time of crossing would be oriented in an offshore direction. However the path of TC Zelia included an approximately 36 hour period where the cyclone stayed near stationary about 130 kilometres north-northwest of Port Hedland and underwent a period of intensification (BoM 2025). This resulted in a discrete period of persistent strong easterly to north easterly wind and wave conditions at Port Hedland which caused the westward sediment transport.

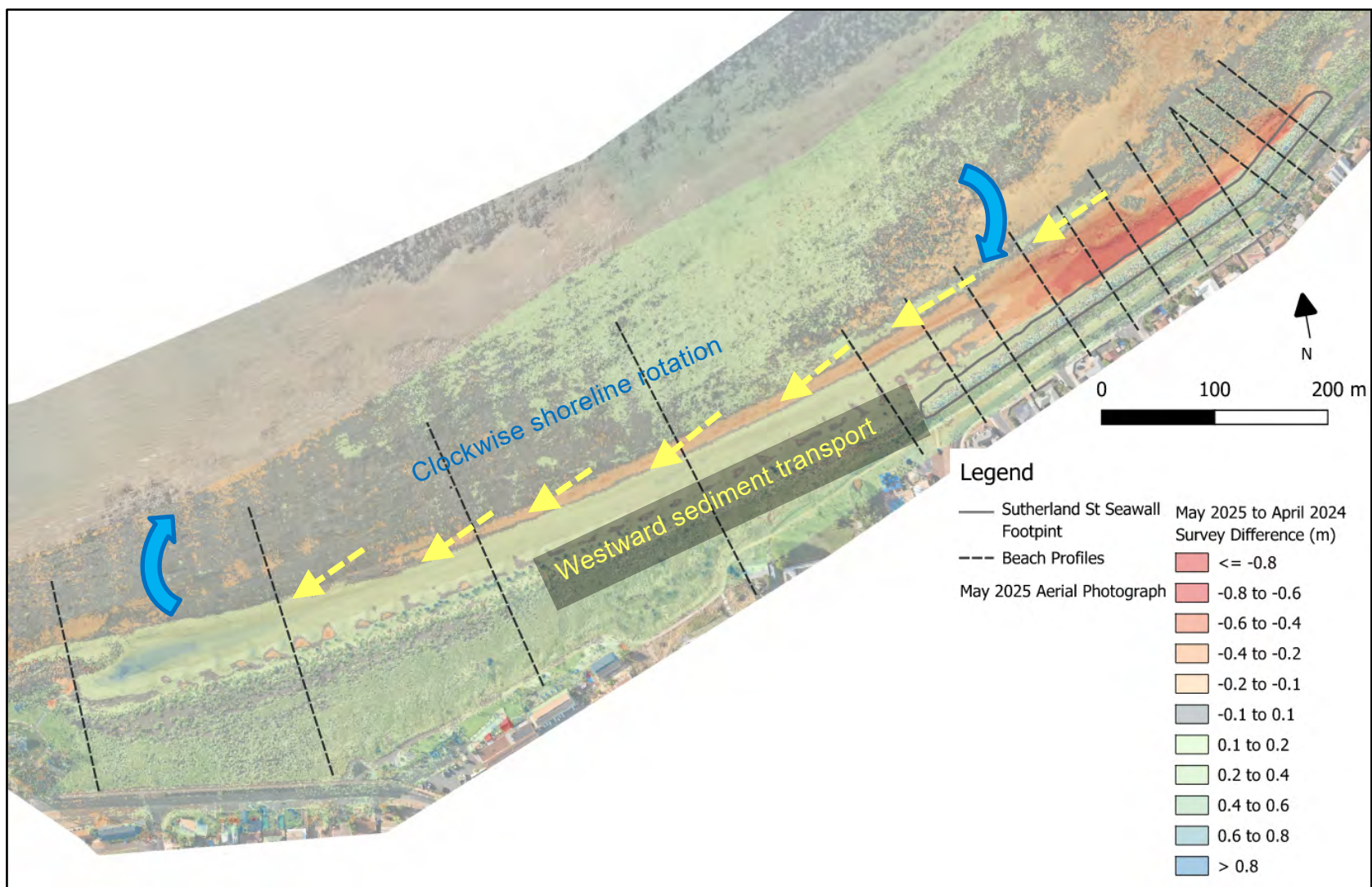


Figure 2.1 May 2025 to April 2024 Survey Difference – Cemetery Beach & Sutherland St Seawall

2.2 Beach Profiles

Plans showing the April 2024, May 2023 and September 2023 beach profiles, are included in Appendix A.

2.2.1 0 mAHD & +4 mAHD Contours

Changes in the position of the 0 mAHD and +4 mAHD contours are presented in Figures 2.2 and 2.3. No coastal monitoring triggers have been exceeded.

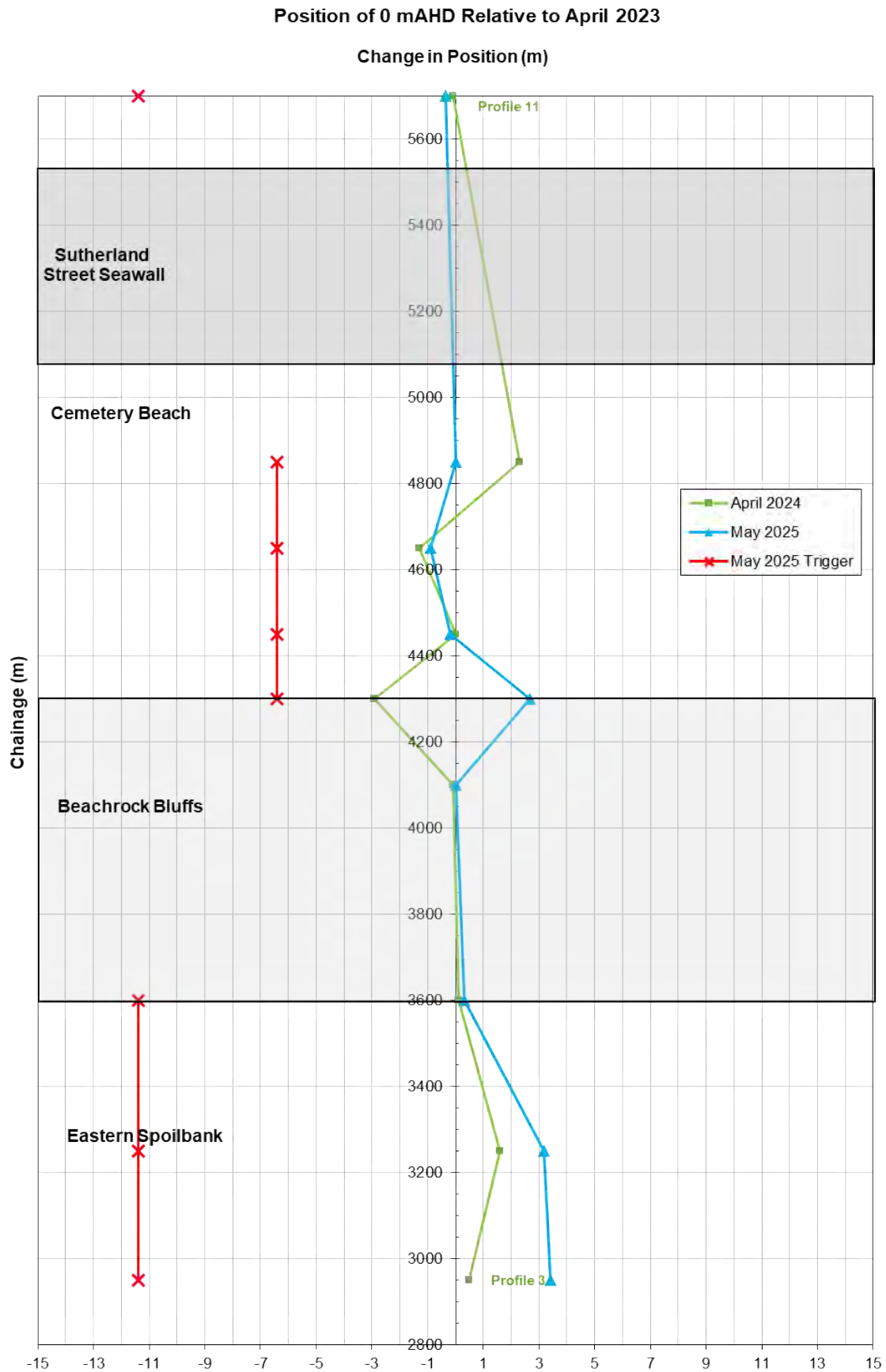


Figure 2.2 0 mAHD Contour Monitoring

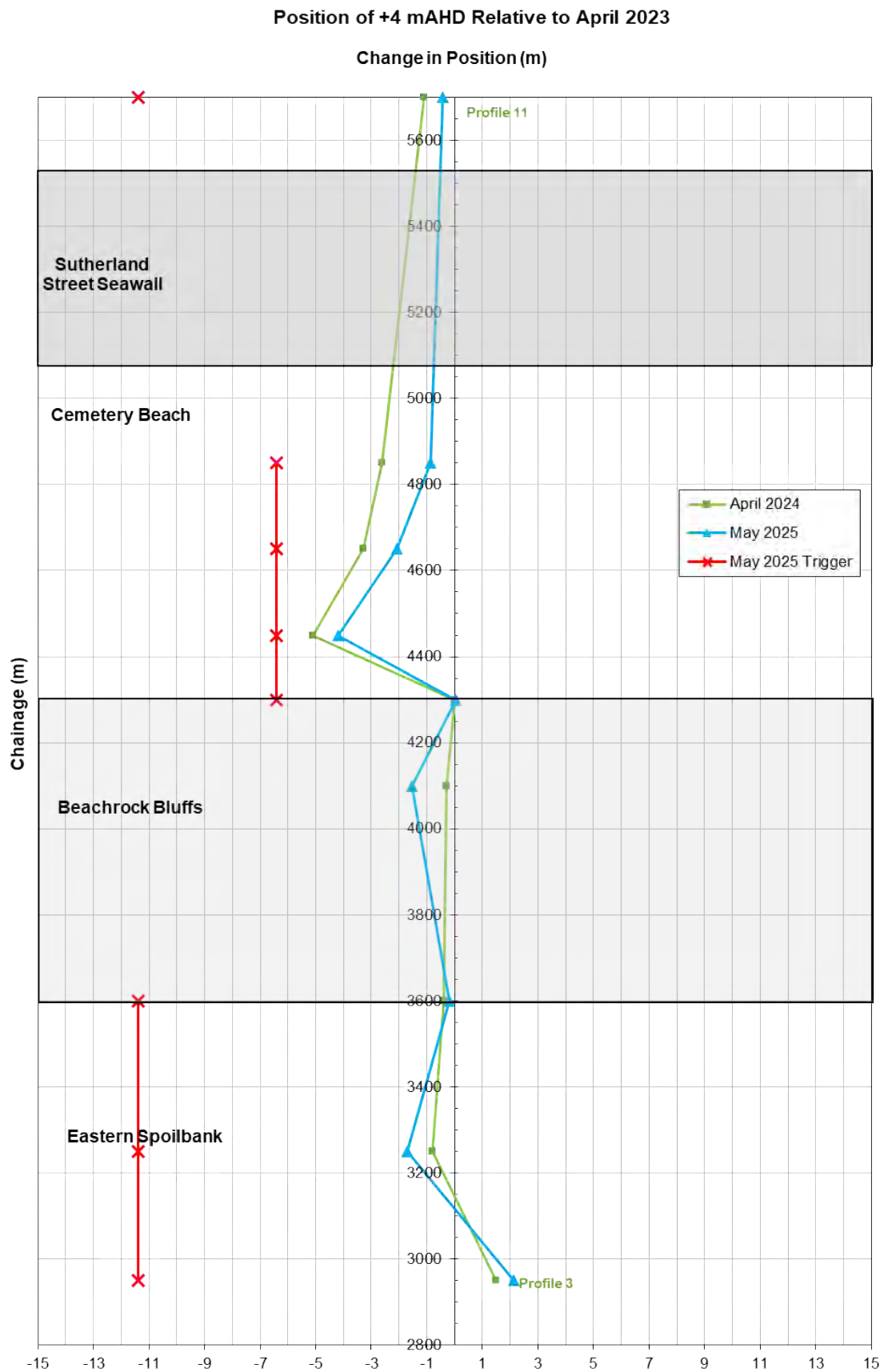


Figure 2.3 +4 mAHD Contour Monitoring

2.2.2 Profiles 1 & 2

Profiles 1 and 2 are not presented in Figures 2.1 and 2.2. These profiles are located to the north of the Spoilbank Marina on the Spoilbank. Changes in this area are best represented with a survey level difference plot viewed in plan. This is provided in Figure 2.4.

Figure 2.4 shows a continued clockwise rotation of the offshore (northern) end of the Spoilbank. However accretion has occurred along the western shoreline, in particular towards the Spoilbank Marina Outer Breakwater Sand Trap. On the eastern side of the Spoilbank, erosion has occurred along the eastern facing portion of the shoreline and accretion has occurred along closer to the base of the Spoilbank where the shoreline has a north easterly alignment.

This pattern of movement of the Spoilbank is generally consistent with the changes expected under the current phase of evolution of the landform as outlined in the SMP (MRA 2024a).

The following is noted regarding the 0 mAHD and +4 mAHD contours.

- Figure 2.4 shows around 2 to 3 m of recession of the 0 mAHD contour at Profile 1 and similar changes at both the eastern and western ends of Profile 2.
- Figure 2.4 shows minimal movement of the +4 mAHD contour at Profile 1 and western end of Profile 2. The +4 mAHD contour has receded by around 3 m at the eastern end of Profile 2.

The coastal monitoring triggers have not been exceeded at Profiles 1 and 2.

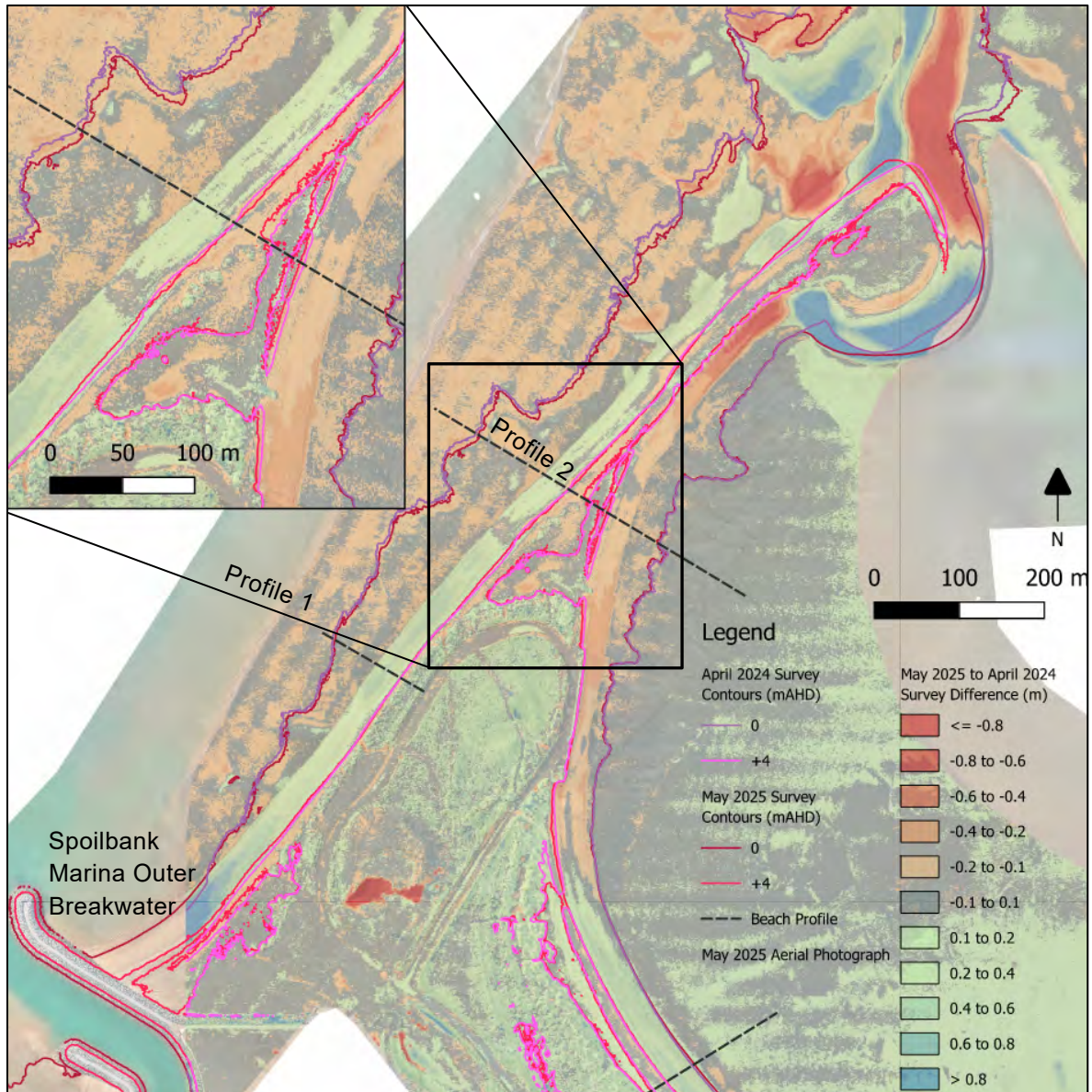


Figure 2.4 May 2025 to April 2024 Difference Plot - Spoilbank

2.3 Photographic Monitoring

The full set of May 2025 monitoring photos for each of the locations shown in Figure 2.5 are included in Appendix B.

These photographs indicate similar shoreline changes to the aerial topographic survey and beach profiles, including accumulation at the Spoilbank Marina Outer Breakwater Sand Trap and erosion of the shoreline fronting the eastern end of the Sutherland St Seawall.



Figure 2.5 Photographic Monitoring Locations

2.4 Shoreline Mapping

Baseline shoreline mapping and assessment for the study area has previously been completed by MRA (2024)a as part of the development of the SMP. This included assessment of shoreline mapping data provided by DoT for 1995, 2004 and 2015 along with mapping of vegetation lines from April 2019, December 2022 and August 2023 completed by MRA using orthorectified aerial photographs.

MRA has purchased the October 2024 orthorectified aerial image (the most recent available) from Landgate and mapped the vegetation line for this round of monitoring. All vegetation line mapping completed by MRA has been in accordance with DoT's methodology and specification of mapping (DoT 2009). Relative movements of the coastal vegetation line have been estimated at 100 m intervals along the study coast. These chainages are presented in Figure 2.6. The shoreline movement plan is included in Appendix C.



Figure 2.6 Shoreline Mapping Chainage Plan

A shoreline movement plot for the area from the eastern Spoilbank shoreline to Pretty Pool is provided in Figure 2.7. For context, the position relative to the 1995 vegetation line is shown, and for clarity, only mapped vegetation lines from April 2019, December 2022, August 2023 and October 2024 are presented.

The following key changes are noted for the period from August 2023 and October 2024.

- Apparent 13 m of recession of the vegetation line at one location (Chainage 2,800 m) on the eastern Spoilbank shoreline. This is due to an isolated loss of ephemeral vegetation between August 2023 and October 2024 in this single location and not notable shoreline change. This is shown in Figure 2.8.
- Apparent recession of the vegetation line to the west of the Sutherland Street Seawall. This apparent recession is up to a maximum of around 7 m at Chainage 4,900 m, though the shoreline position is still very similar to the shoreline position mapped from the December 2022 aerial image. This is discussed further below.
- Apparent 11 m of accretion of the vegetation line at one location, Chainage 7,100 m, on the rocky coast stretch of coast to the east of the Sutherland Street Seawall. This is due to recent growth of ephemeral vegetation in this area.

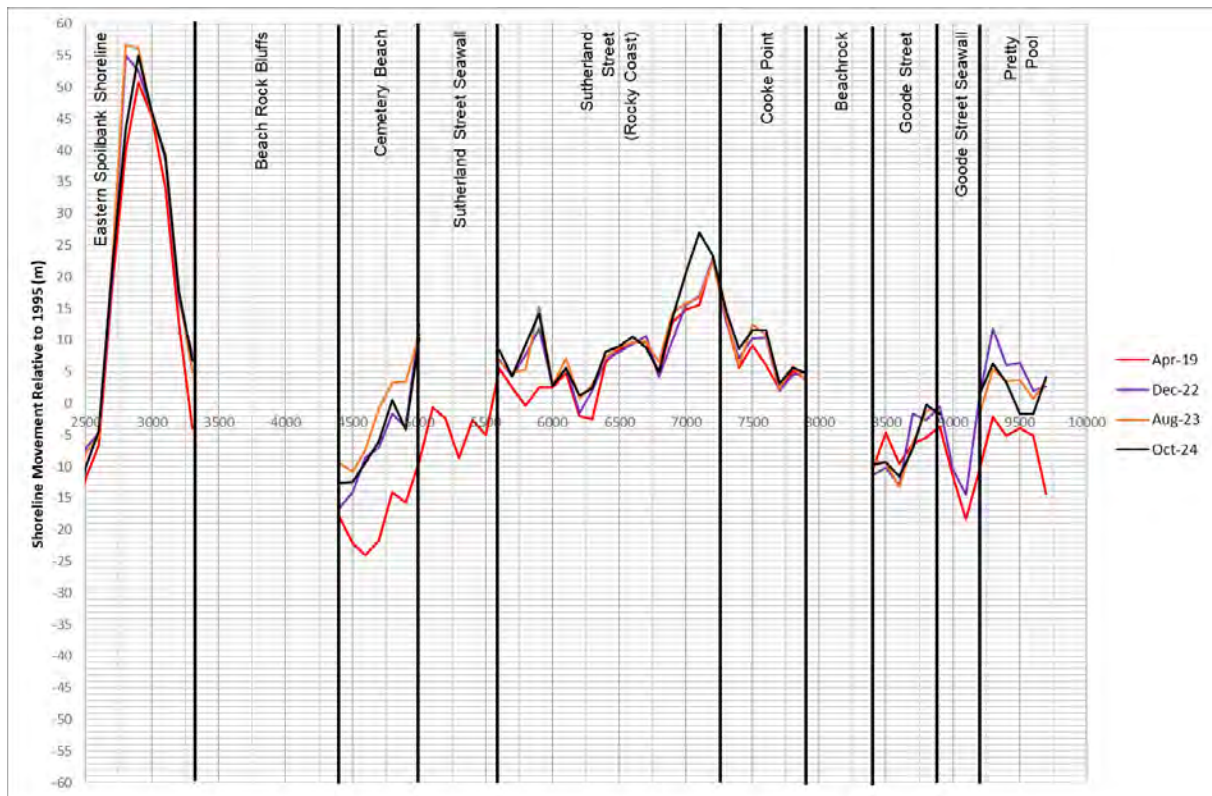


Figure 2.7 Shoreline Movements Relative to 1995

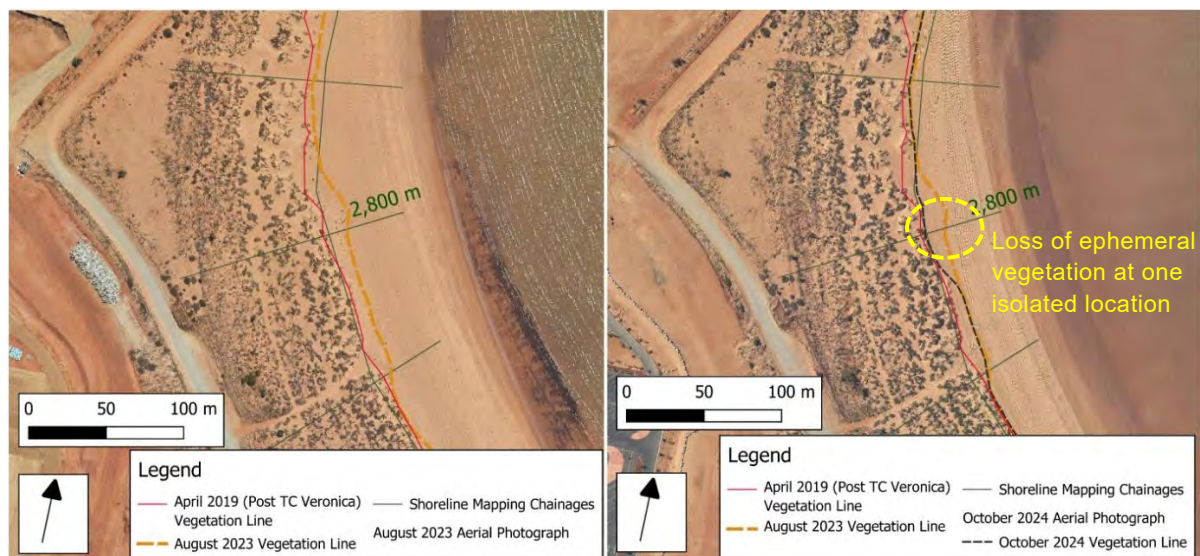


Figure 2.8 Isolated Loss of Ephemeral Vegetation at Chainage 2,800 m between 2023 (left) & 2024 (right)

The apparent recession at around Chainage 4,500 m to 4,900 m is an artefact of the vegetation line mapping methodology and not due to actual erosion in this area. The April 2019, August 2023 and October 2024 vegetation lines along with the August 2023 and October 2024 aerial photographs are shown in Figure 2.9. This figure shows sparse ephemeral vegetation was present in the area fronting the dunes in August 2023. Some of this vegetation is not visible in the October

2024 photograph and, accordingly, the October 2024 vegetation line lies landward where this vegetation is no longer visible.

The topographic surveys show beach and dune levels have increased through this area in the past year. Comparing the aerial images in Figure 2.8, it can be seen that much of the vegetation, including the remaining seaward vegetation, has increased. This confirms that the apparent recession is an artefact of the vegetation line mapping process, and is not indicative of coastal erosion. Hence this is not considered an exceedance of Trigger 1.

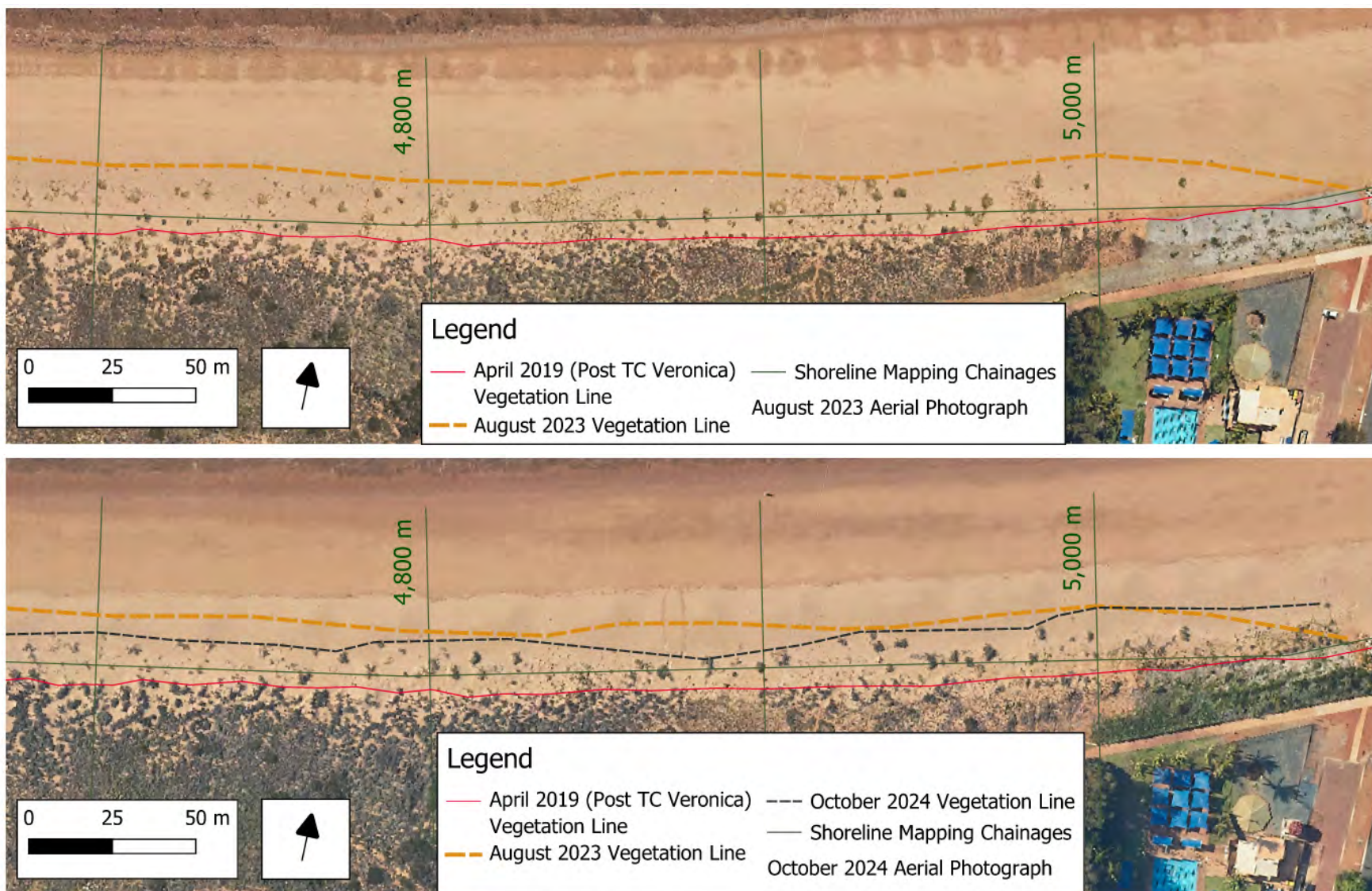


Figure 2.9 Vegetation Lines with the August 2023 (top) and October 2024 (bottom) Aerial Photographs

3. Evaluation

The evaluation of the shoreline changes, discussed above, against the coastal monitoring triggers is presented in Table 3.1 below.

Table 3.1 Evaluation of Shoreline Change Against Triggers

Location	Trigger	Outcome
Cemetery Beach	Trigger 1: Where the observed rate of recession of the shoreline or beach profile on Cemetery Beach is greater than 5 m plus the assessed rate of long term shoreline recession (approximately 0.7 m/yr) as measured from the baseline survey location, or assessed by an experienced coastal engineer, further investigation will be required to ascertain the potential cause of the erosion.	No exceedance(s).
Other areas within the Monitoring Area	Trigger 2: Where the observed shoreline movement outside of Cemetery Beach is significantly different to the expected shoreline changes (approximately greater than 10 m plus the assessed rate of long term approximately 0.7 m/yr rate of shoreline recession as measured from the baseline, or as assessed by an experienced coastal engineer), further investigation will be required to ascertain the potential cause of the difference.	No exceedance(s).

As shown in the Table 3.1, no coastal monitoring triggers were exceeded.

4. Conclusion

This report presents the monitoring data from the 2024 post summer (April/July) round of coastal monitoring carried out in accordance with the *EPBC 2019/8520 Port Hedland Spoilbank Marina Cemetery Beach Sediment Management Plan* (MRA 2024a).

This coastal monitoring includes the following.

- Aerial topographic surveys of the Port Headland coastline in the vicinity of the Spoilbank Marina, the Spoilbank and Cemetery Beach.
- Beach profiles 'cut' from the aerial topographic survey.
- Photographic monitoring.

The changes to the shoreline from April/July 2024 to May 2025 have been assessed against the coastal monitoring triggers outlined in the SMP. No coastal monitoring triggers were exceeded.

The key changes between the May 2025 and April 2024 surveys include ongoing movement of the Spoilbank and westward movement of sediment along Cemetery Beach. This westward movement appears to have been caused by TC Zelia.

5. References

MRA 2024a. *EPBC 2019/8520 Port Hedland Spoilbank Marina Cemetery Beach Sediment Management Plan*, R1665 Rev 7. Prepared for the Pilbara Ports Authority.

MRA 2024b. *EPBC 2019/8520 Spoilbank Marina Cemetery Beach SMP 2024 Report*, R1970 Rev 0. Prepared for the Pilbara Ports Authority.

6. Appendices

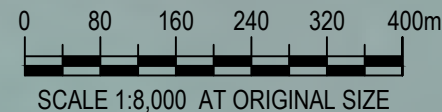
Appendix A May 2025 Aerial Topographic Survey & Beach Profiles

Appendix B May 2025 Photographic Monitoring

Appendix C Shoreline Movement Plan

Appendix A May 2025 Aerial Topographic Survey & Beach Profiles

AT CORRECT SCALE THIS IS 100 mm



NOTES:

1. SURVEY PROVIDED BY MNG SURVEYS COMPLETED IN APRIL 2025. THE LEVELS AND CONTOURS REFLECTS THE SURFACE AT THE TIME OF SURVEY ONLY.
2. AERIAL PHOTOGRAPH FROM MNG SURVEYS TAKEN IN APRIL 2025.
3. HORIZONTAL DATUM IS MAP GRID OF AUSTRALIA IN GDA2020 (MGA2020). VERTICAL DATUM IS AUSTRALIAN HEIGHT DATUM (AHD).
4. CONTOURS SHOWN AT 0.5m INTERVALS.



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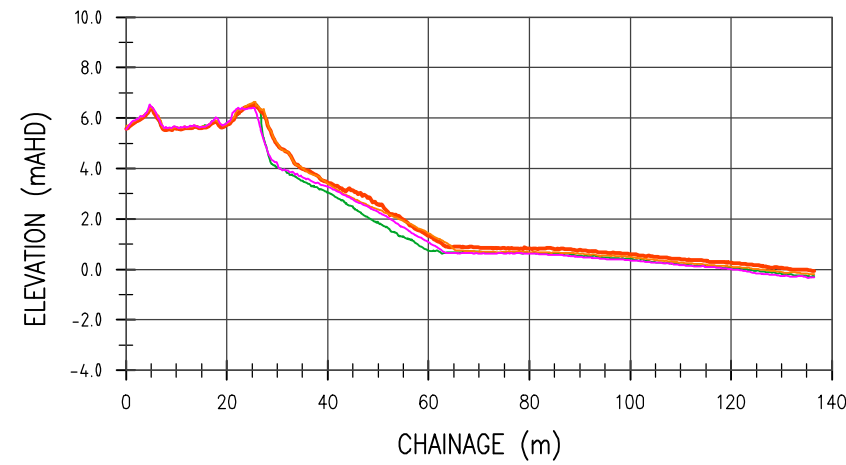
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Western Australia admin@coastsandports.com.au

DRAWN	R ENCINAS
CHECKED	J COSTIN/C DOAK

MAY 2025 AERIAL TOPOGRAPHIC SURVEY & BEACH PROFILES
CEMETERY BEACH SEDIMENT MANAGEMENT PLAN

SCALE
AT A3 1:8,000

MAY 2025
SK1973-02-00E

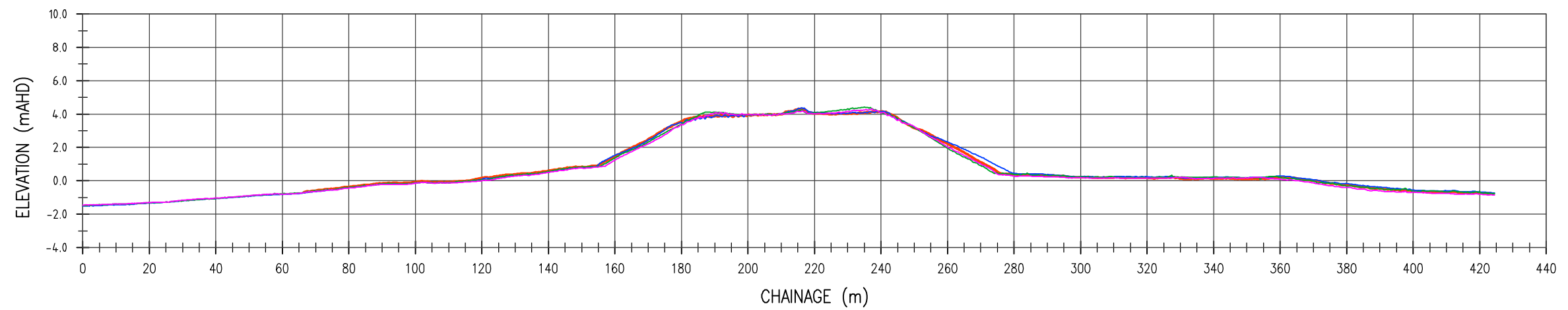


LEGEND:

- 2025 MAY PROFILE LINE
- 2024 APRIL PROFILE LINE
- 2023 SEPTEMBER PROFILE LINE
- 2023 MAY PROFILE LINE

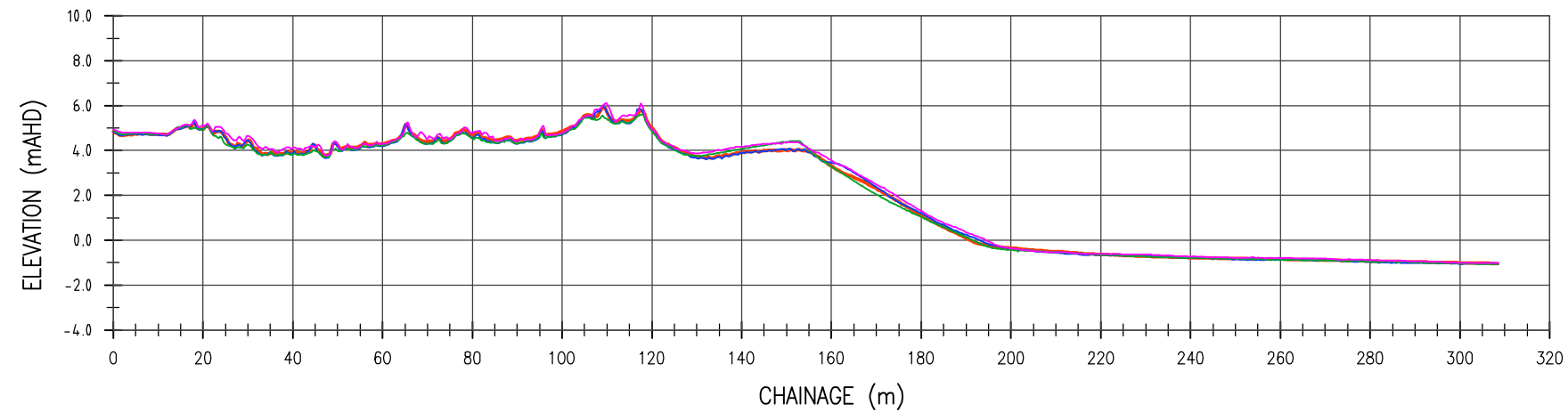
PROFILE 1

VERTICAL SCALE: 1:150
HORIZONTAL SCALE: 1:1,000



PROFILE 2

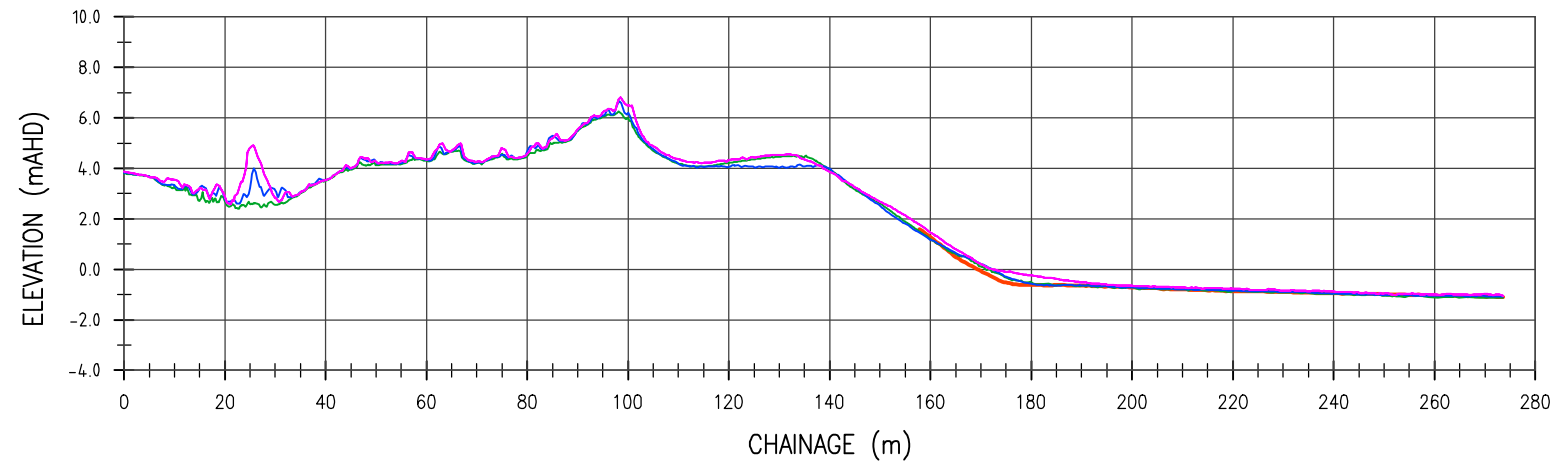
VERTICAL SCALE: 1:150
HORIZONTAL SCALE: 1:1,500



PROFILE 3

VERTICAL SCALE: 1:150
HORIZONTAL SCALE: 1:1,500

AT CORRECT SCALE THIS IS 100 mm

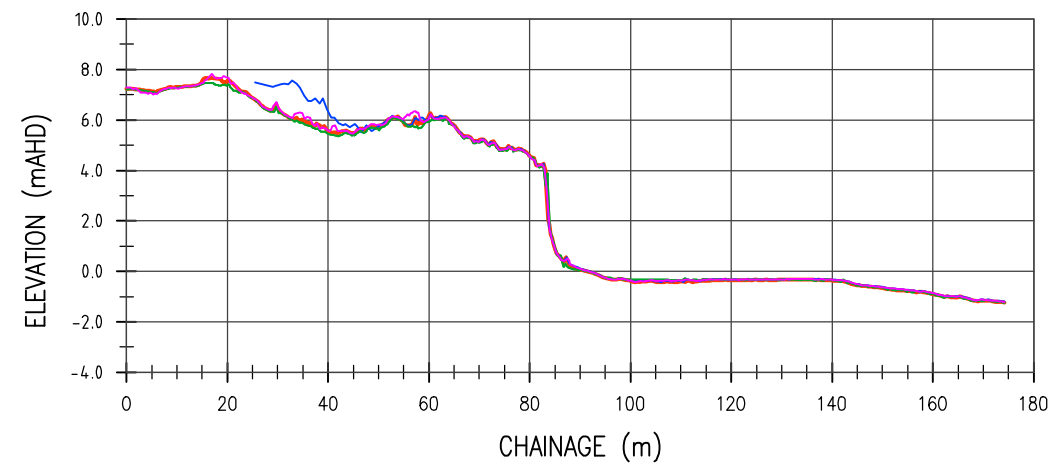


LEGEND:

- 2025 MAY PROFILE LINE
- 2024 APRIL PROFILE LINE
- 2023 SEPTEMBER PROFILE LINE
- 2023 MAY PROFILE LINE

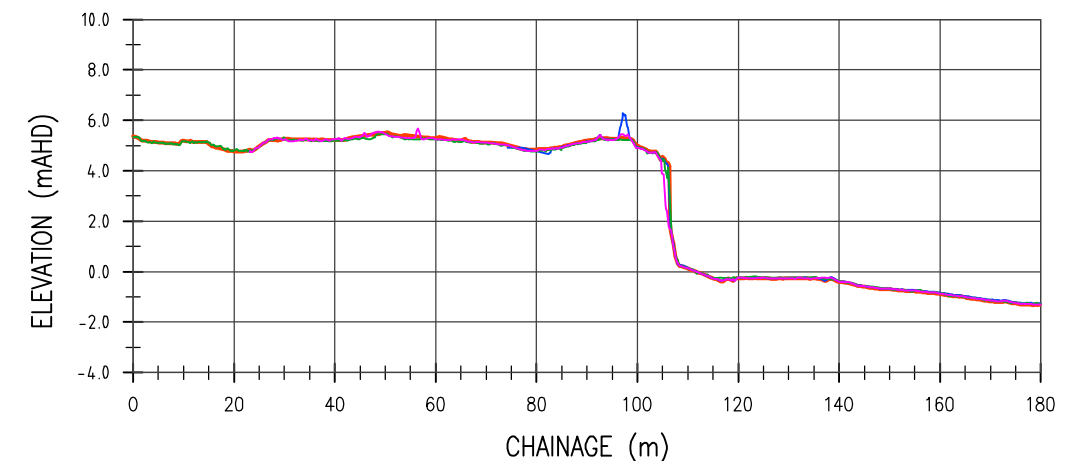
PROFILE 4

VERTICAL SCALE: 1:150
HORIZONTAL SCALE: 1:1,500



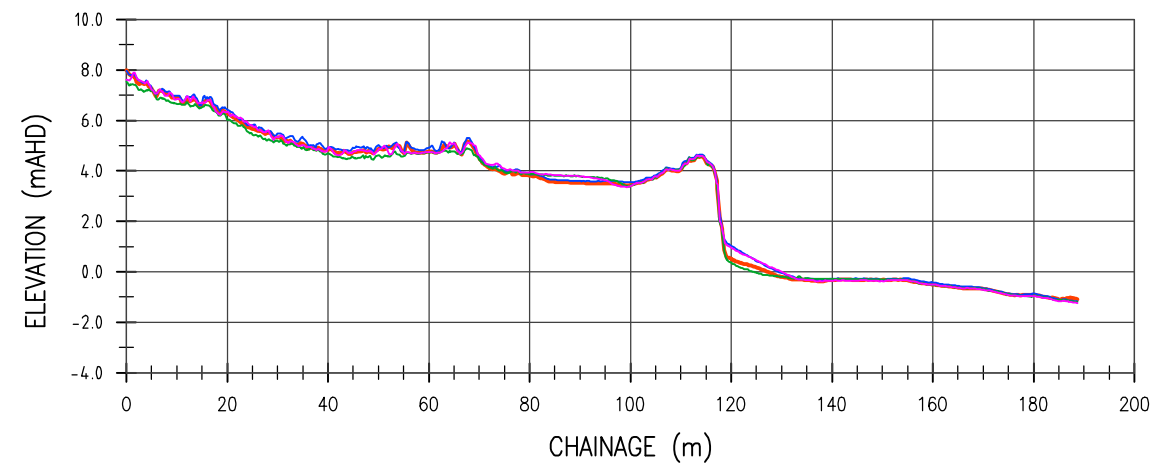
PROFILE 5

VERTICAL SCALE: 1:150
HORIZONTAL SCALE: 1:1,500



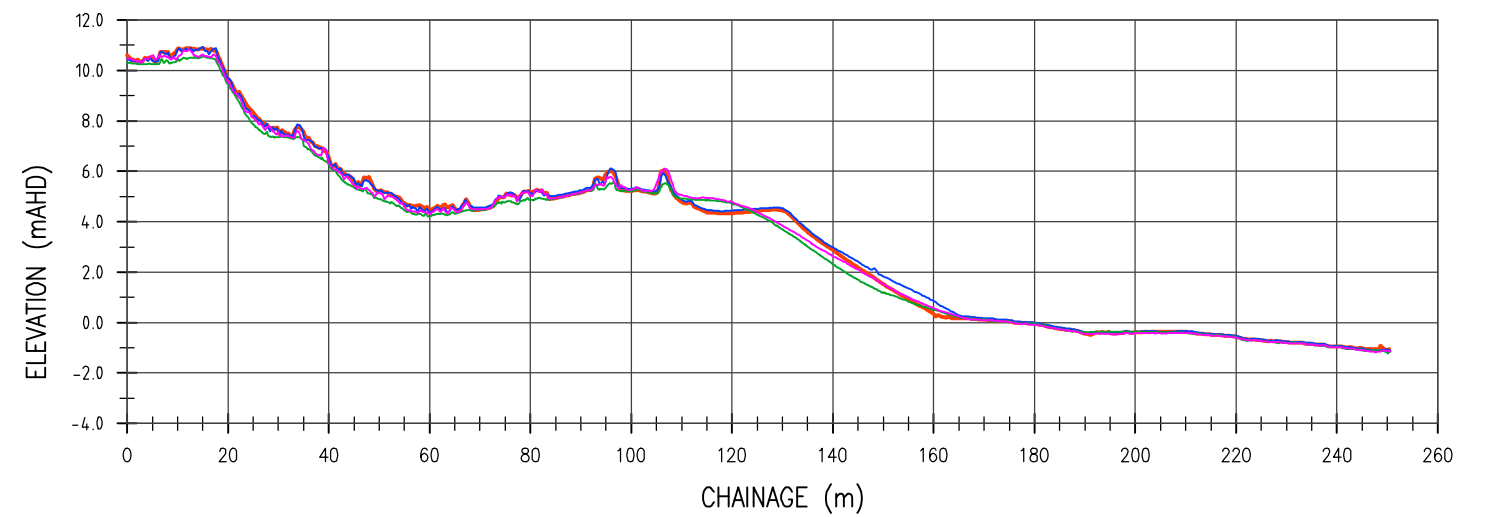
PROFILE 6

VERTICAL SCALE: 1:150
HORIZONTAL SCALE: 1:1,500



PROFILE 7

VERTICAL SCALE: 1:150
HORIZONTAL SCALE: 1:1,500



PROFILE 8

VERTICAL SCALE: 1:150
HORIZONTAL SCALE: 1:1,500

Appendix B May 2025 Photographic Monitoring



P1. June 2023.



P1. June 2024.



P1. May 2025.



P2 – North. June 2023.



P2 – North. June 2024.



P2. May 2025.



P2 – South. June 2023.



P2 – South. June 2024.



P2 – South. May 2025.



P3 – South West. June 2023.



P3 – South West. June 2024.



P3 – South West. May 2025.



P3 – South East. June 2023.



P3 – South East. June 2024.



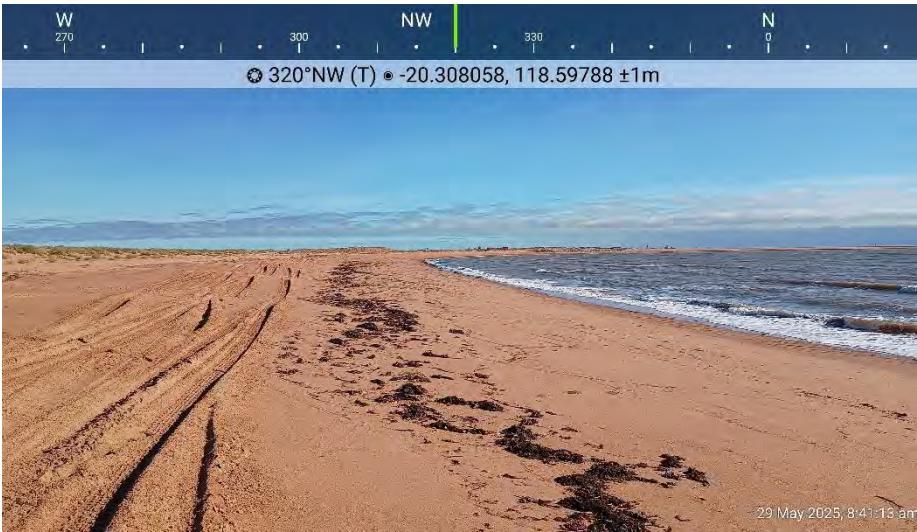
P3 – South East. May 2025.



P4 – North West. June 2023.



P4 – North West. June 2024.



P4 – North West. May 2025.



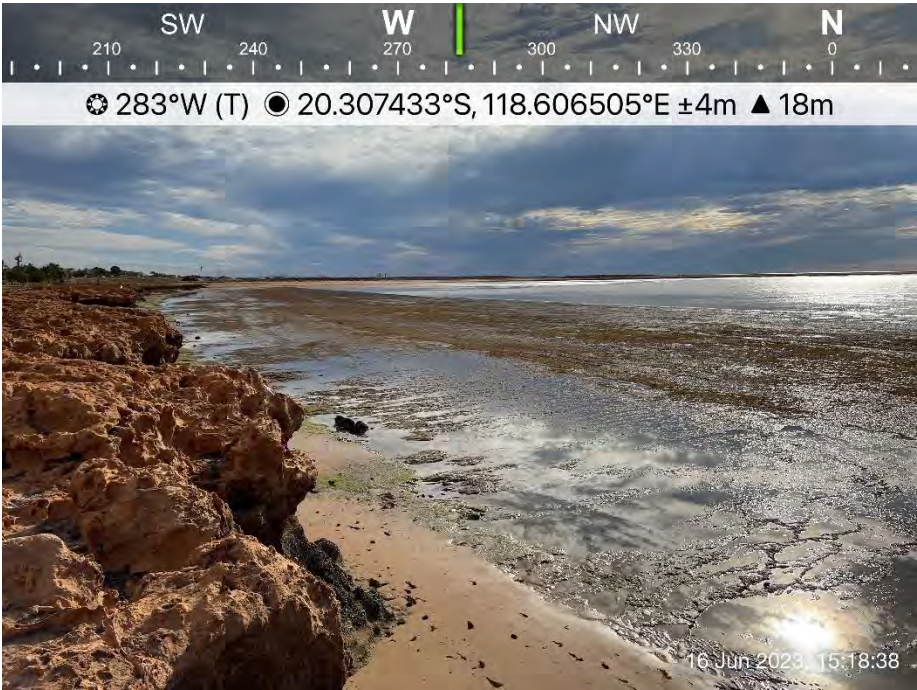
P4 – East. June 2023.



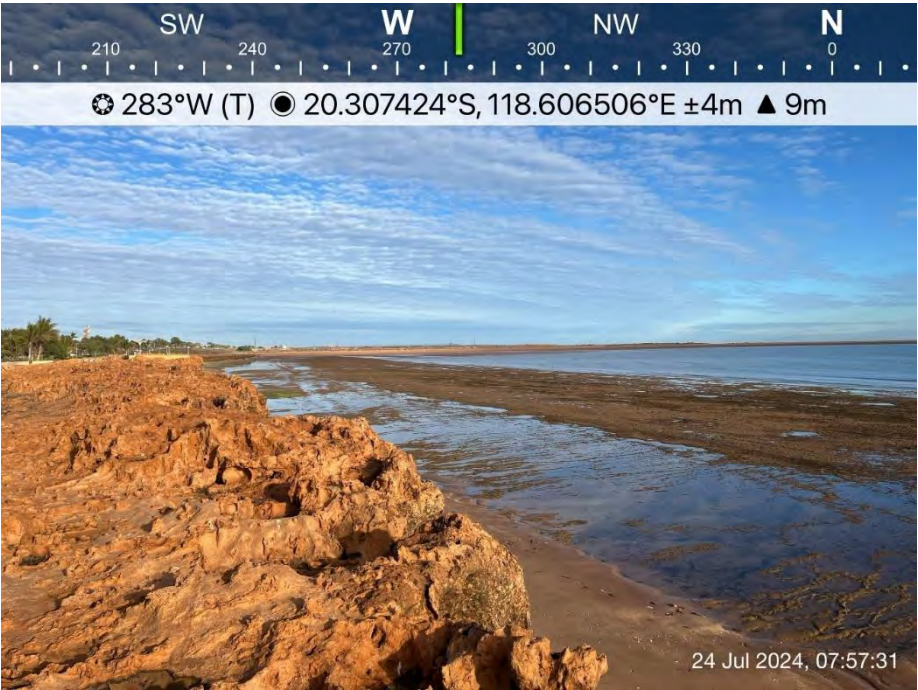
P4 – East. June 2024.



P4 – East. May 2025.



P5 – West. June 2023.



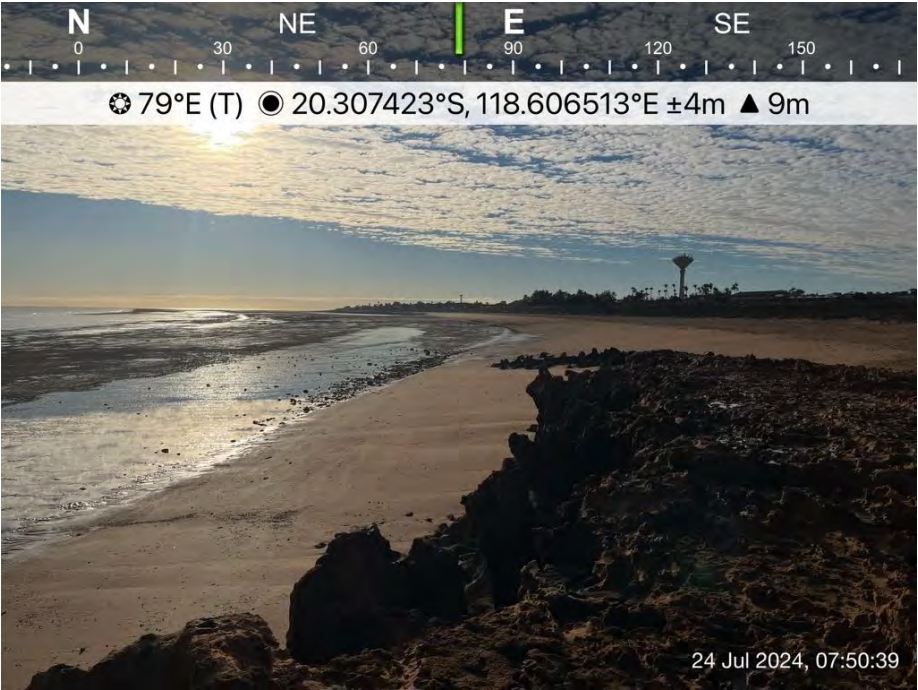
P5 – West. June 2024.



P5 – West. May 2025.



P5 – East. June 2023.



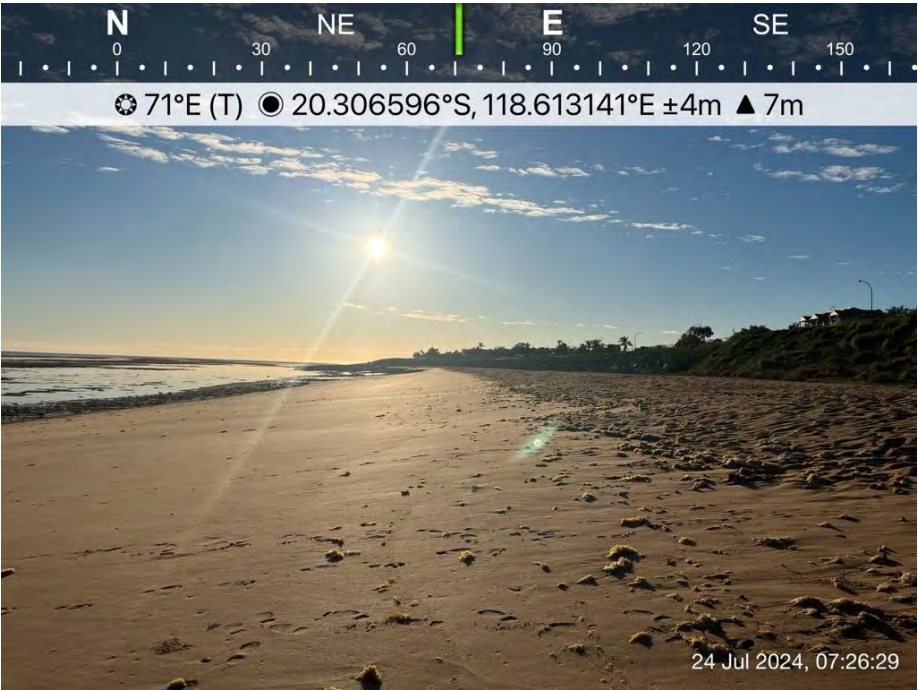
P5 – East. June 2024.



P5 – East. May 2025.



P6 – East. June 2023.



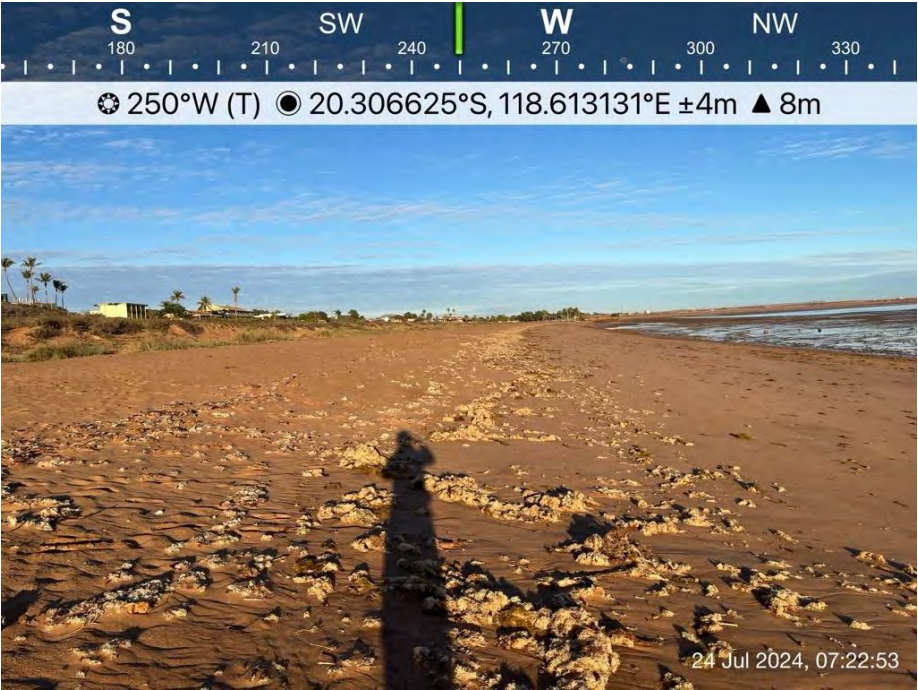
P6 – East. June 2024.



P6 – East. May 2025.



P6 – West. June 2023.



P6 – West. June 2025.



P6 – West. May 2025.



P7. June 2023.



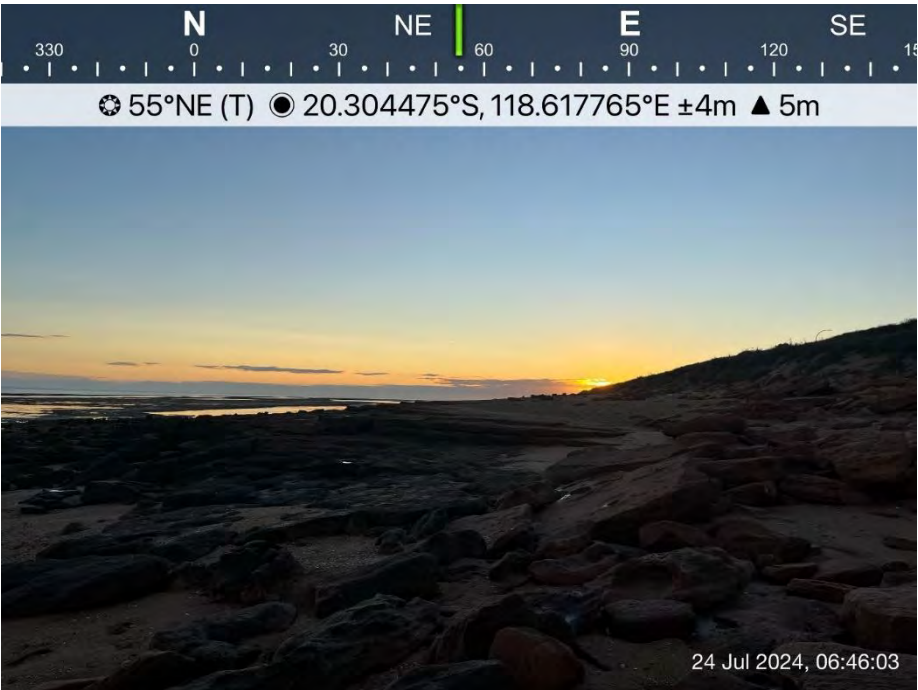
P7. June 2024.



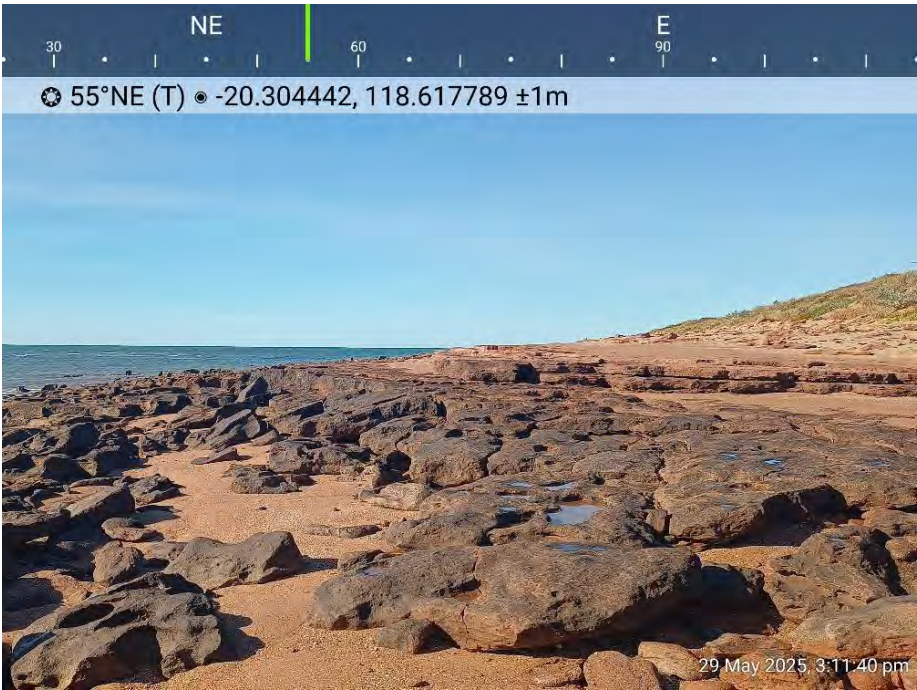
P7. May 2025.



P8. June 2023.



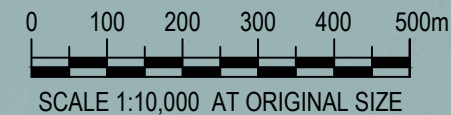
P8. June 2024.



P8. May 2025.

Appendix C Shoreline Movement Plan

AT CORRECT SCALE THIS IS 100 mm



LEGEND:

- 1995 VEGETATION LINE
- 2004 VEGETATION LINE
- 2009 VEGETATION LINE
- 2015 VEGETATION LINE
- 2019 VEGETATION LINE
- 2022 VEGETATION LINE
- 2023 VEGETATION LINE
- 2024 VEGETATION LINE
- ROCK SHORELINE
- SEAWALL

SPOILBANK

SPOILBANK
MARINA

RICHARDSON STREET
BOAT RAMP

CEMETERY
BEACH PARK

MATCH LINE
01-02

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DRAWN R ENCINAS
CHECKED J COSTIN/C DOAK

SHORELINE MOVEMENT PLAN - SHEET 1 OF 2
CEMETERY BEACH SEDIMENT MANAGEMENT PLAN

SCALE
AT A3 1:10,000

JUNE 2025
SK1973-01-01C

AT CORRECT SCALE THIS IS 100 mm



LEGEND:

- 1995 VEGETATION LINE
- 2004 VEGETATION LINE
- 2009 VEGETATION LINE
- 2015 VEGETATION LINE
- 2019 VEGETATION LINE
- 2022 VEGETATION LINE
- 2023 VEGETATION LINE
- 2024 VEGETATION LINE
- ROCK SHORELINE
- SEAWALL

MATCH LINE
01-01

SUTHERLAND STREET SEAWALL

COOKE POINT
VIEWING PLATFORM

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CHECKED	J COSTIN/C DOAK

SHORELINE MOVEMENT PLAN - SHEET 2 OF 2
CEMETERY BEACH SEDIMENT MANAGEMENT PLAN

SCALE
AT A3 1:10,000

JUNE 2025
SK1973-01-02C

The background of the entire page is a photograph of a beach. The top portion shows a clear blue sky with a slight gradient. Below the sky is a wide expanse of light-colored sand. In the bottom right corner, there are gentle, wavy sand dunes or ripples in the sand.

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