IN THE MATTER OF	the Fast-track Approvals Act 2024 ("FTAA")
AND	
IN THE MATTER OF	an application for approvals by **NZ Transport Agency Waka Kotahi** to construct, operate and maintain the State Highway 1 Wellington Improvements project

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STATE HIGHWAY 1 WELLINGTON IMPROVEMENTS PROJECT
TECHNICAL REPORT #12
MARINE ECOLOGY ASSESSMENT

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1. INTRODUCTION

1. My name is Marcus Cameron, and I am the Marine Ecology Specialist assessing the ecological impacts on the marine environment for the State Highway 1 Wellington Improvements Project (Project).

2. I have been assisted in preparing this assessment by colleagues at Tonkin + Taylor (T+T), in particular Vanessa Taikato who carried out the fieldwork, and Melanie Tupe and Joshua Forrest who are marine and penguin ecologists respectively. Sam Reed, Water Engineering Technical Director, and Tom Bassett, Stormwater Specialist for the Project, provided the modelling calculations of stormwater discharge quality and quantity. Shaun Morgan, Environmental Scientist, analysed water quality sampling data and provided technical comparison with the modelled stormwater discharge quality data.

3. This marine ecology assessment is based on the proposed stormwater concept design illustrated in Part G of the Application (drawing set) on drawings DNG-DRG-01100-01148 (stormwater plans) and DNG-DRG-01105-01107 (stormwater details). The scope of the design includes the stormwater collection, conveyance, and water quality treatment infrastructure for the Project. The impacts to the marine receiving environment are assessed based on the output from the stormwater discharges that receive stormwater associated with SH1, the replacement of a stormwater outfall at Evans Bay, and general contaminated discharges into the Coastal Marine Area (CMA) that may occur as a result of the SH1 construction.

Qualifications and experience

4. I am the Technical Director for Marine Ecology and Water Science at T+T. I hold the qualifications of Bachelor of Science (Biology, 2003) and Master of Science (First Class Honours) in Marine Science (2005) from the University of Auckland. My Master's research focused on ecotoxicology and contaminant accumulation in marine invertebrates and sediments. I am a practicing member of the New Zealand Marine Sciences Society, New Zealand Coastal Society and the Society of Environmental Toxicology and Chemistry.

5. I have over 20 years' experience in aquatic science working in Crown Research Institutes, local government and consulting. My experience extends across multiple aspects of aquatic ecology including general marine ecology, sediment, shellfish and water quality, ecotoxicology and fauna management. I have designed and implemented complex monitoring and research programmes, led large scale ecological restoration and enhancement projects, developed ecological offset and compensation packages and guidance documents and carried out numerous ecological effects assessments.

6. Prior to my role at T+T, I worked at Auckland Council for 12 years as an Aquatic Contaminants Scientist. During my time at Auckland Council, I:

   i. Assessed marine ecology effects and gave expert evidence at Auckland Unitary Plan (AUP) hearings including Stormwater provisions, Water Quality (including identifying degraded marine receiving environments), Rural Urban Boundary and Clevedon Waterways

   ii. Was responsible for assessing the effects of antifouling contamination and was an expert witness at the Environment Court hearing for the 2015 Matiatia Bay and 2018 Kennedy Point marina applications on Waiheke Island

   iii. Presented expert evidence on sediment contamination and dredging for the Board of Inquiry East West Link hearings in 2017

7. Since joining T+T in February 2018 I have worked on numerous assessments of ecological effects for projects involving the marine environment including discharge assessments. I have been an expert witness for:

   i. The Christchurch City Council Stormwater Network Discharge Consent hearings representing New Zealand Steel in 2018 regarding effects of discharges on aquatic ecology

   ii. The Auckland Council Stormwater Network Discharge Consent hearings representing New Zealand Steel in 2018 regarding effects of discharges on aquatic ecology

   iii. The Northland Regional Council Coastal Plan hearings representing NZ Steel in 2020 regarding effects of discharges on marine ecology

   iv. The Te Wānanga Downtown Public Space hearing on behalf of Auckland Council in 2020 regarding effects on marine ecology and restoration and enhancement options

   v. The Environment Court hearing for the 2022 Auckland Regional Landfill application representing Waste Management regarding effects of discharges on marine ecology

   vi. The Auckland Council hearing for the 2024 New Zealand Steel Glenbrook Steel Mill discharge consent application regarding effects of the steel mill discharges on marine ecology

8. I have been to the relevant parts of the Project site at Evans Bay and Lambton Harbour, and have been involved in recent site visits for several other projects in the wider Lambton Harbour area and in Evans Bay. I have overseen the marine ecology components of the Project and maintained regular communication with the wider specialist and planning team since joining the Project in June 2025.

Code of conduct

9. I confirm that I have read the code of conduct for expert witnesses contained in the Environment Court Practice Note 2023. This assessment has been prepared in compliance with that code, as if it were evidence being given in Environment Court proceedings. In particular, unless I state otherwise, this assessment is within my area of expertise and I have not omitted to consider material facts known to me that might alter or detract from the opinions I express.

Project description

10. The Project is a Road of National Significance (RoNS) which improves SH1 in Wellington City. The proposal includes the construction, or improvements to SH1 within Wellington City, extending over 5 km through the city. The Project will provide for more efficient and reliable access on SH1 and includes duplicate tunnels at The Terrace and Mount Victoria, a new layout at the Basin Reserve as well as improvements along the remainder of the SH1 corridor from north of the Terrace Tunnel to the intersection of Cobham Drive and Evans Bay Parade.

11. The Project aims to attract traffic onto SH1, reduce traffic on other key routes, unblock critical bottlenecks on the State Highway, maintain access for local vehicle movements and enable public transport growth.

12. The Project construction will also include a replacement or enlarged stormwater outfall into the coastal marine area to accommodate for the upgraded flow discharge into Evans Bay. An options assessment was carried out in late-2025 and the selected option, which utilises the existing outfall location upgrading the pipe to 2100 mm diameter (from 1800 mm diameter) was chosen. The works for the upgrade will likely include:

   i. Removal or partial demolition of the existing outfall structure

   ii. Installation of a new outfall pipe and connection to the upgraded stormwater network

   iii. Construction of new inlets, chambers, or pipework to tie into upstream drainage infrastructure

iv. Construction of new revetment north of the existing / new outfall

v. Replacement of the existing concrete debris revetment south of the existing / new outfall

13. The information provided in this section and in the drawings describe the Indicative Design for the Project. Any numbers, area or dimensions outlined in this section are approximate and may change as a result of the final alignment of the Project (including the designs and locations) and will be refined and confirmed at the detailed design stage following consenting. This flexibility has been considered in my assessment.

Scope of assessment

14. My assessment addresses the following matters:

i. The methodology I have used to assess the effects of the Project

ii. The existing environment

iii. Effects of the Project during operation

iv. Effects of the Project during construction

v. Benefits of the Project

vi. Recommended measures to avoid, remedy or mitigate adverse effects

15. This assessment relies on the stormwater report assessment to inform the magnitude of effects of the construction and operational phase of the Project on the marine receiving environment.

2. EXECUTIVE SUMMARY

Existing environment

16. Evans Bay is a large, semi-exposed embayment at the southern end of Wellington Harbour, extending from Point Jerningham to Point Halswell. The bay lies between the Miramar Peninsula and the urban suburbs of Hataitai and Kilbirnie and covers approximately 4.5 km². It is shallow and north-facing, with a tidal range of 0.7–1.3 m. Historically connected to Cook Strait via the former Rongotai channel, Evans Bay has since been substantially modified by urban development.

17. The Waipapa Stream, formerly a natural inflow, was piped in the early 20th century and now functions as the primary stormwater outlet for the 132 ha Hataitai catchment, discharging into the southwestern corner of the bay. Parts of Evans Bay are recognised in the Wellington Region Natural Resources Plan for significant biodiversity values, including algal meadows and horse mussel beds, however, these are located outside the proposed zone of influence (ZOI)[1]. Ecological values for Evans Bay are summarised in Table 1 below.

18. Lambton Harbour, in the northeastern Wellington Harbour, is a highly modified, semi-enclosed embayment supporting major port, ferry, marina, and waterfront infrastructure, with numerous stormwater discharges primarily from the Waitangi catchment. Ecological values for Lambton Harbour are summarised below in Table 1.

Table 1: Ecological values for Lambton Harbour

Habitat / Species	Ecological value
Evans Bay	
Marine habitats	**Moderate** – due to moderately high diversity of marine species but sediments are mildly contaminated, and invasive *Undaria pinnatifida* is common
Coastal avifauna	**Low to Very High –** due to the presence of numerous coastal bird species within the bay and the potential presence of six Very High value species – the black fronted tern, Caspian tern, pacific reef heron, Salvin's albatross, spotted shag, white heron
Little penguin/ kororā	**High** based on their At Risk – Declining threat classification and confirmed use of the ZOI[1]
Marine fish	**Moderate** – due to the presence of a rare native scaly gurnard, and the diversity of species present.
Marine mammals	**Low –** due to the presence of NZ Fur Seal
Lambton Harbour	
Marine habitats	**Low** – due to the highly modified and degraded environment of the marina and waterfront
Coastal avifauna	**Low** to **Very High** due to five Very High value species, Caspian tern, Hutton's shearwater, Northern royal albatross, pacific reef heron and spotted shag.
Little penguin/kororā	**High** based on their At Risk – Declining threat classification and confirmed use of the ZOI[1].
Marine fish	**Moderate** due to the diversity of fish species present.
Marine mammals	**Low** to **Very High** due to the potential presence of the Threatened – Nationally Critical Orca and Threatened – Nationally Vulnerable bottlenose dolphin within the ZOI[1]

[1] The ZOI for Evans Bay captures the area out to 100m from the Evans Bay outfall, and in Lambton Harbour captures the inner harbour area receiving environment for the assessed stormwater outfalls to approximately 100 m distance from the coastline. These ZOIs allow for full mixing of the discharges. Note a secondary ZOI specifically for noise has been defined for kororā as 20 m in all directions from the edge of the works footprint, calculated from the expected setback to achieve compliant noise management without noise barriers. See Section 9

Potential benefits of the Project

19. The potential marine ecology benefits of the Project include:

    i. There is potential for a slight overall improvement in water quality in the receiving environments at Evans Bay and Lambton Harbour due to the stormwater treatment systems which are incorporated into the design in the Hataitai catchment (discharging into Evans Bay), and The Terrace, Te Aro and Basin Reserve catchments draining into Lambton Harbour

    ii. The additional stormwater treatment within these catchments is expected to result in localised improvements in water quality due to substantially decreased discharges of suspended sediments, heavy metals, hydrocarbons and other pollutants from the Project area to the marine receiving environment once the systems become operational, with longer term benefits to sediment quality and marine habitats over time. However, increased runoff from the larger impervious surface area will cause additional scour within the immediate vicinity of outfalls (particularly at Evans Bay) and some localised reduction in salinity. These positive and negative effects may therefore balance each other out

    iii. Following successful compensation activities, the habitat and artificial nesting structures being provided for the loss of kororā burrows should be more resilient long term, as the existing burrows are at increasing risk of tidal inundation by rising sea levels

Potential adverse effects without mitigation

20. Construction effects from the Project include the replacement of the stormwater outfall in the southwest corner of Evans Bay and construction discharges associated with tunnel drilling, earthworks, and slope stabilisation. Construction discharges are expected to generate sediment laden runoff including fine particulates and contaminants, which may enter coastal waters via the connected drainage networks into either Lambton Harbour or Evans Bay. These physical and chemical stressors may cause injury, loss of life and declines in benthic species in and around the outfalls.

21. During construction at Evans Bay, disturbance of intertidal and subtidal habitats is expected from the removal and replacement of the existing outfall and from construction machinery, which will result in the loss and injury of marine species and habitats, and disturbance to the biosecurity risk species Undaria. Sediment disturbance could temporarily increase turbidity and release contaminants. Construction activities may also disturb bird species and will disturb and remove little penguin (kororā) burrows.

22. Potential adverse operational effects (arising from an increased impervious area) are covered under positive effects above.

Proposed measures to avoid, remedy or mitigate adverse effects, including conditions

23. Mitigation for construction stage discharge effects in both Evans Bay and Lambton Harbour includes industry standard erosion and sediment and spills controls, materials and plant management, and construction discharge monitoring with contingency measures and monitoring if trigger levels are exceeded. Collectively these measures should reduce the overall level of effects on species and habitats in both receiving environments to **Low** or **Very Low** and no further effects management is required for construction discharges.

24. Operational stage discharge effects in both Evans Bay and Lambton Harbour are already addressed through the stormwater treatment system upgrades incorporated into the design across multiple catchments to help manage increased flows and reduce contaminant loads entering the receiving environment. Collectively, these stormwater upgrades should slightly improve overall water quality entering both Evans Bay and Lambton Harbour, whilst increased discharge volumes may slightly

reduce salinity and increase scour (especially in Evans Bay). Taken together this should result in a **Very Low** overall level of effect for all species and habitats, with the possibility of a **Net Gain** for marine habitats in most locations.

25. Mitigation for construction stage effects for the new outfall in Evans Bay includes minimising and avoiding the use of plant in the CMA, minimising the CMA works footprint, targeting low tide and fair-weather timing for works, applying industry-standard erosion and sediment and spills controls, appropriate disposal of contaminated sediment and waste materials and biosecurity controls. Whilst most effects are reduced to **Low** or less with mitigation in place, the level of effects from the permanent loss of three kororā burrows (and temporary loss of one burrow) and 30 m^2 of associated habitat remains **Very High** at the scale of the kororā habitat feature that falls within the Project's ZOI.

26. These residual effects can be readily addressed: I have recommended a compensation package involving the creation of six new kororā nesting structures, in a location near the impact site but less exposed to inundation, supported by 60 m^2 of coastal revegetation and a permanent fence around the nesting structure area to prevent kororā accessing the road corridor and to deter dogs. The end result will therefore be an improvement over the existing situation, in terms of the quality of kororā habitat in this location.

27. Implementation of these measures will be managed through a Kororā Management Plan (KMP) which has been prepared as part of this application.

Conclusions and recommendations

28. Evans Bay and Lambton Harbour are highly modified environments but both support a number of important ecological values including for several Threatened and At Risk species of coastal birds, kororā and marine mammals that could be impacted by the project.

29. Adverse effects from operational discharges have been addressed through the stormwater treatment systems incorporated into the design and no further mitigation is required for operational discharges.

30. For construction stage effects, and for the replacement of the Evans Bay outfall, a number of **Moderate** to **Very High** ecological effects are likely without mitigation in place. Therefore, mitigation is recommended to reduce these effects to below **Moderate** where possible.

31. A number of mitigation measures are therefore proposed during construction and during replacement of the Evans Bay outfall. Subject to full implementation of these recommended measures, the overall level of ecological effects is expected to be reduced to **Low** or **Very Low** for most species and habitats. Remaining residual effects on kororā are due to the loss of habitat and burrows from outfall replacement in Evans Bay, and will be adequately addressed through the recommended provision of new nesting structures, coastal planting, and fencing.

3. ASSESSMENT FRAMEWORK

Statutory context

32. The statutory and planning documents that provide the framework for this impact assessment are detailed in the Assessment of Environmental Effects. Statutory matters which are relevant to this EcIA are outlined in brief and include:

    i. The Greater Wellington Regional Council (GWRC) Natural Resources Plan (Operative, 2023) and Proposed Plan Change 1 to this plan

    ii. The GWRC Regional Policy Statement (RPS)

    iii. The New Zealand Coastal Policy Statement (NZCPS)

    iv. The National Policy Statement for Indigenous Biodiversity (NPS – IB)

NZTA technical publications or guidance documents

33. The following guidance documents have supported the completion of this EcIA:

    i. Information supplied by the design team for the stormwater discharge volumes and contaminant calculations that have been used to assess the impacts on the marine environment

    ii. 'Ecological Impact Assessment Guidelines' by New Zealand Transport Agency Waka Kotahi published August 2023

    iii. 'Road edge-effects ecosystems – A review of international and New Zealand literature, an assessment method for New Zealand roads, and recommended actions' by Simcock et al. (2022)

    iv. State Highway 1 Wellington Improvements Project Technical Report #17 Erosion and Sediment Control Assessment

    v. State Highway 1 Wellington Improvements Project Technical Report #15 Stormwater Assessment

Industry accepted practice and management guidance

34. My assessment has been informed by professional judgement and guided by various industry-accepted practice and management guidance documents, namely:

    i. Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZG, 2018). This document provides guidelines for assessment of contaminant concentrations within marine sediments

    ii. Marine Sediment Contaminant State and Trends in Tāmaki Makaurau / Auckland 2004 – 2023 (Allen, 2025). This document provides guidelines for assessment of contaminant concentrations within marine sediments

    iii. Ecological Impact Assessment (2018). EIANZ guidelines for use in New Zealand: terrestrial and freshwater ecosystems, and Module 1 – Assigning Ecological Value to Marine Benthic Habitats

35. These documents provide guidelines for assigning ecological value, magnitude and overall ecological value assessments for marine habitats and species.

Relevant consents

36. Stormwater monitoring is undertaken as a condition of the existing Wellington State Highway Stormwater Consent, which was granted to Waka Kotahi NZ Transport Agency in October 2022 (Consent WGN220179).

37. Stormwater monitoring is also undertaken as part of the Wellington Water Ltd Stage Two Global Stormwater Discharge Consent (Wellington Water Ltd 2023).

4. ASSESSMENT METHODOLOGY

Introduction

38. This section describes the methodology used to assess the potential effects of the Project on the environment, including a summary of the methodologies, fieldwork and data analysis undertaken to support this assessment.

39. Descriptions are provided for the two marine receiving environments of the stormwater discharges, which are Evans Bay and Lambton Harbour (refer to Figure 1 for discharge locations).

40. The ecological habitats and species that are potentially impacted by this Project include:

    i. Marine habitats for Evans Bay and Lambton Harbour:
        - Marine habitats
        - Benthic invertebrates
        - Marine biosecurity
        - Sediment quality
        - Water quality

    ii. Marine fauna for Evans Bay and Lambton Harbour:
        - Coastal avifauna
        - Little penguin / Kororā
        - Marine fish
        - Marine mammals

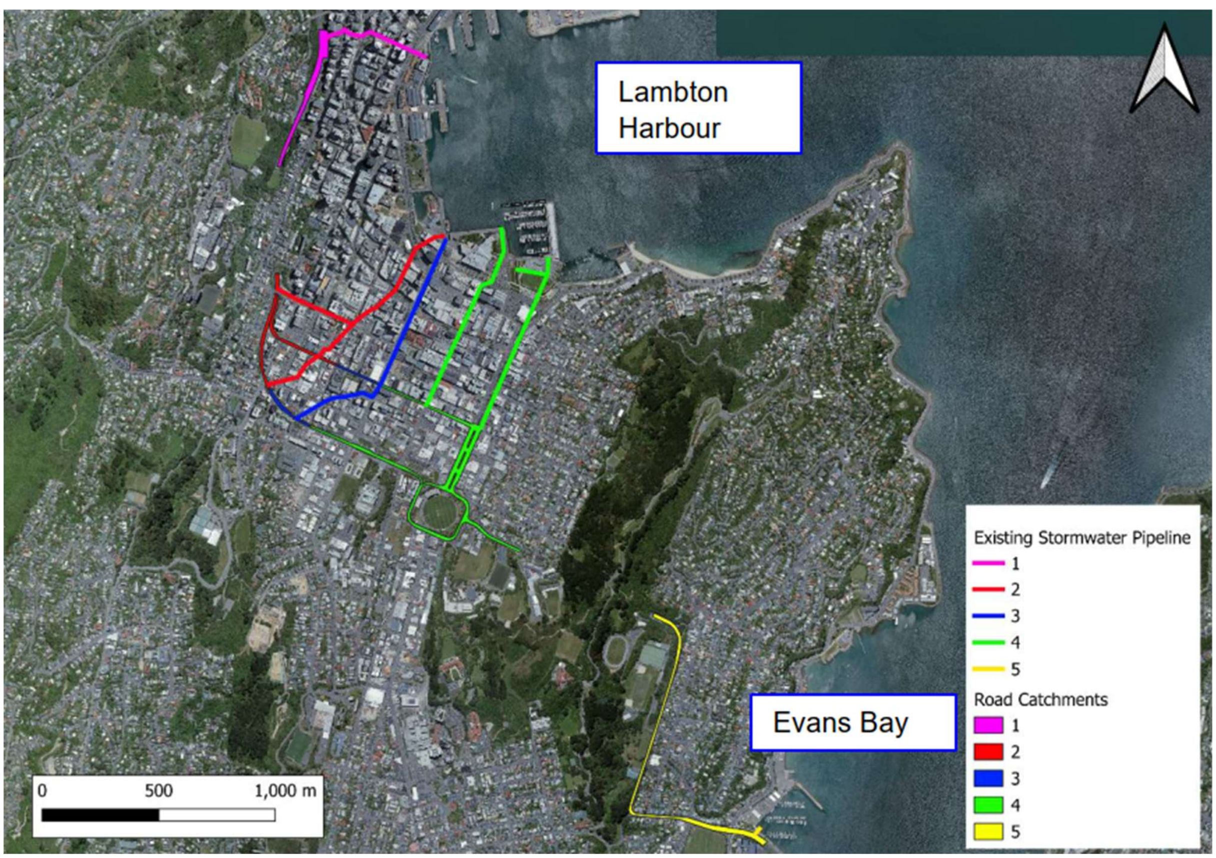

Figure 1 - Receiving environment from the proposed roading alignment (WSP, 2025)

Guidance and scope

41. This assessment is undertaken in alignment with the Environment Institute of Australia and New Zealand (EIANZ) Ecological Impact Assessment Guidelines (EcIAG) (EIANZ, 2018). I have also applied my professional judgement in arriving at my recommendations.

Desktop review of available information

42. Existing information for both Evans Bay and Lambton Harbour have been relied upon to inform this assessment. This includes ecological impact assessments, state of the environment monitoring and other ecological, water and sediment quality reports. These reports were reviewed to determine the values and wider ecological context of each site. The material considered is discussed below.

43. Review of existing reports and plans with reference to the water and sediment quality, ecology (including species databases), and those that include previous local assessments of impacts from existing stormwater networks and discharges provided by Wellington Water Ltd (WWL) and NZTA. The list of information includes the following websites and reports (but is not limited to):

    i. Land, Air, Water Aotearoa (LAWA)
    ii. eBird database (https://ebird.org)
    iii. iNaturalist New Zealand database
    iv. GWRC[2] and Wellington City Council (WCC)[3] geographic information system (GIS) layers
    v. Other publicly available technical reports, literature related to the sites
    vi. Stormwater quality monitoring and assessments

44. Water and sediment quality modelling:

    Reference to the stormwater contaminant load model (CLM) is made to assess discharges from stormwater. The CLM is developed to simulate the change in contaminant loads and uses traffic assumptions (in vehicles per day) and road areas as inputs to a spreadsheet-based model. The CLM provides estimates of the following water quality parameters pre and post project (both mitigated and unmitigated):

    Total suspended solids (TSS)

    i. Total zinc
    ii. Total copper
    iii. Total Petroleum Hydrocarbons (TPH)
    iv. The CLM calculates predicted changes in annual average contaminant loads from traffic changes from the Project area runoff. The CLM calculates the contaminant loads based on the following formula
    v. Source load=source areas x source yield x load reduction factor x area fraction managed (the source yield is the quantity of contaminants generated by an area of 1m^2 over one year)
    vi. Refer to the Stormwater Assessment prepared by Tom Bassett for further information and detail of the CLM

45. Water quality sampling data and ecotoxicity assessment:

    i. Comparative review of water quality data for relevant stormwater discharges to Evans Bay and Lambton Harbour against CLM estimates. This assessment is limited to available data for

[2] Greater Wellington Maps Gallery
[3] Wellington Maps

copper, zinc, and TSS, and is based on estimated proportional contributions of contaminants from the Project within the context of the wider catchment areas

ii. Assessment of potential ecotoxicological effects of relevant stormwater discharges to Evans Bay and Lambton Harbour based on a review of available water quality data

46. Coastal bird observations:

i. Any wading and seabirds present within Evans Bay during site investigations were recorded throughout the period of one tidal cycle and bird behaviours such as foraging, roosting or nesting were noted. A desktop review of coastal birds was also undertaken, identifying any coastal birds present at both Evans Bay

47. Marine fish and mammals:

i. Marine fish and mammals were identified through the desktop review information available from data sources such as National Aquatic Biodiversity Information System (NABIS), iNaturalist and available literature

Site visit and ecological survey

48. A site visit and ecological survey was carried out at Evans Bay. Site selection for the ecological survey was based on providing a representation of stormwater discharges entering Evans Bay and the coastal receiving environment. This was undertaken on 10 September 2025 by two T+T ecologists. The marine survey consisted of benthic invertebrate sampling, sediment quality sampling, flora and fauna observations, environmental descriptors and habitat mapping in the area. Three sites were sampled, directly adjacent to three stormwater outlets within Evans Bay. This included the main Evans Bay stormwater outfall (SW2), along with an outlet to the east (SW3 along Cobham Drive) and an outlet to the west (SW1 associated with the marina) of this stormwater outfall (See Annexure A for site locations).

49. Protected species dog surveys were carried out between April and November 2024[4] and November 2025 to provide baseline information on kororā presence. Surveys included a sweep with a certified Department of Conservation (DOC) penguin detector dog, followed by investigation by a T+T ecologist. Burrow locations and general observations were recorded. Over these periods a total of 5 dog surveys were undertaken.

50. Visual inspections by two T+T ecologists of known kororā burrows and habitat at the impact site were undertaken from April 2024 to November 2024[4], totalling 12 surveys over this time. Signs of occupation or presence of kororā within known burrows were recorded. Two additional kororā visual surveys by a T+T ecologist were undertaken in September 2025.

51. No ecological survey or site visit was undertaken at Lambton Harbour as existing information from surveys of the area is considered sufficient and there are no physical works planned at the outfall locations.

52. Benthic invertebrate sampling:

i. Fine scale monitoring of the benthic environment involves measuring benthic invertebrate community structure (epifauna and infauna). This data is then compared with sediment quality data to assess overall estuarine health. To characterise benthic invertebrate communities, three replicate macroinvertebrate core samples were taken at random locations at each of the three sites near the stormwater outfalls at low tide, (a total of 9 core samples across the survey area). A core sampler measuring 13 cm in diameter and 15 cm in length was manually driven into the sediment and removed with core contents intact. Core samples where then washed through a 0.5 mm mesh sieve and remaining material preserved in 99% ethanol for

[4] Evans Bay Renewal Works – Kororā Compliance Report (2025). Prepared by Tonkin + Taylor on behalf of WCC

invertebrate identification. Samples were sent to Biolive Invertebrate Identification Services for processing. Epifauna and flora was also noted at each site

53. Marine sediment sampling:

    i. Marine sediment sampling was conducted to evaluate the current environmental condition of the receiving environment exposed to stormwater discharges. The sampling included collection of three composite samples taken at random locations at each of the three sites near the stormwater outfalls at low tide. Each sampling point was associated with the three stormwater outlets and taken near to the benthic invertebrate samples. Sediment analytes tested included a suite of metals (Arsenic, Cadmium, Chromium, Copper, Nickel, Lead, Zinc and Mercury), Polycyclic Aromatic Hydrocarbons (PAHs), 7 grain size profile analysis and Total Organic Carbon (TOC). Sediment sampling involved sampling the top 2 cm of surficial sediments. The top 2 cm is considered the most recent and active sediment layer, reflecting current environmental condition (i.e. having been deposited within the last few years depending on sedimentation and bioturbation rates) (Clark et al., 2018). Samples were sent to Hill Laboratories for analysis

Cultural assessment

54. Ongoing consultation with Taranaki Whānui ki Te Upoko o te Ika and Ngāti Toa Rangatira, who hold mana whenua in Te Whanganui-a-Tara (Wellington), is being undertaken in regard to multiple components of this report, including the recommended residual effects management measures and the wildlife approval process. Cultural impact assessments have also been developed to ensure improvements are planned and delivered in a manner that respects and enhances whenua values at each stage of the Project. The assessment specifies kaitiaki involvement in environmental restoration and monitoring which can include monitoring of water quality, biodiversity and ecological features by iwi representatives throughout construction and beyond.

Effects assessment

55. The method applied to this EcIA is undertaken in alignment with the Ecological Impact Assessment Guidelines 2018 (EcIAG) published by the Environment Institute of Australia and New Zealand (EIANZ, Roper-Lindsay et al., 2018). The guidelines provide a standardised framework and matrix allowing a consistent and transparent assessment of ecological effects. As noted above, I have also applied my professional judgement in arriving at my recommendations.

56. The guidelines were used to establish the following (Refer to Annexure F for the criteria and tables used in this assessment):

    i. The ecological values of marine species and habitats within the sites (Table 17 to Table 20 in Annexure F)

    ii. The magnitude of effect (Table 19) on ecological values from the proposed project works in the absence of any controls

    iii. The overall level of effects in the absence of controls to determine whether avoidance, minimisation or remediation is required (Table 20)

    iv. Proposed mitigation measures to address adverse effects and meet statutory planning requirements

    v. The magnitude of effect and overall level of effect, taking into consideration the measures to avoid, minimise or remedy effects (Table 20)

57. Where an overall level of effect is assessed as **moderate** or higher after applying proposed measures to avoid, minimise and remediate effects, then additional effects management in the form of offset

and/or compensation is recommended to achieve a no net loss of biodiversity values. Details of how these residual effects are approached within this EcIA are outlined below.

Residual effects approach

58. The EcIAG states that if, after all efforts to avoid, minimise, and remedy effects, there remains an overall effect of **moderate** or higher, then consideration of further efforts to address these residual adverse effects in the form of offset and/or compensation is recommended so that at least no net loss of biodiversity value occurs (and, if the effects are in the 'Very High' category, then a net biodiversity gain may be appropriate).[5]

59. Policy 11 of The NZCPS directs (among other things) that adverse effects on indigenous taxa that are Threatened or At Risk (such as kororā) should be avoided. The Wellington Natural Resources Plan provides policy direction in respect of Threatened and At Risk taxa at a regional level. I have applied the effects management hierarchy as referenced in the NPS-IB and Wellington Natural Resources Plan, and the EIANZ EcIA guidelines (2018) to assess adverse effects on kororā, and have therefore suggested compensation measures for residual adverse effects.

[5] See Page 84 of the EIANZ EcIA guidelines (2018)

5. EXISTING ENVIRONMENT

Introduction

Project area

60. The existing project area surface is largely impervious, comprising of existing roads and paved surfaces (footpaths and parking areas) and buildings with an existing stormwater network, that considers four areas as shown in Figure 2.

    i. Terrace Tunnel (The Terrace)

    ii. Te Aro

    iii. Basin Reserve

    iv. Eastern Connections (Hataitai)

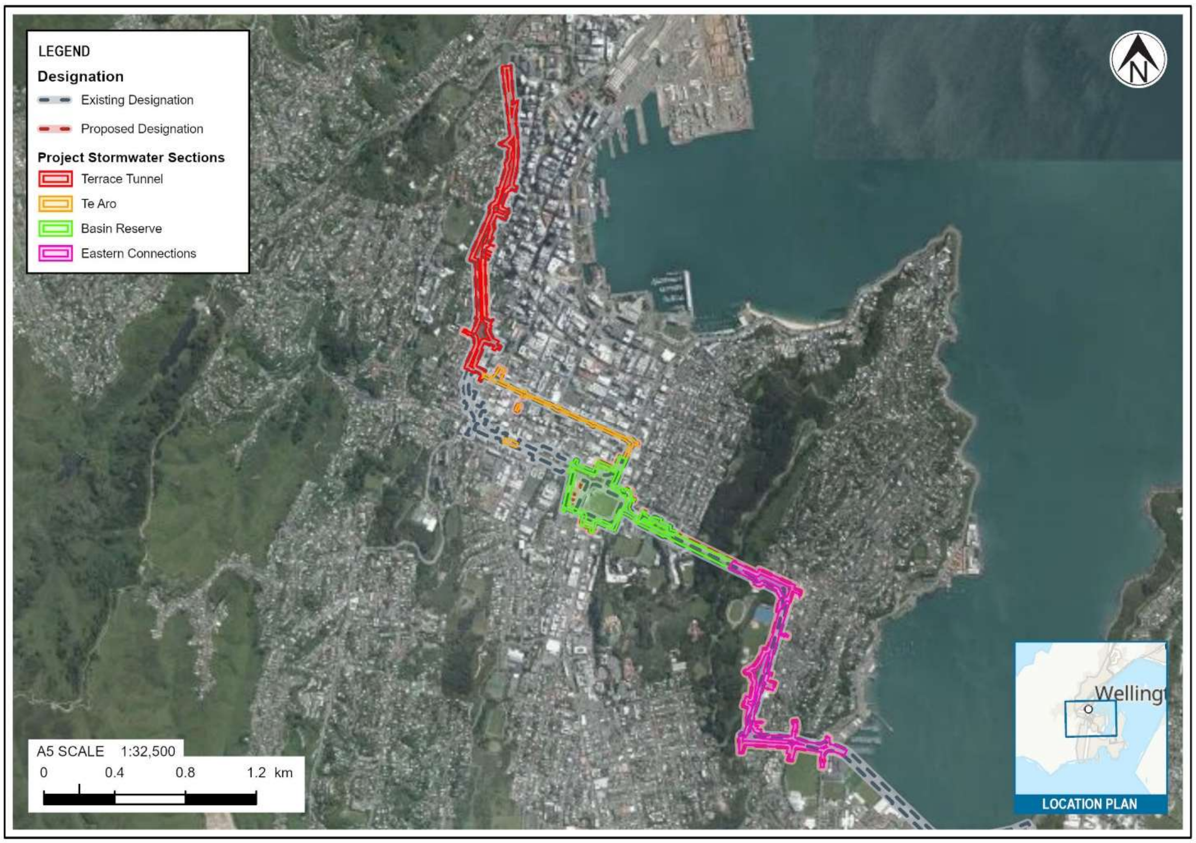

Figure 2- Stormwater project areas

61. Figure 3 shows discharge locations for stormwater originating from the Project. Stormwater discharges from The Terrace, Te Aro and Basin Reserve areas discharge to Lambton Harbour via existing stormwater pipes and culverted awa. Stormwater runoff from Hataitai area discharges to Evans Bay.

62. All the culverted awa within the Project area (Kumutoto, Waikoukou, Waimapihi, Waitangi) discharge into Lambton Harbour. No culverted awa have been identified in the Hataitai area associated with Evans Bay, other than the Waipapa stream discussed in this report.

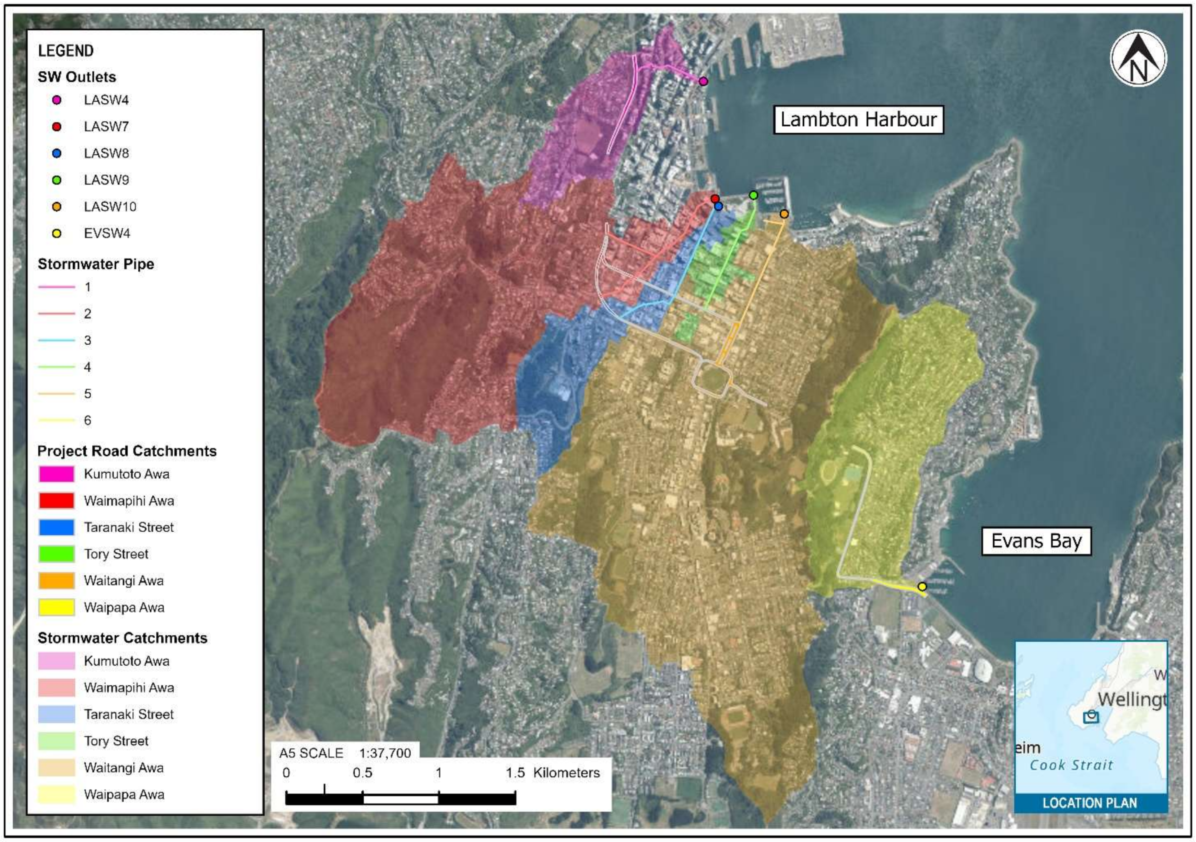

Figure 3 - State Highway 1 Project road catchments (existing) are shown within wider associated stormwater catchments with points indicating outlets to Lambton Harbour and Evans Bay

Site descriptions

63. The existing environment was characterised through a desk based study and site survey of marine habitats and species present at Evans Bay and a desktop assessment at Lambton Harbour. The site visit by T+T marine ecologists and sample collections for marine sediments and macroinvertebrate cores at Evans Bay[6] were undertaken to help characterise benthic ecology and sediment contaminants.

Evans Bay

64. Evans Bay is a large semi-exposed U-shaped inlet located at the southern end of Wellington Harbour. It stretches from Point Jerningham east of Oriental Bay to Point Halswell below Mount Crawford (Wellington Water, 2023). Once connected to the Cook Strait through a channel that is now known as the Rongotai flats, the bay is nestled between the Miramar Peninsula and the suburbs of Hataitai and Kilbirnie. The bay is approximately 3.6 km in length and 1.4 km in width and an area of 4.5 km^2 (Wellington Water, 2023). It is a shallow, north facing embayment bordered with a tidal range between 0.7 – 1.3 m (EOS Ecology, 2013 and references therein).

65. The area historically supported wetland and sublittoral flats which were lost to reclamation. The bay is now highly modified, with a marina, boat ramp, stormwater outlets, coastal protection and carparks. Evans Bay receives stormwater from the suburbs of Roseneath, Hataitai, Kilbirnie, Rongotai, Miramar and Mt Crawford via 10 major stormwater outfalls and numerous smaller outlets. The combined Evans

[6] A site visit, sediment and macroinvertebrate core sampling was not carried out at Lambton Harbour because enough existing information was available for the purposes of this assessment

Bay stormwater catchment has an area of 8.52 km^2 (Wellington Water, 2023), of which 83% consists of urban landcover and 17% rural landcover (NZTA, 2023).

66. There are no significant streams or rivers which drain into the Evans Bay catchment, however, the Waipapa stream would have historically entered the bay, but was piped between 1917 and 1935 and is now the discharge point for stormwater from the Hataitai catchment.

67. The flat central catchment is likely drained via the stormwater network, while open drains, both natural and man made, likely drain the eastern and western hillsides (NZTA, 2023). The discharge is piped to an outfall in the southwestern corner of Evans Bay and is proposed to be upgraded.

68. The terrestrial areas of Evans Bay have no protection from Natural Environment overlays derived from the Wellington City 2024 District Plan (Wellington City Council, 2024). Under the Wellington Region Natural Resources Plan (NRP), part of Evans Bay falls within Schedule F4: Significant CMA site indigenous biodiversity (Map 27) (Natural Resources Plan – Plan Change 1 (2023). The habitats identified are *Adamsiella* algal meadows and horse mussel beds which are known to harbour a range of associated species, however the known location of beds does not fall within the ZOI[15] of the proposed SH1 stormwater discharge, and are further southeast (Greater Wellington Council, 2023).

Lambton Harbour

69. Lambton Harbour, located in the northeastern corner of Wellington Harbour, is a semi-enclosed embayment that has undergone significant modification due to urban development and land reclamation since the 19th century. It stretches from the northern coast along Aotea Quay to Lambton Basin and the beach front at Oriental Bay (Wellington Water, 2023). Lambton Harbour commercial amenities include the Port of Wellington, Inter-island ferry terminals and a large marina. The waterfront is lined with infrastructure including wharves, urban infrastructure, and 28 stormwater outlets discharging into its waters, primarily from the Waitangi catchment (EOS Ecology, 2013). Recreational amenities within the harbour include the Wellington CBD waterfront, Oriental Bay beaches and boat launching and mooring facilities (Wellington Water, 2023).

Ecological characteristics and values

Evans Bay

Marine habitats and ecology

70. The coastal zone of Evans Bay where the existing Evans Bay stormwater outfall (Figure 4) and SH1 stormwater discharge is proposed, has a range of largely manmade structures which influence local ecology below mean high water springs. The embayment contains soft sediment/gravel subtidal habitat and natural or artificial cobble, boulder and rocky shore habitat. Evans Bay is highly modified and reclamation has occurred in the area. To the southeast of the Evans Bay stormwater outfall, the shoreline has been armoured with rock revetment and rubble. The intertidal habitat directly northwest of the stormwater outfall is a gravel and fine sediment beach extending for c.20 m toward the northern section of the coastline and the marina (Annexure A).

71. Small sections of planted vegetation are present between the waters edge and road. Pohutukawa are present intermittently along the road verge, above rock revetment to the east. Along the northwest section of Evans Bay there is a boat ramp and stormwater outlet.

Figure 4 - Evans Bay stormwater outfall looking East, including the fine sediment/gravel beach to the west of the stormwater outfall

72. Along the northwest section of Evans Bay, at the marina, there is a boat ramp and stormwater outlet. Directly adjacent to the outlet, the subtidal benthic habitat is a mixture of soft silt and anoxic muds, large gravel and rock. The benthos also has terrestrial detritus such as leaf litter and sticks indicating the area is receiving inputs from terrestrial sources and is degraded.

73. Southwest of the Evans Bay stormwater outfall along Cobham Drive, rubble extends for c.20 m to a pier (see Annexure A). Rubble in some sections have Mbar protruding. The shoreline at this point is then armoured by rock revetment, extending for c.95 m to a discharge outlet.

74. The Evans Bay stormwater outfall itself is permanently subtidal, with dense mussel beds lining the inner barrel (Figure 7) of the stormwater outfall at the level at which water flows. The stormwater outfall is large and has been previously stabilised by shotcrete. The benthic substrate surrounding the stormwater outfall in the subtidal is a mixture of boulders, cobbles, bedrock, rubble, gravel and fine sediments. The Waipapa stream would have historically entered the bay but was piped between 1917 and 1935 and is now the discharge point for stormwater from the Hataitai catchment. The area surrounding Evans Bay stormwater outfall is indicative of receiving terrestrial inputs.

75. Evans Bay is considered shallow reef habitat that has been heavily impacted with marine litter and anthropogenic alterations to sea beds over time (Micaroni et al., 2023). Marine litter found during previous surveys of the Bay has included bottles, packaging, plastic cups, aluminium cans, ropes, tyres and fishing gear. Evans Bay has been found to have the highest density of litter observed during previous surveys. This litter will be negatively impacting benthic subtidal communities and habitats and was also observed within the bay during the site assessment in 2025.

76. A wide variety of benthic invertebrates and algae were observed within Evans Bay during the site visit in September 2025, most of these associated with rocky shore substrate. Species identified in the rocky shore area included barnacles (*Chamaesipho collumna, C. brunnea, Austrominus modestus*),

limpets (*Cellana radians, C. ornata*), snails (*Diloma* sp., *Haustrum haustorium*, *Lunella smargada, Buccinulum* sp.) calcareous tube dwelling worms and bryazoans (see photo). Cushion stars (*Patiriella regularis*) were found associated with interspersed patches of soft sediment.

77. 2019 surveys by Morrisey et al., (2019) described the intertidal and shallow subtidal areas of Evans Bay containing a diverse and abundant assemblage of plants and animals, particularly associated with natural rocky reefs compared with artificial substrata such as rip rap and concrete seawalls. The shallow sandy areas in southern Evans Bay contained numerous horse mussels (Morrisey et al., 2019).

78. Previous surveys from 2007, 2011 and 2013 and observations made within this bay have found that mussels dominate the intertidal rocky shore community within Evans Bay, higher than other areas within the Wellington harbour, which suggests a productive intertidal rocky shore community (EOS Ecology, 2013 and references therein). This was also found during the site survey in 2025.

79. The mussel beds associated with the Evans Bay stormwater outfall are predominantly blue mussels (*Mytilus edulis,* Figure 8), however they have the potential to be a mixture of mussel species (Ribbed mussel; *Aulacomya maoriana* and Green-lipped mussel; *Perna canaliculus*). (Helson et al., 2007).

80. As was found in 2013 (EOS Ecology, 2013), there was a variety of algae growing near to or on the Evans Bay stormwater outfall and stormwater outfalls to the east and west. Species included sea lettuce (*Ulva lactuca*), green algae (*Enteromopha* sp.), red algae (*Poryphra* sp.), brown algae (*Cystophora* sp) and branching and geniculate coralline algae (*Corallina* sp.). The invasive seaweed *Undaria pinnatifida* was also prolific in the area, including large individuals growing in the sub-tidal, attached to boulders and bedrock (Figure 5 and Figure 6).

81. As part of a Harbour wide shallow reef habitat mapping survey carried out by Micaroni et al., 2023, the eastern side of Evans Bay was surveyed, and a variety of notable habitats were identified. An array of species were found on the seafloor, supporting high biodiversity, with benthic communities dominated by the sponge (*Sberites australiensis*) (Micaroni et al., 2023). Large beds of the red alga *Adamsiella* have been found in the subtidal region of Evans Bay (however not within the ZOI[15] of the project). These beds support a range of species, playing important roles in stabilising muddy bottoms and creating habitat for other animals, and are associated with bivalves including horse mussels and scallops, holothurians, tube worms and fish (D'Archino et al. 2022). Ribbed mussel (*Aulacomya maoriana*) was found near Evans Bay stormwater outfall, a mussel generally distributed south of the north island and in the South Island. Horse mussel (*Atrina zelandica*) has been flagged as a species of note in the wider Evans Bay area. Scallops have previously been reported in several locations in Evans Bay including in the south-western corner of the bay near to the Evans Bay stormwater outfall. Old shells found on the upper intertidal indicate the area once supported soft sediment invertebrates such as cockle (*Austrovenus stutchburyi*) and clams (*Venerupis largillierti*).

Figure 5 - Undaria pinnatifida attached to rock which provides substrate for multiple benthic species including red algae, chiton and 11 armed seastar. Located west of the Evans Bay stormwater outfall within the subtidal area. Photo taken September 2025

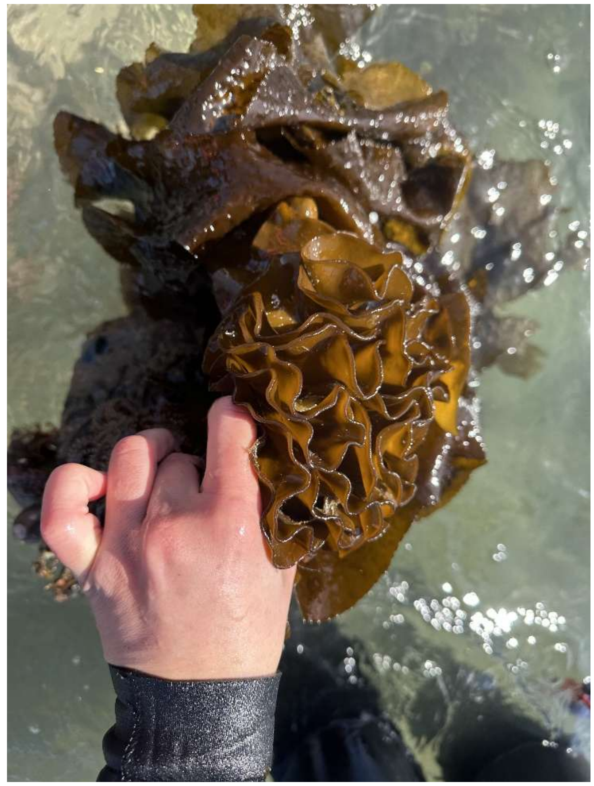

Figure 6 - Large Undaria pinnatifida individual found near the Evans Bay stormwater outfall. Photo taken September 2025

Figure 7 - Mussel beds lining the inner barrel of the Evans Bay stormwater outfall. Photo taken September 2025

Figure 8 - Mussel beds with a mosaic of invertebrate species on artificial rocky substrate. Photo taken September 2025

Benthic ecology invertebrate sample analysis

82. As part of the 2020 Wellington Harbour subtidal sediment sampling programme (Cummings et al., 2021), the analysis of macroinvertebrate cores was run through the national Benthic Health Model (BHM) which is used to track the health of benthic communities in response to metal concentrations and muddiness. The output showed that the majority of Wellington Harbour was categorised as 'good' with the exception of a site in the middle of Evans Bay categorised as 'moderate' (Cummings et al., 2021).

83. Results of benthic invertebrate sampling and analysis are summarised here and presented in Table 2 below and the raw results can be found in Annexure B.

84. Results of the AMBI analysis at Site SW1 (Northwest stormwater outfall associated with the marina) and Site SW3 (stormwater outfall east along Cobham Drive) were indicative of 'slightly disturbed' systems under the AZTI Marine Biotic Index (AMBI) framework. Benthic community health according to these results is potentially 'unbalanced'.

85. AMBI results at Site SW2 (main Evans Bay stormwater outfall) were also indicative of a 'slightly disturbed' system under the AMBI framework and benthic community health is also considered 'unbalanced'. However, it should be noted that AMBI is generally used for soft sediment environments, and the benthic substrate at Site SW2 was a mixture of soft sediments, gravel, cobbles and boulders, with very low numbers of infaunal species in two of the gravelly/rocky replicates. One replicate had a higher percentage of soft sediment and this was reflected in more representative community data for this sample (S2-R2; see Annexure B for Species data results) so only this replicate was assessed against AMBI.

86. Site SW1 (Marina stormwater outfall, west of Evans Bay stormwater outfall) supports a number of polychaete worms, bivalves such as small cockles and wedge shells and amphipods. Brittle stars are also present in the area.

87. Benthic substrate at Site SW2 (main Evans Bay stormwater outfall) is dominated by larger grain sizes, gravel and boulders, which is reflected in the community data as described above. Infaunal species found included small numbers of bivalves including cockles, pipi and wedge shell, as well as polychaete worms and amphipods.

88. Site SW3 (Cobham Drive stormwater outfall, east of main Evans Bay stormwater outfall) also had a small amount of bivalves, snails and polychaete worms. This area was also a mixture of larger grain size, gravel, small and large cobbles.

Table 2: Benthic invertebrate summary statistics

Site	Mean AMBI Score	Disturbance classification	Benthic community health	Mean No. of taxa	Mean No. of individuals	SW Diversity	SW Evenness
Site 1	3.07	Slightly disturbed	Unbalanced	26	194	2.36	0.73
Site 2	2.12	Slightly disturbed	Unbalanced	30	98	2.87	0.85
Site 3	1.88	Slightly disturbed	Unbalanced	17	64	2.15	0.76

Note: A 11.3% average of fauna across the sites could not be assigned values and were excluded from the AMBI analysis. Infaunal core sampling and AMBI analysis may not accurately represent species present at Site 2, which was predominantly gravel, cobbles and boulders and only one soft substrate replicate was used for this site.

89. Little data exists regarding conservation status of many marine invertebrates. As such, much of the invertebrate species identified above do not have a conservation status. Of the species identified within the site footprint that do, none have an At Risk or Threatened conservation status (Freeman et al., 2014).

Sediment quality

Metals

90. Sediment samples were collected from adjacent to the discharge locations of three stormwater drain discharge locations within Evans Bay (see Annexure A for locations).

91. Analysis of heavy metals across the three discharges monitored for sediment contaminants found elevated levels of copper (30 to 60 mg/kg), lead (68 to 105 mg/kg) and zinc (159 to 230 mg/kg). All of the results for lead and zinc exceeded Environmental Response Criteria (ERC) red guidelines for lead and zinc, and for copper at SW1 and SW3. All results for arsenic, chromium, cadmium and nickel were below the Australia and New Zealand Guidelines Default Guideline Values (ANZG DGV) guidelines (Table 3).

Table 3: Sediment contaminant results at Evans Bay compared with the ERC and ANZG DGVs for metals

	ERC			ANZG			
Site number	**Copper**	**Lead**	**Zinc**	**Arsenic**	**Chromium**	**Cadmium**	**Nickel**
SW1	60	77	230	6	23	0.12	10
SW2	30	105	159	5	15	0.08	8
SW3	40	68	197	6	22	0.12	20

92. These results are consistent with several other studies have also found very high levels of heavy metals (zinc, lead, copper) within 50m of the Kilbirnie outfall in marine sediments (T+T, 1996; Bolton-Ritchie, 2003). The relatively sheltered waters of Evans Bay allow for the discharged contaminants to settle near outfalls due to relatively low dispersal processes (i.e. wave action) (Wellington Water, 2023).

Polycyclic Aromatic Hydrocarbons (PAH)

93. 22 polycyclic aromatic hydrocarbons (PAH) analytes were tested and were above detection limits. For total PAH levels all sites exceeded ERC red guidelines, and were below ANZECC guidelines.

94. Testing by Stephenson et al., 2008 found sediments in nearshore locations to contain levels of PAHs and organochlorine pesticides (DDT) to exceed various sediment quality guidelines (Stephenson et al., 2008). Some studies suggest that the PAH concentrations could be historic accumulations and a result of the once-widespread use of coal tar for sealing roads (Milne, 2010).

Grain size

95. Sediment grain sizes were measured at each stormwater drain, with the highest muddiness fraction found at SW1 of 11.7% falling in the ‘Fair’ muddiness category. The sediment grain sizes across SW1 were spread across the grain size classes. For both SW2 and SW3 had highest grain size classes of sediment above 2 mm.

Water quality

96. Water quality in Evans Bay is affected by stormwater runoff from surrounding roads and residential area, which can transport sediments, nutrients, heavy metals, hydrocarbons and faecal bacteria, particularly during and after heavy rainfall events (GWRC, 2024: Wellington Water Ltd, 2023). The water quality within the bay has shown a gradual improvement more recently due to stormwater infrastructure upgrades and catchment management initiatives (GWRC, 2024).

97. Marine water quality is measured at three coastal water sites and four stormwater sites within Evans Bay, two sites of which are close to the stormwater outfall (EVSW3 -Kilbirnie Culvert and EVSW4 – Hataitai Culvert) (Figure 9). Localised observations of oil and grease films and changes in colour and/or clarity were common at Hataitai culvert (~52% of 29 site visits). Discharges contain elevated concentrations of copper and zinc that do not meet Australia and New Zealand Water Quality

Guidelines (ANZG) guidelines (2018); however, it is noted that in most cases a 10-fold dilution in receiving water would be sufficient to achieve default guideline values (Wellington Water Ltd, 2023).

98. Marine water quality monitoring undertaken in Evans Bay by Lachowicz (2005) between August 2002 and September 2023 recorded consistently high salinity (35.08 ± 2.9 PSU) and water temperatures (maximum recorded 18.8˚) and rich phytoplankton (measured as chlorophyll *a* 9.42 ± 4.33 µg 1^{-1}) compared to other parts of Wellington Harbour, likely due to nutrients input from land and from stormwater drains that run into Evans Bay (Lachowicz, 2005).

99. No recent stormwater discharge flow rate information could be obtained for this assessment for the Hataitai – Evans Bay outfall. As such, the changes to contaminant loads estimated in the Contaminant Load Model (CLM) detailed in the State Highway 1 Stormwater Assessment could not be directly related to contaminant concentrations recorded from the Hataitai – Evans Bay outfall (Table 4). Instead, the potential effects of the Project on the coastal discharge quality are discussed within the context of the Project-affected proportion of road area within the wider Waipapa Awa catchment road network.

100. Water quality data presented in Table 4 below summarises monthly samples collected from stormwater outlets draining areas impacted by the Project to Evans Bay. Summary statistics are presented based on 20 – 29 monthly samples, with copper and zinc concentrations compared against the ANZG (ANZG, 2018).

101. The Table 4 water quality summary data indicates that the median copper concentration exceeds the ANZG (2018) default guideline values for the protection of 80% of marine species (80% DGVs). Median zinc concentrations exceed the 95% DGV, whilst the 95th percentile of concentrations also exceeds the 80% DGV.

Table 4: Evans Bay stormwater discharge monthly water quality summary statistics (Jan 2020 – Jun 2022)

Catchment	Site Name	Site ID	Total copper (mg/L)			Total zinc (mg/L)		
			Min	Median	95%ile	Min	Median	95%ile
Evans Bay	Hataitai	EVSW4	**0.001**	**0.003**	**0.0076**	0.004	**0.01**	**0.069**

Note: Data obtained from Wellington Water Ltd Stage Two Global Stormwater Discharge Consent – Assessment of Effects on the Environment (June 2023). Exceedances of ANZG (2018) toxicant default guideline values for marine species protection are indicated by **bold** (95% species protection) and red (80% species protection) concentrations.

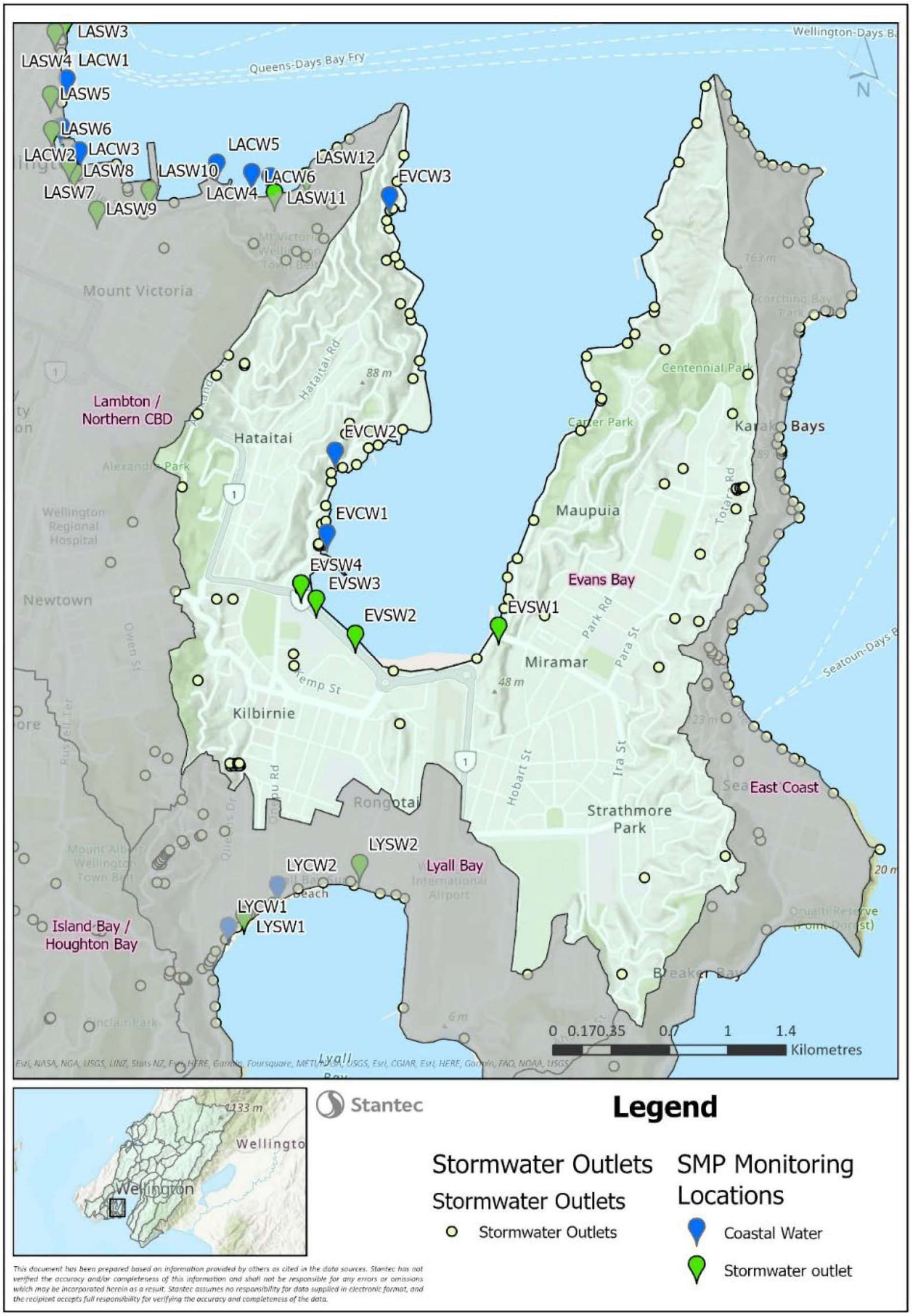

Figure 9 - Wellington Water Stormwater Monitoring Plan (SMP) monitoring locations in Evans Bay (Wellington Water, 2023)

Marine habitat summary

102. Evans Bay's coastal zone is highly modified, featuring manmade structures such as stormwater outfalls, rock revetments, rubble, and boat ramps that influence local ecology. The embayment supports mixed habitats, including soft sediment and gravel subtidal areas, as well as natural and artificial rocky shores. Historically, the Waipapa Stream entered the bay but is now piped, discharging

stormwater from the Hataitai catchment. The Evans Bay stormwater outfall remains permanently subtidal, lined with dense mussel beds (primarily *Mytilus edulis*), and surrounded by boulders, cobbles, and fine sediments.

103. Marine biodiversity includes barnacles, limpets, snails, bryozoans, cushion stars, and polychaete worms, with mussels dominating rocky intertidal zones. Algae species such as *Ulva lactuca*, *Cystophora*, coralline algae, and the invasive *Undaria pinnatifida* are common. Subtidal habitats support sponges (*Sberites australiensis*), red algae (*Adamsiella*), and bivalves like ribbed mussels, horse mussels, and scallops. However, the area is degraded by marine litter and terrestrial inputs, with Evans Bay recording the highest litter density in Wellington Harbour.

104. Sediment analysis revealed elevated copper, lead, zinc, and polycyclic aromatic hydrocarbons exceeding environmental guidelines, indicating contamination. AMBI assessments classify benthic health as slightly to moderately disturbed, reflecting anthropogenic impacts. Despite this, Evans Bay remains ecologically productive, supporting diverse benthic communities.

105. Based on the information above and with reference to the EIANZ EcIA guidelines, the ecological value of marine habitat in this part of Evans Bay is considered to be **Moderate**.

Marine fauna

Coastal avifauna

106. The intertidal gravel beach provides habitat for roosting birds higher on the shoreline, as was observed in September 2025. A flock of adult and juvenile red billed gulls (*Chroicocephalus novaehollandiae scopulinus)* were observed resting and foraging west of Evans Bay stormwater outfall and on the gravel beach. Mallard ducks (*Anas platyrhynchos*) were also present. Variable oystercatchers (*Haematopus unicolor*) and one South Island pied oystercatcher (*H. finschi*) were present to the east of the stormwater outfall, resting on the revetment. There is a likelihood that they could use the gravel beach west of the Evans Bay stormwater outfall as roosting habitat as well. A little shag (*Microcarbo melanoleucos*) was observed to the east of the stormwater outfall, resting on a lone pile. Little shags are widespread along the Wellington City coastline, with noticeably higher densities present at Evans Bay (McArthur, 2025). Spotted shag (*Phalacrocorax punctatus*) has also been observed at Evans Bay during annual surveys carried out between 2018 and 2022 (McArthur, 2022).

107. Data from eBird and iNaturalist, together with a survey of built structures undertaken in 2024, has been collated to describe the occurrence of indigenous birds in built structures in the Wellington region (McArther, 2025). Marine structures were ranked according to the habitat value of the structure for Nationally or Regionally threatened or At Risk bird species. The national and regional threat statuses were taken into account. The Evans Bay Marina was found to have 7 native bird species and was the seventh highest ranking structure out of an assessed 67 structures (McArthur, 2025).

108. The eBird database identifies 50 species of bird which have been observed in Evans Bay between 1924 and 2025, including six nationally threatened species, black fronted tern (*Chlidonias albostriatus*), Caspian tern (*Hydroprogne caspia*), Pacific Reef Heron (*Egretta sacra*), salvin's albatross (*Thalassarche salvini*), spotted shag and white heron (*Ardea modesta*). Coastal bird species of relevance within this dataset are listed in Annexure C, however, these species are only potentially present within the ZOI[15] of the Project, and many may be transiting through the area.

109. With reference to the above information, the conservation status of coastal birds that are likely to occupy Evans Bay, and with reference to the EIANZ guidelines the six species listed with Very High ecological value (Nationally Threatened), are black fronted tern, Caspian tern, Pacific Reef Heron, Salvin's albatross, spotted shag and white heron Four species have High ecological value (kororā, red billed gull, south island pied oystercatcher, white fronted tern). Therefore, the ecological value of coastal avifauna at Evans Bay ranges from **Low** to **Very High.**

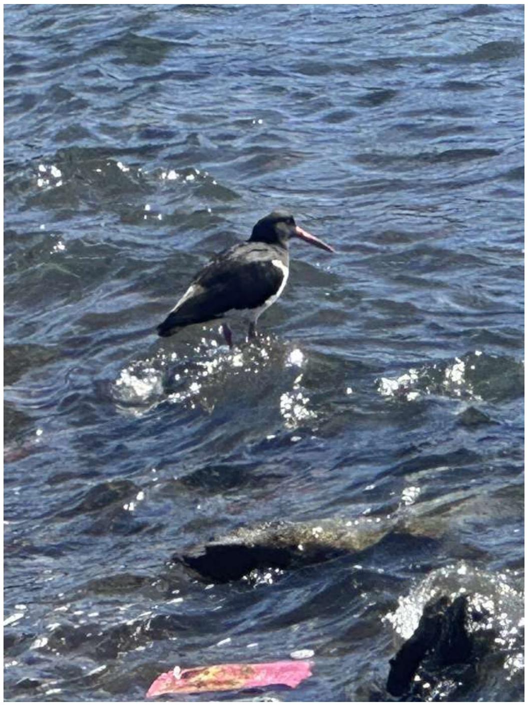

Figure 10 - South Island Pied oystercatcher present within a flock of variable oystercatchers among the revetment, east of the Evans Bay stormwater outfall. Photo taken September 2025

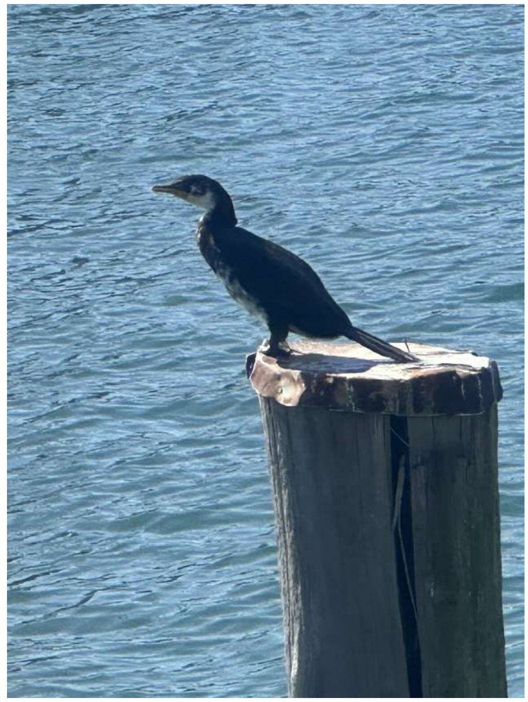

Figure 11 - Little shag resting on pile, east of the Evans Bay stormwater outfall in the subtidal. Photo taken September 2025

Figure 12 - Adult and juvenile Red billed gulls on gravel/ sand beach west of Evans Bay stormwater outfall. Photo taken September 2025

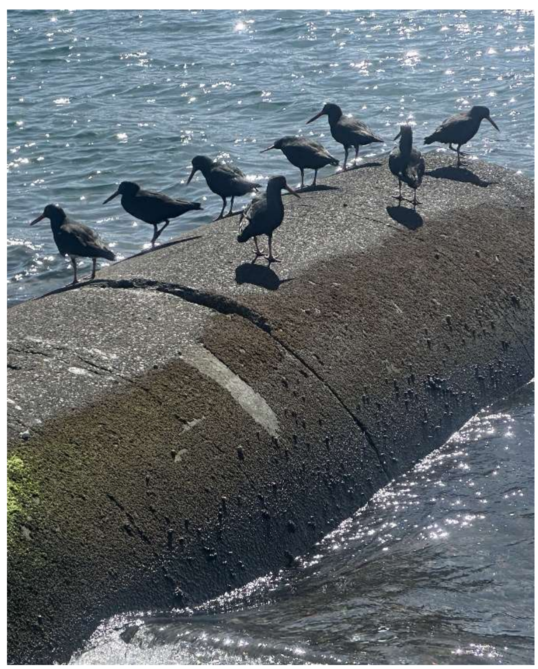

Figure 13 - Flock of variable oystercatchers resting on the eastern stormwater outfall along Cobham Drive. Photo taken September 2025

Little penguin/kororā

110. Revetment and rubble above MHWS to either side of the Evans Bay stormwater outfalls have been identified as containing little penguin/ Kororā burrows (*Eudyptula minor*; At Risk – Declining) during October 2024 and November 2025 surveys (Figure 14). Little Penguins are known for their high site fidelity to existing burrows. These burrows sit in the direct vicinity of the proposed activity.

111. With reference to the EIANZ EcIAG framework (Annexure F), the ecological value of kororā is assessed as **High** given their threat classification of 'At Risk – Declining' (as per the Department of Conservation (DOC) threat classification, Robertson et al. (2021).

Figure 14 - Kororā burrows identified over the 2024/25 and 2025/26 seasons. Surveys conducted in Oct 24 and Nov 25

Marine fish

112. Te Whanganui-a-Tara provides important habitat for fish species, including shelter and nursery grounds. As of 2013, fish species that have been spotted in Evans Bay include schools of juvenile spotty (*Pseudolabrus celidotus*), leatherjacket (*Parika scaber*), flounder (*Rhombosolea* sp.), banded wrasse (*Pseudolabrus fucicola*), gurnard (*Chelidonichthys kumu*), stargazer (*Leptoscopus macropygus*) and low numbers of snapper (*Pagrus auratus*) (EOS Ecology, 2013). Kahawai (*Arripis trutta*) have been reported schooling in Evans Bay[7] and instances of blue moki (*Latridopsis ciliaris*), and trevally (*Pseudocaranx dentex*) have been noted in Evans Bay by recreational fishers.

113. The species above either have no threat status or have a threat status of 'Least Concern' on the IUCN threatened species list[8]. The rare native scaly gurnard has been identified in the Wellington harbour including near sites around Evans Bay and has been associated with sponge gardens, including those

[7] https://www.nzfishingworld.co.nz/reports/wellingtons-windy-week

[8] www.iucnredlist.org

found in Evans Bay[9]. Stingrays (*Dasyatis* sp.) have been observed in Evans Bay, with likely resident individuals in the area.

114. Based on the fish community within Evans Bay being diverse and an important recreational fishing spot, and with reference to the EIANZ guidelines in Annexure F, the ecological value of marine fish in Evans Bay is considered to be **Moderate.**

Marine mammals

115. Te Whanganui-a-Tara is a harbour well utilised by a variety of a marine mammals, with ten species having been recorded within the harbour. These include common dolphin (*Delphius delphis;* Not Threatened), Bottlenose dolphin (*Tursiops trunculatus;* Threatened - Nationally Vulnerable), NZ Fur seal (*Arctocephalus forsteri;* Not Threatened), Hector's dolphin (*Cephalorphynchus hectori;* Nationally Vulnerable), Southern right whale (*Eubalaena australis;* Threatened – Nationally Increasing), Humpback whale (*Megaptera novaengliae;* Migrant), Dusky dolphins (*Lagenorhynchus obscurus*; Not threatened), Long-finned pilot whale (*Globicephala melas*; Not Threatened), Orca / Killer whale (*Orcinus orca*; Nationally Critical), Sperm whale (*Physeter macrocephalus*; At Risk - Declining) and Beaked whale (*Ziphiidae* sp.; Data Deficient) (Lundquist et al. 2025; Childerhouse, 2020, DOC marine mammal sighting and stranding database).

116. That said, Te Whanganui-a-Tara is not currently recognised as an area of ecological significance for marine mammals. The three most common species recorded within the harbour are the orca, Hector's dolphins and common dolphins. New Zealand fur seals are seen regularly within the harbour area, although there are no known breeding or haul out sites within the harbour (Childerhouse, 2020).

117. Evans Bay is within the range of a number of marine mammals listed above. Marine mammals that have been sighted within or near to Evans Bay include the common dolphin, southern right whale[10], orca and NZ fur seal. However, the site location and ZOI[15] is within a shallow bay and it is unlikely that whales and dolphins will frequent the area, except for seals, such as the NZ fur seal which is known to be present from time to time.

118. Based on the information above, and with reference to the EIANZ guidelines Annexure F, the ecological value of marine mammals is considered to be **Low**.

Lambton Harbour

Marine habitats and ecology

119. Lambton Harbour, part of Wellington Harbour (Te Whanganui-a-Tara), is characterised by predominantly soft-sediment subtidal habitats shaped by natural processes and extensive urban modification. These muddy and sandy substrates support diverse benthic communities dominated by polychaete worms, bivalves, and crustaceans. Surveys conducted in 2011 recorded 53 taxa, indicating relatively high diversity and evenness, with a balanced trophic structure comprising predators, deposit feeders, and suspension feeders. Fine sediments provide favourable conditions for some species, including the invasive bivalve *Theora lubrica*, which is particularly abundant in the harbour (EOS Ecology, 2013).

120. Rocky shore habitats, though limited due to reclamation and urban development, support intertidal communities of mussels, barnacles, limpets, and algae. However, all habitats in Lambton Harbour are subject to anthropogenic pressures, including sedimentation, heavy metal contamination, and marine debris. Despite these stressors, the benthic fauna remain relatively resilient, likely due to long-term adaptation (Stephenson et al., 2008).

[9] Rare native fish spotted in Wellington Harbour | News | Te Herenga Waka—Victoria University of Wellington

[10] Watch: Southern right whale spotted swimming in Wellington Harbour

121. Sampling was undertaken by Cummings et al., 2021 at two sites one close to the southern stormwater discharge locations (LB1) and another further north offshore in Lambton Harbour (LB1). Both sites support benthic communities typical of disturbed, urban-influenced harbour environments. Species richness was moderate (≈20 taxa per site), with higher total abundance (mean from 8 samples per 20 cm diameter core) at LB2 (121.38) compared to LB1 (72.63).

122. Benthic assemblages at both sites were dominated by small, opportunistic and disturbance-tolerant taxa. Common species included the non-indigenous bivalve *Theora lubrica*, the small bivalve *Arthritica* spp., ostracods, cumaceans, and polychaete worms such as *Cossura consimilis*, *Labiosthenolepis laevis* and *Aglaophamus verrilli*. These taxa are primarily deposit feeders with high tolerance to mud, organic enrichment, and metal contamination, indicating stressed but functioning benthic systems.

123. Traits-based assessment classified both LB1 and LB2 as having high functional redundancy, reflecting the presence of multiple taxa performing similar ecological roles despite environmental stress. This suggests a degree of resilience to disturbance. The Benthic Health Model (metals-based) rated both sites as "good", despite elevated concentrations of copper, zinc, lead and high-molecular-weight PAHs. Overall, LB1 and LB2 exhibit benthic communities adapted to contaminated, fine-sediment habitats, with ecological functioning maintained but dominated by tolerant species (Cummings et al., 2021).

Sediment quality

124. Lambton Harbour's nearshore sediments are predominantly muddy to very muddy fine sands, with coarser material occurring closer to the shoreline and progressively finer muds toward the central basin of Wellington Harbour (EOS Ecology, 2013). This sediment distribution reflects the combined influence of oceanic processes, catchment and riverine inputs, and extensive urban modification, including historical land reclamation and the construction of wharves and marinas (EOS Ecology, 2013).

125. The harbour's proximity to urban and industrial land uses has also resulted in elevated concentrations of heavy metals (including copper, lead, and zinc) and organic contaminants such as DDT and polycyclic aromatic hydrocarbons (PAHs), with levels in some areas exceeding national sediment quality guidelines (Dickinson et al., 1996; EOS Ecology, 2013). These contaminants are primarily derived from stormwater runoff, historical industrial activities, and ongoing shipping operations; however, the resident benthic fauna appears relatively tolerant, likely due to long-term exposure and adaptation to these modified conditions.

126. The elevated concentration of heavy metals—particularly copper, lead, and zinc are well above pre-1900 baseline levels and exceed Auckland Council Environmental Response Criteria (ERC) sediment quality guidelines, and are substantially higher than those observed elsewhere in Wellington Harbour (Stephenson et al., 2008). These patterns are consistent with other investigations, which identified copper, lead, and zinc concentrations exceeding ANZECC (2000) ISQG-High trigger values near stormwater outfalls in Lambton Harbour (Bolton-Richie, 2003). 2021 subtidal monitoring further confirms these trends, with sediments at Lambton Harbour sites LB1 close to the southern discharge points, comprised of approximately ~70% mud, 24% fine sand and 6.3% organic material, and LB2 further north and offshore had a similar sediment composition, 71% mud and 6.7% organic matter (Cummings, et al. 2022). Both sites had multiple guideline exceedances for lead, mercury, copper, zinc, and high-molecular-weight polycyclic aromatic hydrocarbons (PAHs), placing Lambton Harbour among the more contaminated areas of Wellington Harbour (Cummings et al., 2022).

127. Contaminants entering Lambton Harbour primarily originate from stormwater runoff, historical industrial activities, and shipping operations, with the highest concentrations typically recorded near stormwater discharge points and decreasing with distance from outfalls. In addition to metals, organic contaminants such as PAHs and DDT remain present, reflecting both historic sources such as

coal-tar-based road sealing and the ongoing contribution of contaminated urban stream discharges into the harbour (Stephenson et al., 2008).

Water quality

128. Water quality in Lambton Harbour is strongly influenced by surrounding land use, including the central business district, port and ferry operations, and the stormwater network outfalls (Wellington Water Ltd, 2023). During rainfall events, stormwater runoff delivers sediments, nutrients, hydrocarbons, heavy metals and faecal bacteria into the harbour, temporarily degrading the water clarity (GWRC, 2024).

129. Marine water quality monitoring in the Lambton catchment is conducted at six coastal sites and 12 stormwater sites (Figure 15). Monitoring results for faecal indicator bacteria concentrations near the northern Terrace Tunnel discharge (pipeline 1) were elevated and not meeting coastal water standards at two of the three monitored sites. At Oriental Bay and Whairepo Lagoon (both swimming locations) the concentrations were relatively low. Observations of oil and grease fills and changes in water quality colour and/or clarity were recorded during 5-10% of observations taken at many of the stormwater outlets in Lambton Harbour (amongst the worst were Thorndon, OPT, Grass Street, Te Aro, Taranaki and Troy culverts) (Wellington Water Ltd, 2023).

130. No recent stormwater discharge flow rate information could be obtained for this assessment for the Lambton Harbour outfalls. As such, the changes to contaminant loads estimated in the Contaminant Load Model (CLM) detailed in the Stormwater Assessment of Mr Bassett could not be directly related to contaminant concentrations recorded from the relevant outfalls (Table 5). Instead, the potential effects of the Project on the coastal discharge quality are discussed within the context of the areas of the affected catchments, changes to impermeable surface area, and affected road length.

131. Records of copper and zinc concentrations were not available for Lambton Harbour and Oriental Bay inner harbour monitoring locations, however, sites in the outer Lambton Harbour exceeded the ANZG (2018) guideline concentrations. At the Lambton Harbour and Oriental Bay sites, the heavy metals mercury and lead exceeded ANZG (2018) guideline values. Total PAH concentrations at both Lambton Harbour and Oriental Bay complied with the ANZG (2018) guidelines (Wellington Water, 2023).

132. Water quality data presented in Table 5 below summarises monthly samples collected from Lambton Harbour stormwater outlets draining areas that will be impacted by the Project. Summary statistics are presented based on 20 – 29 monthly samples, with copper and zinc concentrations compared against the Australia and New Zealand Water Quality Guidelines (ANZG, 2018).

133. The Table 5 water quality summary data indicates that median copper concentrations for all discharges exceed the ANZG (2018) default guideline values for the protection of 80% of marine species (80% DGVs), with relatively similar concentrations at each site. Median zinc concentrations exceed the 95% DGV the three northern-most discharges, and also exceed the 80% DGV for the two southern-most discharges. The 95th percentile discharges for all sites exceed the 80% DGV for zinc.

Table 5: Lambton Harbour stormwater discharge monthly water quality summary statistics (Jan 2020 – Jun 2022)

Lambton Harbour Catchment	Site Name	Site ID	Total copper (mg/L)			Total zinc (mg/L)		
			Min	Median	95%ile	Min	Median	95%ile
Kumutoto Awa	Waring Taylor Culvert	LASW4	**0.001**	**0.003**	**0.0202**	0.004	**0.011**	**0.08**
Waimapihi Awa	Te Aro Culvert	LASW7	**0.001**	**0.003**	**0.017**	**0.01**	**0.018**	**0.295**
Moturoa Awa	Taranaki Culvert	LASW8	**0.001**	**0.002**	**0.0159**	0.005	**0.012**	**0.123**
Tory Street	Tory Street Culvert	LASW9	**0.002**	**0.005**	**0.017**	**0.023**	**0.063**	**0.337**
Waitangi Awa	OPT Culvert	LASW10	**0.001**	**0.005**	**0.0113**	**0.016**	**0.042**	**0.142**

Note: Data obtained from Wellington Water Ltd Stage Two Global Stormwater Discharge Consent – Assessment of Effects on the Environment (June 2023). Exceedances of ANZG (2018) toxicant default guideline values for marine species protection are indicated by **bold** (95% species protection) and red (80% species protection) concentrations.

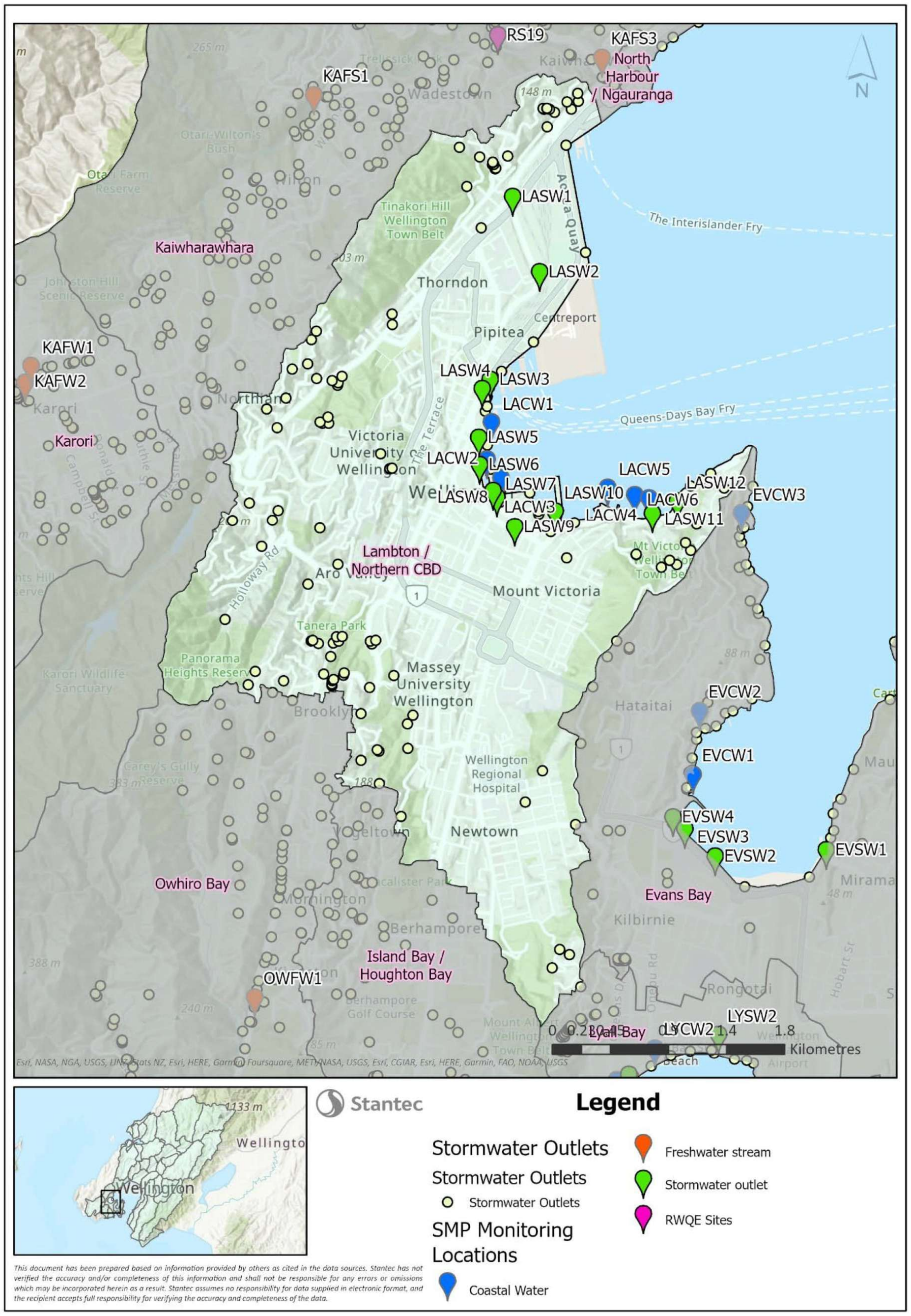

Figure 15 - Wellington Water Stormwater Monitoring Plan (SMP) monitoring locations in Lambton Harbour (Wellington Water, 2023)

Marine habitat summary

134. Lambton Harbour in Wellington hosts diverse marine habitats shaped by natural and urban influences. Subtidal zones feature soft sediments supporting over 50 benthic taxa, including polychaetes, bivalves, and crustaceans. Rocky shores, though limited, sustain mussels, barnacles, and algae. Despite pressures like sedimentation and contamination, benthic fauna show resilience. Sediments are highly polluted with heavy metals—copper, lead, and zinc—especially near stormwater outfalls, alongside organic pollutants like PAHs and DDT. Water quality assessments rate ecological impacts

from wastewater as low. Sediment inputs from rivers and variable turbidity further influence the harbour's condition, though additional disturbances are expected to have minimal ecological impact.

135. Based on the information in the section above, the overall ecological value of marine habitats in Lambton Harbour is **Low** – due to the highly modified and degraded environment of the marina and waterfront, and sediment and water quality guideline exceedances.

Coastal avifauna

136. Coastal avifauna include both seabirds (birds that spend most of their time on open ocean waters and come to shore only to breed) and waders (birds that spend much of their time near bodies of water for foraging and roosting). Wellington Harbour provides foraging habitat for numerous coastal and sea birds (Greater Wellington Regional Council, 2019).

137. The Greater Wellington Regional Council Natural Resources Plan (NRP) (2019) identifies six At Risk coastal bird species known to be present close to Lambton Harbour including fluttering shearwater (*Puffinus gavia*), variable oystercatcher (*Haematopus unicolor*), red-billed gull (*Chroicocephalus novaehollandiae*), black shag (*Phalacrocorax carbo*), pied shag (*Phalacrocorax varius*) and white fronted tern (*Sterna striata*). An additional seven At Risk species have been recorded on iNaturalist and EBird, including five Threatened species, Caspian Tern (*Hydroprogne caspia*), Hutton's Shearwater (*Puffinus huttoni*), Northern Royal Albatross (*Diomedea sanfordi*), Pacific Reef Heron (*Egretta sacra*), Spotted Shag (*Stictocarbo punctatus*) (Annexure D). Although these species have been recorded in the wider area, it is important to note that the Project receiving environment location is a highly developed urban area rather than a natural habitat, so it is likely that several of these species will actively avoid the Project location.

138. Based on the information above, and five Very High ecological value species (Caspian tern, Hutton's shearwater, northern royal albatross, Pacific reef heron, spotted shag) and three high ecological value species (red billed gull, South Island oyster catcher, white fronted tern) the ecological value of coastal birds in the ZOI[15] is considered to be **Low** to **Very High** although the frequency of their presence is unknown.

Little penguin/kororā

139. Kororā/Little penguin (*Eudyptula minor*) are commonly found within Wellington Harbour, with a large colony of approximately 300 pairs known to be present on Matiu-Somes Island (~6 km from the Project site) (de Lisle 2014, Rumble 2018b, Taylor 2018 in Overmars, 2019). In addition to the colony on Matiu-Somes Island kororā are known to nest around much of the Wellington Harbour coastline (Bull and De Luca, 2020).

140. In 2016 a marine ecological assessment was carried out by Tonkin & Taylor Ltd (T+T) as part of a proposal to deepen the Wellington Harbour shipping channel. T+T (2016) undertook an investigation of kororā in the Wellington Harbour area, including Lambton Harbour. GPS tracking of kororā in Wellington Harbour has previously been undertaken and this research was included within the 2016 investigation. The tracking suggested that penguins forage throughout the harbour and that Lambton Harbour is within a 'core area' for foraging during egg incubation stages.

141. Kororā utilise the ocean for foraging and given there are known burrows approximately 2.5 km away on the Wellington Coast adjacent to the Interisland Ferry it is likely that kororā are present and utilising the open water in Lambton Harbour wharf for foraging and transiting from their burrows to other coastal and open ocean areas (Boffa Miskell, 2020).

142. With reference to the EIANZ EcIAG framework (Annexure F), the ecological value of kororā is assessed as **High** given their threat classification of 'At Risk – Declining' (as per the Department of Conservation (DOC) threat classification, Robertson et al. (2021).

Marine fish

143. Wellington Harbour provides important habitat for fish species, including shelter and nursery grounds. Data from the National Aquatic Biodiversity Information System (NABIS) indicates that the Wellington Harbour is within the 'normal range'[11] of several marine fish species, these are presented in Annexure E (NABIS, 2025).

144. Wellington Harbour is within the normal range of several shark species, including white pointer shark (*Carcharodon carcharias*), which is classified as 'Threatened – Nationally Endangered' and basking shark (*Cetorhinus maximus*) which is classified as 'Threatened – Nationally Vulnerable'. However, these species are unlikely to spend extended periods of time within the harbour, or frequent areas within close proximity to the Project receiving environment (Duffy et al., 2018).

145. Wellington Harbour is considered a spawning hotspot for Anchovy (*Engraulis australis*), Hoki (*Macruronus novaezelandiae*) Pilchard (*Sardinops sagax*) and Sand Flounder (*Rhombosolea plebeia*). None of which are considered rare or threatened (NABIS, 2023).

146. Based on the information above the ecological value for the species found within Wellington Harbour is **Low** to **Very High.** However, most of the species known to be present within Wellington Harbour are not threatened, and due to the broad areas provided by the NABIS data there is a low likelihood of any Threatened species being regularly present within the vicinity of the Project. Therefore, the overall ecological value of fish in the ZOI[15] is considered to be **Moderate**.

Marine mammals

147. Te Whanganui-a-Tara is a harbour well utilised by a variety of a marine mammals, with ten species having been recorded within the harbour. These include common dolphin (*Delphius delphis;* Not Threatened), Bottlenose dolphin (*Tursiops trunculatus;* Threatened - Nationally Vulnerable), NZ Fur seal (*Arctocephalus forsteri;* Not Threatened), Hector's dolphin (*Cephalorphynchus hectori;* Nationally Vulnerable), Southern right whale (*Eubalaena australis;* Threatened – Nationally Increasing), Humpback whale (*Megaptera novaengliae;* Migrant), Dusky dolphins (*Lagenorhynchus obscurus*; Not threatened), Long-finned pilot whale (*Globicephala melas*; Not Threatened), Orca / Killer whale (*Orcinus orca*; Nationally Critical), Sperm whale (*Physeter macrocephalus*; At Risk - Declining) and Beaked whale (*Ziphiidae* sp.; Data Deficient) (Lundquist et al. 2025; Childerhouse, 2020, DOC marine mammal sighting and stranding database).

148. Te Whanganui-a-Tara is not currently recognised as an area of ecological significance for marine mammals, nor are there any known resident species, although NZ Fur seals can be found in the harbour year-round. The three most common species recorded within the harbour include the orca/killer whale, Hector's dolphins and common dolphins. New Zealand fur seals are seen regularly within the harbour area, although there are no breeding or haul out sites within the harbour (Childerhouse, 2020). Fur seals have been observed in Evans Bay.

149. Several species of marine mammals have been recorded in Wellington Harbour. According to NABIS, Wellington Harbour is considered a hot spot for Common Dolphin (*Delphinus delphis;* Not Threatened) and is within the 'normal range'[11] for Fur Seal (*Arctocephalus forsteri;* Not Threatened) and Southern right whale (*Eubalaena australis;* Threatened – Nationally Increasing) (Lundquist et al. 2025) (Table 6).

Table 6: Marine mammal species that may be present in the vicinity of Lambton Harbour. Distribution from NABIS (data retrieved 24 October 2025)

Common names	Species name	Threat status	Distribution type*
Common Dolphin	*Delphinus delphis*	Not Threatened	Hot spot
Southern Right Whale	*Eubalaena australis*	Threatened - Nationally Increasing	Normal Range (90 %)

[11] The 'normal' range is considered the 90% distribution range.

Common names	Species name	Threat status	Distribution type*
Fur Seal	*Arctocephalus forsteri*	Not Threatened	Normal Range (90 %)
Orca	*Orcinus orca*	Threatened - Nationally Critical	Full Range (100 %)
Bottlenose Dolphin	*Tursiops truncatus*	Threatened - Nationally Vulnerable	Full Range (100 %)
Dusky Dolphin	*Lagenorhynchus obscurus*	Not Threatened	Full Range (100 %)

* NABIS provides distributions for each species as 'Hot Spot', 'Normal Range (90%)', 'Full Range (100%)', 'Known not to exist' or 'Unknown'.

150. Based on the information above the ecological value for marine mammals is considered to be **Low to Very High** due to the potential presence of NZ fur seal and the 'Threatened' species, Orca and Bottlenose dolphin (Lundquist et al. 2025) within the ZOI[12]. However, marine mammals infrequently spend extended periods of time within Wellington harbour and are unlikely to enter the ZOI except to temporarily transit through, therefore any impacts from the Project are likely to be minimal.

Ecological characteristics and values summary

151. Table 7 below presents a summary of the ecological characteristics and values that have been concluded from the desktop literature review and site investigations.

Table 7: Ecological characteristics and values summary for Evans Bay and Lambton Harbour

Habitat / Species	Ecological value
Evans Bay	
Marine habitats	**Moderate** – due to moderately high diversity of marine species but sediments are mildly contaminated, and invasive *Undaria pinnatifida* is common
Coastal avifauna	**Low to Very High –** due to the presence of numerous coastal bird species within the bay and the potential presence of six Very High value species – the black fronted tern, Caspian tern, pacific reef heron, Salvin's albatross, spotted shag, white heron
Little penguin/ kororā	**High** based on their At Risk – Declining threat classification and confirmed use of the ZOI[15].
Marine fish	**Moderate** – due to the presence of a rare native scaly gurnard, and the diversity of species present.
Marine mammals	**Low –** due to the presence of NZ Fur Seal
Lambton Harbour	
Marine habitats	**Low** – due to the highly modified and degraded environment of the marina and waterfront
Coastal avifauna	**Low** to **Very High** due to five Very High value species, Caspian tern, Hutton's shearwater, Northern royal albatross, pacific reef heron and spotted shag.
Little penguin/kororā	**High** based on their At Risk – Declining threat classification and confirmed use of the ZOI[15].
Marine fish	**Moderate** due to the diversity fish species present.
Marine mammals	**Low** to **Very High** due to the potential presence of the Threatened - Nationally Vulnerable bottlenose dolphin and the Threatened -Nationally Critical Orca within the ZOI[15]

[12] The ZOI for Evans Bay captures the area out to 100m from the Evans Bay outfall, and in Lambton Harbour captures the inner harbour area receiving environment for the assessed stormwater outfalls approximately 100 m distance from the coastline. These ZOIs allow for full mixing of the discharges.

Future environment (without Project)

152. Without the proposed Project upgrades, growing congestion along the main route is likely to worsen environmental impacts, particularly stormwater quality. Increased traffic will contribute to higher concentrations of total suspended solids, zinc, copper and hydrocarbons to receiving waterways, posing risks to aquatic ecosystems and making it harder for councils and the NZTA to meet water quality objectives under regional plan and other consent requirements.

6. BENEFITS OF THE PROJECT (POSITIVE EFFECTS)

153. The upgrades to SH1 provide an opportunity for stormwater networks and systems to be upgraded in The Terrace, Te Aro, Basin Reserve and Hataitai catchments. Collectively the upgrades target the capture and treatment of suspended sediments, hydrocarbons, heavy metals, gross pollutants, and debris, while also providing attenuation and resilience to higher rainfall intensities.

154. As a result of stormwater treatment upgrades contaminant loads to the marine receiving environment will be mitigated, and it is expected that contaminant loads at the majority of outfalls will be reduced. Most of the improvements in stormwater treatment are captured within the discharge to Evans Bay and from the Basin Reserve (Waitangi Stream) into Lambton Harbour (refer to the Stormwater Assessment of Mr Bassett and my assessment below for further detail).

155. In the Hataitai area, significant flood hazard improvements are anticipated due to the upgrading of existing stormwater infrastructure, as described in the Stormwater Assessment report written by Mr Bassett.

156. Materials such as rock armour associated with the new Evans Bay pipeline could potentially provide substrate and new habitats for marine species.

157. Following successful compensation measures, kororā will see a benefit in the replacement of burrows at risk of increased tidal inundation with burrows provided further above the MHWS.

158. Collectively, these elements also respond to community engagement feedback that stated that the “benefits of modern infrastructure could mitigate environmental impacts” and requested that the Project “provide for healthier water flowing into the harbour” and that the project “provides an opportunity to enhance the natural environment” and “do better for our waterways and birdlife.”

7. ASSESSMENT OF EFFECTS

159. The following section first summarises the potential effects of construction and operation of the SH1 upgrades on the ecological values discussed above, and then discusses these specifically for each sub location (Evans Bay and Lambton harbour) both before and after proposed effects management measures are implemented. Conclusions are then drawn as to the overall level of effect on each species or habitat after mitigation, and whether any residual adverse effects remain where further effects management is recommended.

160. Where an overall level of effect is assessed as **moderate** or higher after measures to address effects, then additional effects management in the form of offset and/or compensation is recommended to achieve a no net loss of biodiversity values. Details of how any residual effects are addressed are covered in Section 9. A table summarising the assessment of effects is included at the end of this section.

161. To assist with determining the magnitude of effects of the Project a Zone of Influence (ZOI) of 100 m from the stormwater discharge points in both Evans Bay and Lambton Harbour was adopted. This ZOI was conservatively determined based on the estimated 20-year storm peak discharge of approximately 8.5 m^3/s at the Evans Bay outfall (EOS Ecology, 2013). A simple dilution calculation was then applied based on mixing within the upper ~1 m of the respective receiving environments. The extent of physical disturbance (e.g. scour), sediment deposition and plume effects assuming worst-case contaminant concentrations (Wellington Water Ltd, 2023) were then factored in.

162. This approach also accounts for cumulative effects as the SH1 works will only increase road runoff to the Evans Bay outfall from 22,297 m^2 to 40,161 m^2, which represents an increase from only 8.1% to 14.6%.of the wider catchment road area (275,000 m^2) within a total catchment of approximately 1,320,000 m^2. This indicates the Project is a relatively minor contributor to overall catchment flows.

163. On this basis, and noting even smaller proportional catchment contributions to the Lambton outfalls (Table 10), the 100 m ZOI is considered highly conservative for both Evans Bay and Lambton Harbour outfalls.

164. Note a secondary ZOI specifically for potential noise effects on kororā has been defined as 20 m in all directions from the edge of the works footprint, calculated from the expected setback to achieve compliant noise management without noise barriers. See Section 9 for further detail.

Potential construction stage effects

165. Construction effects from the Project include the replacement of the stormwater outfall in the southwest corner of Evans Bay.

166. Construction activities associated with tunnel duplication, bulk earthworks, and slope stabilisation are expected to generate sediment-laden runoff and may produce elevated-pH discharges through stormwater from these works entering existing networks that drain to either Lambton Harbour or Evans Bay.

167. Earthworks runoff, stormwater, and spills during construction may contain suspended sediments, fine particulates, nutrients, hydrocarbons, concrete leachate, and heavy metals, which may enter coastal waters via the connected drainage networks. These physical and chemical stressors may cause injury, loss of life and declines in benthic species richness and abundance in and around the discharge if not appropriately managed.

Evans Bay outfall replacement

168. Potential construction effects from the replacement of the Evans Bay outfall are:

i. Disturbance of hard shore structures which currently serve as habitats including disturbance of sediments and bedrock in the intertidal and subtidal areas during removal of the outfall and installation of the new outfall which is increasing in size from 1.8 m to 2.1 m diameter and includes a new 350 mm concrete encasement on each side of the pipe plus rock armouring around it

ii. Injury and loss of life of marine invertebrate and algae from the removal of the existing pipe and outfall in Evans Bay

iii. Permanent loss of a small area (approximately 4 – 5 m^2) of soft sediment intertidal and subtidal habitat under the new larger outfall structure and the associated rock amour protection materials

iv. Disturbance and potential dispersal of marine biosecurity risk organisms into the surrounding water column, such as *Undaria pinnatifida* found attached to the outfall

v. Disturbance and release of sediment from construction earthworks into the marine receiving environment

vi. Increased sediment and contaminant discharges during construction may cause a temporary decline in water quality, leading to elevated turbidity that can impair primary production, fish and invertebrate health, benthic conditions, and coastal bird foraging efficiency

vii. Noise and vibration from excavation, pipe cutting and joining, demolition of existing structure, erosion protection placement, construction machinery (excavators, pumps, compactors)

viii. Tracking of machinery and construction of a temporary causeway may be required for replacement of the Evans Bay outfall if machinery is unable to be operated solely outside the coastal marine area (CMA). If so, this will result in smothering and compaction of benthic habitats, and potential loss of life and injury to benthic species

ix. If piling or coffer dams are required in Evans Bay, disturbance to benthic habitats and sediment release could cause loss of life and injury to benthic species

169. The design of the replacement outfall (see Part G of the Application (drawing set) DNG-DRG-01105_01107 - Stormwater details) was previously identified as a potential risk for kororā becoming trapped, given they could not be excluded from the outfall through the design. Subsequent workshops have confirmed this risk is not present in the design, as sumps within the associated stormwater pipe do not contain perches or drop heights.

Potential operational effects

170. The SH1 upgrades will result in increased impervious area and vehicle capacity on the highway. Potential associated effects to the marine environment include runoff from impervious surfaces which could carry sediments, heavy metals, hydrocarbons and other pollutants which could degrade water quality lead to localised increases in turbidity and sediment contamination in nearshore water and sediments and affect species and habitats in the marine receiving environment close to the discharge points (Jayaratne et al., 2019; GRWC, 2022; Allan, 2024).

171. Changes to hydrology may alter salinity, turbidity, and influence nutrient cycling and contaminant bioavailability and promote stratification due to an increase in freshwater input to the marine receiving environment (Paul and Meyer, 2001; Schiff and Bay, 2003; Hewitt et al., 2009). Increased runoff can also cause additional scour within the immediate vicinity of outfalls (particularly at Evans Bay). These effects could impact benthic communities and ecological function, and change species composition due to freshwater intolerance.

172. In summary, marine species and benthic habitats exposed to increased contaminants and freshwater inputs often exhibit reduced diversity, shifts toward pollution tolerant species, and sublethal effects such as impaired growth and reproduction.

Evans Bay

173. Comprehensive stormwater treatment has been incorporated into the design, including stormwater upgrades across the Hataitai catchment draining to Evans Bay which are designed to improve stormwater quality, manage increased flows, and reduce contaminant loads entering the receiving environment. These are described fully in the Stormwater Assessment of Mr Bassett. Collectively, the measures target the capture and treatment of suspended sediments, hydrocarbons, heavy metals, gross pollutants, and debris, while also providing attenuation and resilience to higher rainfall intensities.

174. In Hataitai, a new stormwater network is proposed to address existing capacity and treatment limitations. Mitigation measures include proprietary stormwater treatment devices located above Mean High Water Springs (MHWS), a Vortechs 1600 gross pollutant trap, and 275 StormFilter units to improve contaminant removal prior to discharge. Pipe upgrades, collector pipes, catchpits, and anchor blocks will enhance conveyance capacity and network stability. A new natural wetland is also proposed to offset the loss of the existing wetland, providing ecological compensation while contributing to stormwater treatment, flow attenuation, and habitat values.

175. A slight increase in road discharge volume is expected due to the small increase in impervious area along with an increase in particulate and contaminant runoff. The increased discharge volume will slightly increase scour and reduce salinity around the immediate area of the Evans Bay outfall.

176. Contaminant load modelling results detailed in the State Highway 1 Stormwater Assessment of Mr Bassett are summarised in Table 8 for Evans Bay stormwater discharges. The data indicates expected proportional changes in contaminant loads generated from the Project areas as a result of Project works and the management measures that are inherent in the Project's design (i.e. stormwater treatment devices). These changes are compared against baseline present day traffic conditions (2026) and predicted future traffic conditions (2033).

Table 8: Stormwater contaminant load modelling indicating expected contaminant load changes from the Project scenarios with and without the incorporated treatment measures for the Evans Bay Waipapa Awa catchment. Statistics are specifically associated with Pro

Evans Bay – Waipapa Awa	Present day (2026)				Future conditions (2033)			
	TSS	Zn	Cu	TPH	TSS	Zn	Cu	TPH
Untreated	28%	32%	32%	32%	26%	29%	29%	29%
Treated	-59%	-18%	-42%	-54%	-60%	-20%	-43%	-55%

Note: Contaminant load model data extracted from State highway 1 Stormwater Assessment.

177. For both the 2026 and 2033 baseline scenarios, the modelling data presented in Table 8 indicates substantial untreated proportional load increases, and substantial reductions for all contaminants for treated works. Changes are similar between 2026 and 2033 traffic conditions. TSS and TPH are the most effectively mitigated contaminants, whilst zinc loads show more limited reductions in the mitigation scenario.

178. The total area of the Waipapa Awa (Hataitai) catchment is 1,320,000 m^2 (132 ha). The current road area within the Project footprint draining to the Hataitai – Evans Bay outfall from the Waipapa Awa catchment (30,880 m^2) is expected to increase by more than a third (42,390 m^2) as a result of Project works. This increase does, however, represent a relatively small proportion of the overall road area of the wider catchment (275,000 m^2), with the affected road area increasing from 11.2% to 15.4%.

179. Within the context of the contaminant data presented in Table 4, impermeable surface area is expected to be the primary determinant of heavy metal and TPH contamination in an urban catchment's stormwater. The increased Project road area represents a relatively small percentage of the overall road area of the wider catchment, which also does not account for other stormwater contaminant sources such as building surfaces. Additionally, the modelled changes in contaminant load presented in Table 8 indicate large proportionate reductions in all contaminant loads under the mitigation scenario.

180. Existing contaminant load estimates could not be made for the combined wider catchment discharge at the Hataitai – Evans Bay stormwater outlet due to an absence of flow data. However, the Project is not expected to have a notable effect on individual contaminant concentrations or collective contaminant loads discharged to Evans Bay due to the relatively small proportion of road affected by the Project (relative to the catchment's total road area). Nevertheless, the operational Project without stormwater treatment would result in a substantial proportional increase in contaminant loads from the Project area, whilst the incorporated treatment measures will substantially reduce loads from the Project area relative to present day and 2033 conditions.

Lambton Harbour

181. As per Evans Bay comprehensive stormwater treatment has been incorporated into the design for Lambton Harbour stormwater network, including stormwater upgrades across the road catchments draining to Lambton Harbour which are designed to improve stormwater quality, manage increased flows, and reduce contaminant loads entering the receiving environment. These are described fully in the Stormwater Assessment of Mr Bassett. Collectively, the measures target the capture and treatment of suspended sediments, hydrocarbons, heavy metals, gross pollutants, and debris, while also providing attenuation and resilience to higher rainfall intensities.

182. The proposed stormwater upgrades across the Terrace, Te Aro and Basin Reserve catchments are designed to improve stormwater quality, manage increased flows, and reduce contaminant loads entering the Lambton Harbour receiving environment as outlined in Table 9.

183. At The Terrace, stormwater mitigation is provided through upgraded treatment systems at both the northern and southern outlets. The northern system incorporates a storage tank to attenuate peak stormwater flows, supported by catchpit filters and proprietary treatment devices, including a 1200 mm VortCapture unit and 18 StormFilter cartridges. This system is designed to remove a broad range of pollutants and enhance compliance with water quality standards. The southern outlet includes upgraded catchpits with flame traps, proprietary treatment devices, and a Stormwater360 VortCapture gross pollutant trap combined with StormFilter filtration, improving removal of sediments, debris, hydrocarbons, and associated contaminants.

184. Within Te Aro, no new stormwater network is proposed; however, mitigation is achieved through the retention of the existing drainage system and targeted upgrades to catchpits. The installation of catchpit filters will improve interception of sediment, debris, and gross pollutants, resulting in incremental improvements to stormwater quality without altering existing discharge locations.

185. At the Basin Reserve, stormwater mitigation includes the installation of three bioretention devices (rain gardens), which provide treatment through filtration, adsorption, and biological uptake. These are supported by upgraded catchpits, proprietary treatment devices, and a Stormwater360 VortCapture gross pollutant trap with StormFilter filtration. A deluge system is also proposed to manage high intensity rainfall events, reducing the risk of uncontrolled overflows and downstream impacts.

186. A slight increase in road discharge volume is expected due to the small increase in impervious area. The increased discharge volume will slightly reduce salinity around the immediate area of the Lambton

Harbour outfalls, although changes in discharge volumes and reductions in salinity are anticipated to be minor.

187. Contaminant load modelling results detailed in the Stormwater Assessment of Mr Bassett are summarised in Table 9 for stormwater discharges from the Project footprint that contribute to the discharges from the wider catchment that ultimately enter Lambton Harbour. The data indicates expected proportional changes in contaminant loads generated from the Project areas for each catchment as a result of the Project scenarios with and without the incorporated treatment measures. These changes are compared against both baseline present day traffic conditions (2026) and predicted future traffic conditions (2033).

Table 9: Stormwater contaminant load modelling indicating expected contaminant load changes from the Project scenarios with and without the incorporated treatment measures. Statistics are specifically associated with Project areas based on predicted traffic co

Scenario	Lambton Harbour Catchment	Present day (2026)				Future conditions (2033)			
		TSS	Zn	Cu	TPH	TSS	Zn	Cu	TPH
Untreated	Kumutoto Awa	16%	18%	18%	18%	15%	16%	16%	16%
	Waimapihi Awa	7%	15%	11%	9%	2%	10%	6%	4%
	Moturoa Awa	30%	34%	34%	34%	27%	30%	30%	30%
	Tory Street	45%	50%	50%	50%	42%	46%	46%	46%
	Waitangi Awa	26%	22%	22%	21%	22%	20%	20%	19%
	Total	**20%**	**20%**	**19%**	**18%**	**16%**	**17%**	**16%**	**15%**
Treated	Kumutoto Awa	-24%	-2%	-8%	-15%	-25%	-3%	-9%	-16%
	Waimapihi Awa	-15%	8%	2%	-6%	-18%	4%	-3%	-11%
	Moturoa Awa	-2%	20%	18%	10%	-5%	17%	15%	7%
	Tory Street	9%	35%	32%	23%	6%	31%	28%	20%
	Waitangi Awa	-48%	-26%	-36%	-40%	-49%	-26%	-36%	-40%
	Total	**-32%**	**-9%**	**-17%**	**-23%**	**-33%**	**-11%**	**-18%**	**-24%**

Note: Contaminant load model data extracted from the Stormwater Assessment.

188. There are expected to be substantial load reductions from the Project footprint for most contaminants entering the Kumutoto Awa, Waimapihi Awa, and Waitangi Awa catchments, with increased loads for most contaminants in the Moturoa Awa and Tory Street catchments. TSS and TPH are generally the most effectively treated contaminants, whilst copper and zinc loads show more limited reductions (and greater increases where they do increase).

189. Existing road areas within the five Lambton Harbour catchments are presented in Table 10. Project-affected road areas and associated net increases in impermeable areas are also presented. This data indicates a relatively small proportion of existing road areas are affected by Project works, with relatively small changes to impermeable surface area within the context of the Project and wider catchment road areas.

Table 10: Lambton Harbour catchment and road comparisons for existing and proposed areas

Lambton Harbour Catchment	Site Name	Catchment Area (m²)	Catchment Road Area (m²)	Existing Project Road Area (m²)	Proposed Project Road Area (m²)	Proposed Road Area / Catchment Road Area (%)
Kumutoto Awa	Waring Taylor Culvert	520,000	138,000	19,370	19,790	14.3%
Waimapihi Awa	Te Aro Culvert	2,584,000	451,000	25,780	31,160	6.9%
Moturoa Awa	Taranaki Culvert	583,000	183,000	7,840	7,840	4.3%
Tory Street	Tory Street Culvert	155,000	70,000	720	720	1.0%
Waitangi Awa	OPT Culvert	4,603,000	728,000	45,270	50,320	6.9%

Note: Catchment road areas based on NZ Primary Road Parcels (LINZ, 2026)

190. Within the context of the contaminant data presented in Table 5, impermeable surface area is expected to be the primary determinant of heavy metal and TPH contamination in an urban catchment's stormwater. Table 10 indicates that the Project road areas represent only a very small percentage of the overall road area of each catchment, which also doesn't account for other contaminant sources such as building surfaces. Additionally, the modelled changes in contaminant load presented in Table 9 indicate large proportionate reductions in most contaminant loads for the three catchments where road areas will increase under the treatment scenario. The greatest predicted reductions are associated with the Waitangi Awa catchment which is where the greatest increase in road area will occur.

191. The Project is not expected to have a notable effect on individual contaminant concentrations or collective contaminant loads discharged to Lambton Harbour due to the relatively small proportion of road affected by the Project (relative to each catchment's total road area). However, contaminant load modelling indicates that, collectively, Lambton Harbour is expected to experience a reduction in the load of contaminants from stormwater runoff as a result of Project works. i.e. stormwater treatment measures in the design would substantially reduce collective contaminant loads from the Project area to Lambton Harbour relative to present day conditions.

Evans Bay

Effects on marine habitats

Outfall replacement effects – Marine habitats

192. Removal and replacement of the existing outfall will result in the loss and injury of many of the marine benthic species currently colonising the outfall as described in Section 5. Disturbance and crushing of species around the pipe may also occur due to the use of plant in the CMA. Both processes could also result in the disturbance and dispersal of biosecurity risk species (including the invasive kelp *Undaria pinnatifida*) and in disturbance of contaminated sediments around the outfall.

193. Most benthic species are expected to recolonise within 1 – 3 years post construction except in the new area of permanently occupied seabed. This is because the new outfall is slightly larger (2.1 m diameter vs 1.8 m diameter of the old pipe) and has an approximately 350 mm concrete encasement surrounding it (see Part G of the Application (drawing set) DNG-DRG-01105_01107 - Stormwater details). This increases the footprint of the new outfall in the CMA by approximately 4 – 5 m^2, and it is expected that the soft sediment habitat will be permanently lost underneath the new outfall. There could also be another ~10 m^2 of soft sediment habitat in the CMA lost to the installation of new rock revetment around the outfall. Without mitigation, this is considered to result in a **Moderate** magnitude of effect at the scale of the ZOI, as habitat under the footprint will be permanently lost and unmitigated

construction activity could impact a moderate area of the ZOI. However, some of the construction effects will be temporary. Based on **Moderate** ecological value this results in a **Moderate** overall level of unmitigated effects.

Construction discharge effects – Marine habitats

194. Earthworks runoff, stormwater, and spills during construction may contain suspended sediments, fine particulates, nutrients, hydrocarbons, concrete leachate, and heavy metals, which may enter coastal waters via the connected drainage networks. These physical and chemical stressors may cause, smothering, injury, loss of life and declines in benthic species richness and abundance in and around the discharge.

195. As described in the erosion and sediment control assessment of Mr van De Munckhof, and given the scale of earthworks on the project, without mitigation, discharges of this nature could result in a short term **Moderate** to **High** magnitude of effect on marine habitats within the ZOI with potential for variation dependant on the extent and duration of weather events during construction. Based on **Moderate** ecological value this results in a **Moderate** overall level of unmitigated effects.

Operational discharge effects – Marine habitats

196. With the proposed stormwater treatment measures in place the operational discharges are considered to have a **Negligible** to **Positive** magnitude of effect based on a slight reduction in contaminants and a slight increase in discharge volume. Based on Moderate ecological values this results in a **Very Low** to **possible Net Gain** overall level of effects. No further effects management is considered necessary.

Mitigation measures and residual effects – Marine habitats

Outfall replacement mitigation

197. Mitigation to reduce impacts on marine habitats during construction of the new outfall has been achieved by minimizing the footprint of the outfall and is further recommended through avoiding or minimising the operation of plant within the CMA, minimising disturbance of contaminated sediments through carefully removing all old materials out of the CMA and disposing to landfill, and management of marine sediment through temporary installation of protection such as cofferdams or similar controls.

198. Biosecurity controls include disposal of any marine biosecurity risk species into landfill noting that *Undaria pinnatifida* has been identified attached to the existing outfall.

Construction discharges mitigation

199. The Natural Resources Plan for the Wellington Region requires the application of industry accepted practice, standards and methods to minimise sediment discharges, including adherence to the GWRC Erosion and Sediment Control Guide for Land Disturbing Activities. Implementation of a Construction Erosion and Sediment Management Plan (CESMP) and site-specific Erosion and Sediment Control Plans (ESCPs) will ensure appropriate measures are in place, including containerised treatment systems for tunnel and surface water, progressive stabilisation of exposed ground, spill response plans and targeted controls such as silt fences and filter socks.

200. The CESMP incorporates an adaptive management framework supported by ongoing monitoring to ensure compliance with the GWRC sediment limit of 100 g/m³ and to enable refinement of management actions if performance issues or unexpected adverse ecological effects arise. A limit of 100 g/m³ is typical for construction for bulk works throughout Wellington.

201. It is recommended that discharge monitoring during construction include defined trigger levels that initiate a field response. For containerised treatment system discharges, exceeding a trigger of 100/m³ TSS is suggested — which can be measured prior to release. This would require an ecologist to undertake a visual inspection at Evans Bay to assess whether turbid water or deposited sediment attributable to the discharge is present. For non-treatment-system discharges, triggers would be

incident-related only, such as a device failure resulting in an unintended release, in which case an ecologist inspection should also be initiated.

202. Further details of the proposed measures to avoid, remedy or mitigate construction related effects on stormwater discharges and the marine receiving environment are covered in the Erosion and Sediment Control (ESC) specialist assessment of Mr van de Munckhof, and are suitable to manage effects on the marine environment.

Residual effects on marine habitats after mitigation

203. **Outfall replacement residual effects -** with the proposed mitigation measures in place the outfall replacement is considered to have a **Low** magnitude of effect due to the small-scale permanent loss of habitat under the new outfall but the ample similar and higher value habitat available elsewhere in the ZOI and Evans Bay. There will be a **Low** magnitude of effect on a small surrounding area of marine habitats during construction. However, this effect will be temporary and short term and will reduce to **Negligible** once species recolonise after 1-3 years. With Moderate ecological value this results in a **Low** Overall level of permanent effect from habitat loss and a **Very Low** Overall level of effect from construction disturbance effects after 1-3 years once species have recolonised. No further effects management is considered necessary.

204. **Construction discharge residual effects -** with the proposed mitigation measures in place construction discharges are considered to have a **Low** magnitude of effect resulting in a **Low** Overall level of effects. No further effects management is considered necessary.

Effects on coastal avifauna

Outfall replacement effects – Coastal avifauna

205. Disturbance from construction machinery and activities to coastal avifauna roosting on the gravel beach and on revetement/rubble in Evans Bay, and foraging in the intertidal area of the Evans Bay outfall, may cause them to be displaced from usual feeding and roosting locations.

206. With no effects management in place the Magnitude of effects is considered to be **Low** as there are abundant alternative feeding and roosting locations nearby and elsewhere in the harbour. Based on **Low** to **Very High** ecological value this results in a **Low** to **Moderate** overall level of unmitigated effect.

Construction discharge effects – Coastal avifauna

207. Road construction discharge effects arise primarily from earthworks runoff, stormwater, and accidental releases during construction. These discharges may contain suspended sediments, fine particulates, nutrients, hydrocarbons, concrete leachate, and heavy metals, which may enter coastal waters via the connected drainage networks.

208. These effects may reduce abundance and accessibility of prey (worms, bivalves, crustaceans, fish) and alter sediment characteristics that support invertebrate communities. This can result in reduced foraging efficiency, particularly for wading birds reliant on intertidal areas and so affect feeding and roosting locations near the outfall.

209. With no effects management in place the Magnitude of effects is considered to be **Moderate**. Based on **Low** to **Very High** ecological value this results in a **Low** to **High** overall level of unmitigated effect.

Operational discharge effects – Coastal avifauna

210. With the proposed stormwater treatment measures in place the operational discharges are considered to have a **Negligible** magnitude of effect on feeding habitat based on a slight reduction in contaminants and a slight increase in discharge volume. Based on **Low** to **Very High** ecological

values this results in a **Very Low** to **Low** overall level of effects. No further effects management is considered necessary.

Mitigation measures and residual effects – Coastal avifauna

Outfall replacement

211. Controls to reduce the noise and disturbance level within the CMA are detailed in the kororā effects mitigation section and will be included in the Kororā Management Plan. Industry standard erosion and sediment controls will be implemented as per the Marine Habitats section of this assessment.

212. With the proposed mitigation measures in place outfall replacement effects are considered to have a **Negligible** magnitude of effect resulting in a **Very Low** to **Low** overall level of effects. No further effects management is considered necessary.

Construction discharges

213. Industry standard erosion and sediment and spills controls will be implemented as well as materials and plant management as per the Marine Habitats section of this assessment.

214. With the proposed mitigation measures in place construction discharges effects are considered to have a **Negligible** magnitude of effect resulting in a **Very Low** to **Low** overall level of effects. No further effects management is considered necessary.

Effects on kororā

Outfall replacement effects – Kororā

215. The construction of the outfall at Evans Bay requires the permanent removal of at least three penguin burrows within the construction footprint. Two of these three burrows are of moderate value, noting they do not appear to support breeding (and are instead used for general roosting and possible moulting); while one of the three burrows is of lower value primarily due to the level of tidal inundation.

216. Additional disturbance will occur to hard shore structures outside of the construction footprint which currently serve as habitats (revetment/rubble containing penguin burrows).

217. In line with industry accepted practise, it is expected that an area of habitat either side of the construction footprint will be modified to temporarily prevent kororā access. This extent has been assessed at 10 m to either side of the works footprint, and includes the temporary loss of one further moderate value burrow. Temporary exclusion from refuge will result in a higher energy expense for displaced kororā, potential loss of breeding productivity, and may also result in kororā accessing unsafe urban areas in search of new refuge. The removal and replacement of the existing culvert, outfall, and protective revetment surrounding the structure in Evans Bay have the potential to cause injury and loss of life to kororā. Kororā are protected under the Wildlife Act 1953. Therefore, measures to avoid injury and mortality throughout construction works are required.

218. Without effects management the removal and replacement of the outfall is considered to have a **Very High** magnitude of effect **at the scale of kororā habitat feature that falls within the ZOI**[13].

219. Due to both adverse construction interactions with kororā, and through burrow loss, based on a **High** ecological value the resulting level of unmitigated effect is **Very High.**

Construction discharge effects – Kororā

220. Disturbance or release of sediment from construction works could lead to elevated turbidity. As kororā are visual hunters, an increase in turbidity would reduce their ability to hunt efficiently. It is expected

[13] As per EcIAG (2018) guidance, and given the high site fidelity of kororā, the revetment habitat feature that falls within the ZOI is considered the appropriate scale at which to assess effects as it contains all six burrows that are part of a discrete and connected area of kororā habitat which provides all the refuge and moulting habitat in this area.

that during construction kororā will hunt elsewhere if their preferred feeding ground is impacted by increased turbidity, which is likely to result in an increased energetic cost to kororā. An increase in energetic cost may reduce breeding and moulting success, and overall impact kororā survivability.

221. Given the tidal influence, the potential effects from sediment in the water column represent a temporary shift away from baseline conditions and have been assessed as having a **Moderate** magnitude of effect without mitigation given sediment plumes and associated contaminants could extend across the approach pathway of the penguins and degrade associated habitat. Based on a **High** ecological value this results in a **High** overall level of unmitigated effect.

Operational discharge effects – Kororā

222. With the proposed stormwater treatment measures in place the operational discharges are considered to have a **Negligible** magnitude of effect on feeding habitat based on a slight reduction in contaminants and a slight increase in discharge volume. Based on **High** ecological values this results in an overall level of effect of **Very Low**. No further effects management is considered necessary.

Mitigation measures and residual effects - Kororā

Outfall replacement

223. A Kororā Management Plan (KMP) and associated Wildlife Approval (WA) detailing industry accepted practise will be developed as part of this application. The KMP and WA will detail:

    i. Methods to survey kororā prior to works

    ii. Suitable exclusion measures should kororā be discovered pre-works

    iii. Methods to salvage and relocate kororā outside of the construction footprint (discussed further below)

    iv. Controls to protect kororā during construction activities, including imposing noise limits on construction activities so that noise levels at the entrance of any active burrow remain below 90db L_{AFmax} and 75db $L_{Aeq(15min)}$.[14]

    v. Seasonal restrictions on works and controls associated with construction activities

    vi. How to partially remedy the removal of revetment at the outfall by reinstating in collaboration with a penguin ecologist. The goal is to ensure that the new revetment does not inhibit kororā ingress to the site

    vii. How to minimise the likelihood of kororā accessing the road corridor through construction by adequately fencing off access points within 30 m of destroyed or modified habitat

224. Kororā will be relocated from the Project site during construction if required. The proposed relocation site is situated 250 m north of the Project site at the Evans Bay breakwater, opposite the coastguard building. This is the considered the closest available site that can provide adequate protection to kororā. The southern face of the breakwater has been planted in conjunction with Places for Penguins (PfP) to provide a kororā haven. Ten nest boxes are also maintained and monitored within this area. The Project will seek to use these existing nest boxes, in collaboration with WCC (the landowner) and PfP. Should this not be possible, additional nest boxes may need to be placed within this area.

225. Kororā are known to occupy the breakwater year round, but monitoring by PfP indicates that it is not nearing carrying capacity. Over the 2025/2026 season only one nest box was occupied. The habitat consists primarily of low lying native shrub (Harakeke, Ngaio, Karo) with patchy rank grass in the understory. Additionally, the site has extensive and ongoing predator control and has dog control

[14] Note a secondary ZOI specifically for potential noise effects on kororā has been defined as 20 m in all directions from the edge of the works footprint, calculated from the expected setback to achieve compliant noise management without noise barriers. See Section 9.1 for further detail.

measures (dogs prohibited, and secure fencing around the perimeter). Subject to WCC's agreement, additional signage will be implemented at pedestrian access points to the release site advising that dogs are restricted in this area.

226. Based on previous survey results (section 2.2) of the impact site, it is expected that no more than eight kororā would be likely to need relocation. In the unlikely event that more than eight kororā need to be relocated, adaptive management techniques and additional alternative locations or nest boxes will be implemented in consultation with DOC (as per the KMP).

227. Following all above steps, and further implementation of the KMP and WA, it is expected that many of the individual effects arising from the replacement of the outfall will be significantly lowered and effects on kororā will be **Low**. However, the permanent loss of three burrows and the temporary loss of $30m^2$ of habitat (including one further burrow) cannot be avoided. Therefore, while the magnitude of effect on this habitat feature is reduced to **High** with mitigation, the resulting overall level of effect remains **Very High.**

228. Due to the residual **Very High** level of effect on burrow loss and temporary habitat loss from the replacement of the outfall residual effects management is recommended. This is outlined in Section 9. The measures recommended (provision of nest boxes, enhancement planting and protective fencing) will all occur within the ZOI.

Construction discharges

229. Industry standard erosion and sediment and spills controls as well as materials and plant management and construction discharge monitoring and contingency measures as per the Marine Habitats section should be applied.

230. Following the marine habitat mitigation measures, the construction discharge effects are considered to have a **Negligible** magnitude of effect, resulting in an overall level of effect of **Very Low**. No further effects management is considered necessary.

Effects on marine fish

Outfall replacement effects – Marine fish

231. Disturbance of contaminated sediments during pipe removal and replacement, and sediment discharges from earthworks may affect marine fish.

232. With no effects management in place the Magnitude of effects is considered to be **Moderate** but is a small spatial scale and effects are localised to species present in the immediate surrounds of the outfall. Fish can move away to similar habitats nearby. Based on a **Moderate** ecological value, this results in a **Moderate** overall level of unmitigated effect.

Construction discharge effects – Marine fish

233. Earthworks runoff, stormwater, and spills during construction may enter coastal waters via the connected drainage networks. These discharges can reduce water clarity, impair fish feeding, clog gills, cause physiological stress, and result in sub lethal effects such as reduced growth and altered behaviour, with potential indirect effects on food quality and availability through bioaccumulation.

234. With no effects management in place the Magnitude of effects is considered to be **Moderate** but is a small spatial and temporal scale and effects are localised to species present in the immediate surrounds of the outfall. Fish can move away to similar habitats nearby. Based on a **Moderate** ecological value this results in a **Moderate** overall level of unmitigated effect.

Operational discharge effects – Marine fish

235. With the proposed stormwater treatment measures in place the operational discharges are considered to have a **Negligible** magnitude of effect on fish based on a slight reduction in contaminants and a

slight increase in discharge volume. Based on **Moderate** ecological values this results in an overall level of effect of **Very Low**. No further effects management is considered necessary.

Mitigation measures and residual effects – Marine fish

Outfall replacement

236. Mitigation measures include the careful removal of old materials and keeping plant out of the CMA to minimise works footprint and disturbance of sediments and the implementation of industry standard erosion and sediment controls.

237. With the proposed mitigation measures in place outfall replacement effects are considered to have a **Low** magnitude of effect resulting in a **Low** overall level of effects. No further effects management is considered necessary.

Construction discharges

238. Mitigation measures include the implementation of industry standard erosion and sediment and spills controls as well as materials and plant management as per the Marine Habitats section. Construction discharge monitoring and contingency measures will be implemented if trigger levels are exceeded, as per the Marine Habitats section of this assessment.

239. With the proposed mitigation measures in place construction discharges effects are considered to have a **Low** magnitude of effect resulting in a **Low** overall level of effects. No further effects management is considered necessary.

Effects on marine mammals

Outfall replacement effects – Marine mammals

240. Noise and disturbance to NZ Fur Seal which may utilise the project area for resting. Disturbance of contaminated sediments in the CMA and sediment discharges from earthworks may degrade prey habitats indirectly affecting foraging success, and energy expenditure to avoid turbid waters.

241. With no effects management in place the Magnitude of effects is considered to be **Low** due to the small spatial and temporal scale and ample alternative foraging habitat for NZ fur seal nearby and elsewhere in the harbour. Based on a **Low** ecological value This results in a **Very Low** overall level of unmitigated effect.

Construction discharge effects – Marine mammals

242. Untreated earthworks runoff, stormwater and spills during construction may enter coastal waters via the connected drainage networks. These short-term acute discharges may degrade prey habitats indirectly affecting foraging success, and energy expenditure to avoid turbid waters.

243. With no effects management in place the Magnitude of effects is considered to be Low due to the small spatial and temporal scale and ample alternative foraging habitat for NZ fur seal nearby and elsewhere in the harbour. Based on a Low ecological value This results in a Very Low overall level of unmitigated effect.

Operational discharge effects – Marine mammals

244. With the proposed stormwater treatment measures in place the operational discharges are considered to have a **Negligible** magnitude of effect on marine mammals based on a slight reduction in contaminants and a slight increase in discharge volume. Based on **Low** ecological values this results in an overall level of effect of **Very Low**. No further effects management is considered necessary.

Mitigation measures and residual effects – Marine mammals

Outfall replacement

245. Mitigation measures are recommended and include the careful removal of old materials and keeping plant out of the CMA to minimise works footprint and disturbance of sediments and the implementation of industry standard erosion and sediment controls.

246. With the proposed mitigation measures in place outfall replacement effects are considered to have a **Negligible** magnitude of effect resulting in a **Very Low** overall level of effects. No further effects management is considered necessary.

Construction discharges

247. Industry standard erosion and sediment and spills controls are recommended, as well as materials and plant management as per the Marine Habitats section. Construction discharge monitoring and contingency measures if trigger levels are exceeded as per the Marine Habitats section of this assessment.

248. With the proposed mitigation measures in place construction discharges effects are considered to have a **Negligible** magnitude of effect resulting in a **Very Low** overall level of effects. No further effects management is considered necessary.

Lambton Harbour

Effects on marine habitats

Construction discharge effects – Marine habitats

249. Earthworks runoff, stormwater, and spills during construction may contain suspended sediments, fine particulates, nutrients, hydrocarbons, concrete leachate, and heavy metals, which may enter coastal waters via the connected drainage networks. These physical and chemical stressors may cause injury, loss of life and declines in benthic species richness and abundance in and around the discharge. Potential effects to marine habitats include disruption or death of species living in and around the discharge through the settlement of fine sediments smothering benthic organisms and contaminants causing declines in benthic species richness and abundance.

250. Without mitigation, these effects would result in a short-term **High** magnitude of effect on marine habitats with potential for variation dependant on the extent and duration of weather events during construction. Based on **Low** ecological value this results in a **Low** overall level of unmitigated effects.

Operational discharge effects – Marine habitats

251. With the proposed stormwater treatment measures in place the operational discharges are considered to have a **Negligible** to **Positive** magnitude of effect based on a slight reduction in contaminants and a slight increase in discharge volume. Based on **Low** ecological values this results in a **Very Low** to possible **Net Gain** overall level of effects. No further effects management is considered necessary.

Mitigation measures and residual effects – Marine habitats

Construction mitigation

252. Mitigation measures during construction are recommended as per those described in the Evans Bay marine habitats mitigation measures section. These include industry standard erosion and sediment and spills controls, materials and plant management and construction discharge monitoring and contingency measures if trigger levels are exceeded.

253. With the proposed mitigation measures in place construction discharges are considered to have a **Low** magnitude of effect resulting in a **Very Low** Overall level of effects. No further effects management is considered necessary.

Effects on coastal avifauna

Construction discharge effects – Coastal avifauna

254. Construction discharges may have an effect on primary production reducing abundance and accessibility of prey. Water quality and ecological quality decline can have flow on effects reducing the effectiveness of coastal bird foraging due to decreases in water clarity. These effects may reduce the ability of coastal and seabird species to detect prey and may cause temporarily displacement during construction (Lukies et al., 2021). However, there is ample alternative feeding habitat nearby.

255. Without mitigation, this is considered to result in a short-term **Moderate** magnitude of effect on coastal birds with potential for variation dependant on the extent and duration of weather events during construction. Based on **Low** to **Very High** ecological value this results in a **Low** to **High** overall level of unmitigated effects.

Operational discharge effects – Coastal avifauna

256. Stormwater treatment system upgrades as detailed in the Marine Habitats section should result in a **Negligible** magnitude of effect or even a slight improvement in feeding habitat due to improved stormwater discharge quality. However, this improvement may be offset by additional freshwater input reducing salinity and causing scour. Based on **Low** to **Very High** ecological values this results in a **Very Low** to **Low** overall level of effect. No further effects management is considered necessary.

Mitigation measures and residual effects – Coastal avifauna

Construction discharges

257. The mitigation measures outlined under Marine Habitats are expected to be sufficient to mitigate effects to coastal avifauna.

258. With the proposed mitigation measures in place construction discharges effects are considered to have a **Negligible** magnitude of effect resulting in a **Very Low** to **Low** overall level of effects. No further effects management is considered necessary.

Effects on kororā

Construction discharge effects - Kororā

259. Earthworks runoff, stormwater, and accidental releases during construction may contain suspended sediments, fine particulates, nutrients, hydrocarbons, concrete leachate, and heavy metals, which may enter coastal waters via the connected drainage networks and increase turbidity. As kororā are visual hunters, an increase in turbidity would reduce their ability to hunt efficiently. It is expected that during construction kororā will hunt elsewhere if their preferred feeding ground is impacted by increased turbidity, which is likely to result in an increased energetic cost to kororā.

260. The potential effects from construction discharge represent a temporary shift away from baseline conditions and have been assessed as having a **Moderate** magnitude of effect. Based on a **High** ecological value this results in a **High** overall level of unmitigated effect.

Operational discharge effects - Kororā

261. With the implementation of stormwater treatment in the existing design, contaminant loads to the marine receiving environment will be somewhat reduced. However, an increase in road discharge volume is expected along with a reduction in salinity around the ZOI of the outfalls. Changes to hydrology may alter salinity, turbidity, and nutrient levels due to an increase volume of freshwater input to the marine receiving environment.

262. On balance, it is expected that the magnitude of effect will therefore be **Negligible**. Based on a **High** ecological value the overall level of effect will be **Very Low**.

Mitigation measures and residual effects - Kororā

Construction discharges

263. The mitigation measures outlined under Marine Habitats are expected to be sufficient to mitigate effects to kororā arising from construction discharges.

264. With mitigation measures in place, construction discharges are considered to have a **Negligible** magnitude of effect, resulting in an overall level of effect of **Very Low**.

Effects on marine fish

Construction discharge effects – Marine fish

265. Potential effects from the increase of sediment and contaminant loads during construction discharging from the outfalls includes a temporary decline in water quality. An increase in suspended sediments and turbidity can reduce light levels, subsequently reducing primary production, clog fish gills, reduce visual acuity and prey detection by fish and increase deposition on the seafloor affecting prey species (Lukies et al., 2021). Contaminants can effect primary production and bioaccumulate in food webs, potentially reducing food quality and availability for marine fish.

266. With no effects management in place the Magnitude of effects is considered to be **Moderate** and short term but with potential for variation due to weather events. The spatial scale is also somewhat limited, and effects are localised to species present in the immediate surrounds of the outfall. Fish can move away to similar habitats nearby. Based on a **Moderate** ecological value this results in a **Moderate** overall level of unmitigated effect.

Operational discharge effects – Marine fish

267. Implementation of stormwater treatment in the existing design as detailed in the Marine Habitats section should result in a **Negligible** magnitude of effect or even a slight improvement in feeding habitat due to improved stormwater discharge quality. However, this improvement may be offset by additional freshwater input. Based on **Moderate** ecological value this results in a **Very Low** overall level of effect. No further effects management is considered necessary.

Mitigation measures and residual effects – Marine fish

Construction discharges

268. The mitigation measures outlined under Marine Habitats are expected to be sufficient to mitigate effects to marine fish.

269. With the proposed mitigation measures in place construction discharges effects are considered to have a short term **Low** magnitude of effect resulting in a **Low** overall level of effects. No further effects management is considered necessary.

Effects on marine mammals

Construction discharge effects – Marine mammals

270. Untreated earthworks runoff, stormwater and spills during construction may enter coastal waters via the connected drainage networks. These short-term acute discharges may degrade prey habitats indirectly affecting foraging success, and energy expenditure to avoid turbid waters.

271. While the Very High ecological value marine mammal species, orca are recorded as present within Lambton Harbour, they are unlikely to stay in the bay for long periods of time. The records are likely

from occasional transient movement through the harbour and they are unlikely to enter to the ZOI[15] any more than occasionally and temporarily.

272. However, with no effects management in place the Magnitude of effects is considered to be **Moderate** due to the collective number of different discharge points and that the water is theoretically deep enough for marine mammals to forage near the outfalls. Based on a **Low** to **Very High** ecological value this results in a **Low** to **High** overall level of unmitigated effect.

Operational discharge effects – Marine mammals

273. Stormwater treatment system upgrades as detailed in the Marine Habitats section should result in a **Negligible** magnitude of effect or even a slight improvement in feeding habitat due to improved stormwater discharge quality. However, this improvement may be offset by additional freshwater input. This results in a **Very Low** to **Low** overall level of effect. No further effects management is considered necessary.

Mitigation measures and residual effects – Marine mammals

Construction discharges

274. The mitigation measures outlined under Marine Habitats are expected to be sufficient to mitigate effects to marine mammals.

275. With the proposed mitigation measures in place construction discharge effects are considered to have a **Negligible** magnitude of effect resulting in a **Very Low** to **Low** overall level of effects. No further effects management is considered necessary.

[15] The ZOI for Evans Bay captures the area out to 100m from the Evans Bay outfall, and in Lambton Harbour captures the inner harbour area receiving environment for the assessed stormwater outfalls approximately 100 m distance from the coastline. These ZOIs allow for full mixing of the discharges.

8. SUMMARY OF EFFECTS

Table 11 - Summary table of ecological values, magnitude of effect from the Project construction and operational effects and the overall level of ecological effect at Evans Bay

Evans Bay								
Habitat / Species	**Ecological Value**	**Actual and potential project effects**	**Magnitude of Effect (unmitigated)**	**Overall level of effect (unmitigated)**	**Proposed effects management (avoid, remedy, minimise)**	**Magnitude of Effect (mitigated)**	**Overall level of Effect (mitigated)**	**Residual Effects Management**
Marine Habitats	**Moderate** due to moderate to high diversity of species but sediments are mildly contaminated, and invasive *Undaria pinnatifida* is abundant	**<u>Outfall replacement effects:</u>** **During construction** – disturbance of contaminated sediments, some species loss and injury and loss of soft sediment habitat from the pipe removal and replacement. Permanent loss of a small area of soft sediment habitat under the new larger outfall. **Post construction** – benthic species are expected to recolonise within 1 – 3 years post construction except in the new area of permanently occupied seabed.	**Moderate** (but small spatial scale and some effects temporary)	**Moderate**	• Avoid and minimise plant in the CMA and minimise CMA works footprint • Careful removal of old materials from the CMA • Industry standard erosion and sediment controls • Biosecurity controls	**Low** (small spatial scale and some effects temporary and reducing to **Negligible** after 1 - 3 years)	**Low** for permanent loss of benthic habitat under the outfall **Low** short term construction related effects reduce to **Very Low** 1 - 3 years post construction	No further effects management required.
		<u>Construction discharge effects:</u> Road construction discharge effects arise primarily from earthworks runoff, stormwater, and accidental releases and spills. These discharges may contain suspended sediments, fine particulates, nutrients, hydrocarbons, concrete leachate, and heavy metals, which may enter coastal waters via the connected drainage networks. These discharges will be short term but could be acute without mitigation. These physical and chemical stressors may cause injury, loss of life and declines in benthic species richness and abundance in and around the discharge.	**Moderate to High** (short term but potential for variation due to weather events)	**Moderate**	• Industry standard erosion and sediment and spills controls and materials and plant management • Construction discharge monitoring and contingency measures if trigger levels are exceeded	**Low** (but potential for variation due to weather events)	**Low**	No further effects management required.
		<u>Operational discharge effects:</u> With the stormwater treatment incorporated into the design water quality will improve due to a reduction in contaminant load but an increase in road discharge volume due to a small increase in impervious area will slightly increase scour and reduce salinity around the outfall. This is expected to provide a neutral outcome for marine habitats	**Negligible to Positive**	**Very Low to possible Net Gain**	• No further effects management required			
Coastal Avifauna	**Low to Very High** due to the presence of numerous coastal bird species within the bay and the potential presence of six Very High value species – the black fronted tern, Caspian tern, Pacific reef heron, Salvin's	**<u>Outfall replacement effects:</u>** Disturbance to coastal avifauna from the construction machinery and activities causing them to be displaced from usual feeding and roosting locations.	**Low** (other feeding and roosting locations close by)	**Low** to **Moderate**	• Implement noise and disturbance controls as per the kororā management plan below. • Industry standard erosion and sediment controls	**Negligible** (due to the small spatial scale)	**Very Low** to **Low**	No further effects management required.

Evans Bay								
Habitat / Species	**Ecological Value**	**Actual and potential project effects**	**Magnitude of Effect (unmitigated)**	**Overall level of effect (unmitigated)**	**Proposed effects management (avoid, remedy, minimise)**	**Magnitude of Effect (mitigated)**	**Overall level of Effect (mitigated)**	**Residual Effects Management**
	albatross, spotted shag, white heron	**<u>Construction discharge effects:</u>** Construction discharge effects described under marine habitats may reduce food availability and reduce foraging efficiency, particularly for wading birds reliant on intertidal areas.	**Moderate** (but short term)	**Low to High**	• As per marine habitats	**Negligible**	**Very Low to Low**	
		<u>Operational discharge effects:</u> As per marine habitats stormwater treatment is expected to provide a neutral outcome for coastal avifauna	**Negligible** (Possible slight improvement in feeding habitat due to improved stormwater discharge quality but may be offset by additional freshwater input and scour)	**Very Low** to **Low**	• No further effects management required			
Little Penguin / Kororā	**High** due to their At Risk – Declining threat classification and confirmed use of the ZOI.	**<u>Outfall replacement effects:</u>** Permanent loss of three penguin burrows, additional temporary loss of one burrow during construction phase. Disturbance of occupied burrows within the ZOI. Potential injury or mortality through deconstruction of habitat and interactions with plant and machinery.	**Very High** (at the scale of the ZOI)	**Very High**	• Implementation of a kororā management plan and associated Wildlife Approval, detailing: – seasonal restrictions to avoid breeding and moulting season – survey methods to avoid impact on kororā within the works area – exclusion zones to avoid and minimise indirect impacts on kororā within the works area – salvage and relocation methods to minimise direct impacts on kororā if found (potential injury and mortality during salvage will be addressed through a Wildlife Approval) – construction discharge management including maintaining access through any silt curtains or bunds etc – habitat reinstatement methods to remedy the temporary loss of habitat – noise controls	**High** (due to the permanent loss of three burrows and temporary loss of 30m^2 of habitat (including one further burrow) which cannot be avoided – all other magnitudes of effect are considered **Low** after mitigation) (at the scale of the ZOI)	**Low to Very High**	Due to the **Very High** level of residual effect due to burrow and habitat loss compensation is recommended. Compensation measures, including the provision of new habitat and artificial burrows, are outlined in Section 9
		<u>Construction discharge effects:</u> Construction discharge effects described under marine habitats may result in reduced hunting efficiency for visual hunters such as kororā around the discharges and affect prey quality and abundance.	**Moderate**	**High**	• As per marine habitats	**Negligible**	**Very Low**	No further effects management required.
		<u>Operational effects:</u> As per marine habitats stormwater treatment is expected to provide a neutral outcome for kororā	**Negligible** (Possible slight improvement in feeding habitat due to improved stormwater discharge quality may be offset by additional freshwater input and scour)	**Very Low**	• No further effects management required			

Evans Bay								
Habitat / Species	**Ecological Value**	**Actual and potential project effects**	**Magnitude of Effect (unmitigated)**	**Overall level of effect (unmitigated)**	**Proposed effects management (avoid, remedy, minimise)**	**Magnitude of Effect (mitigated)**	**Overall level of Effect (mitigated)**	**Residual Effects Management**
Marine Fish	**Moderate** due to the presence of a rare native scaly gurnard, and the diversity of other species present.	**Outfall replacement effects:** Disturbance of contaminated sediments during pipe removal and replacement, and sediment discharges from earthworks.	**Moderate** (small spatial and temporal scale and effects localised to species present in the immediate surrounds of the outfall. Fish can move away to similar habitats nearby)	**Moderate**	• As per marine habitats	**Low**	**Low**	No further effects management required.
		Construction discharge effects: Construction discharge effects described under marine habitats may reduce water clarity, impair fish feeding, clog gills, cause physiological stress, and result in sub-lethal effects such as reduced growth and altered behaviour, with potential indirect effects on food availability through bioaccumulation.	**Moderate**	**Moderate**	• As per marine habitats	**Low**	**Low**	
		Operational discharge effects: As per marine habitats stormwater treatment is expected to provide a neutral outcome for fish	**Negligible** (A slight improvement in stormwater discharge quality and an increase in discharge volume, should result in an overall neutral effect)	**Very Low**	• No further effects management required			
Marine Mammals	**Low** due to the presence of NZ Fur Seal (Not threatened)	**Outfall replacement effects:** Noise and disturbance to NZ Fur Seal which may utilise the project area for resting. Disturbance of contaminated sediments in the CMA and sediment discharges from earthworks.	**Low (**small spatial scale and alternative foraging habitat for NZ fur seal nearby)	**Very Low**	• As per marine habitats	**Negligible**	**Very Low**	No further effects management required.
		Construction discharge effects: Construction discharge effects described under marine habitats may degrade prey habitats indirectly affecting foraging success, and energy expenditure to avoid turbid waters.	**Low**	**Very Low**	• As per marine habitats	**Negligible**	**Very Low**	
		Operational discharge effects: As per marine habitats stormwater treatment is expected to provide a neutral outcome for marine mammals	**Negligible** (A slight improvement in stormwater discharge quality and an increase in discharge volume, should result in an overall neutral effect)	**Very Low**				

Table 12 - Summary table of ecological values, magnitude of effect from the Project construction and operational effects and the overall level of ecological effect at Lambton Harbour

<table>
<tr><th colspan="9">Lambton Harbour</th></tr>
<tr><th>Habitat / Species</th><th>Ecological Value</th><th>Actual and potential project effects</th><th>Magnitude of Effect (unmitigated)</th><th>Overall level of effect (unmitigated)</th><th>Proposed effects management (avoid, remedy, minimise)</th><th>Magnitude of Effect (mitigated)</th><th>Overall level of Effect (mitigated)</th><th>Residual Effects Management</th></tr>
<tr><td rowspan="2">Marine habitats</td><td rowspan="2">Low - due to the highly modified and degraded environment of the marina and waterfront</td><td rowspan="10"><u>Construction discharge effects:</u>
Construction discharge effects described under Evans Bay marine habitats may cause similar effects to marine habitats, coastal avifauna, marine fish, marine mammals and kororā in the ZOI in Lambton Harbour.
<u>Operational discharge effects:</u>
With the stormwater treatment incorporated into the design water quality will improve due to a reduction in contaminant load but an increase in road discharge volume due to a small increase in impervious area will slightly increase scour and reduce salinity around the outfalls.
This is expected to provide a neutral outcome for marine habitats and species</td><td><u>Construction:</u>
High (short term but potential for variation due to weather events)</td><td>Low</td><td rowspan="10"><u>Construction:</u>
• Industry standard erosion and sediment and spills controls and materials and plant management
• Construction discharge monitoring and contingency measures if trigger levels are exceeded.

<u>Operational:</u>
• No further effects management required</td><td><u>Construction:</u>
Low (short term but potential for variation due to weather events)</td><td>Very Low</td><td rowspan="10">No further effects management required.</td></tr>
<tr><td><u>Operational:</u> Negligible to Positive (A slight improvement in stormwater discharge quality and an increase in discharge volume, should result in an overall neutral effect)</td><td>Very Low to possible Net Gain</td><td></td><td></td></tr>
<tr><td rowspan="2">Coastal avifauna</td><td rowspan="2">Low to Very High due to five Very High value species, Caspian tern, Hutton's shearwater, Northern royal albatross, pacific reef heron and spotted shag</td><td><u>Construction:</u>
Moderate</td><td>Low to High</td><td><u>Construction:</u>
Negligible</td><td>Very Low to Low</td></tr>
<tr><td><u>Operational:</u>
Negligible</td><td>Very Low to Low</td><td></td><td></td></tr>
<tr><td rowspan="2">Little Penguin / Kororā</td><td rowspan="2">High based on their At Risk - Declining threat classification and confirmed use of the ZOI.</td><td><u>Construction:</u>
Moderate</td><td>High</td><td><u>Construction:</u>
Negligible</td><td>Very Low</td></tr>
<tr><td><u>Operational:</u>
Negligible</td><td>Very low</td><td></td><td></td></tr>
<tr><td rowspan="2">Marine fish</td><td rowspan="2">Moderate due to the diversity of fish species present.</td><td><u>Construction</u>:
Moderate</td><td>Moderate</td><td><u>Construction:</u>
Low</td><td>Low</td></tr>
<tr><td><u>Operational:</u>
Negligible</td><td>Very Low</td><td></td><td></td></tr>
<tr><td rowspan="2">Marine mammals</td><td rowspan="2">Low to Very High due to the potential presence of the Threatened - Nationally Critical Orca and the Threatened - Nationally Vulnerable bottlenose dolphin within the ZOI</td><td><u>Construction</u>:
Moderate</td><td>Low to High</td><td><u>Construction:</u>
Negligible</td><td>Very Low to Low</td></tr>
<tr><td><u>Operational:</u>
Negligible</td><td>Very Low to Low</td><td></td><td></td></tr>
</table>

9. RESIDUAL EFFECTS MANAGEMENT

276. The EcIAG (2018) identifies that where a moderate or higher overall level of effect remains after efforts to avoid, minimise and remedy effects, then further efforts to address these residual adverse effects in the form of offset and/or compensation should occur so that a no net loss of biodiversity value is realised.

277. As a result of residual effects identified for the permanent loss of three penguin burrows and habitat at the Evans Bay outfall, and the temporary loss of penguin habitat and one further burrow at the Evans Bay outfall, further measures are recommended to compensate for these residual effects.

278. Recommended compensation measures are presented in the following sections. These will be specified in, and implemented through, the Kororā Management Plan (KMP).

279. For the purpose of this EcIA, the proposed compensation measures have been developed having regard to the principles for compensation as outlined in the Wellington Natural Resources Plan, NPS-IB and relevant guidance in the EcIAG. By implementing the following residual effects management recommendations, residual adverse effects are considered to be adequately addressed.

Kororā burrows and habitat

280. I have considered how best to address the permanent loss of three burrows, and the additional temporary loss of 30 m^2 of kororā habitat (including an additional burrow). I consider those effects can be readily addressed through actions within the ZOI[16], at the impact site, including:

   i. The provision of replacement nesting structures, in the form of nest boxes, to replace the lost burrows (noting that the lost burrows are of moderate or lower value, and do not provide for nesting)

   ii. Enhancing this area through coastal planting, which will improve the habitat values for kororā, and

   iii. Fencing this area to protect kororā against predators (dogs in particular) and to discourage kororā from accessing the road corridor

281. I have applied the Biodiversity Compensation Model (BCM) to support my professional judgement that these measures should result in an improved outcome for kororā over the status quo. The BCM was used to generate a calculated quantum of compensation (BCM, Baber et al., 2021, Annexure G). I consider the proposed actions are ’compensation’, as the response from kororā is uncertain, and the current burrow area is limited in its capacity for like-for-like offset due to the risk of storm surge inundating these burrow locations. In this case like-for-unlike habitat trading-up presents a more beneficial outcome both for kororā and the Project, as it future proofs the compensation for sea level rise.

282. Nesting structures could be in the form of nest boxes or concrete culverts set back from the revetment in vegetation, or concrete culverts partially dug into the substrate at the revetment crest. However, concrete culverts in this location would be approximately 2.2 m above RL MSL, whereas nest boxes or concrete culverts integrated into vegetation set back from the crest would be approximately 2.7 m above RL MSL. Therefore, nest boxes or concrete culverts integrated into vegetation set back from the crest are recommended due to greater sea level rise resilience. Furthermore, in this instance, nest

[16] Note this refers to a secondary ZOI for potential noise effects on kororā and is defined as 20 m in all directions from the edge of the works footprint, calculated from the expected setback to achieve compliant noise management for kororā and other avifauna without noise barriers. See Figure 16.

boxes are recommended over concrete culverts as they have a longer track record and are known to be successful in similar urban coastline environments (Bourne and Klomp, 2004).

283. The loss of burrows (both the permanent loss of three burrows and temporary exclusion of at least one additional burrow during works) is recommended to be compensated with a minimum of six nesting structures at the impact site. This total accounts for the value of the individual burrows (which have been conservatively scored), the timescale over which they are not available, and the predicted value of nesting structures[17] at the impact site 5 years post-establishment with the new habitat (described below) and protective structures in place.

284. The residual effects from the loss of revetment habitat (after reinstatement of protective revetment around the outfall and removal of exclusion measures) is recommended to be compensated through 60 m^2 of coastal revegetation above the impact site to provide cover for the nest boxes and sufficient shading from the streetlights along Cobham Drive. A permanent fence around this revegetated area is also recommended to prevent kororā access to the road corridor and to deter dogs. It is recommended that the nesting structures be incorporated into this area so that compensation is focussed on the site of impact.

285. Collectively, in my view these measures should result in an improved outcome for kororā over the status quo and in BCM terms they should generate a predicted 'net gain' biodiversity outcome.

286. For ease of reference, Figure 16 below shows the key relevant kororā locations, which are:

   i. The relevant part of the Project site (impact site) and associated secondary ZOI[16] for potential noise effects on kororā

   ii. The proposed site for relocation of kororā during construction (if required)

   iii. The proposed location for the compensation measures (nesting structures, planting and fencing)

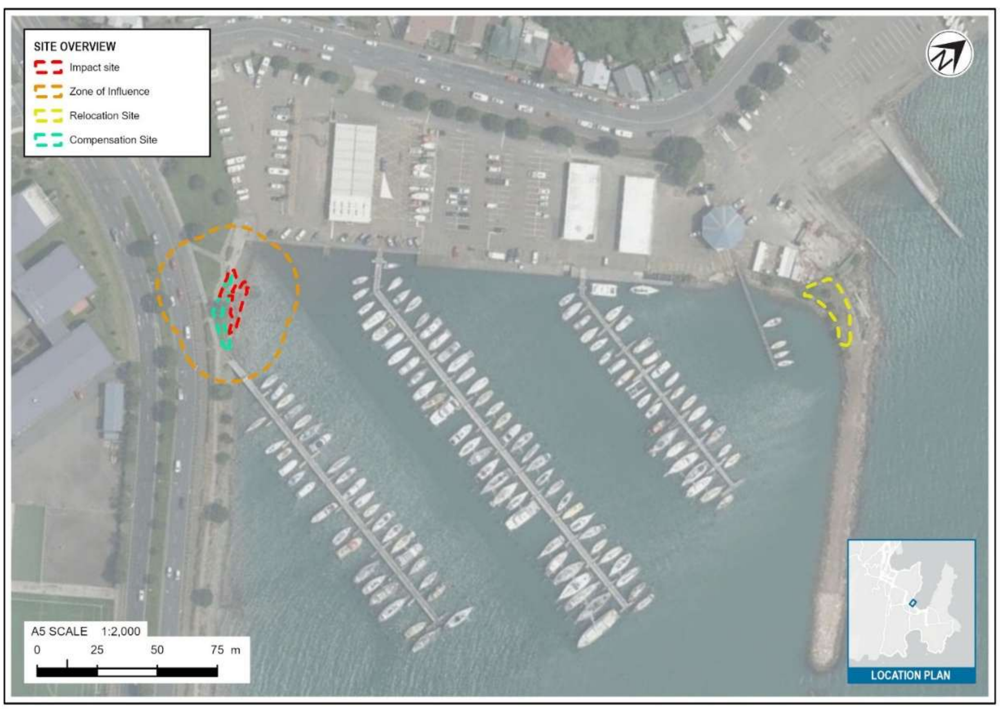

Figure 16 - Site overview showing the impact within the zone of influence at the Evans Bay Outfall

[17] Values quantified within BCM values input – see Annexure G

10. CONCLUSIONS AND RECOMMENDATIONS

287. Evans Bay and Lambton Harbour both support a number of important ecological values including for several Threatened and At Risk species of coastal birds, kororā and marine mammals that could be impacted by the project.

288. Construction effects from the Project include the replacement of the stormwater outfall in the southwest corner of Evans Bay and construction discharges associated with tunnel drilling, earthworks, and slope stabilisation. Construction discharges are expected to generate sediment laden runoff including fine particulates and contaminants, which may enter coastal waters via the connected drainage networks into either Lambton Harbour or Evans Bay. These physical and chemical stressors may cause injury, loss of life and declines in benthic species in and around the outfalls.

289. During construction at Evans Bay, disturbance of intertidal and subtidal habitats is expected from the removal and replacement of the existing outfall and from construction, which will result in the loss and injury of marine invertebrates, small fish and algae and disturbance to the biosecurity risk species *Undaria*. Sediment disturbance could temporarily increase turbidity and release contaminants. Construction activities may also disturb bird species and will disturb and remove little penguin (kororā) burrows and habitat.

290. Operational effects result from increased impervious area and vehicle capacity on the highway. Effects to the marine environment include increased runoff from impervious surfaces carrying sediments, heavy metals, hydrocarbons and other pollutants which could degrade water quality and lead to localised decreases in salinity and increases in turbidity and sediment contamination in nearshore water and sediments. This could affect species and habitats close to the discharge points. Increased runoff can also cause additional scour within the immediate vicinity of outfalls (particularly at Evans Bay).

291. Without mitigation in place a number of **Moderate** to **Very High** ecological effects levels are likely. Therefore, mitigation is recommended to reduce these effects below **Moderate** where possible.

292. Mitigation for construction stage effects for the new outfall in Evans Bay includes keeping plant out of the CMA where possible, minimising the CMA works footprint, applying Industry standard erosion and sediment and spills controls, and biosecurity controls. Whilst most effects are reduced to **Low** or less with mitigation in place, the level of effects from the loss of kororā burrows and associated habitat remains **Very High.** Therefore, compensation is recommended to address this residual effect. This is explained further below.

293. Mitigation for construction stage discharge effects in both Evans Bay and Lambton Harbour includes: industry standard erosion and sediment and spills controls, materials and plant management, and construction discharge monitoring with contingency measures and further monitoring if trigger levels are exceeded. Collectively these measures should reduce the overall level of effects on species and habitats in both receiving environments to **Low** or **Very Low** and no further effects management is required for construction discharges

294. Operational stage discharge effects in both Evans Bay and Lambton Harbour are addressed in the current design through a number of stormwater treatment system upgrades across multiple catchments to help manage increased flows and reduce contaminant loads entering the receiving environment. Collectively, these stormwater upgrades should slightly improve overall water quality entering both Evans Bay and Lambton Harbour, whilst increased discharge volumes may slightly reduce salinity and increase scour. Taken together this should result in a **Very Low** overall level of effect for all species and habitats, with the possibility of a **Net Gain** for marine habitats in most locations.

295. Residual effects on kororā - the permanent loss of kororā burrows and temporary loss of other habitat - will be addressed through the provision of six nesting structures above the impact site, supported by 60 m^2 of coastal revegetation and a permanent fence around this area to prevent kororā accessing the road corridor and to deter dogs.

296. Subject to full implementation of these recommended measures, the overall level of ecological effects is expected to be reduced to low or very low for most species and habitats, with residual effects on kororā in Evans Bay adequately addressed through the recommended ecological compensation.

11. RESPONSE TO PRE-LODGEMENT COMMENTS

297. In response to pre-lodgement feedback (including from DOC, GWRC, WCC and mana whenua) on a draft version of this report and the related KMP, the following changes and points of clarification have been addressed in this document:

   i. Further detail provided regarding survey methodology for kororā, including timing and number of surveys

   ii. Further detail provided regarding inputs into the BCM, to clearly outline assumptions made and weighting of inputs

   iii. Further detail on the extent and duration of impacts, including ZOI justifications (for both stormwater discharges and for kororā), and habitat modification extents and duration for kororā

   iv. Further justification for the compensation approach and associated modelling, and why remedy or offset for kororā burrows was not considered appropriate, including further clarity around the intent of the compensation recommendations

298. Additionally, the following feedback was not adopted from the pre-lodgement comments:

   i. Feedback questioning the site selected for compensation actions, and the use of nest boxes as opposed to concrete culverts, was not adopted. The compensation site, and additional mitigation against known threats, provides an option that is in line with or exceeds industry accepted practice, and is in line with or exceeds the implementation of similar sites for recent projects in the region. The recommendation to include concrete culverts as opposed to nest boxes was not adopted as the use of concrete culverts is not yet proven to be as preferable to kororā, and is not yet proven to support the same outcomes as nest boxes. The suggested use of concrete culverts in the crest of the revetment was also not adopted, as this would place the structures approximately 0.5 m further down the intertidal range, thus increasing their susceptibility to sea level rise over nesting structures set back from the crest

   ii. Feedback questioning the application of compensation, rather than offset, was not adopted. In applying the EIANZ EcIA (2018) framework, and GWRC Marine offsetting and compensation guidance, it is my view that the recommended location and nature of the artificial nesting structures and associated vegetated habitat best reflects the principles of compensation rather than offset

   iii. Feedback questioning the use of the Biodiversity Compensation Model was not adopted. The BCM is an industry accepted decision support tool that has been applied to numerous species and habitats (including kororā) and has been tested numerous times in hearings including environment court and fast track consenting processes

   iv. Feedback questioning the need for ongoing monitoring was not adopted. Monitoring is a core principle of offset and compensation and is tied to testing the predicted outcomes of the BCM and to site maintenance requirements. To omit monitoring requirements from the delivery of compensation would not be good practice, and risks losing important information that can help determine the outcome of this project and help improve the success of future projects

12. REFERENCES

ANZG (2018). Australian and New Zealand Guidelines for Fresh and Marine Water Quality. Australian and New Zealand Governments and Australian state and territory governments, Canberra, ACT, Australia. https://www.waterquality.gov.au/anz-guidelines.

Boffa Miskell, (2020). Seawall Repair Works: Ecological Impact Assessment, Prepared for Centreport Ltd.

Bolton-Ritchie, (2003). The effect of stormwater discharge on the nearshore benthic environment of inner Wellington Harbour. Unpublished thesis, Victoria University, Wellington, New Zealand 317p.

Bourne, J., & Klomp, N.I. (2004) Ecology and Management of the Little Penguin Eudyptula minor in Sydney Harbour. Department of Environment and Conservation (NSW)

Clark, D., Taiapa, C., Sinner, J., Taikato, V. R., Culliford, D., Battershill, C. N., Ellis, J.I,. Hewitt, J. E, Gower, F., Borges, H., & Patterson, M. (2018). 2016 Subtidal Ecological Survey of Tauranga Harbour and development of benthic health models.

Crisp, P., Robertson, H., McArthur, N., Cotter, S. (2023). Conservation status of birds in the Wellington Region, 2023. Greater Wellington Te Pane Matua Taiao.

D'Archino, R., Nelos, W., Neill, K., Pallentin, A. & Notman., Pete. (2022) Characterisation of Evans Bay Adamsiella algal bed. Prepared by NIWA for Wellington Regional Council

Dickinson, W. W., Dunbar, G. B., & McLeod, H. (1996). Heavy metal history from cores in Wellington Harbour, New Zealand. Environmental Geology, 27(1), 59–69.

Dickinson, W. W., Dunbar, G. B., & McLeod, H. (1996). Heavy metal history from cores in Wellington Harbour, New Zealand. Environmental Geology, 27(1), 59–69.

EIANZ ECIA Module 1 (2024). Ecological Impact Assessment (EcIA): Module 1 - Assigning Ecological Value to Marine Benthic Habitats. Published by Environment Institute of Australia and New Zealand.

EOS Ecology (2013) Mt Victoria Tunnel Duplication Project: Assessment of Effects on Marine Ecology. Technical Report 8. Prepared for New Zealand Transport Agency (NZTA). NZTA Project Report No. 604PN-E-ECM-RPT-001.

Greater Wellington Regional Council. (2022). Te Whanganui-a-Tara / Wellington Harbour monitoring data summary.

Greater Wellington Regional Council, (2023). Te Tikanga Taiao o Te Upoko o Te Ika a Maui. Natural Resources Plan for the Wellington Region – Regional Coastal Plan provisions.

Helson, J.G., Pledger, S. & Gardner, J.P.A. 2007. Does differential particulate food supply explain the presence of mussels in Wellington Harbour (New Zealand) and their absence on neighbouring Cook Strait shores? Estuarine Coastal and Shelf Science 72: 12.

Hewitt, J. E., Thrush, S. F., & Dayton, P. D. (2009). Habitat variation, species diversity and ecological functioning in a marine system. Journal of Experimental Marine Biology and Ecology, 366(1–2), 116–122. https://doi.org/10.1016/j.jembe.2008.07.016

Jayaratne, R., Williamson, B., Idris, I., Wood, N., & Wilson, A. (2019). Our capital beaches – effects of stormwater discharges. Water New Zealand.

Lachowicz, L. (2005). Population biology of mussels (Aulacomya maoriana, Mytilus galloprovincialis and Perna canaliculus) from rocky intertidal shores in Wellington Harbour. Thesis for Victoria University of Wellington.

Lukies, K. A., Gaskin, C.P., Whitehead, E. A. (2021). The effects of sediment on birds foraging in the intertidal and nearshore habitats in Aotearoa New Zealand: A literature review and recommendations for future work. Prepared for the Department of Conservation by the Northern New Zealand Seabird Trust, Auckland.

Lundquist, D., Boren, I., Childerhouse, S., Constantine, R., van Helden, A., Hitchmough, R., Michel, P., Rayment, W., and Baker, S (2025). Conservation status of marine mammals in Aotearoa New Zealand, 2024. New Zealand Threat Classification Series 48. Department of Conservation, Wellington.

McArthur, N (2022) State and trends in the indigenous bird values of the Wellington City coastline. Client report prepared for Greater Wellington Regional Council, Wellington.

McArthur, N (2025) State and trends in the indigenous bird values of Pōneke/Wellington City coastline. Client report prepared for Greater Wellington Regional Council, Wellington.

Micaroni, V., Strano. & Bell, J. (2023) Identification and mapping of shallow-water (<30 m) animal-dominated habitats in Wellington Region. Victoria University of Wellington. Report prepared for the Greater Wellington Regional Council. October 2023.

Mills, G. N., & Williamson, R. B. (2008). The impacts of urban stormwater in Auckland's aquatic receiving environment: A review of information 1995–2005 (Auckland Regional Council Technical Report 2008/029). Auckland Regional Council.

Milne, J.R. (2010). Wellington Harbour marine sediment quality investigation: Supplementary report. Greater Wellington Regional Council, Welington, New Zealand. Publication No. GW/EMI-T-10/76 50p.

Muxika, I., Borja, A., & Bonne, W. (2005). The suitability of the marine biotic index (AMBI) to new impact sources along European coasts. Ecological indicators, 5(1), 19-31.

Robertson, B. P., Gardner, J. P., & Savage, C. (2015). Macrobenthic–mud relations strengthen the foundation for benthic index development: A case study from shallow, temperate New Zealand estuaries. Ecological Indicators, 58, 161-174.

Robertson, H. A., Baird, K. A., Elliott, G. P., Hitchmough, R. A., McArthur, N. J., Makan, T. D., Miskelly, C. M., O'Donnell, C. F., Sagar, P. M., & Scofield, R. P. (2021). Conservation status of birds in Aotearoa New Zealand, 2021. New Zealand Threat Classification Series. Department of Conservation, Wellington, 43.

Roper-Lindsay, J., Fuller S.A., Hooson, S., Sanders, M.D., Ussher, G.T. (2018). Ecological impact assessment. EIANZ guidelines for use in New Zealand: terrestrial and freshwater ecosystems. 2nd edition.

Schiff, K. C., & Bay, S. M. (2003). Impacts of stormwater discharges on the nearshore benthic environment of Santa Monica Bay. Marine Environmental Research, 56(1–2), 225–243. https://doi.org/10.1016/S0141-1136(02)00332-X

Waka Kotahi NZ Transport Agency (2023). Wellington State Highway Network Stormwater Monitoring Plan. SLR Project No. 820.V30066.0000

Wellington City Council eTool (2024). Wellington City 2024 District Plan: Appeals Version. Accessed 28 October 2025 from https://eplan.wellington.govt.nz/proposed/property/0/0/96

Wellington Water Ltd (2023). Stage Two Global Stormwater Discharge Consent – Assessment of Effects on the Environment.

ANNEXURE A: Evans Bay habitat map and sample site locations

Figure 17 - Marine sampling sites and observations at Evans Bay

ANNEXURE B: Benthic invertebrate data

Table 13: Benthic invertebrate data from cores collected by stormwater outfalls in Evans Bay

General group	Taxa	Common name	S1-R1	S1-R2	S1-R3	S2-R1	S2-R2	S2-R3	S3-R1	S3-R2	S3-R3
Nemertea	Nemertea	Proboscis worms	2		1				1	1	
Platyhelminthes	Platyhelminthes	Flat Worm							2		
Nematoda	Nematoda (large size)	Roundworm	1	2	2			2	1	1	3
Gastropoda	Cominella adspersa	Speckled whelk									1
Gastropoda	Cominella virgata	Whelk							3	3	3
Gastropoda	Turbonilla sp.	Small spiral shell	1								
Gastropoda	Zeacumantus subcarinatus	Small Mud Snail	1		1						
Opisthobranchia	Philine auriformis	White Slug		1							
Bivalvia	Mussel Unid (spat)	Unidentified Mussel juvenile							2	1	
Bivalvia	Austrovenus stutchburyi (0-5mm)	Cockle (0-5mm)	19	6	1		1				
Bivalvia	Austrovenus stutchburyi (21-30mm)	Cockle (21-30mm)						1			
Bivalvia	Gari stangeri	Sunset shell									1
Bivalvia	Hiatula silequens	Sunset shell	3	1							
Bivalvia	Leptomya retiaria retiaria	Small bivalve						1			1
Bivalvia	Macomona liliana	Wedge shell (Hanikura)	4	3	2			3			
Bivalvia	Mytilus galloprovincialis	Blue mussel									1
Bivalvia	Nucula hartvigiana	Nut Shell	1					1			
Bivalvia	Paphies australis	Pipi					1				
Bivalvia	Scintillona zelandica	small bivalve							1		
Bivalvia	Tawera spissa	Morning Star			1						
Bivalvia	Theora lubrica	Window shell			1						
Oligochaeta	Oligochaeta	Oligochaete worms	11	5							
Polychaeta: Orbiniidae	Scoloplos cylindrifer	Polychaete worm	1								
Polychaeta: Cossuridae	Cossura consimilis	Polychaete worm	2								
Polychaeta: Spionidae	Boccardia sp.	Polychaete worm	1	7							
Polychaeta: Spionidae	Polydora sp.	Polychaete worm	9	11	8			2			
Polychaeta: Spionidae	Prionospio aucklandica	Polychaete worm	69	80	51			8	1	1	

General group	Taxa	Common name	S1-R1	S1-R2	S1-R3	S2-R1	S2-R2	S2-R3	S3-R1	S3-R2	S3-R3
Polychaeta: Spionidae	Prionospio multicristata	Polychaete worm	1								
Polychaeta: Spionidae	Spio readi	Polychaete worm	2	2							
Polychaeta: Magelonidae	Magelona dakini	Polychaete worm						1			
Polychaeta: Capitellidae	Barantolla lepte	Polychaete worm	1								
Polychaeta: Capitellidae	Capitella sp.	Polychaete worm	10	15	13					1	
Polychaeta: Capitellidae	Heteromastus filiformis	Polychaete worm	12	17	1			14	1	1	2
Polychaeta: Opheliidae	Armandia maculata	Polychaete worm	2	3					1		
Polychaeta: Scalibregmidae	Scalibregma inflatum	Polychaete worm						1			
Polychaeta: Polynoidae	Polynoidae	Scale worms	1					1			
Polychaeta: Syllidae	Syllidae	Polychaete worm								1	1
Polychaeta: Syllidae	Exogoninae	Polychaete worm Family	1	3					1	2	4
Polychaeta: Hesionidae	Hesionidae	Polychaete Worm							2		
Polychaeta: Nereidae	Nereidae (juvenile)	Rag worms	4	7	12	1	1	2		1	
Polychaeta: Nereidae	Perinereis amblyodonta	Rag worm		1							
Polychaeta: Nereidae	Platynereis australis	Rag worm						4			
Polychaeta: Glyceridae	Glyceridae	Polychaete worm	3	2	4			1		1	3
Polychaeta: Lumbrineridae	Lumbrineridae	Polychaete worm						1			
Polychaeta: Dorvilleidae	Dorvilleidae	Polychaete worm		2	7		1	2		3	2
Polychaeta: Oweniidae	Myriochele sp.	Polychaete worm						5			
Polychaeta: Oweniidae	Owenia petersenae	Polychaete		1				1			
Polychaeta: Cirratulidae	Cirratulidae	Polychaete worm	1	4	1			1			1
Polychaeta: Pectinariidae	Lagis (Pectinaria) australis	Polychaete worm	2	2				1			
Polychaeta: Terebellidae	Terebellidae	Polychaete worm						3			
Polychaeta: Serpulidae	Spirobranchus sp.	Fan worm							10		
Polychaeta: Spirorbinae	Spirorbidae	Polychaete spiral tube							3		13
Polychaeta: Sabellidae	Sabellidae	Umbrella worms								1	
Tanaidacea	Tanaidacea	Tanaid shrimp	1	1	2						
Amphipoda	Caprellidae	Caprillid amphipod						5			
Amphipoda	Corophiidae	Amphipod (family)	30	29	27						
Amphipoda	Phoxocephalidae	Amphipod (family)	18	5	5			19			

General group	Taxa	Common name	S1-R1	S1-R2	S1-R3	S2-R1	S2-R2	S2-R3	S3-R1	S3-R2	S3-R3
Amphipoda	Amphipoda Unid.	Amphipod			12			9	2		
Decapoda	Austrohelice crassa	Tunnelling Mud Crab						1			
Decapoda	Halicarcinus cookii	Pill-box Crab			1						
Decapoda	Plagusia sp.	Crab						1			
Decapoda	Decapoda (larvae Unid.)	Unidentified Crab Larvae	1	1							
Ostracoda	Diasterope grisea	Ostracod						3			
Ostracoda	Euphilomedes agilis	Ostracod	1	1				2			
Cirripedia	Austrominius modestus	Estuarine Barnacle							87	2	
Phoronida	Phoronus sp.	Horseshoe worms						1			
Bryozoa	Bryozoa (encrusting)	Bryozoan colony	1					1	1		1
Asteroidea	Patiriella regularis	Cussion star (Juvenile)							1	3	
Ophiuroidea	Ophiuroidea	Brittle stars			1				1	1	1
Holothuroidea	Trochodota dendyi	Sea cucumber							3	3	2
	Count: No of Individuals		**217**	**212**	**154**	**1**	**4**	**98**	**124**	**27**	**40**
	Count: No of Taxa		**32**	**26**	**21**	**1**	**4**	**30**	**19**	**17**	**16**
	SW_Diversity		**2.4962**	**2.3385**	**2.2415**		**1.3863**	**2.8731**	**1.3768**	**2.7049**	**2.3655**
	SW_Evenness		**0.7202**	**0.7178**	**0.7362**		**1**	**0.8447**	**0.4676**	**0.9547**	**0.8532**

ANNEXURE C: Coastal bird species list for Evans Bay

List of native coastal bird species present of potentially present in or near proposed SH1 stormwater discharge and stormwater outfall in Evans Bay (data retrieved from iNaturalist, eBird, site surveys and reports of Evans Bay).

** Data references include (1) iNaturalist, (sourced 28 September 2025), (2) eBird hotspot (Evans Bay – in the middle of the bay outside the ZOI of the Project), (3) Evans Bay report – McArthur, (2022), (4) Evans Bay report McArthur, (2025)

Table 14: Native coastal bird species present of potentially present in or near proposed SH1 stormwater discharge and stormwater outfall in Evans Bay

Common name	Species name	National conservation status (Robertson et al. 2021)	Regional conservation status (Crisp et al. 2023)	Observed on site	Ecological value (EIANZ criteria; Roper-Lindsay et al. 2018)	Reference*
Artic skua	*Stercorarius parasiticus*	Non resident native	Migrant		Negligible	2
Australasian gannet | tākapu	*Morus serrator*	Not Threatened	Migrant		Negligible	2
Black fronted tern | tarapirohe	*Chlidonias albostriatus*	Threatened – Nationally Endangered	Endangered		Very High	2
Black shag | kawau tuī	*Phalacrocorax carbo*	At Risk - Relict	Endangered		High	2
Caspian Tern | taranui	*Hydroprogne caspia*	Threatened – Nationally Vulnerable	Critical		Very High	2
Fluttering shearwater | pakahā	*Puffinus gavia*	At Risk - Relict	Extirpated		Moderate	1
Little penguin | kororā	*Eudyptula minor*	At Risk - Declining	Endangered	Burrows found	High	1, 2
Little shag | kawaupaka	*Microcarbo melanoleucos*	At Risk - Relict	Endangered	Yes	Moderate	1, 2, 3, 4
Little black shag | kawau tūī	*Phalacrocorax sulcirostris*	At Risk – Naturally Uncommon	Endangered		Moderate	2, 4
Mallard | rakiraki	*Anas platyrhynchos*	Introduced	Introduced and naturalised	Yes	Negligible	1
New Zealand kingfisher | kōtare	*Todiramphus sanctus vagans*	Not Threatened	Not Threatened		Low	2
Pacific reef heron | matuku moana	*Egretta sacra*	Threatened - Nationally Endangered	Critical		Very High	2
Paradise shelduck | pūtangitangi	*Tadorna veriegata*	Not Threatened	Not Threatened		Low	1

Common name	Species name	National conservation status (Robertson et al. 2021)	Regional conservation status (Crisp et al. 2023)	Observed on site	Ecological value (EIANZ criteria; Roper-Lindsay et al. 2018)	Reference*
Pied shag | kāruhiruhi	*Phalacrocorax varius*	At Risk - Recovering	Vulnerable		Moderate	2
Red-billed gull | tarāpunga	*Chroicocephalus novaehollandiae*	At Risk - Declining	Vulnerable		High	1, 2, 4
Salvin's albatross | toroa	*Thalassarche salvini*	Threatened – Nationally Critical	Critical		Very High	2
Spotted shag | kawa tikitiki	*Phalacrocorax punctatus*	Threatened – Nationally Vulnerable	Critical		Very High	1, 2, 3, 4
Southern black-backed gull | karoro	*Larus dominicanus*	Not Threatened	Not Threatened		Low	1, 2
South Island pied oystercatcher | Tōrea	*Haematopus finschi*	At Risk – Declining	Migrant	Yes	High	2
Variable oystercatcher | Tōrea pango	*Haematopus unicolor*	At Risk - Recovering	Endangered	Yes	Moderate	1, 2, 3, 4
White-faced heron | matuku moana	*Egrett novaehollandiae*	Not Threatened	Not Threatened		Low	2
White heron | kōtuku	*Ardea modesta*	Threatened – Nationally Critical	Critical		Very High	2
White-fronted tern | tara	*Strena striata*	At Risk - Declining	Critical		High	2

ANNEXURE D: Coastal bird species list for Lambton Harbour

List of native coastal bird species present of potentially present in or near proposed SH1 stormwater discharge and stormwater outfall in Lambton Harbour (data retrieved from Greater Wellington Regional Council Natural Resources Plan, iNaturalist, EBird hotspots)

** Data references include (1), Greater Wellington Regional Council Natural Resources Plan, (2) iNaturalist (sourced 28 October 2025), (3) EBird hotspot (Wellington – Waitangi Park adjacent to Clyde Quay Wharf), (4) EBird hotspot (Wellington-Lambton Harbour), (5) EBird hotspot - Te Papa Tongarewa Museum of New Zealand

Table 15: Native coastal bird species present of potentially present in or near proposed SH1 stormwater discharge and stormwater outfall in Lambton Harbour

Common names	Species name	National conservation status (Robertson et al. 2021)	Regional conservation status (Crisp et al. 2023)	Ecological value (EIANZ criteria; Roper-Lindsay et al. 2018)	Reference*
Artic skua | NA	*Stercocaris parasicicus*	Non Resident Native – Migrant	Migrant	Low	4
Australasian Gannet | Tākapu	*Morus serrator*	Not Threatened	Migrant	Low	2, 3, 4
Black browed Albatross | Toroa	*Thalassarche melanophris*	Non-Resident – Coloniser	Migrant	Low	4
Black shag | Māpunga	*Phalacrocorax carbo*	At Risk - Relict	Critical	Moderate	1, 2, 3, 4
Cape petrel | Karetai hurukoko	*Daption capense*	At Risk – Relict	Migrant	Moderate	4
Caspian Tern | Taranui	*Hydroprogne caspia*	Threatened – Nationally Vulnerable	Critical	Very High	4
Fairy Prion | tītī wainui	*Pachyptila turtur*	At Risk - Relict	Extirpated	Moderate	2
Fluttering shearwater | Pakahā	*Puffinus gavia*	At Risk - Relict	Extirpated	Moderate	1, 2, 3, 4
Grey faced Petrel |Ōi	*Pterodroma gouldi*	Not Threatened	Migrant	Low	4
Hutton's Shearwater | Kaikōura tītī	*Puffinus huttoni*	Threatened – Nationally Vulnerable	Vulnerable	Very High	4
Little Black Shag | Kawau tūī	*Phalacrocorax sulcirostris*	At Risk – Naturally Uncommon	Endangered	Moderate	2, 3, 4, 5
Little Shag | Kawaupaka	*Microcarbo melanoleucos*	Not Threatened	Endangered	Low	2, 4
New Zealand Kingfisher | Kōtare	*Todiramphus sanctus*	Not Threatened	Not Threatened	Low	2, 3, 4, 5
Northern Giant-Petrel | Pāngurunguru	*Pelecanoides urinatrix*	At Risk – Relict	Migrant	Moderate	4

Common names	Species name	National conservation status (Robertson et al. 2021)	Regional conservation status (Crisp et al. 2023)	Ecological value (EIANZ criteria; Roper-Lindsay et al. 2018)	Reference*
Northern Royal Albatross | Toroa	*Diomedea sanfordi*	Threatened – Nationally Vulnerable	Vulnerable	Very High	4
Pacific Reef Heron | Matuku moana	*Egretta sacra*	Threatened – Nationally Endangered	Critical	Very High	3, 4
Pied shag | Kāruhiruhi	*Phalacrocorax varius*	At Risk - Recovering	Vulnerable	Moderate	1, 2, 3, 4, 5
Pied stilt | poaka	*Himantopus leucocephalus*	Not Threatened	Not Threatened	Low	3
Pomarine skua | NA	*Coprotheres pomarinus*	Not Threatened	Migrant	Low	4
Red-billed gull | Tarāpunga	*Chroicocephalus novaehollandiae*	At Risk - Declining	Vulnerable	High	1, 2, 3, 4, 5
Spur-winged plover	*Vanellus miles*	Not Threatened	Not Threatened	Low	2
Southern Black-backed gull | Karoro	*Larus dominicanus*	Not Threatened	Not Threatened	Low	2, 3, 4, 5
Southern diving petrel	*Pelecanoides urinatrix*	At Risk – Relict	Critical	Moderate	2
Spotted Shag | Kawau tikitiki	*Stictocarbo punctatus*	Threatened – Nationally Vulnerable	Critical	Very High	2, 3, 4, 5
South Island Oystercatcher | Tōrea	*Haematopus finschi*	At Risk – Declining	MIgrant	High	3, 4
White faced Heron | Matuku moana	*Egrett novaehollandiae*	Not Threatened	Not Threatened	Low	3, 4, 5
White-fronted tern | Tara	*Sterna striata*	At Risk - Declining	Critical	High	1, 2, 3, 4, 5
Variable oystercatcher | Tōrea pango	*Haematopus unicolor*	At Risk - Recovering	Endangered	Moderate	1, 3, 4, 5
Westland petrel | Tāiko	*Procellaria westlandica*	At Risk – Naturally Uncommon	Migrant	Moderate	4

ANNEXURE E: Marine fish present at Lambton Harbour (source NABIS)

Fish species likely to be present in Wellington Harbour based on annual normal range distributions from the National Aquatic Biodiversity Information System (NABIS)

* Indicates Wellington Harbour is a hotspot for the species (Data retrieved 28 October 2025).

Table 16: Fish species likely to be present in Wellington Harbour

Common name	Māori name[1]	Scientific name	NZ threat status[2, 3]
Anchovy	Kokowhaawhaa	Engraulis australis	Least concern
Barracouta	Makaa	Thyrsites atun	N/A
Basking shark	Mango	Cetorhinus maximus	Threatened – Nationally vulnerable
Black flounder	Patiki-mohoao	Rhombosolea retiaria	Data deficient
Blue cod	Paakirikiri, Raawaru	Parapercis colias	Least concern
Blue Mackerel	Tawatawa	Scomber australasicus	Least concern
Blue moki*	Moki	Latridopsis ciliaris	N/A
Blue shark	Mango-pounamu, Poutini	Prionace glauca	Not threatened
Blue warehou	-	Seriolella brama	N/A
Brill	Patikinui	Colistium guntheri	N/A
Butterfish*	Mararii, Kooeaea	Odax pullus	Least concern
Elephant fish	-	Callorhinchus milii	Least concern
Frostfish	Paara	Lepidopus caudatus	Data deficient
Garfish	Ihe	Hyporhamphus ihi	N/A
Gemfish	Tikati	Rexea spp Rexea solandri	N/A
Golden Mackerel	Tawatawa	Trachurus novaezelandiae	Least concern
Hake	Kehe	Merluccius australis	N/A
Hapuku	Haapuku, Kapua, Whapuku	Polyprion oxygeneios +Polyprion spp	N/A
Hoki	Hoki	Macruronus novaezelandiae	N/A
Horse Mackerel	Hauture	Trachurus declivis	Least concern
John Dory	Kuparu	Zeus faber	Not threatened
Kahawai	Kahawai	Arripis trutta	N/A
Lemon Sole	Paatiki	Pelotretis flavilatus	Least concern
Ling	Hoka, Hokarari	Genypterus blacodes	N/A
Murphy's Mackerel	-	Trachurus murphyi	Data deficient
New Zealand Sole	Paatikirori	Peltorhamphus novaezeelandiae	N/A
Pilchard	Mohimohi	*Sardinops sagax*	Least concern
Porae	Porae	Nemadactylus douglasii	N/A

Common name	Māori name[1]	Scientific name	NZ threat status[2, 3]
Red Cod	Hoka	Pseudophycis bachus	N/A
Red gurnard	Kumukumu	Chelidonichthys kumu	Least concern
Red Moki	Nanua	Cheilodactylus spectabilis	N/A
Rig*	Kapetaa, Mangaa, Mangoo	Mustelus lenticulatus	Not threatened
Rough Skate	Pakaurua, Waewae	Dipturus nasutus	Not threatened
Sand Flounder	Paatiki	Rhombosolea plebeia	N/A
School Shark	Tupere, Makohuarau	Galeorhinus galeus	Not threatened
Sea Perch	Pohuiakaroa	Helcolenus percoides	N/A
Silver Warehou	-	Seriolella punctata	Least concern
Smooth Skate	Uku	Dipturus innominatus	Least concern
Snapper	Taamure	Pagrus auratus	Least concern
Spiny Dogfish	Kaaraerae	Squalus acanthias	Vulnerable
Sprats	Kupae	Sprattus muelleri	Least concern
Thresher shark	Mango ripi	Alopias vulpinus	Not threatened
Turbot	Patiki	Colistium nudipinnis	N/A
White pointer, Great white shark	Mango taniwha, Mango ururoa, Tupa	Carcharodon carcharias	Threatened – Nationally endangered
White Warehou	-	Seriolella caerulea	Least concern
Yellow-eyed Mullet*	Aua	Aldrichetta forsteri	Least concern

ANNEXURE F: Environment Institute of Australia and New Zealand (2018) Ecological Impact Assessment Guideline (EcIAG) tables for marine species and habitats

Table 17: Criteria for assigning ecological value to estuarine and marine species

Ecological Value	Species
Very High	▪ Internationally or 'Nationally Threatened' species (Nationally Critical, Nationally Endangered, Nationally Vulnerable, Nationally Increasing) found in the ZOI* either permanently or seasonally.
High	▪ Species listed as Internationally or Nationally 'At Risk' – Declining, found in the ZOI* either permanently or seasonally.
Moderate	▪ Locally uncommon or distinctive species; or ▪ Species listed as any other category of 'At Risk', found in the ZOI* either permanently or seasonally.
Low	▪ Nationally and locally common indigenous species.
Negligible	▪ Exotic species, including pests, species having recreational value.

*In this case the Zone of Influence (ZOI) refers to all estuarine and marine water bodies and environments that could potentially be affected by the Project. It includes the Project Site and any environments beyond the Project Area where the 'indirect effects' of activities such as discharges may extend (sometimes called the Study Area).

Table 18: Qualitative and quantitative fine scale attributes for assigning ecological values for soft sediment benthic habitats

Ecological Value	Attributes
Negligible	▪ Benthic invertebrate community degraded with very low species richness, diversity, and abundance for the habitat type. ▪ Benthic invertebrate community dominated by organic enrichment tolerant, contaminant tolerant, and mud tolerant organisms with no sensitive taxa present. E.g. rated as 'Poor' using the Auckland Council[16] or National Benthic Health Models (BHM)[17] or similar indices. ▪ Invasive[18], opportunistic and disturbance tolerant species highly dominant. ▪ Marine sediments dominated by silt and clay grain sizes (> 80%) or rated as 'Poor' using a BHMmud or similar index. ▪ Surface sediment anoxic (lacking oxygen)[19]. ▪ Annual average sedimentation rates typically greater than 10 mm above background levels[20]. ▪ Elevated contaminant concentrations in surface sediment, above ANZG Guideline Values – High (GV-High) effects threshold concentrations[21]. ▪ Where shellfish are present, flesh has moderate-high contaminant concentrations present compared to natural background levels. ▪ Water column contaminant concentrations typically at or worse than ANZWQG 80% species protection levels and/or scored as 'Poor' on a recognised WQI. ▪ Fish community[22] depleted with very low species richness, diversity and abundance[23]. ▪ Native estuarine vegetation or macroalgae absent or so sparse as to provide very limited ecological value. ▪ Nuisance phytoplankton or macroalgal blooms may occur frequently over a large spatial scale. ▪ No Threatened or At Risk marine species[24] present. ▪ No Threatened ecosystems[25] present. ▪ Physical habitat extremely modified.
Low	▪ Benthic invertebrate community degraded with low species richness, diversity and abundance for the habitat type. ▪ Benthic invertebrate community dominated by organic enrichment tolerant, contaminant tolerant and mud tolerant organisms with few/no sensitive taxa present e.g. rated as 'Marginal' using the Auckland Council[5] or National Benthic Health Models (BHM)[6] or similar index. ▪ Invasive[7], opportunistic and/or disturbance-tolerant species dominant. ▪ Marine sediments dominated by silt and clay grain sizes (> 70%) or rated as 'Marginal' using the Auckland Council BHMmud or similar index. ▪ Surface sediment predominantly anoxic (lacking oxygen)[8]. ▪ Annual average sedimentation rates typically less than 10 mm above background levels[9].

Ecological Value	Attributes
	▪ Elevated contaminant concentrations in surfaces sediment, between ANZG Default Guideline Values (DGV) and GV-High effects threshold concentrations[10]. ▪ Where shellfish are present, flesh has moderate contaminant concentrations present compared to natural background levels. ▪ Water column contaminant concentrations typically between ANZWQG 80% and 90% species protection levels and/or scored as 'Marginal' on a recognised WQI. ▪ Fish community[11] depleted with low species richness, diversity and abundance[12]. ▪ Native estuarine vegetation and/or macroalgae community provides minimal/limited habitat for native fauna. ▪ Nuisance phytoplankton or macroalgal blooms may occur commonly over a moderate scale. ▪ No Threatened of At Risk marine species[13] present. ▪ No Threatened ecosystem[14] present. ▪ Physical habitat highly modified.
Moderate	▪ Benthic invertebrate community typically has moderate species richness, diversity and abundance for the habitat type. ▪ Benthic invertebrate community has taxa both tolerant and sensitive to organic enrichment, contaminants and mud present E.g. rated as 'Fair' using the Auckland Council5 or National Benthic Health Model (BHM)6 or similar index. ▪ Few invasive7 opportunistic and/or disturbance tolerant species present. ▪ Marine sediments typically comprise less than < 60% silt and clay grain sizes or rated as 'Fair' using the Auckland Council BHMmud or similar index. ▪ Shallow dept of oxygenated surface sediment to 1-2 cm depth8. ▪ Annual average sedimentation rates typically less than 5 mm above background levels9. ▪ Contaminant concentrations in surface sediment generally below ANZG Default Guideline Values (DGV)10 and Auckland Council ERC-Red effects threshold concentrations26. ▪ Where shellfish are present, flesh has low to moderate contaminant concentrations present compared to natural background levels. ▪ Water column contaminant concentrations typically between ANZWQG 90% and 95% species protection levels and/or scored as 'Fair' on a recognised WQI. ▪ Fish community11 typically has moderate species richness, diversity and abundance12. ▪ Native estuarine vegetation and macroalgae community dominated by native species and provides moderate habitat for native fauna. ▪ Nuisance phytoplankton or macroalgae blooms may occur sporadically over a moderate spatial scale. ▪ Few Threatened of At Risk marine species13 present. ▪ Few Threatened ecosystems14 present. ▪ Physical habitat moderately modified.
High	▪ Benthic invertebrate community typically has high diversity, species richness and abundance for the habitat type. ▪ Benthic invertebrate community contains many taxa that are sensitive to organic enrichment, contaminants and mud. E.g. rated as 'Good' using the Auckland Council5 or National Benthic Health Model (BHM)6 or similar index. ▪ Invasive7 opportunistic and/or disturbance tolerant species largely absent. ▪ Marine sediments typically comprise < 40% silt and clay grain sizes or rated as 'Good' using the Auckland Council BHMmud or a similar index. ▪ Surface sediment oxygenated up to 5cm depth8. ▪ Annual average sedimentation rates typically less than 2 mm above background levels9. ▪ Contaminant concentrations in surface sediment rarely exceed ANZG Default Guideline Values (DGV)10 concentrations and AC ERC-Orange effects threshold concentrations15. ▪ Where shellfish are present, flesh has contaminant concentrations close to natural background levels or not above conservative laboratory detection limits. ▪ Water column contaminant concentrations typically between ANZWQG 95% and 99% species protection levels and/or scored as 'Good' on a recognised WQI. ▪ Fish community11 typically has high diversity, species richness and abundance12. ▪ Native estuarine vegetation or macroalgae community dominated by native species and provides high quality habitat for native fauna. ▪ Nuisance phytoplankton or macroalgal blooms may occur infrequently at a limited spatial scale. ▪ Threatened or At Risk marine species13 present.

Ecological Value	Attributes
	▪ Threatened ecosystem14 present. ▪ Physical habitat largely unmodified.
Very High	▪ Benthic invertebrate community typically has very high diversity, species richness and abundance for the habitat type. ▪ Benthic invertebrate community is dominated by taxa that are sensitive to organic enrichment, contaminants and mud e.g. rated as 'Excellent' using the Auckland Council[5] or National Benthic Health Model (BHM)[6] or similar index. ▪ Invasive[7] opportunistic and disturbance tolerant species absent. ▪ Marine sediments typically comprise < 20% silt and clay grain sizes (mud) or rated as 'Excellent' using the Auckland Council BHMmud or similar index. ▪ Surface sediment oxygenated to >5 cm depth[8] with no anoxic sediment present. ▪ Annual average sedimentation rates typically less than 1 mm above background levels[9]. ▪ Contaminant concentrations in surface sediment significantly below ANZG Default Guideline Values (DGV)[10] and Auckland Council ERC-Orange effects threshold concentrations[15]. ▪ Contaminant concentrations in shellfish at or below natural background levels or not above conservative laboratory detection limits. ▪ Water column contaminant concentrations typically at or better than ANZWQG 99% species protection level and/or scored as 'Excellent' on a recognised WQI. ▪ Fish community[11] typically has very high diversity, species richness and abundance[12]. ▪ Native estuarine vegetation or macroalgae community intact and provides significant habitat for native fauna. ▪ No evidence of nuisance phytoplankton or macroalgal blooms. ▪ Threatened or At Risk marine species[13] present. ▪ Threatened ecosystems[14] present. ▪ Physical habitat unmodified.

Table 19: Summary of the criteria for describing the magnitude of effect

Magnitude	Description
Very High	▪ Total loss of, or very major alteration to, key elements/features/ of the existing baseline conditions, such that the post-development character, composition and/or attributes will be fundamentally changed and may be lost from the site altogether; AND/OR ▪ Loss of a very high proportion of the known population or range of the element/feature.
High	▪ Major loss or major alteration to key elements/features of the existing baseline conditions such that the post-development character, composition and/or attributes will be fundamentally changed; AND/OR ▪ Loss of a high proportion of the known population or range of the element/feature.
Moderate	▪ Loss or alteration to one or more key elements/features of the existing baseline conditions, such that the post-development character, composition and/or attributes will be partially changed; AND/OR ▪ Loss of a moderate proportion of the known population or range of the element/feature.
Low	▪ Minor shift away from existing baseline conditions. Change arising from the loss/alteration will be discernible, but underlying character, composition and/or attributes of the existing baseline condition will be similar to pre-development circumstances or patterns; AND/OR ▪ Having a minor effect on the known population or range of the element/feature.
Negligible	▪ Very slight change from the existing baseline condition. Change barely distinguishable, approximating to the 'no change' situation; AND/OR ▪ Having negligible effect on the known population or range of the element/feature.

Table 20: Criteria for describing overall level of ecological effects

Magnitude of effect	Ecological Value				
	Very High	**High**	**Moderate**	**Low**	**Negligible**
Very High	Very High	Very High	High	Moderate	Low
High	Very High	Very High	Moderate	Low	Very Low
Moderate	High	High	Moderate	Low	Very Low
Low	Moderate	Low	Low	Very low	Very Low
Negligible	Low	Very low	Very low	Very low	Very Low
Positive	Net gain	Net gain	Net gain	Net gain	Net gain

1. Overall level-of-effect categories are used to determine if residual effects management is required over and above measures to reduce the severity of effects through efforts to avoid, remedy or mitigate adverse effects. Usually, if the level of residual effect is assessed as being "Moderate" or greater, this warrants efforts to offset or compensate for these effects.

ANNEXURE G: Biodiversity Compensation Modelling for Kororā

Biodiversity Compensation Modelling was conducted to account for:

- Permanent loss of 3 burrows
- Habitat value lost in the revetment rebuild compared to the original revetment that contained the 3 burrows
- Temporary exclusion (12 months) from 1 burrow
- Temporary exclusion (12 months) from 30 m^2 of potential habitat (containing the 1 temporary exclusion burrow above) during the works window.

Existing burrows have been conservatively valued, with higher uncertainty multipliers applied, to ensure that their potential as refuge is not under-estimated. A guide for burrow scoring has been provided in the table below, but note that these weightings should be adapted for site specific conditions. Usage data is accumulated from 2 years of surveys (including 14 visual inspections by a penguin ecologist and 5 dog surveys). Given the high site fidelity of kororā to their burrows, this quantum of surveys over 2 years is deemed sufficient to broadly categorise the burrows given the time of year that surveys were undertaken. This also aligns with the proposed strategy to assess occupancy of the nestboxes at the relocation site.

Tonkin + Taylor kororā burrow value scoring criteria guidance.

Value	Physical Criteria	Behavioural Criteria
0	• Burrow collapsed, structurally unusabe, flooded • Poor substrate • Microclimate entirely unsuitable • No resilience to SLR	• No evidence of penguin activity at any time of year. • No breeding attempts, no roosting, no moulting. • Provides **zero contribution** to colony behaviour or recruitment.
1	• Burrow structurally intact but poor (shallow chamber, not providing shelter) • Prone to flooding • Poor microclimate • Poor resilience to SLR	• Rare or incidental visits; may be briefly inspected but not used. • Occasional short-term roosting (limited by tide). • No breeding attempts • No moulting behaviour observed or expected.
2	• Burrow structurally intact • Poor microclimate, but provides some buffering to elements • Some tidal inundation likely • Vulnerable to SLR	• Limited or inconsistent use for roosting outside the breeding season. • Rare or unsuccessful breeding attempts; low likelihood of egg laying. • Moulting may occur but is infrequent or incomplete.
3	• Burrow structurally intact, good chamber depth and shelter • Microclimate stable during typical weather • Positioned above inundation zone • Vulnerable to SLR, but in the medium term	• Regular roosting by adults during non-breeding periods. • May have evidence of breeding attempts (incubation, nest building). • Moulting observed occasionally • Penguins show moderate site familiarity but not strong fidelity.
4	• Burrow structurally intact, good chamber depth and shelter, long term stability • Microclimate consistently aqequate • Positioned above inundation zone, erosion resitant • Vulnerable to SLR, but onlyin the long term	• Repeated breeding attempts with **some successful fledging**. • Frequent roosting throughout the year by multiple individuals. • Reliable use for complete moulting with low stress behaviours. • Penguins show clear preference for the site and return across seasons.
5	• Burrow structurally intact, good chamber depth and shelter, long term stability • Microclimate consistently aqequate, including in extreme and persistent weather • Positioned well above inundation zone, highly erosion resitant including access • Above long term SLR projections	• Consistent, multi-year **successful breeding** with high fledging rates. • Strong site fidelity: same individuals return annually. • Regular moulting observed each year. • High roosting value across all seasons, including non-breeding adults and juveniles. • Burrow contributes measurably to colony recruitment and long-term persistence.

Annexure G Table 1: Biodiversity Compensation Modelling for kororā burrow loss

General model descriptor inputs	
Model inputs	**Explanation**
Project / reference name	State HW1 – RoNS – Evans Bay outfall replacement
Biodiversity type	Kororā burrows
Technical expert input(s)	Joshua Forrest, Marcus Cameron
Benchmark	A benchmark of 5 equates to a burrow (natural or artificial) that has regular evidence of full lifecycle support of kororā (i.e breeding (including pair-bonding, copulation, chick rearing), moulting, and refuge). High fledging success recorded across multiple seasons, and likely evidence of site fidelity. Artificial burrows receive regular maintenance to ensure they are watertight and in an ongoing condition that supports the full life-history. Burrow demonstrates long-term structural stability and consistently optimal microclimate conditions. Located in elevated, erosion-resistant habitat beyond projected long-term inundation and storm-surge impact zones. Contributes measurably to colony recruitment and long-term persistence.
How many habitat types OR sites are impacted	4
Number of proposed mitigation measures	2
Net Gain target	10% (i.e. the compensation score needs to be at least 10% higher than the impact score.)

Impact model inputs and description	
Habitat / site impacted	**Burrow – confirmed roosting. Temporary modification of burrow.**
Impact risk contingency	**Data input:** 3 = High risk / High value Kororā are "At Risk – Declining" which equates to a high ecological value.
Impact uncertainty contingency	**Data input:** 3 = High uncertainty Data is only available from a single season, represented by three data points. This does not confirm the full potential use of this burrow, therefore the impact is uncertain.
Areal extent of impact	**1** (unit is burrow count)
Value score prior to impact	**Data input:** 2.25 Low end of moderate value, in that the burrow does not appear to support breeding or moulting based on survey data. Could not be considered higher due to the physical characteristics of the burrow limiting its means of supporting a greater proportion of the life-history of kororā. Could not be considered lower as the burrow appears to have the characteristics to support moulting penguins and breeding attempts
Value score <u>after</u> impact	**Data input:** 0.001 A value of 0.001 as there will be a permanent and complete loss of habitat for works programme **without remediation actions** (noting that the formula cannot work with 0).

Impact model inputs and description	
Habitat / site impacted	**Burrow – confirmed moulting. Permanent loss of burrow.**
Impact risk contingency	**Data input:** 3 = High risk / High value Kororā are "At Risk – Declining" which equates to a high ecological value.
Impact uncertainty contingency	**Data input:** 3 = High uncertainty Data is available from two seasons, represented by nineteen data points. This does not confirm the full potential use of this burrow, therefore the impact is uncertain.
Areal extent of impact	**1** (unit is burrow count)
Value score prior to impact	**Data input:** 3 Moderate value, in that the burrow does not appear to support breeding or moulting based on survey data. Could not be considered higher due to the physical characteristics of the burrow limits its means of supporting a greater proportion of the life-history of kororā. Could not be considered lower as the burrow appear to have the characteristics to support moulting penguins and breeding attempts. Burrow structurally stable, dry, and adequately insulated. Used for roosting and evidence of old moulting, though potentially exposed to extreme weather or disturbance. Located above frequent inundation zones but potentially at risk under higher-end SLR projections.

Impact model inputs and description	
Value score <u>after</u> impact	**Data input:** 0.001 A value of 0.001 as there will be a permanent and complete loss of habitat (noting that the formula cannot work with 0).

Impact model inputs and description	
Habitat / site impacted	**Burrow – confirmed roosting. Permanent loss of burrow.**
Impact risk contingency	**Data input:** 3 = High risk / High value Kororā are "At Risk – Declining" which equates to a high ecological value.
Impact uncertainty contingency	**Data input:** 3 = High uncertainty Data is only available from a single season, represented by three data points. This does not confirm the full potential use of this burrow, therefore the impact is uncertain.
Areal extent of impact	**1** (unit is burrow count)
Value score prior to impact	**Data input:** 2.25 Low end of moderate value, in that the burrow does not appear to support breeding or moulting based on survey data. Could not be considered higher due to the physical characteristics of the burrow limiting its means of supporting a greater proportion of the life-history of kororā. Could not be considered lower as the burrow appears to have the characteristics to support moulting penguins and breeding attempts
Value score <u>after</u> impact	**Data input:** 0.001 A value of 0.001 as there will be a permanent and complete loss of habitat (noting that the formula cannot work with 0).

Impact model inputs and description	
Habitat / site impacted	**Burrow – historic roosting. Permanent loss of burrow.**
Impact risk contingency	**Data input:** 3 = High risk / High value Kororā are "At Risk – Declining" which equates to a high ecological value.
Impact uncertainty contingency	**Data input:** 3 = High uncertainty Data is available from two seasons, represented by nineteen data points. This does not confirm the full potential use of this burrow, there for the impact is uncertain.
Areal extent of impact	**1** (unit is burrow count)
Value score prior to impact	**Data input:** 1.75 Exceeds criteria for refuge, microclimate and structure. Marginal for sea level rise resilience. Marginal for moulting potential. Marginal for disturbance. Low for breeding potential. The burrow does not appear to support breeding or moulting based on survey data. Could not be considered lower as the burrow appears to have the characteristics to

Impact model inputs and description	
	support moulting penguins and breeding attempts. Could not be considered higher due to the physical characteristics of the burrow limiting its means of supporting a greater proportion of the life-history of kororā.
Value score after impact	**Data input:** 0.001 A value of 0.001 as there will be a permanent and complete loss of habitat (noting that the formula cannot work with 0).

Compensation model inputs	
Compensation action	**Reinstatement of modified burrow**
Discount rate	**Data input:** 3% Default value
Finite end-point	**Data input:** 1 It is expected that within one year of the modification being removed that the value after compensation will be realised.
Compensation confidence contingency	**Data input: 1** The action will result in the return of identical habitat. There is high confidence that this action will result in the burrow being used as it was previously.
Areal extent of compensation type	**Data input:** 1 1 burrow is being returned in its original state once modifications are removed.
Value score prior to compensation measure	**Data input:** 0.001 A value of 0.001 as there is completely inhibited access while the modification is in place (noting that the formula cannot work with 0).
Value score after compensation measure	**Data input:** 2.25 Provided the burrow remains structurally undisturbed throughout modification works, it is expected to return to its pre-impact value upon the removal of the modifications (effects remedied). Therefore, compensation applied through this tool only accounts for the timescale in which the burrow was unavailable.

Compensation model inputs	
Compensation action	Three burrows replaced with artificial refuge (nestboxes or culverts). Note: wider habitat replacement is considered separately. Burrows to be reinstated within the impact site.
Discount rate	**Data input:** 3% Default value
Finite end-point	**Data input: 1** It is expected that within 1 year the value of the burrows will be realised.
Compensation confidence contingency	**Data input: 3**

Compensation model inputs	
	The action will result in the return of similar (or better) value habitat. There is moderate confidence that this action will result in the nesting structures being used as the burrows were previously.
Areal extent of compensation type	**Data input:** 6 6 burrows provided in the form of nestboxes.
Value score prior to compensation measure	**Data input:** 0.001 A value of 0.001 as there is completely inhibited access while the modification is in place (noting that the formula cannot work with 0).
Value score after compensation measure	**Data input:** 3.25 A value score of 3.25 after 1 year equates to an ecological value of 65% relative to the benchmark. The physical criteria of the burrow will be met – the burrows will be structurally stable, support the appropriate microclimate for incubation, be placed in erosion resistant areas and above long-term projected sea level rise levels. Nest boxes when made of treated timber are expected to last 15 years in coastal conditions, and this has been reflected in the overall value. Despite all physical characteristics being met, burrow value is also determined by the behavioural characteristics of penguins using them – such as site fidelity - and therefore value cannot be considered higher.

Model Inputs

Input descriptors	Input data			
Project/reference name	State Highway 1 - Evans Bay Outfall			
Biodiversity type	Kororā Burrows			
Technical expert(s) input	JOSF MACA			
Benchmark	5			
How many habitat types OR sites are impacted	4			
Number of proposed compensation actions	2			
Net gain target	10%			
Habitat/Site Impact(s)	**Burrow modification**	**Lost burrow - moult**	**Lost burrow - roost**	**Lost burrow - historic**
Impact risk contingency:	3	3	3	3
Impact uncertainty contingency:	3	3	3	3
Areal extent of impact (ha):	1	1	1	1
Value score prior to impact:	2.25	3	2.25	1.75
Value score after impact:	0.001	0.001	0.001	0.001
Compensation Action(s)	**Burrow reinstatement**	**Nest boxes**		
Discount rate:	3.0%	3.0%		
Finite end point (years):	1	1		
Compensation confidence contingency:	1	3		
Areal extent (ha) of compensation type:	1	6		
Value score prior to compensation:	0.001	0.001		
Value score after compensation:	2.25	3.25		

Model outputs

Impact score	Total impact score	Burrow modification	Lost burrow - moult	Lost burrow - roost	Lost burrow - historic
	-2.44094	-0.59374	-0.79174	-0.59374	-0.46174
Compensation score	Total compensation score	Burrow reinstatement	Nest boxes		
	2.76972	0.40395	2.36578		
Net gain outcome	13.5%				

This Biodiversity Compensation Model (BCM) and the accompanying User Guide has been developed by:

M. Baber, J. Dickson, J. Quinn, J. Markham, G. Ussher, S. Jackson and S. Heggie-Gracie

Annexure G Table 2: Biodiversity Compensation Modelling for kororā habitat loss

General model descriptor inputs	
Model inputs	**Explanation**
Project / reference name	State HWY 1 – RoNS – Evans Bay outfall replacement
Biodiversity type	Kororā coastal habitat
Technical expert input(s)	Joshua Forrest, Marcus Cameron
Benchmark	A benchmark of 5 equates to habitat that can support all life stages and functions and contributes to long-term colony persistence under climate change. Physical characteristics of the habitat include long term resilience to sea level rise, coastal vegetation providing cover to refuge, a landing area that avoids bottle necks (relating to predator pathways and resource guarding), intensive predator suppression (mustelids and rats), no human disturbance, structural exclusion measures from dogs, and protection from the road corridor. In a benchmark habitat kororā will display high site fidelity, with a strong recruitment contribution from returning fledglings. Roosting is seen year round, and reliable breeding and moutling occurs all years.
How many habitat types OR sites are impacted	2
Number of proposed mitigation measures	4
Net Gain target	10% (i.e. the compensation score needs to be at least 10% higher than the impact score.)

Impact model inputs and description	
Habitat / site impacted	**Revetment containing burrows – temporary exclusion measures**
Impact risk contingency	**Data input:** 3 = High risk / High value Kororā are "At Risk – Declining" which equates to a high ecological value.
Impact uncertainty contingency	**Data input:** 3 = High uncertainty Data is only available from a single season, represented by three data points. This does not confirm the full potential use of this habitat. Impacts from displacing penguins are unknown – energetic costs, impacts on side fidelity, displacement to less safe habitat cannot be quantified.
Areal extent of impact	**30m^2**
Value score prior to impact	**Data input:** 1.25 Habitat is physically occupiable but currently unsuitable for sustained use. -Limited or poor-quality substrate; few or no functional burrows -Access to sea present but suboptimal -High exposure to flooding or erosion -No evidence of breeding; may have occasional exploratory visits -Supports: Rare or transient roosting only -Climate resilience: Low; unlikely to persist without intervention. -Confirmed to support short-term roosting, could support the longer term requirements of moulting -Excellent predator control.
Value score <u>after</u> impact	**Data input:** 0.001 A value of 0.001 as there will be a complete loss of habitat for works programme **without remediation actions** (noting that the formula cannot work with 0).

Impact model inputs and description	
Habitat / site impacted	**Permanent loss of revetment containing penguin burrows**
Impact risk contingency	**Data input:** 3 = High risk / High value Kororā are "At Risk – Declining" which equates to a high ecological value.
Impact uncertainty contingency	**Data input:** 3 = High uncertainty Data is only available from a single season, represented by three data points. This does not confirm the full potential use of this habitat. Impacts from displacing penguins are unknown – energetic costs, impacts on site fidelity, displacement to less safe habitat cannot be quantified.
Areal extent of impact	**20m^2**
Value score prior to impact	**Data input:** 1.75

Impact model inputs and description	
	Habitat is physically occupiable but currently unsuitable for sustained use. - Limited or poor-quality substrate; some functional burrows - Access to sea present but suboptimal - High exposure to flooding or erosion - No evidence of breeding; may have occasional exploratory visits - Confirmed to support short-term roosting, very limited moulting (under certain conditions, but may not be reliably). - Climate resilience: Low; unlikely to persist without intervention. - Excellent predator control.
Value score after impact	**Data input:** 0.001 A value of 0.001 as there will be a permanent and complete loss of habitat (noting that the formula cannot work with 0).

Compensation model inputs	
Compensation action	**Removal of exclusion measures for revetment.**
Discount rate	**Data input:** 3% Default value
Finite end-point	**Data input:** 1 It is expected that within one year of the modification being removed that the value after compensation will be realised.
Compensation confidence contingency	**Data input: 1** The action will result in the return of identical habitat. There is high confidence that this action will result in the burrow being used as it was previously.
Areal extent of compensation type	**Data input: 30** 30m^2 of revetment habitat is being returned in its original state once modifications are removed.
Value score prior to compensation measure	**Data input:** 0.001 A value of 0.001 as there is completely inhibited access while the modification is in place (noting that the formula cannot work with 0).
Value score after compensation measure	**Data input:** 1.25 Provided the burrows within the revetment remain structurally undisturbed throughout modification works, it is expected to return to its pre-impact value upon the removal of the modifications (effects remedied). Therefore, compensation applied through this tool only accounts for the timescale in which the revetment was unavailable.

Compensation model inputs	
Compensation action	**Ecological input into the reinstatement of protective revetment around the outfall**
Discount rate	**Data input:** 3% Default value
Finite end-point	**Data input:** 1 It is expected that within 1 year the value of the reinstated revetment will be realised.
Compensation confidence contingency	**Data input:** 2 The action will result in habitat of a lower quality being reinstated. It is not expected that the habitat will result in a higher value score but may result in a lower score if refuge is completely unavailable. Given the very low predicted value score currently there is a moderate level of confidence that this can be achieved.
Areal extent of compensation type	**Data input:** 20 20m^2 of revetment habitat is being created in place of the removed revetment.
Value score prior to compensation measure	**Data input:** 0.001 A value of 0.001 as there is no habitat available prior to the revetment rebuild (noting that the formula cannot work with 0).
Value score after compensation measure	**Data input:** 0.5 A value score of 0.5 after 1 year equates to an ecological value of 10% relative to the benchmark. The coastal engineering requirements for the revetment mean habitat is physically occupiable but unsuitable for sustained use. The primary feature of the rebuild revetment will be its improved landing areas and access to habitat more resilient to sea level rise.

Compensation model inputs	
Compensation action	**Protective fencing around compensation site**
Discount rate	**Data input:** 3% Default value
Finite end-point	**Data input:** 1 Benefits from fencing will have an immediate impact
Compensation confidence contingency	**Data input:** 2 Physical barriers to prevent penguins crossing through the road corridor are frequently utilised and evidence to prevent vehicle strike in high traffic areas. Fencing may not be sufficient to completely exclude people and therefore confidence is not higher.
Areal extent of compensation type	**Data input:** 60 60m^2 of habitat is being protected by the fencing.
Value score prior to compensation measure	**Data input:** 0.001

Compensation model inputs	
	A value of 0.001 as there is no habitat available prior to the revetment rebuild (noting that the formula cannot work with 0).
Value score <u>after</u> compensation measure	**Data input:** 0.75 A value score of 0.75 after 1 year equates to an ecological value of 15% relative to the benchmark. Kororā have been recorded killed by vehicle strike along Cobham Dr in low numbers. In urban settings vehicle strike remains a significant barrier to population growth. The protective fence largely eliminates that risk from the impact site and provides a foundation for colony growth once other environmental factors are provided.

Compensation model inputs	
Compensation action	**Coastal planting and landscaping**
Discount rate	**Data input:** 3% Default value
Finite end-point	**Data input:** 10 Revegtation will take 10 years to fully establish.
Compensation confidence contingency	**Data input:** 2 Coastal vegetation, when successfully implemented, is known to provide value across a range of criteria. Confidence cannot be higher as plantings may not take to the site or establish fully.
Areal extent of compensation type	**Data input:** 60 $60m^2$ of coastal vegetation planted within the fenced area.
Value score <u>prior to</u> compensation measure	**Data input:** 0.001 A value of 0.001 as there is no habitat available prior to the revetment rebuild (noting that the formula cannot work with 0).
Value score <u>after</u> compensation measure	**Data input:** 0.75 A value score of 0.75 after 1 year equates to an ecological value of 15% relative to the benchmark. Vegetation improves the barren site and supports appropriate microclimate within nestboxes, deterrence from human disturbance, nest building materials, provides separation and screening between nest boxes, stabilises the site further from erosion, and mitigates exposure. Cannot be considered higher as vegetation only *enhances* key penguin criteria for site selection.

Model Inputs

Input descriptors	Input data			
Project/reference name	State Highway 1 - Evans Bay Outfall			
Biodiversity type	Kororā Habitat			
Technical expert(s) input	JOSF MACA			
Benchmark	5			
How many habitat types OR sites are impacted	2			
Number of proposed compensation actions	4			
Net gain target	10%			
Habitat/Site Impact(s)	**Revetment exclusion**	**Revetment lost**		
Impact risk contingency:	3	3		
Impact uncertainty contingency:	3	3		
Areal extent of impact (ha):	30	20		
Value score prior to impact:	1.25	1.75		
Value score after impact:	0.001	0.001		
Compensation Action(s)	**Exclusion removed**	**Revetment reinstatement**	**Protection fencing**	**Coastal planting in fenced**
Discount rate:	3.0%	3.0%	3.0%	3.0%
Finite end point (years):	1	1	1	10
Compensation confidence contingency:	1	2	2	2
Areal extent (ha) of compensation type:	30	20	60	60
Value score prior to compensation:	0.001	0.001	0.001	0.001
Value score after compensation:	1.25	0.5	0.75	0.75

Model outputs

Impact score	**Total impact score**	**Revetment exclusion**	**Revetment lost**		
	-19.12680	-9.89208	-9.23472		
Compensation score	**Total compensation score**	**Exclusion removed**	**Revetment reinstatement**	**Protection fencing**	**Coastal planting in fenced a**
	21.04544	6.73005	1.59874	7.19913	5.51753
Net gain outcome	10.0%				

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