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GISBORNE PORT TWIN BERTHS PROJECT

Resource Consent Applications Assessment of Ecological and Water Quality Effects

21 July 2022

REPORT INFORMATION AND QUALITY CONTROL

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EXECUTIVE SUMMARY

i. Eastland Port Ltd (Eastland) is preparing resource consent applications to the Gisborne District Council (Council) for the Twin Berths project (Twin Berths).

ii. The full project known as the Twin Berth Project (TBP), is designed to enable two ships up to 200m long to berth at the port simultaneously, unlocking greater capacity for bulk freight and potential options for container freight in future. Stage 1 of the Twin Berths was consented in December 2020. This stage consented remediation of the former slipway to reduce its footprint within the port to enable more manoeuvring space for ships, and rebuilt part of Wharf 6 and all of Wharf 7.

iii. Stage 2 provides for the remaining works required to complete the TBP, and comprises the:

a. Extension of the existing Wharf 8 structure into the area of the inner breakwater;

b. Reclamation next to the Southern log yard;

c. Rebuilding the outer breakwater structure;

d. Deepening access channels in the outer port to accommodate larger Handymax vessels; and

e. Improving stormwater collection and treatment facilities in the Southern log yard.

iv. As described above, in this report we have assessed the ecological effects from the operation of Stage 2, which is referred to below as 'Twin Berths'.

v. The purposes of this report are to:

a. describe the ecology and water quality of the port environs including the Offshore Disposal Ground (OSDG); and

b. identify marine features of scientific and/or conservation importance, or which are otherwise of ecological interest; and

c. describe the temporal and spatial extent and severity of marine ecological and water quality effects, including any cumulative effects. Mitigation requirements are also considered.

Assessment framework

vi. To assist with the effects assessment, this report discusses separately both a 'first principles' approach and a marine iteration of the Environmental Impact Assessment Guidelines of New Zealand, 2018 (EIANZ). EIANZ provides a criteria-based regime to assess the 'Ecological Value' of species and habitats. It provides a five-level hierarchy to assign a 'Magnitude of Effect' to the specific Twin Berth project elements, and then integrates these two descriptors to provide what this report refers to as an overall 'Derived Level of Effect' which also has five categories (Very Low, Low, Moderate, High and Very High). EIANZ anticipates management response to effects is appropriate for Derived Level of Effects which score Moderate or greater. Both approaches lead to similar conclusions as to the minor scale and significance of ecological effects.

vii. The source information for the ecological and water quality analysis in this report comes mainly from baseline studies and monitoring carried out by Eastland over the last six years and which have been previously reported to Council. Early ecological studies from the late 1990s and early 2000s are reviewed. It considers recent information provided as part of a Cultural Impact Assessment (CIA) prepared by and on behalf of Rongowhakaata iwi, relating to an existing resource consent application for maintenance dredging within the port. This covers elements that are in common with the proposed Twin Berths dredging and disposal. All of this information is reviewed and summarised along with reference to broader data bases, scientific literature as applicable, and in relation to the findings of port related coastal processes studies, modelling of physical processes (including morphodynamics and hydrodynamics), and geotechnical investigations. Collectively the information for the assessment of the effects of the Twin Berths includes that on habitat types and quality, biological community composition and biodiversity, fisheries, marine biosecurity; and contaminant levels in sediments and water.

Existing environment

viii. The physical footprint of the Twin Berth activities is mostly highly modified and/or man-made and is restricted mostly to the areas which are part of, or affected by, the existing port and its operations. Consequently, ecological values and sensitivity of the existing environment are low. Existing water quality similarly reflects the influence of port activities, and in particular ship movements and tug activity which frequently cause high turbidity and reduced water clarity which dominates conditions. At other times, and sometimes cumulatively with port related activity, background water quality is strongly adversely influenced by discharges from the Turanganui River and Waipaoa River, which increase suspended sediment and turbidity and decrease visual quality of waters at the port, the OSDG and more generally throughout Poverty Bay.

Ecological values

ix. No specific features of scientific or ecological conservation importance or value occur within the Twin Berths footprint but some ecological elements have been identified in or adjacent to the port. These are:

a. seasonal settlement of post-larval red rock lobsters beneath part of Wharf 7, which is a feature of importance to iwi and is of some ecological and scientific interest;

b. the use of the Outer Breakwater by high numbers of small post juvenile lobsters, which has been recently documented;

c. the Kaiti Reef, which is an extensive area of intertidal and shallow subtidal habitat and patch reef and, although not directly within the Twin Berths footprint, is a potentially sensitive ecological feature nearby;

d. itinerant use of the Outer Breakwater by NZ fur seal;

e. use of the Outer Breakwater for resting by small flocks of white fronted tern and redbilled gull; and

f. the use of parts of the southern seawall by Little Penguin (kororā).

Summary of effects on marine ecology

x. The **Wharf 8 extension,** which will require new piles along the existing quaywall, will cause the loss of about 250m^2 of soft, muddy seabed habitat and a small section of revetment. This will have a negligible impact on ecological values and is not a material concern in terms of the assessment of effects. Under EIANZ, the Derived Effect Level is *Very Low*.

xi. The **Outer Breakwater** upgrade will effectively restore the existing structure to a more functional state and, on completion, will occupy a slightly larger area of seabed, constituting a loss of seabed of about 2,700m^2. The intertidal area associated with the refurbished structure will increase by 1,400m^2. Subtidal habitat will also increase following the reconstruction which will use large prefabricated concrete units. The result will be a relatively porous structure which is estimated to be 60% voids. Overall, there will be an increase in subtidal and intertidal habitat area on the flanks of the rebuilt structure. The southern side of the structure hosts a reef type community of algae, macroinvertebrates and fish. Both sides of the Breakwater host substantial numbers of lobsters suggesting that lobsters will use the voids provided in rock spall and concrete units as refuge. It also suggests that these introduced habitats host enough associated marine life on which lobsters prey in order to survive. There will be a loss of much of the existing habitat and community during construction. The marine community should begin to recover progressively along its length as the reconstruction proceeds. Long term, ecological values should be restored to at least a similar state. Baseline monitoring is being undertaken to better document the seasonal use of the structure by lobsters prior to the upgrade and to facilitate future assessment of effects and ecological recovery. Seabirds and itinerant NZ fur seals also use the existing structure but such use is unlikely to be impacted long term following the upgrade. Under EIANZ, the Derived Effect Level is *Low*.

xii. The proposed **reclamation** is an extension of the Southern Logyard (SLY). The area of seabed which will be lost to new reclamation is 0.63ha. Loss of intertidal habitat and biota is negligible. The subtidal substrate that will be reclaimed is mostly a layer of shelly sand overlying bedrock and because this location is exposed to high wave energy the substrate is likely to be highly unstable and host limited biota. It is anticipated that the subtidal area of the new seawall, which will sit in deeper water, will develop a comparatively diverse ecology in time similar to other local hard substrate habitats. It too is estimated to be 60% voids and will offer an increased habitat potential to a variety of marine life relative to the habitat that currently exists. This will more than offset the effect of the loss of the small patch of rock within the reclamation. Under EIANZ, the Derived Effect Level of the reclamation is *Low*.

xiii. **Kororā** use of the southern seawall has been documented. A Kororā management plan will be prepared and implemented by ecologists suitably qualified and experienced in little penguin management. It will be complementary to the approach taken for the Southern Seawall project which covers the southern half of the southern logyard seawall and which is therefore close to the section of seawall affected by the reclamation. The implementation and compliance with this management plan is anticipated to ensure that adverse effects on Kororā can be avoided during both the construction and operational phases of the new reclamation.

xiv. The **dredging** is required to deepen and maintain the depths in areas mostly previously dredged. Of the 140,600m³ of material estimated to be removed, only about 3,500m³ (2.5%) is from an area not previously dredged. The additional dredging footprint constitutes about 0.4ha or about 1.7% of the existing maintenance dredged area. Sediment texture from several port related studies confirms that the near surface material in the dredging area within the port is 80% cohesive material (silt 60% and clay 20%) and 20% sands and in the more exposed Port Navigation Channel (PNC) is 80% sands and 20% fines. Sediment quality data collected as part of annual consent-related monitoring for Eastland's maintenance dredging confirm that the material that is dredged is unpolluted and suitable for offshore disposal. The deeper 'inert' clays, silts, sands and rock to be dredged have not been exposed to contaminant sources and their excavation and disposal poses no concerns regarding potential toxicity. Biological information from port studies suggests port sediments contain a limited biodiversity of common taxa and do not include biosecurity species such as Mediterranean fanworm. This is expected in a soft sediment zone that is under a continual regime of disturbance from maintenance dredging. The potential sensitivity of biota and habitat within the dredging footprint is low and not of concern in terms of ecological effects of the dredging. Under EIANZ, the Derived Effect Level is *Very Low*.

xv. The dredging materials are proposed to be discharged in the Offshore Disposal Ground (**OSDG)**. The OSDG was first used in 2003 and was consented for reasons that appear to have included its proximity to the mouth of the Waipaoa River which is estimated to discharge some 16 million m³ of sediment annually.

xvi. The proximity of the OSDG to the Waipaoa River discharge results in the site having a naturally muddy surficial seabed lithology and a relatively sparse benthos, which is not of special ecological significance. The nearest reef areas including the Kuri Banks, the Foul Grounds, and Waihora Rocks, are at least 2km from the edge of the OSDG and not in the predominant direction of movement of sediment from the OSDG based on the predictions of the physical modelling. Coastal process studies have confirmed the general direction of sediment transport in the area is offshore and the net 'export' of material from the site is of at least the same order of magnitude as the volume of dredgings to be disposed.

xvii. Ecological studies carried out as part of consent monitoring over at least 10 years confirm that benthic community composition in the OSDG is either not affected by the spoil disposal; or the spoil is disbursed beyond the OSDG and all communities are equally affected; and/or any effects are masked by the effects of more dominant processes such as the natural flux in sediment associated with the Waipaoa River discharge, which determine the character of the site. There is not considered to be a risk to nearshore surf clam populations, or other shellfisheries and marine resources beyond the OSDG. There is no information to suggest the area is used significantly for fishing or other recreational boating activities.

xviii. Overall, the OSDG is considered ecologically to be a sustainable location to receive the capital dredgings and ongoing subsequent maintenance dredgings from the Twin Berths. Under EIANZ, the Derived Effect Level is *Low*.

Summary of effects on water quality

xix. **Water quality** effects have also been assessed for the different Twin Berth elements.

xx. Water quality effects from the **Wharf 8 extension and Outer Breakwater** upgrade will be restricted to minor local turbidity associated with construction, including piling and placement of the new concrete units. These are negligible and temporary effects.

xxi. The engineering information suggests construction of the **reclamation** has the potential to generate sediment associated with the establishment of the new seawall and the filling of the area being reclaimed. The coastal processes assessment identifies factors that will influence the behaviour of such plumes migrating away from the works site. The modelling predicts that increases in suspended fine sediment will be localised and occur at low concentrations that will not significantly affect background concentrations in the water column beyond the works area. Also, increased sediment deposition is predicted to occur at very low levels.

xxii. The risk of significant plumes or sedimentation events of ecological relevance beyond the works area will be small and mitigated by factors which include the highly exposed and well flushed location which will rapidly disperse and dilute suspended sediment; it being unlikely that plumes will have the opportunity to concentrate over successive tidal cycles; modelling predictions that plume fields are most likely to move north rather than south toward the potentially more sensitive zone of the Kaiti Reef system; the implementation of an Erosion and Sediment Control Plan during the construction phase to ensure that so far as is possible the risk of effects is mitigated by a construction methodology which limits loss of sediment beyond the reclamation site. In summary, plumes are not expected to cause sedimentation or other than localised and temporary changes in water clarity

xxiii. The **upgraded SLY stormwater treatment** system which will integrate the stormwater from the reclamation area, will use an enhanced treatment train approach. This will provide additional storage and incorporate the now well proven chemical flocculation and particulate interception system which has been developed for and successfully implemented at the other Eastland logyards. Monitoring data from these upgraded systems, when compared against that for the current discharges from the SLY, indicate that the discharge quality should improve significantly. The treated stormwater discharges are expected to pose no threat to the local receiving environment or its ecology and will maintain the applicable water quality standards.

xxiv. The **capital and ongoing maintenance dredging** will cause localized temporary sediment plumes and impacts on water clarity and the visual characteristic of waters in the port and at the OSDG. Similar effects are well recognized as part of existing dredging programme. For the Twin Berths, their duration and intensity should be no greater after each dredging episode than is currently the case for routine dredging operations. They do not require any special management or protocols beyond current best practice.

xxv. Overall, water quality effects from the Twin Berths will occur at a low level of visual effect and will not cause toxicological or other risks to the receiving environment such as impacts on kai moana. Water quality classification standards that apply to the port (SC), the PNC and nearby inshore zones to the north (SB) and the general marine area including the Kaiti Reef and the OSDG (SA), will be maintained. There may be visually conspicuous changes in water clarity due to localized plumes that will inevitably arise over short duration from time to time associated with specific events (eg dredging). There will not be adverse effects that are significant in terms of the prevailing water quality in Poverty Bay.

Conclusion

xxvi. Overall, the analysis under both a first principles and EIANZ approach, concludes that ecological effects for all project elements will be minor and identifies no ecological effects will occur at a scale and intensity which would require specific ecological mitigation or offset.

1 INTRODUCTION

1.1 Background

This Ecology and Water Quality Report (EWQR) has been prepared for Eastland Port Ltd (Eastland) in support of resource consent applications to the Gisborne District Council (the Council) for the Twin Berths project (Twin Berths). The Twin Berths is a multifaceted and complex package of discrete projects which encompass repair of structures; new construction elements including a wharf and reclamation; new and upgraded treated stormwater discharges, capital and maintenance dredging; and offshore disposal of dredged material. This report provides an assessment of the actual and potential ecological and water quality effects of the various elements of the Twin Berths.

1.2 Assessment Approach and Purpose

The Twin Berths has a footprint confined mostly to the existing port, Offshore Disposal Ground (OSDG) and its immediate influence. The assessment approach for this report relies largely on local port related ecological and water quality studies, most of which have been undertaken and reported by 4Sight Consulting over recent years in relation to other resource consent applications which have included dredging and disposal, wharf construction, stormwater discharges and monitoring. These studies are reviewed, and relevant information is presented.

Engineering (Worley)[1],[2], coastal processes (MetOcean Solutions)[3],[4],[5],[6], and stormwater management (Cheal Consultants)[7] reports have been reviewed in preparing this report and where relevant below, this report refers to reliance on those conclusions.

This assessment has also been prepared by reference to a draft Cultural Impact Assessment (CIA)[8] provided by Rongowhakaata representatives which was prepared for an earlier resource consent application for port maintenance dredging. That application is in process but much of the background resource information in the CIA is equally applicable within the context of the Twin Berths which also includes a significant dredging element.

Scientific and public science literature and information; published records of marine mammals and coastal birds; and commercial fishery data bases for Poverty Bay are reviewed and information is presented as applicable. A recent review of coastal habitats of the Gisborne Region (Tairawhiti), notes the region is reported to have comparatively little information on marine biodiversity and the distribution of coastal habitats (Ross, 2021)[9]. Although this is the case at a

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[1] Worley, March 2022 'Eastland Port Reclamation, Wharf 8 Extension and Outer Breakwater. Engineering Report for Consent Application' Revision D. Document No Rev 0: 301015-04045-MA-REP-00207

[2] Worley, March 2022. 'Eastland Port Ltd Capital and Maintenance Dredging and Disposal. Port Navigation channel, Vessel Turning Basin and Wharves 6-8. Coastal permit applications. Engineering Report'. Document No RevO:301015-04045-CS-REP-002 -07 March 2022

[3] MetOcean Solutions Ltd April 2018 'Dredging Plume Modelling' report prepared for Eastland Port Gisborne' Revision B

[4]. MetOceans Solutions Ltd (November 2019). 'Eastland Port Dredging Project. Morphological response of the proposed offshore disposal ground to the discharge of maintenance dredging sediments'. Prepared for Eastland Port, Gisborne. MetOcean, September 2021

[5] MetOcean, November 2021 'Gisborne Port-Twin Berths Project 'Effect of Capital and Maintenance Dredging. Summary of Reports'

[6] MetOcean, 02 March 2022. 'Gisborne Port-Twin Berths Project. Assessment of potential sediment plume during Port reclamation works'. Prepared for Eastland Port, Gisborne

[7] Cheal Consultants June 2022. 'Eastland Port Twin Berth Project Stormwater Management Engineering Report' 200577 24 June2022

[8] L. Easton, M. Palmer and D. Coulston. 'An assessment of the potential effects of the Eastland Port Dredging Operations on Rongowhakaata values and interests'. Draft V4 Prepared for Eastland Port. February 2022

[9] Ross PM. 2021. 'The coastal habitats of Tairawhiti: A review of the scientific, local, and customary knowledge' Environmental Research Institute Report No. 152. Client report prepared for Gisborne District Council. Environmental Research Institute, The University of Waikato, Hamilton. 81pp. ISSN 2463-6029 (Print), ISSN 2350-3432 (Online)

regional scale, there is a significant body of information available from 4Sight surveys, monitoring and other local studies on the ecology and habitats of the Eastland Port and the local environs.

The main purposes of this assessment are to:

- Characterise the existing environment against which the Twin Berths elements need to be considered.
- Identify the intertidal and subtidal habitats and ecology including any benthic habitats or communities of special scientific or conservation value, or which are otherwise of ecological interest within or near the Twin Berths footprint;
- Describe the temporal and spatial extent and severity of marine ecological and water quality effects on the existing environment;
- Identify potential cumulative effects; that is future effects that could happen over time, or in combination with other effects.

1.3 Report Scope and Contents

This report has eight sections, as summarised below:

Section 1 – Introduction. An explanation of the report, its contents, assessment approach and purpose.

Section 2 – A summary of each of the project elements, which are detailed in the Assessment of Environmental Effects (AEE) and are relevant to a consideration of effects on the existing ecology and water quality. The locations of these principal elements and the port layout is shown in schematic form are identified in Figure 1 and Figure 2 below. Project elements are:

- the upgrading of the outer breakwater (# 5, Fig 1);
- extension of Wharf 8 over part of the inner breakwater (#3, Fig 1);
- a reclamation adjacent to the Wharf 8 extension (#4, Fig 1);
- the management, treatment and discharge of stormwater from the new reclamation and its integration into the Southern Logyard stormwater system upgrade (not shown in Fig 1);
- capital dredging (deepening) to accommodate future logging and other vessels (#3 (ie adjacent to the Wharf 8 extension), 6, 7 and 8, Fig 1);
- maintenance dredging of areas previously dredged (#3 (ie adjacent to the Wharf 8 extension), 6, 7 and 8, Fig 1);
- disposal of dredged material from capital and maintenance dredging to the existing Offshore Disposal Ground (OSDG) in Poverty Bay. The OSDG location is shown in Figure 13 of this report.

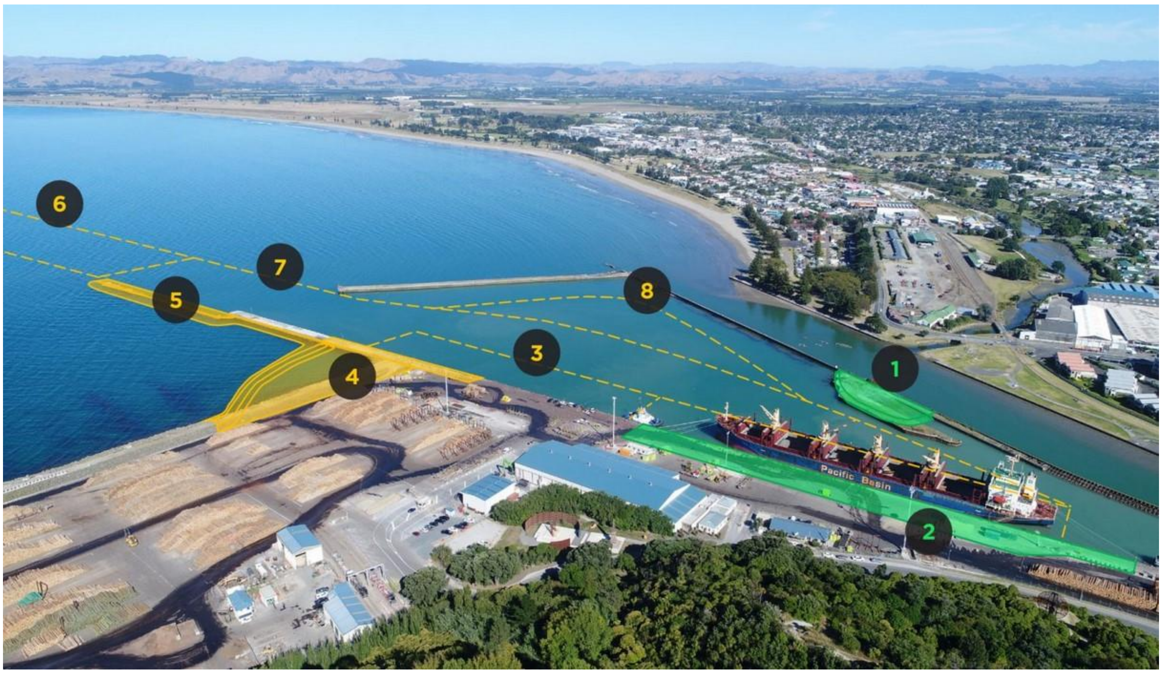

Figure 1:Twin Berths Project Illustrative Plan (refer text re numbering).

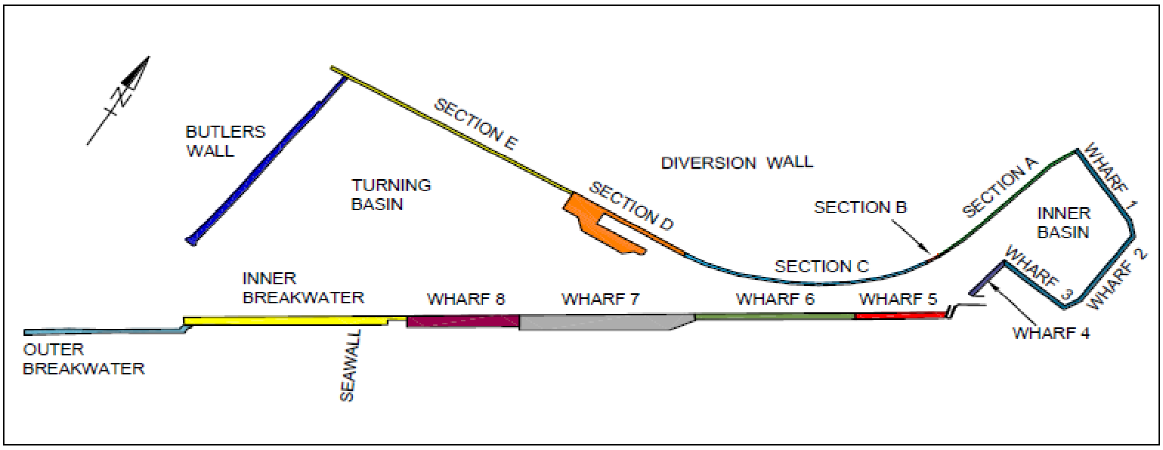

Figure 2: Current Port of Gisborne Schematic Showing Key Features.

Section 3 – Existing Environment. A description of the existing environment within the context of, and as relevant to, the key project elements and other background influences.

Section 4 – Assessment of Effects. An assessment of the ecological and water quality effects of each of the project elements identified above. This covers construction and operational effects, cumulative effects and includes a discussion of the need or otherwise of mitigation for ecological and water quality effects.

Section 5 – A brief consideration of how the Twin Berths relates to the ecological provisions of the New Zealand Coastal Policy Statement (NZCPS).

Section 6 – Biosecurity Considerations.

Section 7 – Monitoring considerations.

Section 8 – Conclusions in respect of the ecological and water quality effects of each of the project elements.

2 DESCRIPTION OF PROJECT ELEMENTS

The Twin Berth elements are briefly described below.

2.1 Outer Breakwater Upgrade

The breakwater (#5, Fig 1) upgrade will take up to five years to construct. This work could be undertaken post the reclamation and Wharf 8 extension. The upgrade will involve placement of seawall rock and fabricated 12-30 tonne concrete armour units on both sides of the existing structure, reshaping including a concrete capping layer, and the incidental discharge of contaminants to the coastal marine area (CMA) during construction from disturbance of the seabed which may include ground stabilisation and other measures.

The seabed 'footprint' of the structure will increase from about 8,000m^2 to 10,700m^2, constituting a loss of seabed of about 2,700m^2. The intertidal area associated with the refurbished structure will increase by 1,400m^2 (Worley, March 2022-Table 8). The outer (southern-ocean side) slope of the upgraded structure will be 1V:2H and the inner side (port navigation channel) side slope will be steeper at 1V:1.25H to avoid the navigation channel. Overall, there will be an increase in subtidal and intertidal habitat area on the flanks of the rebuilt structure.

Ground stabilisation measures to treat the expected soft alluvial sediments could include deep soil mixing combined with high strength geofabric, mass stabilisation, a combination of both, and jet grouting. There may be a need to consider temporary measures to prevent the dispersal of fine sediment beyond the works area from ground stabilisation works.

The engineering report indicates a comprehensive erosion and sediment control plan (ESCP) will be prepared by the contractor and briefly identifies matters to be included (Worley, March 2022-section 6.4). It is noted that those matters relate to land-based activities. The ESCP should also include the controls and strategies that will be employed to minimise losses of sediment from construction in the coastal marine area (CMA). This aspect is discussed more fully in section 4.4.3 of this report.

2.2 Wharf 8 Extension

The existing 140m long wharf is to be extended approximately 130m into the area of the inner breakwater. The construction and use of the extended wharf (#3, Fig 1) involves disturbance of the seabed by ground stabilisation and other measures, installation of sheet pile walls and deposition of imported cleanfill material. There may be incidental discharges of sediment to the CMA during construction. The area of seabed lost to the piling (250m^2) is minimal and not a material consideration in terms of ecological effects.

2.3 Outer Port Reclamation

The proposed Outer Port Reclamation (#4, Fig 1) totals an area of approximately 0.89ha of which 0.26ha is existing revetment footprint (Worley March 2022-Table 8). Therefore, the area of seabed lost to new reclamation is some 0.63ha. The reclamation involves multiple stages which will extend the construction over a period of up to 3 years or more depending on specific staging.

The reclamation will be constructed of imported rocky granular fill held in place by a new southern revetment wall comprising a crushed rock core, a secondary armour layer of 0.3-1 tonne rocks; and outer primary armour layer of 10 tonne Accropode or X-Bloc units. The top surface will be paved suitable for logging trucks and other vehicles to access the extended Wharf 8.

The engineering report indicates a revetment core and toe protection (bund) will be required to protect the works area during construction. This bund will subsequently be 'incorporated into the revetment (Worley, March 2022-page 15). An ESCP will need to describe how sediment control will be achieved, including for any temporary bund establishment, management and decommissioning.

2.4 Stormwater from the New Reclamation and the Southern Logyard Stormwater Upgrade

Stormwater from the new reclamation will be captured within an upgraded Southern Logyard stormwater management and treatment system (Cheal Consultants, June 2022). This new system will involve an enhanced treatment train which will include increased storage, and addition of chemical coagulant prior to particulate interception by lamella clarifiers. This system will be similar to those operating successfully in the Eastland Upper and Wharfside Logyards. It is understood the system is designed to achieve at least 75% particulate retention for 90% of storm events.

Treated stormwater will be discharged from two separate treatment systems which will capture water from discrete subcatchments in the SLY and discharge to the existing two stormwater outlets; one to the inner harbour (northern discharge) and one in the seawall nearer toward the Kaiti Reef (southern discharge).

2.5 Port Capital Dredging (Deepening)

Eastland Port has a long history of capital dredging since at least the 1880s. Today's port configuration was largely established in 1967. The most recent capital dredging was carried out in 2011 when approximately 32,000m^3 of material was removed from the Port Navigation Channel (PNC) and Vessel Turning Basin (VTB) and prior to that 21,000m^3 in 2009

In the present application, approval for up to 140,600m^3 of capital dredging (117,600 m^3 of sediment and 23,000 m^3 of rock-Worley March 2022-Table 3-2) is sought for the Port Navigation Channel (PNC), Vessel Turning Basin (VTB), and the Wharves 8 and 7 berth pockets and associated vessel manoeuvring areas. The proposed capital dredging area (and consequentially also the future maintenance dredging area) extends from the outer (western) end of the PNC to the inner (eastern) end of Wharf 7. The total area of proposed capital and future maintenance dredging is approximately 24ha.

2.6 Port Maintenance Dredging

Between 2003 and 2020, on average 71,260m^3 per annum was maintenance dredged and disposed. The annual dredging volume varied from 16,500m^3 (in 2005) to 138,200m^3 (in 2011) (Worley, March 2022, section 4.2). Subsequent maintenance dredging volumes to maintain vessel access, manoeuvring and berthing depths are likely to be similar, in the order 70-80,000m^3 but could spike to 140,000m^3 annually on occasions.

Of the proposed area to have maintenance dredging undertaken, only 1,250 m^2 (Area 4, Figure 3-4 and Table 3-2) or 0.6% of the total area, is not presently the subject of maintained dredging (Worley March 2022-section 4.3).

There will also be dredging-associated discharges during maintenance dredging.

2.7 Disposal of Material from Capital and Maintenance Dredging

Disposal of the same volume of dredged material (up to 140,000 m^3 per year) at the OSDG is required. There will be discharges of sediment enriched sea water associated with the transport and disposal operations.

3 EXISTING ENVIRONMENT

Overview

Most of the elements considered in this report are physical changes to, or part of, the existing man-made environment that comprises the Port of Gisborne. The outer breakwater upgrade and the Wharf 8 extension are largely modifications to existing structures. The capital dredging involves deepening seabed most of which is already maintenance dredged and is thus a seabed habitat routinely modified by port operations. The disposal of the dredged material to the OSDG involves volumes of material that are within the annual maximum volume currently consented for disposal at that site.

The 'existing environment' includes the environment as it exists now. It includes and is overlaid on the future environment as it may be modified by the carrying out of permitted activities under applicable statutory plans and by the implementation of extant resource consents held by Eastland or other parties.

From an ecological and water quality effects perspective, it includes the effects of existing authorised port activities such as shipping movements, maintenance dredging and approved discharges (stormwater and dredging related). It also includes background effects from natural riverine discharges including those from the Waipaoa and Tūranganui rivers, the Kopuawhakapata Stream and from other consented activities such as the Gisborne District Council's urban stormwater discharges and the approved treated municipal wastewater discharge which is near to the outer port navigation channel. These influences are described in this section.

The key elements of the existing environment as relates to Port structures and the ecology and water quality are summarised below.

3.1 Port of Gisborne

The Port of Gisborne is located towards the north-eastern end of Poverty Bay (Tūranganui-a-Kiwa) adjacent to the Turanganui River and city centre. The port contains a large wharf area, a breakwater, seawalls, a river diversion wall, reclaimed land, and land-based port facilities.

Representative oblique views of the port are shown in Figure 3 and Figure 4 which show the key facilities in more detail.

Breakwater – This concrete/rock rubble structure is comprised of inner and outer sections and is approximately 470m long. It protects the port from south to south-east quarter ocean swells and other weather events.

Butlers Wall – This approximately 300m long structure was built in the early 1930's and refurbished in the 1960's. It provides the western boundary to the Vessel Turning Basin (VTB) and protects the port from wave energy and westerly weather. Butlers Wall is not affected by the Twin Berths.

Turanganui River Diversion Wall – This approximately 1km structure was built in the late 1920's and has been progressively repaired over the years. It separates the port proper from the Turanganui River flow. The diversion wall is not affected by the Twin Berths.

Wharves 6 and 7 – Wharf 6 was built in the early 1960's and is used by the fishing fleet and port tugs. Wharf 7 was built in the late 1960's and is used by larger vessels, including log ships. Wharves 6 and 7 is the subject of a redevelopment project recently approved by the Environment Court. Wharf 7 and will not be modified by the Twin Berths project.

Wharf 8 – This wharf is presently the main log vessel loading facility. It was built in the mid 1990's. Changes will include the extension to Wharf 8 and new stormwater infrastructure.

Southern Logyard – This logyard was established on reclaimed land in the 1990's and covers an area of approximately 6.7 ha. As noted, there will be changes to how stormwater is managed on this logyard.

Port Navigation Channel (PNC), VTB and berth pockets – The PNC is approximately 1.5km long and is routinely maintenance dredged. The VTB, which is approximately 2.7ha, and the berth pockets, are regularly maintenance dredged. Some capital dredging has also been undertaken in these areas over the years.

Figure 3: Oblique Aerial Photograph of the Port Looking South Towards Poverty Bay.

Figure 4: Oblique Aerial Photograph of the Port Looking North Towards the Southern Logyard and City Beyond.

3.2 Ecology of the Port Marine Environs

The existing ecology of the port environs relating to and potentially affected by the Twin Berths encompasses the following five predominantly marine habitat areas:

- The Outer Breakwater: The existing concrete units and 'rubble' on the northern side and the concrete units and rock spalls on the southern side of the breakwater, offers potential 'reef type' habitat for marine life. The elevated parts of the structure provide resting habitat for some coastal birds. One NZ fur seal was observed during the 4Sight work.
- The Inner Breakwater: The northern (harbour) side is a vertical concrete surface and the southern side offers limited shallow man-made reef type habitat.
- The northern third of the southern seawall of the Southern Logyard and a small area of the adjacent subtidal zone will be within the proposed reclamation. This is a subtidal area of soft sediment seabed which includes a small patch of rock.
- The PNC, VTB and berth pockets offer mainly soft sediment habitat. The PNC toward its outer end includes rock which is either exposed or covered by a shallow layer of mobile sandy sediment and which itself is the result of the capital dredging that established the PNC.
- The OSDG which studies have shown to be soft sediment habitat.

Twin Berth features overlaid on aerial imagery of the port is shown below in Figure 5.

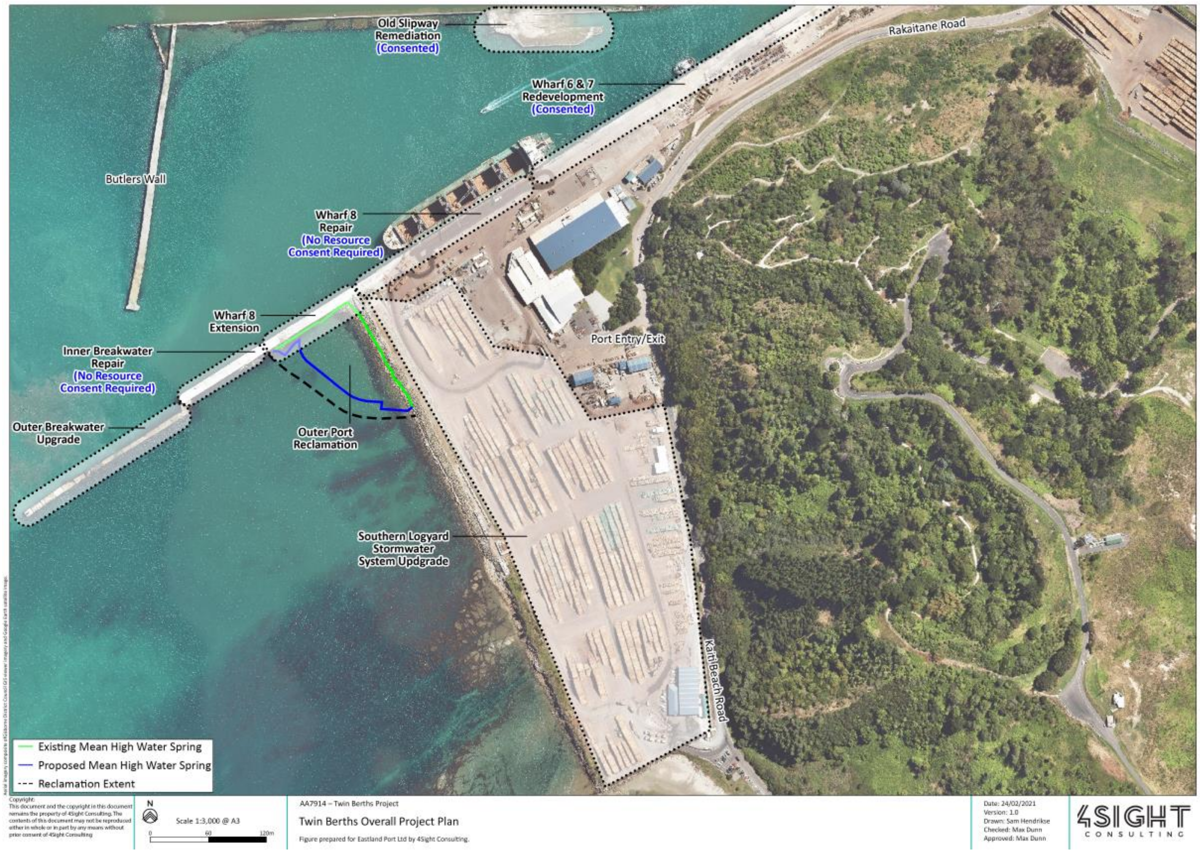

Figure 5: Aerial Photograph of the Port Features overlain with Twin Berth development (indicative only).

Ecological information for and relevant to these areas of marine habitat within or immediately adjacent to the Twin Berth footprint is reviewed below in sections 3.2.1 to 3.2.4.

3.2.1 Breakwater

The existing breakwater is approximately 469m long and contains an inner vertical sided concrete section (274m) beyond which there is an outer rock rubble (195m) section which is capped with concrete. Views of the Inner and Outer breakwater are shown in Figure 6.

The Inner Breakwater includes a protective rock spall revetment on its southern side. Geotechnical information indicates the Outer Breakwater is generally located on soft alluvial sediments up to 15m deep overlying papa mudstone rock. Sections of the Outer Breakwater area have failed (sunk), with parts of the existing structure now below Mean High Water Springs (MHWS). Some of the concrete cube armour units have been dislodged by wave action. The crest of the Outer Breakwater is regularly overtopped by waves during rough weather conditions.

a) b)

Figure 6: a) Photograph of Inner Breakwater; b) Photograph of Outer Breakwater.

Breakwater Subtidal Habitat and Community

Marine habitat information for the southern side of the Outer Breakwater is available from subtidal photographic information reported by 4Sight (February,2020)[10]. The subtidal habitat on this side of the breakwater appears to be large rock spalls which provide a rocky reef type habitat which supports kelps including *Ecklonia radiata*, *Carpophyllum* sp. and *Zonaria auriomarginata*); encrusting species including coralline algae, sponges and ascidians. Photographs of this habitat are shown in Figure 7 below. This community appears to be quite diverse. The habitat surface was clean and low in sediment at the time of survey.

The northern side of the Outer Breakwater has not been similarly surveyed but being also comprised of a mixture of rock and concrete units, is likely to host a similar community.

[10] 4Sight Consulting, February 2020. 'Gisborne Port: Maintenance dredging & associated disposal of dredged material. Port Navigation Channel, Vessel Turning Basin and Wharf 4-8. For Eastland Port. Resource Consent Application. Assessment of Environmental effects Ecology and Water Quality Report'. February 2020

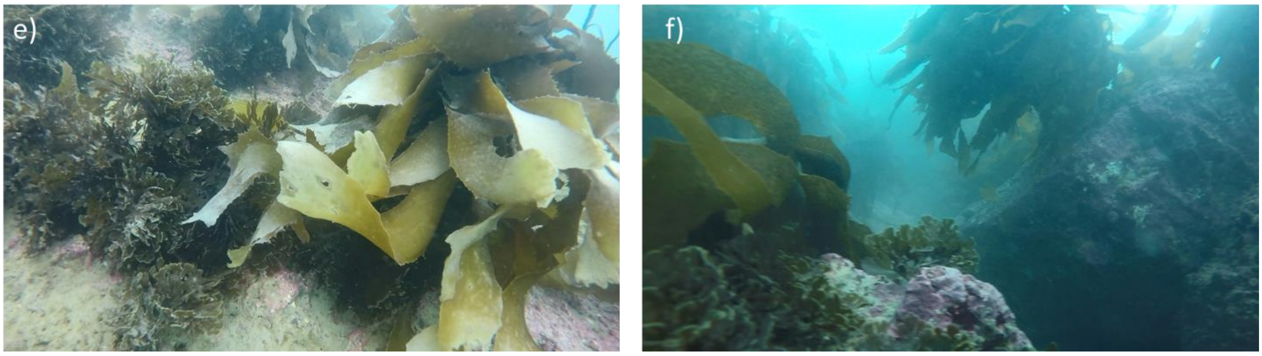

Figure 7: Photograph of Outer Breakwater.

Breakwater Crayfish

4Sight have surveyed the Outer Breakwater. Baited 'drop pots' deployed along the northern side of the Outer Breakwater in February 2021, recorded 12 small crayfish (*Jasus edwardsii*) approaching 'legal size'. This capture rate over a late afternoon 2-hour period, suggested a sizable population of small crayfish in this section of the breakwater at the time.

This survey was repeated in June 2021, again over a late afternoon period. On this occasion 17 crayfish were captured, which reaffirmed that crayfish are using that structure. This capture included 9 crayfish on the northern side of the breakwater and 8 on the southern side. Of the 17 crayfish, 5 were small females in berry (and were thus at least several years old). Six of the crayfish were of a legally takeable size.

This sampling effort included a short period of deployment of the pots within that part of the southern side of the breakwater that will fall within the proposed reclamation footprint. Two of the total 17 crayfish were caught in that zone. One conger eel (*Leptocephalus verreauxi*) about 1.3m long was also captured in one haul. Figure 8 shows one of the drop pot hauls.

Figure 8: Haul of small crayfish from northern side of the Outer Breakwater.

Breakwater Ecological Value -Overview

In overview, while the Inner and Outer breakwaters present rather nondescript habitat as seen from the surface, the subtidal parts of the structure provide habitat for a reef type community, which includes habitat that is utilised by crayfish. One NZ fur seal has been observed on the structure and two coastal seabird species.

The ecological value of the breakwater habitat is assessed in relation to specific species and habitat criteria later in this report (section 4.6). In terms of a general comment, the subtidal parts of the inner and outer breakwater sections can be considered to have a low and medium ecological value respectively notwithstanding the predominantly introduced nature of the habitat. The intertidal parts of the breakwater and those parts above MHWS have a low ecological value.

3.2.2 Southern Logyard Southern Seawall and Adjacent Marine Environs

The Southern Logyard seawall is approximately 550m long. Presently, the northern third of the seawall, which will be encapsulated in the proposed new Twin Berth reclamation, is comprised mostly of large rock spalls and concrete units. At its junction with the inner breakwater there is a mixture of large concrete sections and rock (Figure 9). This northern area of seawall is very highly exposed to storm waves which limits opportunities for marine life. This part of the seawall has a low marine ecological value.

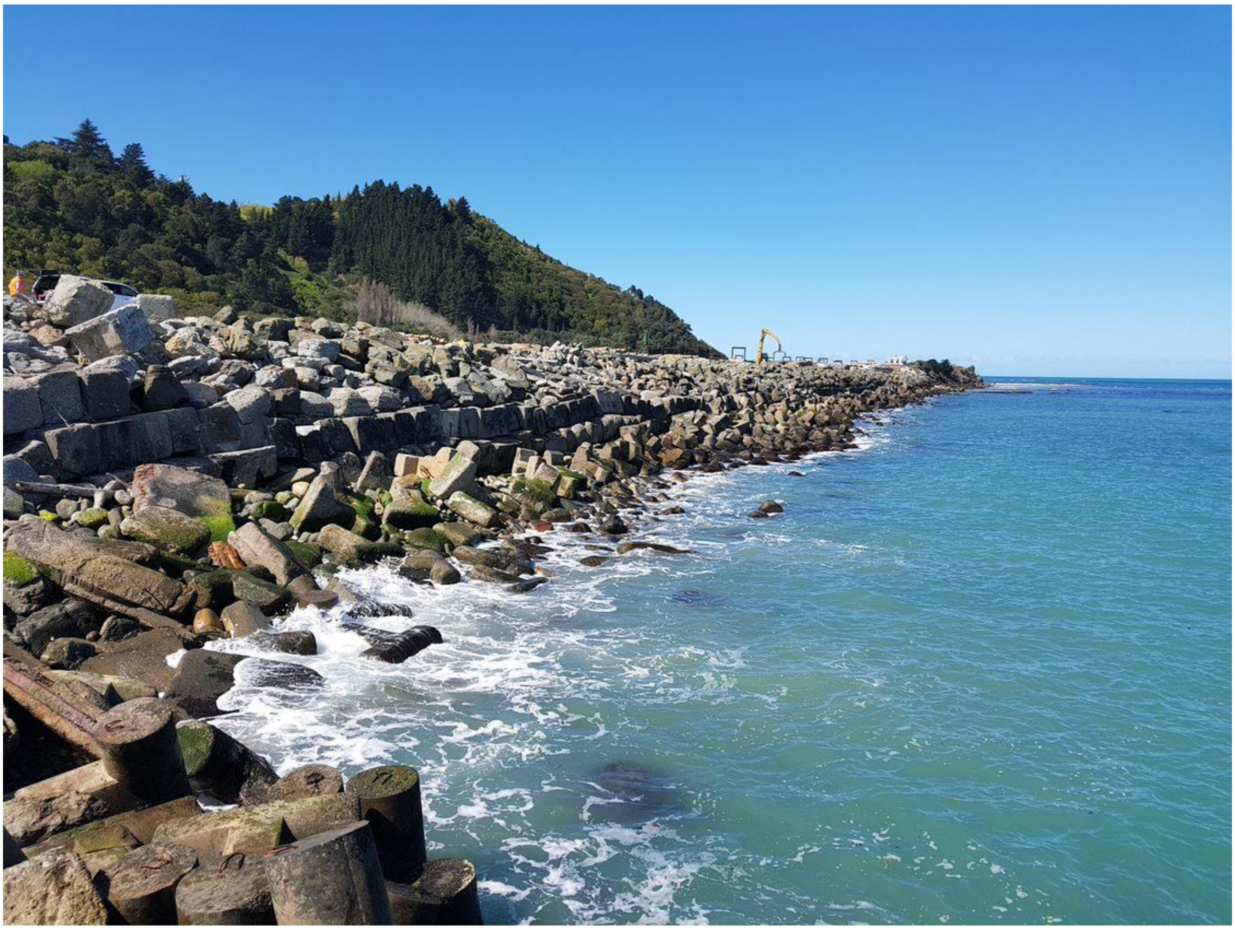

Figure 9: Junction area of inner breakwater looking along the southern seawall.

Penguin

Little penguin (*Eudyptula minor)* is briefly mentioned here although the presence, impacts and management of the project in relation to this this species are covered separately in reporting[11],[12]. The southern half of the seawall has been recently reconstructed as part of the Southern Seawall maintenance project (this is not as part of the Twin Berths). It has been surveyed by avian specialists and recorded to be used by little penguin. The northern part of the structure, which comprises about 25% of its length falls within the Twin Berths reclamation footprint, has also been identified to host at least one site potentially used by penguins during a bird survey in early November 2021[13] .

Until recently, the souther half the southern seawall extending south toward the Kaiti Reef, was a near vertical wall comprised of unstable old rubble and concrete debris and rebar, and exposed earth. Representative photos of this seawall state taken in August 2019 are shown in (Figure 10) below (a and b) along with an aerial view of the reconstructed part of this seawall completed in 2021 (Fig. 10c).

a)

b)

c)

Figure 10: Southern part of the southern seawall pre (a & b) and post reconstruction (c).

The 2021 reconstruction of the southern part of this seawall is likely to have significantly improved the habitat potential for kororā, which can use the voids in the more elevated parts of the structure for and during resting, moulting and

[11] 4Sight, July 2022 'Eastland Port Twin berths Project. Little Penguin (*Eudyptula minor*). Assessmetn of Ecological Effects'.

[12] Ecoworks, March 2022 'Kororā Conservation Management Plan 2022-2032 'Prepared for Eastland Port

[13] J Simm. 'Dog survey of East Port Seawall Area, 11 November 2021'. DabChickNZ. Report to M Bayley. Eastland Port

nesting. Use of this area by penguin is now subject to a specific Kororā Conservation Management Plan (KCMP) (Ecoworks, March 2022) which has been developed as part of the Southern Seawall Maintenance Project. The KCMP Vision Statement states as its purpose to 'develop protected coastal habitat which protects and supports visiting and breeding Kororā into the future'.

Adjacent Intertidal Area

There is a negligible intertidal area adjacent to the northern third of the southern seawall which would fall within the reclamation. Loss of intertidal area as part of the reclamation is not a material consideration for the Twin Berths project.

Adjacent Subtidal Area

In March 2018, 4Sight undertook an investigation of the subtidal area to the immediate south of the breakwater (reported in 4Sight, 2020). This included the seabed area within the reclamation footprint. The survey collected visual information by a suspended GoPro camera. The two main habitat types were 'soft' sediment (sand) and rocky reef. Representative photographs of the habitats are shown in Figure 11.

The habitat within the reclamation zone is mainly 'soft' sandy sediment (Fig 11a) in which holes and burrows made by small invertebrates were common and patches of surface microalgae were visible. The sand surface appeared relatively silt free at the time of survey.

There is a small, isolated kelp covered rock subtidally at the edge of the proposed reclamation. This is the only natural hard substrate feature that would be lost within the reclamation.

Very close to the proposed reclamation is patch reef which supports kelps including *Ecklonia radiata*, *Carpophyllum* sp. and *Zonaria auriomarginata* (Fig 11b,); encrusting species including coralline algae, sponges and ascidians (Fig 11c); and fish including Triplefins (*Forsterygion* sp.) (Fig 11c), sweep (*Scorpis lineolatus*) and koheru (*Decapterus koheru*) (Figure 11d).

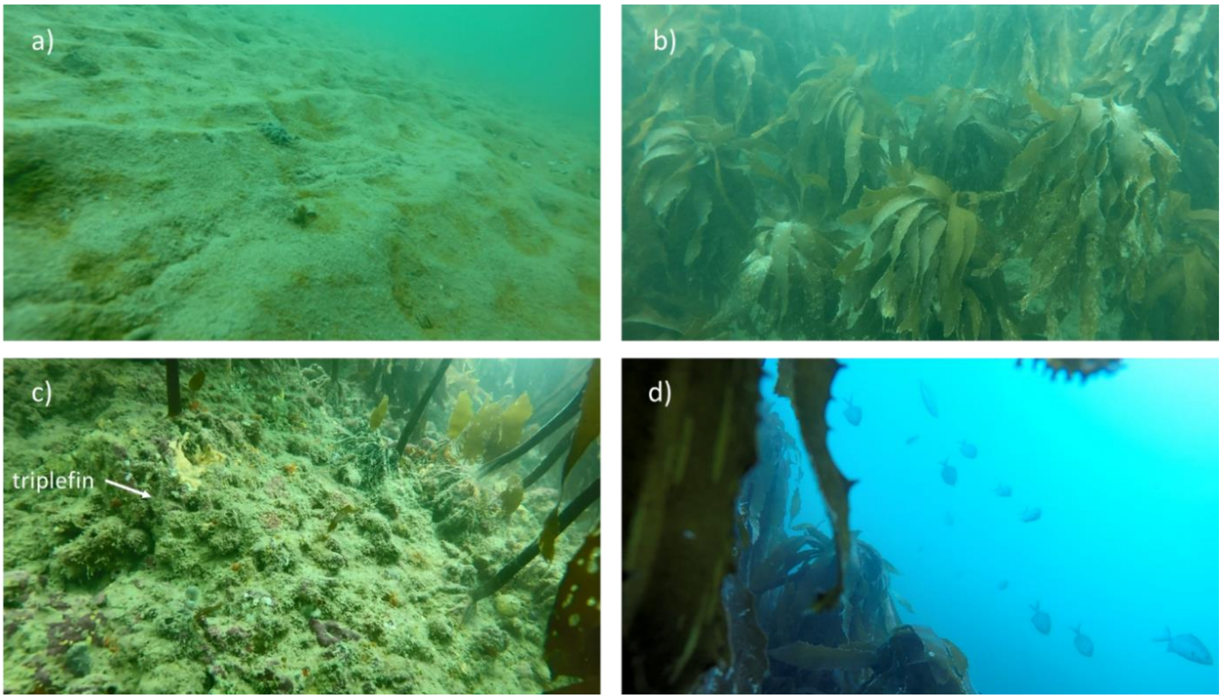

Figure 11: Subtidal sand and patch reef habitat south-east of the port breakwater (from 4Sight, February 2020).

Overall, the soft sediment substrate and the isolated patch of rock that comprises the reclamation footprint has a low ecological value. The adjacent patch reef (which has potential relevance in the effects assessment in terms of the potential for construction related water quality effects) has a moderate ecological value.

3.2.3 Vessel Turning Basin, Berth Pockets and Port Navigation Channel

The Vessel Turning Basin (VTB), berth pockets and Port Navigation Channel (PNC), comprise the marine environment that is within the footprint of the dredging associated with the Twin Berths. The ecology of this area has not been subjected to extensive field survey, largely because most of it is under a regime of constant disturbance from maintenance dredging and vessel movements. There are historical studies and some local sampling that provide relevant information on the type of habitat and communities that occur or are to be expected.

Vessel Turning Basin and Berth Pockets

A 2005 NIWA study (NIWA, 2005)[14] suggests that at that time the port environment sustained a relatively diverse assemblage of marine life (compared to other ports) predominantly associated with the port structures. A limited range in macroinvertebrate biota were returned in the sampling of the seabed from the VTB and Berth Pockets using grabs, sleds and traps. Most of the diversity was recorded from diver observations and scrapings from piles and hard surfaces within the port. This is as would be expected given that the soft substrata of the port environment adjacent to the port structures, offer a much more limited opportunity and a much more disturbed habitat for marine life.

A quantitative survey of 8 sites in the mid and inner harbour (4Sight, 2021)[15] identified 36 taxa in the soft sediments. These included 18 polychaetes (marine bristle worms), 7 bivalves, 3 amphipod crustaceans, and 9 'other' taxa. Most taxa were infaunal or surface-dwelling deposit feeders. All species were common types. Habitat was reported as predominantly soft muds and the associated benthic community is common and of limited biodiversity and of low ecological value. A study which included several samples of soft sediments adjacent to the Turning Basin (4Sight, 2017b[16]) also suggested a low species diversity of common macroinvertebrates in soft sediments.

The ecology of the VTB and Berth Pockets is expected to be of low ecological value.

PNC

Habitat type in the PNC can be deduced from coastal engineering information which confirms a high rate of littoral sediment transport from west to east through this area. A proportion of this sediment deposits in and adjacent to the PNC. The near surface material of the PNC is predominantly unconsolidated silts and sands. Overall, the ecology of this area, which is characterised by mostly mobile relatively unconsolidated substrate, is likely to be limited by the physically transient conditions.

The material in the PNC is mainly sands (70-80%); silt (10-20%) and clays (10%) (in Worley, March 2022-Table 5.1). There is a zone where the depth of consolidated material is less than 0.5m and there may be outcropping rock at the southern end and minor outcrops along the northern boundary of the PNC. These potential rock outcrops are shown in red in Figure 12 below.

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[14] Inglis, G., Gust, N., Fitridge, I., Floerl, O., Woods, C., Hayden, B. and Fenwick, G (2005). *Port of Gisborne Baseline survey for non-indigenous marine species* (Research Project ZBS2000/04). Prepared by NIWA for Biosecurity New Zealand, Technical Paper No: 2005/11

[15] 4Sight Consulting June 2021 'Inner Harbour dredging and water quality report. Tug Berths at Wharf 1. Eastland Port. Ecological effects Assessment'. Prepared for Eastland Port. June 2021- draft'

[16] 4Sight Consulting 2017b. 'Gisborne Port Slipway Redevelopment. Eastland Port Ltd. Ecological and Water Quality Report for Consent Application. September 2017' Prepared for Eastland Port

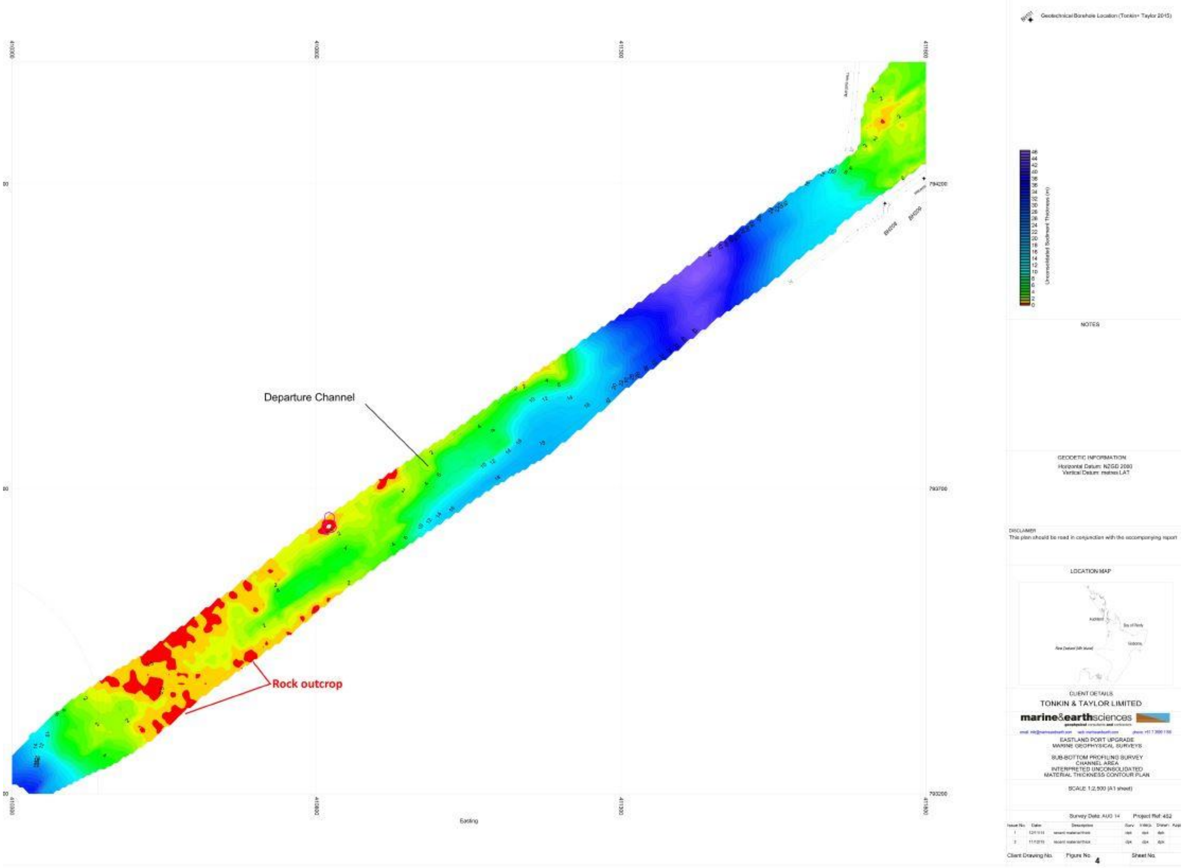

Figure 12: Rock Outcrops on the Outer PNC (Marine & Earth Sciences Pty Ltd (MES), 2016)

This rock substrate is part of a wider feature of reef habitat which extends to the south-east. This is charted as the 'Foul Grounds' and includes Tokomaru Rock, Hawea Rock and Temoana Rock.

This rock area of the PNC was subjected to the early capital dredging which established the channel into the port. This rocky zone is not maintenance dredged and may have recovered some reef community features which have been documented in earlier studies.

Cole et al (1997)[17] records '*a SCUBA survey within and adjacent to the existing approach channe*l' and comments '*Reefs within the shipping channel*' were surveyed, and further '…*The reefs of the proposed approach channel and adjacent to the present approach channel have a limited fauna of encrusting organisms*…'. Biota reported included a range of macroalgae (brown, green and turfing red), sponges and bryozans. Small post juvenile crayfish (*Jasus edwardsii*) were also recorded. The findings of Cole et al (1997) are likely to remain broadly relevant because the prevailing physical conditions which govern and limit ecological potential in the PNC have not changed.

Keeley et al (2002) also considered these reefs which are near to the GDC wastewater outfall (which is a short distance south-west of the PNC) and commented that the benthic reef communities are subject to low light conditions, high loads of suspended particulates and regular disturbance by storms. Reef communities close to the wastewater outfall were reported as appearing to be particularly suppressed 'by a sandblasting effect from waves and suspended sediment'. This is likely also to reflect conditions in the PNC.

[17] Cole, R., Dobbie, N., Healy, T., Hull, P., Purdue, S., Stevens, S. (1997). *Port Gisborne Dredging and Development AEE: Assessment of impacts on fauna and flora of areas affected by the expansion of Port Gisborne Ltd*

3.2.4 Offshore Disposal Ground

The OSDG is located approximately 4km to the south-west of the port (Figure 13). It is approximately 3km^2 in area in water depths 18-20m below Chart Datum (CD).

Figure 13: Aerial Photograph of the Gisborne Port Offshore Spoil Disposal Ground.

The OSDG was first used in 2003 and early reports indicate it was chosen for reasons which included the following:

- the site is close to the mouth of the Waipaoa River and has a naturally muddy surficial seabed lithology;
- the muddy based benthic ecology was considered to be sparse and not of special ecological significance;
- there are no reefs close nearby;
- the area was not used significantly for fishing or other recreational boating activities;
- the general direction of sediment transport in the area was offshore which reduced the likelihood of disposed material being captured in the inshore littoral system and potentially re-entering the port or affecting the Gisborne city beaches.

The effect of the dredging spoil disposal operations on ecological values at the OSDG has been monitored by a benthic ecology study approximately every 5 years. The sediment chemistry of the OSDG and nearby areas has also been assessed in recent years.

The most recent ecological assessment of the benthic ecology of the OSDG and adjacent areas and which reviews the earlier work, was undertaken by 4Sight in July 2020 (4Sight March 2021)[18]. That work used the methodology previously approved by GDC and assessed 74 quantitative 0.1m² grab samples from within and around the OSDG. It confirmed the following:

[18] 4Sight Consulting, March 2021 Offshore disposal ground for dredged material. Benthic fauna survey (July 2020). Prepared for Eastland Port. March 2021.

- The OSDG and adjacent area supports a moderately diverse assemblage of macroinvertebrates. In total 86 taxa were identified, of which 30 were polychaetes, 23 were crustaceans, 17 were bivalves and 7 were gastropods. There was also 1 species of Opisthobranch, 2 echinoderm taxa and 4 unidentified taxa.
- These recent results compared well with the previous monitoring in 2014 (Edhouse et al, 2014)[19] for which the major breakdown recorded 79 taxa of which 32 were polychaetes, 24 were crustaceans, 10 were bivalves and 4 were gastropods.
- A range in life history modes was recorded including carnivorous and omnivorous biota, but most taxa were in-faunal or surface-dwelling deposit feeders.
- Summary statistics (presented in Table 1 below) show the 'Inside' area scored lowest in all metrics. This was reported as not unexpected and was anticipated for an area actively used for sediment disposal where environmental stress is likely to be highest.

Table 1: Average abundance, richness, Shannon Weiner diversity and Simpson's diversity for the sampled areas inside, on the edge and outside the offshore disposal ground (grab area = 0.1m²)

	Inside	Edge	Outside
Average Abundance/grab	62	86	73
Average Richness/grab	11.7	15.6	14.4
Shannon-Weiner Diversity Index	1.48	1.90	1.81
Simpsons Diversity Index	0.61	0.75	0.74

- Metrics recorded their highest value in the 'Edge' zone before levelling off in the 'Outside' zone. The Edge and Outside zones showed more similarity in both Diversity Indices suggesting diversity, dominance, and evenness in community composition is restored to a background condition beyond the OSDG.
- Three taxa had similar dominating contributions to overall abundance in the three sampling zones: specifically, the infaunal deposit feeding polychaete *Heteromastus filiformis;* Cumacean crustaceans; and a spionid polychaete *Prionospio sp.* This suggests the benthic community within and beyond the OSDG is similar in respect of its overall structure.
- To further assess for differences (or similarities) in the community assemblages between sample sites, non-metric multidimensional scaling (nMDS) was performed, and the results displayed in an ordination plot for Inside, Edge and Outside locations. Ordination summarizes community data for which similar grab samples will plot close together and dissimilar species and samples will plot further apart. Ordination is used to visualise relationship between sample sites based on species compositions and any intrinsic patterns that the data may have.
The ordination plot is shown below in Figure 14. The ordination displays no evidence of groupings based on the three sampling zones.

[19] Edhouse, S., Hailes, S., & Carter, K. (2014). *Effects of Dredge Spoil Disposal on Benthic Fauna of the Eastland Port Offshore Disposal Ground* (p. 39). National Institute of Water and Atmospheric Research.

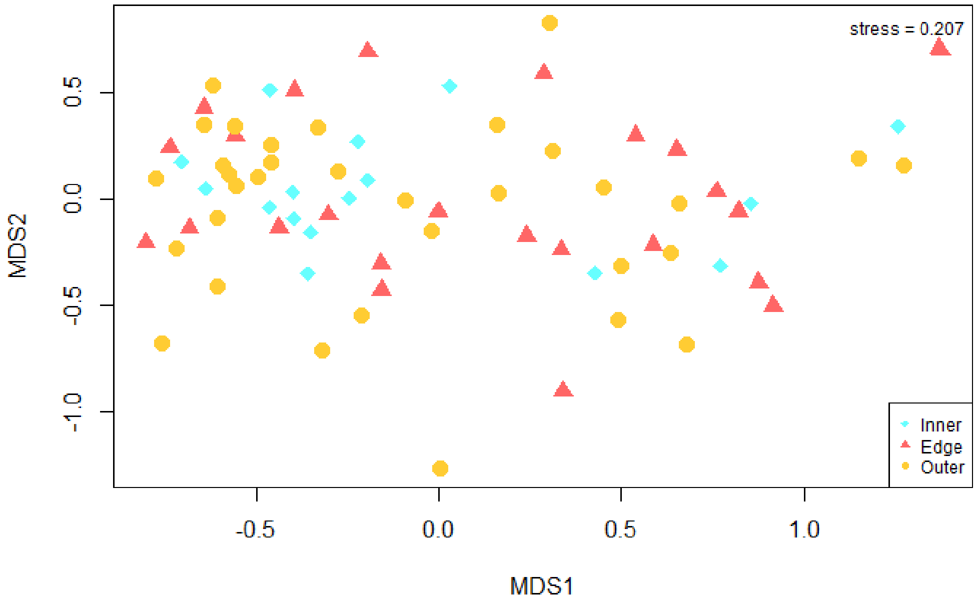

Figure 14: Non-metric Multi-dimensional Scaling plot (MDS) using Bray-Curtis similarities, displaying grab sample communities inside, on the edge and outside the disposal area.

- Overall, the ordination analysis suggested that community composition in the OSDG is either not affected by the spoil disposal; or, the spoil is being disbursed beyond the OSDG and all communities are equally affected; and/or any effects are masked by the effects of more dominant processes.

Sediment Texture at the Offshore Disposal Ground

A previous survey of the OSDG (4Sight, November 2019)[20] in which six seabed samples were collected for grain size analysis (four sites inside and two 'control' sites east and west of the OSDG) reported 'Very Fine Sand' to be by far the dominant sand fraction in this area. The grain size analysis is shown in Figure 15 below.

This compares with the dredged source material from the port which is disposed to the OSDG and is reported comprised of cohesive mud (66%) and Very Fine Sand and Fine Sand representing 19% and 15% respectively (MetOcean, November 2019).

The 4Sight, March 2021 study also reported on the dominant sediment composition of the top approximately 15cm of material sampled. Vertical horizons in sediment type were reported as evident in some samples with mud overlaying more consolidated sand toward the bottom of the grab sampler. All sand samples were categorised from visual observations as 'Fine Sands'. This occurred in 41% of the samples. Samples which contained a composite of sands and muds occurred in 23% of the samples and 'Mud' which ranged from quite cohesive to very sloppy, accounted for 36%. Samples from within the OSDG rather than on its edge or beyond it, were not observed to contain higher proportions of 'Mud' than the other zones.

The distribution of both biota abundance and taxa showed no obvious relationship to the clusters of 'Mud' and 'Fine Sand' substrates. This result was considered to further support the biological data which suggested that disposal of dredge material within the OSDG is having no significant measurable ecological impact on the benthic environment and that larger scale coastal processes are likely to determine the character of the site.

[20] 4Sight Consulting Ltd, November 2019. 'Outer spoil ground and Kaiti reef sediment quality assessment'. Prepared for Eastland Port by 4Sight Consulting

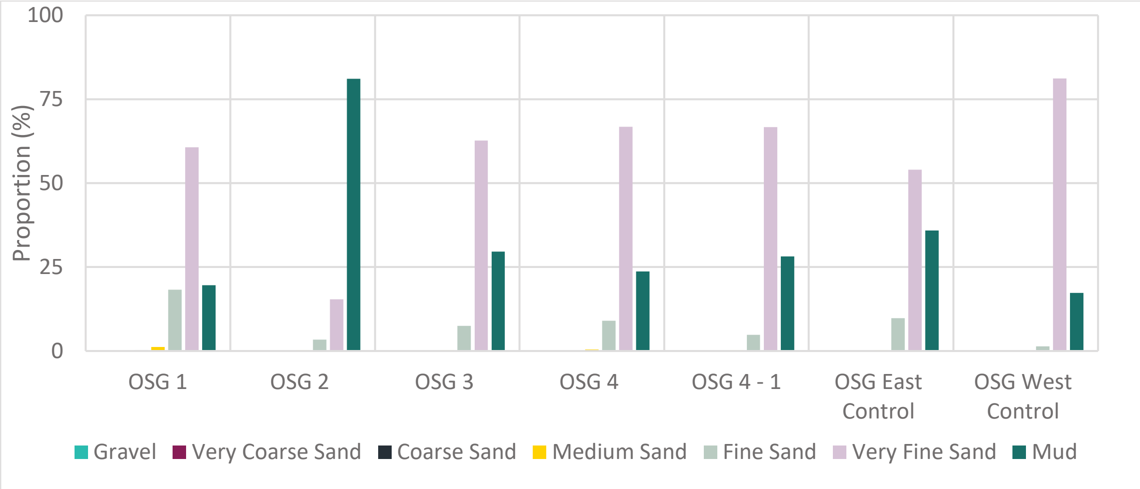

Figure 15: Particle size distribution at the Offshore Disposal Ground.

3.3 Other Ecological Information for the Port Area

Biosecurity Surveillance 2004 – 2021

Currently, SCUBA based biosecurity surveys are carried out of the hard surfaces (structures and vessels) within the inner and mid port area by a contracted biosecurity dive team. These surveys are commissioned by and reported to GDC and Ministry of Primary Industries (MPI) pursuant to the Tairāwhiti Regional Pest Management Plan. This Plan is administered and implemented in the first instance by GDC, which monitors and manages the fanworm (*Sabella spallanzanii*) under GDC's Eradication Programme. The purpose is to identify and remove fanworm and any other species encountered for which there is a biosecurity concern. This aims, with the cooperation of stakeholders as required, to have all sites controlled to zero density by 2026 while inspecting known and vulnerable sites annually by biosecurity divers.

To date, these surveys appear to have been focused on the mid and inner harbour areas. The most recent survey was carried out in July 2021. The area surveyed is shown in Figure 16.

Figure 16: Mediterranean Fanworm (Sabella spallanzanii) survey area (December 2020) [21] .

[21] Source Gisborne District Council

Mediterranean fanworm was recorded at 32 locations on structures and some vessels[22] which was a similar scale of infestation recorded previously at 34 locations within the same sampling area.

A recent (April 2021) diving survey of Wharf 7 piles was commissioned by Eastland in relation to its Wharf 7 upgrade. The survey was undertaken by specialist divers looking for Clubbed tunicate (*Styela clava*); Mediterranean fanworm (*Sabella spallanzanii*), and Undaria algae (*Undaria pinnatifida*). That survey reported two single small specimens of fanworm on Piles 6 and 8 at the northern end of the wharf[23].

Surveys over recent years suggest a reproducing population of fanworm occurs somewhere within the port.

No biosecurity surveillance is carried out for the seabed of the PNC, VTB, berth pockets, or breakwater of the port.

Ecological Surveys

Habitats adjacent to the dredging areas within the port are mostly man made and highly impacted by port activities and in particular ship movements which generate large pulses in disturbed sediment. A survey of marine habitat (Figure 17) and biota beneath the Wharf 6 and Wharf 7 area (4Sight, September 2017a)[24] documented surfaces heavily silted and a limited encrusting and sessile biota which included solitary and compound ascidians and oysters. Mobile invertebrates included half crabs (*Petrolisthes* sp.), decorator crabs (*Notomithrax* sp.) and a small conger eel (*Leptocephalus vereauxi*).

Figure 17: Habitat beneath Wharf 7.

Crayfish

The port has long been recognised to host settlement of very young red rock lobster pueruli (*Jasus edwardsii*). Crayfish settlement peaks in the winter/spring period. Settlement is highly variable year on year and may not occur at all in some years. Settlement density is greatest in a small transition area between Wharf 6 and 7 (see Figure 17) mostly on the hard structures and natural papa rock batters where they may remain for a period of months. This settlement has been the subject of detailed assessment, reporting and discussion in resource consent applications by Eastland, most recently for the Wharf 6 and 7 redevelopment consent applications (which included dredging) and related council

[22] Gisborne Marine Pest surveillance July 2021-Excel File-available from GDC

[23] Report to Eastland Port. 'Wharf 7 Bio Inspection. Inspection Report'. Indepth Diving Construction Diving Services. 21 April 2021

[24] 4Sight Consulting 2017a. 'Gisborne Port: Wharf 6 and 7 Redevelopment. Eastland Port Ltd. Ecological and Water Quality Report. Coastal Permit Application. September 2017'

hearing[25,26,27] These consents were approved by the Environment Court in December 2020, subject to consent conditions that require mitigation (ecological offsetting in this case) of direct effects on crayfish habitat beneath Wharf 7.

Typically post settlement juvenile mortality in crayfish species is reported to be very high[28],[29],[30] and in the order 95% mortality even in optimal open coastal environments. This naturally high mortality is likely to be exacerbated in the port environs due to the sub-optimal nature of the settlement habitat. The naturally high sediment regime and at times low salinity, are likely environmental stressors to juvenile crayfish.

The port experiences significantly reduced salinity at times. Reduced salinity is reported to reduce growth rate in some spiny lobster studies and to increase osmotic stress and increase oxygen requirements which can also be exacerbated by elevated seasonal water temperature[31,32,33].

The specific tolerance of juvenile *Jasus edwardsii* to salinity variations that occur in the port is unknown, but the documented periodic low salinity may indicate another local port-specific pressure resulting in a greater potential for mortality.

The level of likely mortality suggests that even optimally, a small percentage of the juvenile crayfish population in the port at any time, could at some future point enter the wild fishery beyond the port environs. The role of crayfish settlement in the port in supplying young crayfish to the wider coastal fishery beyond the port is unknown but is unlikely to be significant. Notwithstanding this, and as previously noted, small post juvenile crayfish have been documented on the Outer Breakwater and reported anecdotally on the Foul Grounds near to the outer PNC.

3.4 Information on Other Potentially Sensitive Ecology and Habitat

The following sections identify potentially sensitive resources in the wider ecological setting beyond the immediate Twin Berths footprint but which could potentially be influenced by the Twin Berths project.

Kaiti Reef Intertidal Area

Intertidal habitat (Kaiti Reef) becomes more prominent to the south of the proposed reclamation area. Views of this intertidal area are shown in Figure 18 below and views closer to the port can also be seen in Figure 10.

A survey of this intertidal area in September 2019 (reported in 4Sight, February 2020) recorded 30 taxa (algae 18; snails 6; limpets 2; anemones 2; chitons and calcareous tube worm). The high tide zone was dominated by turfing coralline

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25 Jeffs, A 2017. 'Permanent devices to promote the settlement of post larval lobsters in Gisborne'. Prepared for 4Sight Consulting. August 2017

26 Jeffs, A 2018. 'Review of artificial structures for promoting the settlement of post-larval lobsters in Gisborne'. Prepared for 4Sight Consulting. May 2018

27 Jeffs, A 2018. 'The settlement of post larval lobsters in Gisborne'. Prepared for 4Sight Consulting. May 2018

28 Phillips, B. 2003. FRDC 1998/302 – 'Rock lobster enhancement and aquaculture subprogram: Towards establishing techniques for large scale harvesting of pueruli and obtaining a better understanding of mortality rates,'Fisheries Research Report No. 144, Department of Fisheries, Western Australia, 138 pp.

29 Herrnkind, W. F. and Butler, M. J. 1994. 'Settlement of spiny lobster, Panulirus argus (Latrielle, 1804), in Florida: Pattern without predictability'. Crustaceana, 67 (1): 46-64.

30 Marx, J.M. 1986. 'Settlement of spiny lobster, Panulirus argus, pueruli in south Florida: an evaluation from two perspectives'. Can. J. Fish. Aquat. Sci., 43 (11): 2221-2227.

31 McLeese, D.W. 1956. 'Effects of Temperature, Salinity and Oxygen on the Survival of the American Lobster'. Journal of the. Fisheries Research Board of Canada. 13, 247–272. doi:10.1139/f56-016

32 Jury, S., Kinnison, Huntting, M., Howell, W. and Watson, W.H. 1994. 'The effects of reduced salinity on lobster (Homarus americanus Milne-Edwards) metabolism: implications for estuarine populations'. Journal of Experimental Marine Biology and Ecology 176, 167–185. doi:10.1016/0022-0981(94)90183-X

33 Vidya, K and Joseph, S 2012. 'Effect of salinity on growth and survival of juvenile Indian spiny lobster Panulirus homarus (Linnaeus)'. Indian Journal of Fisheries, 59(1):113-118, 2012

algae and bare rock; the mid tidal zone by the Neptune's Necklace algae (*Hormosira banksii*) and patches of seagrass (*Zostera muellleri*). The low tidal zone was characterised by rock pools, channels and a variety of seaweeds. The habitat was clean and not silty and the ecology appeared very healthy.

Overall, the intertidal habitat and biota on the Kaiti reef was predictable for an exposed platform of low relief in a high energy location. No food species were obvious but at the time people were observed collecting what appeared to be seaweed from the low shore edge.

Figure 18: Seagrass near the southern seawall and a representative view of Kaiti Reef low tidal zone.

<u>Nearby Subtidal Areas</u>

The near shore subtidal habitats to the immediate southeast of the port breakwater include fingers and stacks of patch reef interspersed with sand. These are the subtidal part of the extensive shallow Kaiti Reef. These are the nearest natural reef habitats of ecological value which are relevant to a consideration of the potential for effects from port activities. The system comprises a broad band of intertidal and subtidal habitat which extends some distance offshore where reef and coarse substrates occur in water depths of 5m to 8m.

This subtidal area was previously studied by Cole et al (1997) who surveyed the rocky shorelines and adjacent shallow subtidal areas as part of an assessment of effects prior to the Southern Logyard expansion to its present footprint. This information, which was focused on areas seaward of the then proposed reclamation, provides a broad baseline picture of the habitat and biota that is still expected.

These authors recorded a diversity of biota which included brown algae (four species); molluscs (12 species including snails, chitons and limpets); echinoderms (two species); crustacea (two species); other invertebrates (sponges and anemones); and 14 species of fish. Taxa included common potential kai moana species: urchins (*Evechinus chloroticus*); small paua (*Haliotis iris*); edible snails (e.g. pupu *Lunella smaragdus*); and small crayfish (*Jasus edwardsii*). The authors observed fine sediment covered most of the rock substrate at the time. The work suggested a reasonably diverse community was present at that time.

Overall, this section of coastline both intertidally and subtidally is characterised by a diverse substrate and is assessed currently to be in very good habitat condition. The associated marine communities are likely to be of high ecological value. Habitat condition and the community are likely to reflect the dominating influence of the high wave energy over the Kaiti Reef.

3.4.1 Marine Mammals

Five marine mammal species are likely to inhabit Poverty Bay seasonally or regularly, including the 'nationally critical' orca, 'nationally endangered' bottlenose dolphin, common dolphin, and New Zealand fur seal. Groups of "nationally vulnerable" hectors dolphin with 10 to 50 individuals have been sighted in the bay from locations along Midway beach (DOC, marine mammals sighting database, 2010 and 2011). Any of these species could potentially be present in or near the port intermittently. One NZ fur seal has been observed incidental to 4Sight surveys.

Table 2: Commonly sighted marine mammal species in the Poverty Bay and Gisborne area (Clement, 2009[34]). Threatened species are highlighted in teal (Baker *et al*., 2010[35]).

Common Name	Scientific Name	Threat Category
Orca - Killer whale	*Orcinus orca*	Threatened – Nationally Critical
Bottlenose dolphin	*Tursiops truncatus*	Threatened – Nationally Endangered
Hectors dolphin	*Cephalorhynchus hectori hectori*	Threatened – Nationally Vulnerable
Common dolphin	*Delphinus delphis*	Not Threatened
Long-finned pilot whale*	*Globicephala melas*	Not Threatened
Pygmy sperm whale*	*Kogia breviceps*	Data Deficient
Beaked whale*	*Ziphiidae (7 species)*	Data Deficient
New Zealand fur seal	*Arctocephalus forsteri*	Not Threatened

*Potential offshore residents but little is known about their regular and seasonal movement patterns.

3.4.2 Seabirds

A total of 16 species of coastal birds are known inhabit Poverty Bay (Table 3) of which 10 have a threat classification (Robertson *et al*., 2017)[36]. Any of these species might be present at one time or another as itinerants within the Twin berths area. However, only three species are notable in terms of a documented use of structures within the Twin Berths footprint.

White fronted terns (*Sterna striata*) and Red billed gulls (*Larus novaehollandiae*) have been observed resting on the elevated outer end of the Outer Breakwater (near the starboard channel marker for port entry). It is not known how frequently the birds use this site for resting and possibly roosting. Red billed gulls observed in June 2021 are shown in Figure 19. Both these bird species have a threatened conservation status of 'at risk-declining' (Robertson *et al*., 2017).

A recent survey of the of Southern Logyard seawall by a specialist investigator and trained dog (Simm, November 2021) recorded 18 sites of interest (birds seen, heard, observed indirectly (e.g., guano) or likely)[37] which would suggest the penguin are relatively common in the area.

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[34] Clement D., (2009). 'Marine mammals within Gisborne District Coastal Waters'. Prepared for Gisborne District Council. Cawthron Report No. 1698. 76p.

[35] Baker, C.S.; Boren, L.; Childerhouse, S.; Constantine, R.; van Helden, A.; Lundquist, D.; Rayment, W.; Rolfe, J.R. (2019). 'Conservation status of New Zealand marine mammals, 2019'. New Zealand Threat Classification Series 29. Department of Conservation, Wellington. 18 p.

[36]. Robertson, H.A., Baird, K, Dowding, J.E., Elliott, G.P., Hitchmough, R.A., Miskelly, C.M., McArthur, N., O'Donnell, C.F.J., Sagar, P.M., Scofield; R.P., Taylor, G.A. (2017) ' New Zealand Threat Classification Series 19' 27 p.

Figure 19: Flock of red billed gulls at the end of the Outer Breakwater.

Table 3: Summary of bird species from eBird hotspot citizen science database recorded from Poverty Bay and their threatened status (Robertson *et al*., 2017).

Common Name	**Scientific Name**	**Threat Category**
Penguins		
Little penguin	*Eudyptula minor*	At Risk - Declining
Gulls and Terns		
Black-billed gull	*Larus bulleri*	Threatened - Nationally Critical
Caspian Tern	*Hydroprogne caspia*	Threatened- Nationally Vulnerable
Red-billed gull*	*Larus novaehollandiae scopulinus*	At Risk - Declining
Southern black-backed gull	*Larus dominicanus dominicanus*	Not Threatened
White-fronted Tern*	*Sterna striata*	At Risk - Declining
Petrels, and Shearwaters		
Flesh-footed Shearwater	*Puffinus carneipes*	Threatened- Nationally Vulnerable
Fluttering Shearwater	*Puffinus gavia*	At Risk - Relict
Sooty shearwater	*Puffinus griseus*	At Risk - Declining
Wilson's storm petrel	*Oceanites oceanicus*	Migrant
Gannets and Shags		
Australasian Gannet	*Morus serrator*	Not Threatened
Little Black Shag	*Phalacrocorax sulcirostris*	At Risk – Naturally Uncommon
Little shag	*Microcarbo melanoleucos*	Not Threatened
Pied shag	*Phalacrocorax varius*	At Risk - Recovering
Shore Birds		
Pied stilt	*Himantopus leucocephalus*	Not Threatened
Variable oystercatcher	*Haematopus unicolo*	At Risk – Recovering
White-faced heron	*Egretta novaehollandiae*	Not threatened

*Observed on site during 4Sight surveys.

3.4.3 Fisheries

Government Sourced Information

Information on commercial fishing activity within and specific to Poverty Bay including potentially the areas near to the Eastland port and the OSDG, is difficult to identify other than by reference to the broader fishery in Fisheries Management Area Two – Central East. This encompasses East Cape from Cape Runaway to Titahi Bay north of Wellington on the west coast. The principal commercial species include spiny red rock lobster (*Jasus edwardsii*), tarakihi (*Nemadactylus macropterus*), and pāua (two species - *Haliotis iris* and *H. australis*)[38].

The region has a mixed trawl fishery that targets tarakihi and gurnard as well as red cod, snapper, trevally, blue warehou and flatfish. The midwater trawl fishery targets bluenose, gemfish and rubyfish while the bottom longfishery targets bluenose and hapuku. The set net fishery targets blue warehou, butterfish and blue moki. Most of the surface long line fishery for tuna and swordfish are landed through Gisborne and Napier.

Since January 2020, there has been a commercial ban on the take of pāua and mussels within this area (Central Area Commercial Fishing Regulations 1986: 10 - CFR0199). There are other commercial fishing restrictions in the central area including a vessel length limit under 46 m (regulation CFR0116) and set net soak time limit of less than 24 hours (regulation CFR0281). Commercial fishing intensity for Poverty Bay is low to moderate compared to the rest of New Zealand for all fishing methods from 2007 to 2019. Intensity is calculated using catch per km^2 and effort returns for aggregated areas[39].

Recreational fishing effort is low for the Poverty Bay area when compared to the rest of New Zealand (number of vessels per km^2). It is also noted that there is an extensive zone around the port in which it is illegal to set crayfish pots and set nets (commercial or recreational).

Poverty Bay has two Rohe Moana or customary fishing areas for Tangata Whenua. The coastal marine area to the north is gazetted to The Paikea Whitireia Trust on behalf of Ngati Konohi and that to the south to Ngai Tamanuhiri as represented by the Ngai Tamanuhiri Whanui Charitable Trust.

Fisheries-Iwi sourced Information

The draft Cultural Impact Assessment prepared on behalf of Rongawhakaata (Easton et al, February 2022) for the existing maintenance dredging application provides the following information on fish, shellfish and crustaceans. This information is also relevant to the Twin Berths.

The CIA notes in respect of bivalve shellfish (CIA p28-30; section 4.4.2):

> "In the 1960's either tuatua (*Paphies subtriangulata*) or deepwater tuatua (*Paphies donacina*) were collected by the onion bag full west of where midway surf life-saving club (SLC) is now located. Tuangi-haruru (ringed dosinia/*Dosinia anus*) and harihari (silky docinia/*Dosinia subrosea*) were noted in the SLC area. Kuhakuha (Trough shell/*Mactra discors*) and large trough shell (*Mactra murchisoni*) were noted washed ashore after storm events. Kaikai karoro (Triangle shell/*Spisula aequilatera*) were also washed up around the southern Rohe Moana boundary. Kutai/kuku (mussel / *Perna canaliculus*) were gathered from river mouths and certain rocks. Tuangi (cockle/*Astrovenus stutchburyi*) from Waikanae beach. These species still exist today but as recently as three years ago people have become ill from eating them…"

This would suggest a variety of surf clams and other species inhabit the beaches west of the port and the adjacent nearshore subtidal and surf zone including areas shoreward of the OSDG.

The CIA further notes local marine life which mostly likely associated with intertidal and subtidal hard reefs which is culturally important and which includes seaweed species, kina (*Evechinus chloroticus*), crayfish (*Jasus edwardsii* and *Sagmariasus verreauxi*), a range of marine snails (cats eye (*Lunella smaragda*), knobbled whelk (*Austrofusus glans*), Cook's turban (*Cookia sulcata*), black (*Haliotis iris*) and yellow foot (*Haliotus australis*) paua), mussels (green lipped

[38] Accessed from Fisheries New Zealand Info Site on 20/09/2021 - https://fs.fish.govt.nz/Page.aspx?pk=41&fyk=37

[39] Ministry for Primary Industries website accessed on 21/09/2021 - https://www.mpi.govt.nz/legal/legislation-standards-and-reviews/fisheries-legislation/maps-of-nz-fisheries/

(*Perna canaliculus*), blue (*Mytilus galloprovinciallis*) and horse mussel (*Atrina zelandica*)). Other species noted include limpets (*Cellana* spp) and octopus (*Pinnoctopus cordiformis*).

The CIA notes at least 13 fish species which are collected within the rohe moana by shore-based surfcasting and handline; a further 11 species that are collected by boat-based recreational methods; and 7 species that are mostly targeted using set nets. Additional species identified include several flatfish species and also paddle crab (*Ovalipes catharus*).

The CIA also provides anecdotal information based on interviews with local recreational fishers, that crayfish are caught in the rohe moana. Specific locations are not identified other than it being noted that in the area known as the Foul Grounds to the southeast of the outer Port navigation channel, hand potting is also carried out.

The CIA notes in respect of commercial fishing (CIA p30-32 section 4.4.3) a number of interviews which establish locations of fishing effort. These include general references to trawling 'in the bay' and 'across the bay'. Most locations referenced appear to be areas well distanced from the port and the OSDG (eg Tuahine Point, Kuri Bank, Whare ongaonga, Wharerata) although some areas referenced although known to locals are not identifiable from the information provided (eg fluke rock 'middle ground' 'tunnels').

3.4.4 Sediment Quality Near the Port

In August 2019, 4Sight undertook seabed sampling for grain size and contaminant analysis, to the immediate south of Eastland Port seaward of the Kaiti reef system (within 1.5km of the port entrance). Sampling sites are shown in Figure 20. This location may lie within, or is at least close to, the potential plume field of discharges from dredging operations at the port as well as from stormwater discharges from the Eastland Port Southern Logyard southern discharge outlet.

Figure 20: Kaiti Reef offshore benthic sampling (from 4Sight, February 2020).

Parameters assessed in the August 2019 work included heavy metals, total organic carbon (TOC) and texture (particle size).

Metals

Results from the survey are presented as Appendix A to this report.

In brief summary of that work, sediment quality is assessed against the Australia and NZ Guidelines For Fresh and Marine Water Quality (ANZ)-Default Guideline Value (DGV) and DGV High[40],[41] which provide sediment toxicant default guideline values for aquatic ecosystems[42]. Broadly, 'DGV' values represent a threshold below which there is a low probability of toxicological effect on marine organisms in sediment. DGV-High is a threshold above which there is a high probability of such effect.

All sediment metals concentrations were well below ANZG 2018 DGV's except at one site (P17) where arsenic was comparatively higher. The P17 result was approximately double the Threshold Effects Level (TEL)[43] of MacDonald et al. (1996). The **TEL** is a sediment contamination concentration at which a toxicity response has started to be observed in benthic organisms. The P17 value may be related to the higher levels of organic material also recorded at this site. Nonetheless average (and median) values for arsenic from the seven sites was still below the TEL which itself is only about one third of the applicable DGV. The arsenic value at P17 is not significant.

TOC

TOC is a proxy for the total amount of organic matter in sediment and is a useful indicator near a log port that inevitably discharges organic matter in stormwater. Determination of TOC is an important part of environmental characterisation of sediments. Increasing organic content of sediment is often accompanied by other chemical stressors co-varying with sediment particle size (Hyland et al 2005)[44]. Through the direct effect on redox potential (the measurement of the tendency of an environment to oxidize or reduce substrates) of sediments, TOC can have a major influence on chemical and biological processes occurring in sediment, including regulation of the behaviour (and toxicity) of metals and other contaminants. Generally, benthic species diversity and biomass would decrease at high TOC values (> 3.5 %).

All August 2019 samples showed low TOC (<1%).

Although there are no nationally accepted guideline values for TOC in marine sediments, values can be compared to the classification of sediment enrichment system of Robertson and Stevens (2007)[45] that was developed for estuarine systems. Under that system, TOC % of less 1% is classified as 'Very Good'.

Particle Size

Four of the five sediment samples collected were comprised predominantly of fine sand and very fine sand and varying proportions of mud and medium sand. Coarse sand, very coarse sand and gravel were minor components of these samples. The particle size distribution of site P17 was notably different compared to the other samples, being comprised predominantly of gravel and medium sand.

[40] 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. Available at https://www.waterquality.gov.au/anz-guidelines

[41] https://www.waterquality.gov.au/anz-guidelines/guideline-values/default/water-quality-toxicants/toxicants#metals-and-metalloids

[42] DGV's were published in the ANZECC 2000 guidelines and new and revised DGV's were published in 2018. However, there were no changes made in the 2018 to the numerical values for sediment contaminants published in ANZECC 2000

[44] Hyland, J., Balthis, L., Karakassis, I., Magni, P., Petrov, A., Shine, J., Warwick, R. (2005). *Organic carbon content of sediments as an indicator of stress in the marine benthos*. Marine Ecology Progress Series, 295, 91-103.

[45]Robertson B, Stevens L (2007) *Waikawa Estuary 2007. Fine Scale Monitoring & Historical Sediment Coring*.

3.5 Water Quality of the Port Area

3.5.1 Tairawhiti Resource Management Plan Classification

Expectations for water quality at the port and OSDG, and impacts on that water quality, can be assessed in relation to a water quality classification, the standards for which are presented in the Tairawhiti Plan. The water quality classifications applying to the Port, PNC and OSDG are shown in Figure 21. Details of the standards that apply to the water classes are described in Table 4.

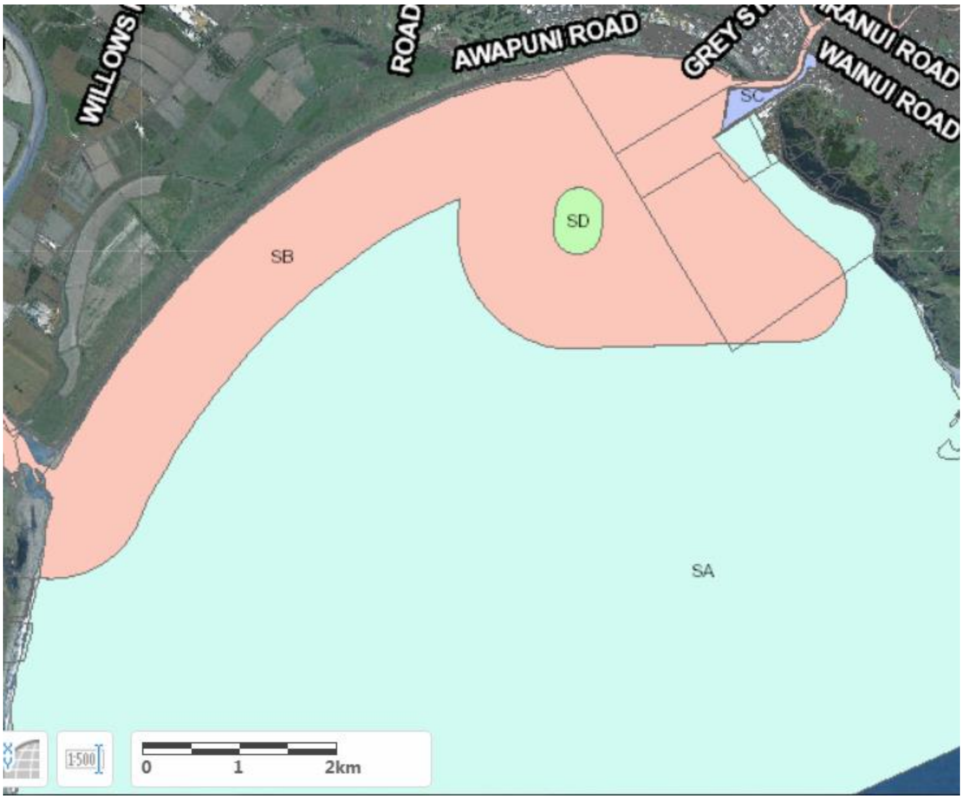

Figure 21: Water Classifications.

Table 4 :Water Classification Standards.

Requirements	SA	SB	SC
The quality of the Class XX waters shall conform with the following requirements:			
a. The natural temperature shall not be changed by more than 3 degrees Celsius	X	X	X
b. The natural pH of the waters shall not be changed by more than 0.1 unit and at no time shall be less than 6.7 or greater than 8.5	X	X	X
c. There shall be no destruction of natural aquatic life by reason of a concentration of toxic substances nor shall waters emit objectionable odours	X	X	X
d. The natural colour and clarity of the water shall not be changed to a conspicuous extent	X	X	X
e. Aquatic organisms shall not be rendered unsuitable for human consumption by the presence of contaminants, and	X		
The water shall not be rendered unsuitable for bathing by the presence of contaminants	X	X	

There are four applicable standards in and adjacent to the port. The SC and SB standards (or classes) are most relevant to the locations in which the dredging activities are proposed. SA is most relevant to the OSDG and the inshore zone that might be affected by discharges associated with the construction of the reclamation and subsequent operational discharges from the upgraded stormwater system. The SD standard is a mixing zone for the GDC municipal treated wastewater discharge.

Class SB and SC differ only in respect that SB has a requirement to protect bathing water quality.

Class SA differs from SB in that it also requires kai moana not to be contaminated, hence its application to the nearshore Kaiti Reef waters which are potentially used for the collection of shellfish and other species for food.

The SC Standard covering the port reflects the wide range of influences on water quality. These include the significant influence of the Turanganui River and the Kopuawhakapata Stream discharges; ship movements and dredging; stormwater discharges from the port land; other activities from the upper harbour (the marina and small commercial and recreational boat activities)

The SB standard reflects some similar port related influences and particularly that from dredging and the Turanganui River discharge. It is unclear as to why the part of the PNC seaward of Butlers Wall is included in this classification zone.

3.5.2 Catchment Influences

Typically, water quality at the port is influenced by relatively 'clean' coastal waters. However, even at times of apparently good water quality in the port basin, it is not unusual following rainfall for the waters of the adjacent Turanganui River on the northern side of the training wall to be highly turbid. This situation is shown in Figure 22 which is a drone photograph taken early on a flood tide on 05 July 2017.

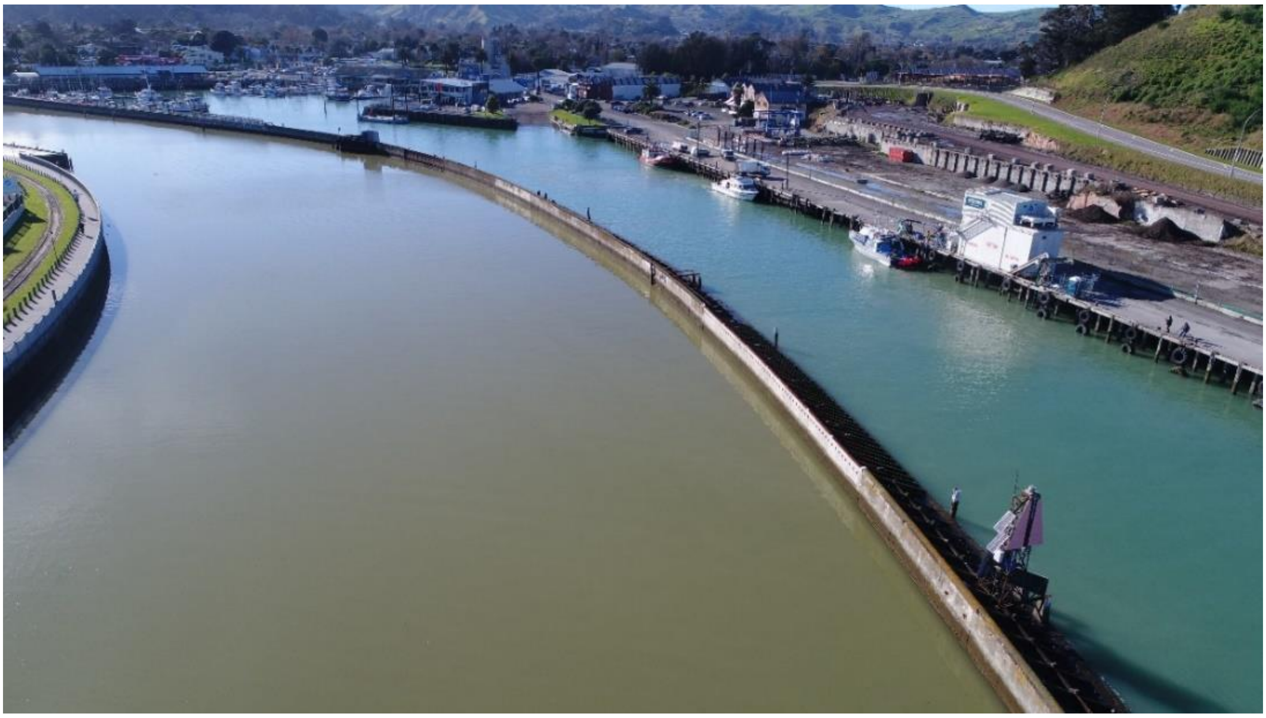

Figure 22: Turanganui River and inner port area (photo taken 05/07/2017, 10:37am).

Riverine sediment load has been documented for the Turanganui River. The river has been reported to carry up to 3 to 8 kg/m^3 of sediment during storm events (MetOcean, December 2017; page 29)[46]. This equates to suspended sediment concentrations of between 200 to 550 times typical background conditions during non-storm periods.

[46] Met Oceans Solutions Ltd (2017). 'Eastland Port Dredging Project. Morphological Model Validation. December 2017'

Such influence is illustrated by a storm event in late May 2017 which resulted in high sediment load being discharged from the Turanganui River, which then entered the port area through natural tidal movement. This is not an unusual occurrence. Water sampling was undertaken by 4Sight the day following that event to document the 'natural' range in some parameters experienced at the locality. There was no shipping movement that day or other port related activity that could have significantly influenced port suspended sediment load. Water sampling was undertaken at five sites within the harbour basin (Sites 1- 5) and one site (Site 6) was also sampled outside the harbour basin (located 150 metres beyond the Butlers Wall) as a background site. Results are presented in Error! Reference source not found..

In that event, vertical water clarity as measured by secchi disk, was very low within the port basin. Vertical clarity was in the range 18-19.5 cm. By comparison, background vertical clarity beyond the harbour was 94 cm.

During the May 2017 event, suspended sediment levels within the port basin were in the range 130-230 g/m^3 and turbidity in the range 85-160 NTU. Background suspended sediment and turbidity beyond the harbour was 20 g/m^3 and 5 NTU respectively.

The results also show the reduced salinity throughout the port at that time (salinity range 12.8-16.2 ppt) compared to the background site (salinity 28.5 ppt).

Table 5 : 28 May 2017 Water Sampling Results (Sites 1-5=harbour basin; Site 6 =background beyond harbour.

Parameter	Unit	Sampling Site					
		1	2	3	4	5	6
Vertical Clarity (Secchi Disk)	cm	—	—	18	19.5	19.5	94
Total Suspended Solids	g/m^3	230	260	170	150	130	20
Turbidity	NTU	150	160	85	110	85	5.6
Salinity	ppt	12.8	16.2	15.9	13.6	14.8	28.5

These examples illustrate the range in water quality and the lowered quality of the harbour waters at times due to natural storm events. The elevated suspended sediment levels at Sites 1-5 in Error! Reference source not found. can b e compared with 'background' concentrations in the main turning basin during or shortly after rainfall as recorded as part of monitoring of the Eastland Southern Logyard discharge. That data (which is reported to Council on a regular basis) shows a total suspended solids median concentration of 14 g/m^3 and range of 3 to 89 g/m^3 for 60 harbour background 'wet period' sampling results collected between March 2017 and October 2020 within the VTB[47]. These results confirm a highly variable water quality in respect of suspended sediment, with the upper concentrations occurring in the harbour being more than 10 times this median.

3.5.3 Shipping

A further drone photograph is presented as Figure 23 which shows a typical example of the influence of tug activity. In the photograph, which was taken around the same time as that in Figure 22 in otherwise 'clear' port waters, the tug wash from a vessel being berthed at Wharf 8 has generated a heavy, conspicuous plume of turbid water from the main wharf extending across to the old slipway and over much of the port basin.

Such activity at Wharf 7 can have similar effect and generate such plumes which also include Wharf 6 and adjacent areas. These influences permeate the entire inner port area, VTB and berth pockets and effectively become the background state at such times.

[47] 4Sight Consulting (November, 2020). 'Eastland Port Southern Logyard. Water Sampling Report, Quarter 3 2020. November 2020'. Submitted to Gisborne District Council

Figure 23: Turbidity generated by tug activity within the port basin (photo taken 05/07/2017, 10:38am).

3.5.4 Logyard Discharges

All three logyards (upper, wharfside and southern) discharge runoff to the harbour. The upper and wharfside logyards have comprehensive treatment systems which include chemical treatment (flocculation) and lamellar clarifiers prior to discharge. These logyards produce a stormwater discharge which meets a high discharge quality which maintain receiving water quality standards.

3.5.4.1 Southern Logyard

The southern logyard (SLY) is of most relevance to the Twin berths as a significant upgrade is proposed as part of the project. The SLY contains log storage and traffic areas, a refuelling station, debarking and anti-sap stain treatment facilities. The SLY stormwater is presently served by a Hynds downstream defender particulate interceptor system and two associated outlets: one to the north (MH1) which discharges to the harbour and one to the south (MH11) which discharges to the open coast (locations of the outlets are shown in Figure 24 below).

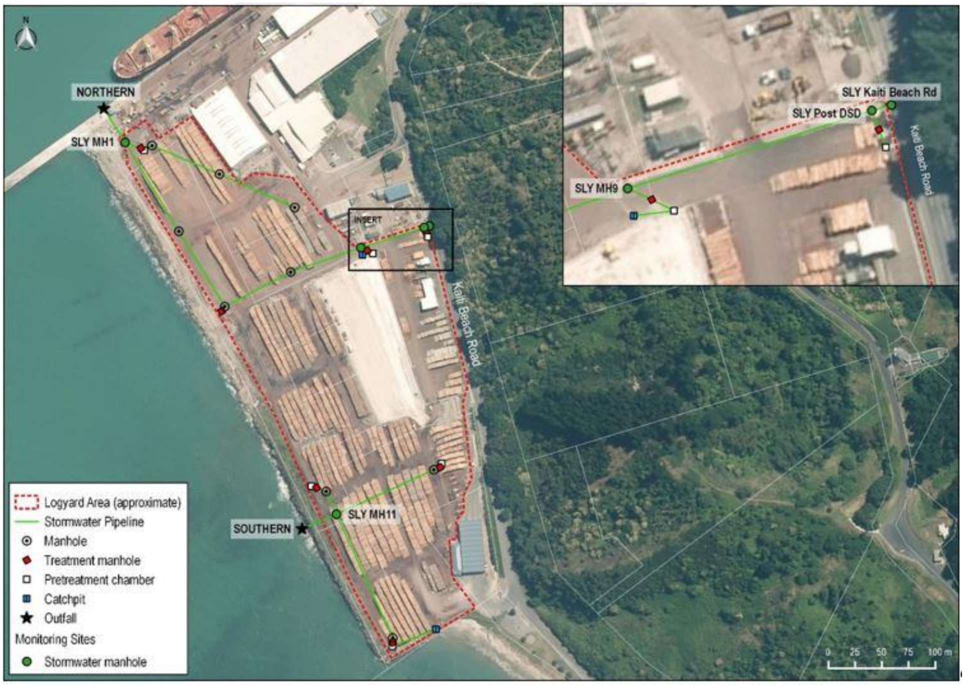

Figure 24: Southern Logyard Stormwater Discharge Locations.

Stormwater Management Plan and Monitoring

A Stormwater Management Plan (SMP) is in place to guide day to day management of the SLY and the associated water quality monitoring programme. The stormwater monitoring collects samples from the two manholes (MH1 and MH11) which are close to the two stormwater outfalls. Receiving environment sampling is also undertaken in the harbour at consent-specified mixing and background locations. Most receiving environment monitoring data relates to the MH1 (harbour) discharge due to the frequent difficulty of accessing the area seaward of MH11 in rough sea conditions.

The stormwater from two other manholes (Post DSD & MH9) adjacent to the anti-sap stain facility is sampled to check there are no contaminants (particularly copper) entering the logyard stormwater from this facility, which is fully bunded. A Council stormwater sump in Kaiti Beach Rd is also sampled because some stormwater from the Council system enters the Eastland Port system.

The stormwater discharges and receiving environment are sampled and reported to GDC approximately three-monthly. Ten water quality parameters are tested and analysed (pH, total suspended solids, volatile suspended solids, chemical oxygen demand, total organic content, tannin, total petroleum hydrocarbons, dissolved copper, lead and zinc). Of these, TSS, TPH and the metals are assessed against specific consent discharge limits although the TSS limits are expressed in the consent as 'interim limits' pending a period of monitoring and review.

A recent Eastland review of SLY stormwater monitoring results (a summary is included as Appendix C:) indicates that suspended sediment concentrations in the discharge are above consent targets of a median and 75 percentile of not more than 300 and 450g/m^3 TSS respectively. The most recent monitoring report (4Sight Consulting, November 2021[48]) indicates that the discharge quality meets all consent limits other than the TSS thresholds.

Quantitative receiving environment consent limits are also specified after reasonable mixing for pH and metals. These are met but a narrative standard requiring no conspicuous visual change in receiving waters beyond the mixing zone boundary, is sometimes not met, due to the elevated TSS and associated discolouration This is due to very fine fraction particulates which are not able to be captured in the present system.

The frequently elevated suspended solids and turbidity and reduced visual clarity due to natural events and routine authorised activities within the port confines, are important aspects of the existing environment when considering part (d) of the SC water classification detailed in Table 4 above. It is clear that existing permitted operations, as illustrated by Figure 23, cause the water quality standard (i.e. '*The natural colour and clarity of the water shall not be changed to a conspicuous extent*) to be exceeded.

3.5.4.2 Other Influences on Local Water Quality

Other potential influences on local nearshore and harbour water quality include the Gisborne District Council's treated wastewater discharge which is via a seabed diffuser slightly inshore of the outer PNC, and intermittent but unpredictable dry and wet weather overflows from the Gisborne city wastewater reticulation system under extreme rainfall events.

The Council's existing consent for the diffuser discharge has not been reviewed as part of this report. It is understood that the wastewater treatment plant has been relatively recently upgraded and has been the subject of health risk assessment and hydrodynamic modelling in relation to prediction of contaminant concentrations within and beyond the defined mixing zone (see water classification standard area SD in Figure 21 of this report). While the discharge of potential microbiological pathogens and nutrients in the discharge, and the localised effects on surface water clarity which are often associated with such marine outfalls, are relevant to the water quality of nearshore waters, particularly with respect to public health, they do not materially interact with the port operations or the effects of dredging in particular.

The consents strategy for the wastewater overflows[49] is broadly elimination within 10 years for discharges other than those beyond the control of the GDC. While important from a public health perspective, these discharges too are not

[48] 4Sight Consulting (November 2021) Eastland Port Southern Logyard Sampling Report-Quarter 4, 2021

[49] GDC Consent DW-2020-109732-00/WD-2020-109733

of much relevance to the port operations other than to note that the wastewater discharge may contribute to background water clarity conditions in the PNC at times.

3.6 Port and Offshore Disposal Ground Sediment Character and Quality

The characteristics and quality of the sediment in the port zone that is likely to be dredged (as part of a capital dredging programme) can be described in terms of the near surface material, and the bulk material which occurs at a depth beyond that typically influenced by maintenance dredging.

The physical character and quality of the near surface sediment that is captured during both maintenance and capital dredging is well documented and is discussed below. Maintenance dredging typically removes recently accumulated material down to a depth of up to 1.0m

The physical character of the deeper bulk sediment to be capital dredged (that is to lower levels than excavated during the maintenance dredging) as part of the Twin Berths is known from geotechnical information. The quality of that deeper material has not been specifically investigated but can be deduced from the geotechnical information in combination with some recent sampling of deeper sediments from the mid and inner harbour.

3.6.1 Seabed Physical Characteristics and Sediment Quality

Near surface seabed sediments within the port basin are reported to be in the range of 80% cohesive material (silt 60% and clay 20%) and 20% sands and in the PNC beyond Butlers Wall, 80% sands and 20% fines (MetOcean, April 2018 -Table 2.1, page 21)

Since 2006, sediments sampled annually from three sites within the Port have been analysed for a range of heavy metals [50] to assess trends in the contaminant levels and the suitability of the dredged material for offshore disposal. Surface sediments are most likely to accumulate and to reflect contaminants from anthropogenic sources. Therefore, they are likely to represent a potential worse case picture of pollutants in sediments to be dredged and potentially otherwise disturbed.

The sites sampled as part of the maintenance dredging are the vessel turning basin (S4), the port entry adjacent Butlers Wall (S5), and the Port Navigation Channel S6). Sampling sites are shown below in Figure 25.

Figure 25: Outer port annual sediment quality sampling sites.

[50] 4 Sight Consulting 2017. 'Maintenance Dredging Annual Monitoring. For Eastland Port Ltd. Sediment Monitoring and Elutriate Testing. April 2017'. Prepared for Eastland Port Ltd.

This information on heavy metals is summarized in Figure 26 which covers annual monitoring data from 2006 to March 2021. It is noted that arsenic, nickel and silver were added to the metal suite for analysis in 2014.

The consent trigger values, which are represented by the horizontal red lines in Figure 26 are ANZECC 2000 Interim Sediment Quality Guideline (ISQG)[51] values (now the replaced by but the same numerical values in ANZG 2018 DGV). The trigger limit applicable is set at a level below which toxicity effects on biota are unlikely. Results confirm that metals concentrations are well below the specified resource consent limits. Taking the results as indicative of the surficial sediments generally in the port area which are likely to be dredged, the material is considered unpolluted and suitable for offshore disposal.

Figure 26: Sediment metals concentrations at the three maintenance dredging monitoring sites (Turning Basin; Butlers Wall; Channel) 2006 to 2021. Horizontal red line is consent trigger value. All values mg/kg dry weight. Zero values represent non sampling events[52].

Total petroleum hydrocarbons (TPH) are also monitored as part of the annual sediment quality monitoring. Results confirm that TPH concentrations are low and typically below analytical detection.

3.6.2 Bulk Material Physical Characteristics and Sediment Quality

The bulk of material to be capital dredged will be silts and clays within the port and a higher proportion of sands in the PNC (Worley, June 2021-Section 5.1). Rock material is expected to be encountered in some areas including parts of the PNC as noted above, and parts of the Wharf 7 and Wharf 8 berth pockets. Rock is reported to be slightly weathered mudstone and unweathered siltstone. The quality of the material to be capital dredged (which by definition has not

[51] Australian and New Zealand Environment and Conservation Council, Agriculture and Resource Management Council of Australia and New Zealand (2000). *Australian and New Zealand guidelines for fresh and marine water quality. Volume 1*.

[52]The 2013 mercury result for the 'Butlers Wall' site appears anomalous and is an order of magnitude higher than expected based on the results for the other sites. It is likely this is a data entry issue. 4Sight have been unable to locate the analytical result sheet for that year (which predates 4Sight's involvement in this work)

been previously dredged or exposed to contaminant sources), is likely for the most part to be 'inert' clays, silts, sands and rock. It should pose no water quality concerns regarding its removal or disposal.

The predicted low contaminant status of deeper sediments is supported by a recent report on sediment quality[53] from mid and inner harbour locations in relation to a proposed dredging programme to deepen this area to facilitate access and berthing of new tugs which are to arrive in 2022. This work sampled sediments from borelogs at five locations between 0.5m and 1.8m below the seabed surface. Material was described as dark silt with some clay and minor organics below which there is a parent clay. The samples were analysed for organic matter, ash, and heavy metals: arsenic, cadmium, chromium, copper, lead, mercury, nickel, and zinc. The results showed that all heavy metals concentrations except nickel, were below the ANZG (2018) guidelines values and within the range reported for the surficial sediments. Nickel was below the ANZG value in 4 of the 5 samples and equal to the ANZG value (21 mg/kg) for one site. These values are also in the range reported for the surficial sediment sampling. Nickel has typically been closer to the ANZG value than other metals in sediment sampling undertaken at the port and at background sites. The nickel concentrations may reflect natural influence from the background geology.

3.6.3 Resource Management (Marine Pollution) Regulations 1998

Disposal of the dredged material is also subject to the Resource Management (Marine Pollution) Regulations 1998. Schedule 3 Part 1 of those regulations identifies technical information to be provided which is additional to that required under section 88 of the Resource Management Act.

Of relevance to ecological and water quality matters related to the port area, Schedule 3 of the Regulations requires the following information (paraphrased):

- A characterisation of the dredged material that includes physical, chemical, biochemical and biological properties (Clause 2(b), Schedule 3);
- Toxicity (Clause 2(c), Schedule 3);
- Physical, biological and chemical persistence (Clause 2(d), Schedule 3);
- Accumulation and biotransformation in biological materials or sediments (Clause 2(e), Schedule 3);
- Sources of contamination in the dredged material (Clause 4, Schedule 3);
- Physical, chemical and biological characteristics of the water column and seabed (6(a));

These assessment criteria can be satisfied by the available information and are addressed in the body of this report and more specifically discussed below. The Regulations also require information in relation to effects assessment and management, as well as assessment of the disposal site. Those matters are covered in sections 4.0 and 3.5 of this report respectively.

The dredged material removed as maintenance and capital dredging can be considered in relation to the Schedule 3 Criteria.

Characterisation of the Dredged Material

Physical: The near surface material to be dredged has been described above in section 3.6.2 and (as described below) is similar in texture to the Offshore Disposal Ground.

Chemical: The chemistry of the near surface material is known and can be predicted with confidence in relation to the concentrations of heavy metals documented to date from port monitoring (see Figure 27). Concentrations of those metals are well within the applicable ANZG limits below which toxicity effects on biota are less likely. The dredgings are of an appropriate quality for disposal to a similarly fine grained, highly dispersive site offshore. The deeper material is likely to reflect similar or lesser metals concentrations and is unlikely to pose a risk in terms of its chemistry. It is most likely to be comprised of inert silts, clays, sand and rock which has not been exposed to pollutant sources.

Biochemical: The dredged material is not likely to have accumulated significant organic material or be significantly influenced by industrial or other waste. It is mostly inorganic (clays, silts, sands and rock). The dredged material is not considered to pose a risk to the receiving waters or disposal the site in terms of its biochemical properties.

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[53] Memorandum to Eastland Port prepared by Mark Poynter 23 September 2021

Biological Properties: Only the near surface sediment to be removed has a macro-biology. It is relatively recently deposited and frequently excavated or disturbed by dredging and natural processes. Based on macroinvertebrate sampling of soft sediments elsewhere in the port, the biology of the sediments is likely to be very limited and not notable in terms of biodiversity, abundance or rarity. Biological properties are not considered to be of concern.

Toxicity: Toxicity risk can focus on chemicals of recent anthropogenic origin which can become sequestered in the near-surface sediments. The chemistry can be complex and is a function of exposure of biota to bioavailable compounds which is itself influenced by the complex suite of physical, chemical and biological factors. Sediment monitoring data related to in-situ heavy metal concentrations (which provides a first level screen as to a possible toxicity concern) indicates surface sediments are not toxic. This is not unexpected given that the catchments contributing runoff to the port area are not industrialised. Fauna within the dredged zone is unlikely to be sensitive. Bulk sediments are also very unlikely pose any toxicity for reasons discussed above. The dredged material does not contain qualities that would render a toxicological risk associated with its excavation or disposal.

Persistence: Due to their frequent disturbance and excavation over the life of the port, the current near surface sediments are considered unlikely to contain persistent and potentially bioaccumulative chemicals such as polyaromatic hydrocarbons and organochlorines above trace levels. Deeper sediments similarly pose no risk in terms of persistent chemicals.

Accumulation and Biotransformation: Accumulation and biotransformation are not considered to be relevant risk factors in relation to the proposed dredged material. The dredging area has been subject to regular removal of near surface silts and sands.

Sources of Contamination: The catchments include farmland; urban, commercial, and residential areas; and a marina. These uses will generate some contamination entrained in stormwater and perhaps dust. If the port was not present, the Turanganui River and Kopuawhakapata Stream, which are likely to contribute much of the contaminant load sequestered in the sediments which are maintenance dredged, would still discharge sediment and any other contaminants, to the nearshore coastal environment. Being a 'downstream' depositional zone, the port area provides a location where a proportion of that 'contaminant load' settles out on the seabed and is subsequently moved via maintenance dredging to the OSDG, and effectively beyond the inshore coastal ecosystem.

The primary activity on the port land, being log storage, generates some site-specific contamination in the form of sediment and small quantities of natural wood residues (e.g particulates and dissolved compounds such as natural wood leachates). However, these activities are themselves the subject of specific resource consents which control (via consent conditions) the quality of discharges to ensure that the local receiving environment is not adversely affected.

It is considered that there are no material concerns in relation to the quality of the dredged material and its suitability for disposal

3.6.4 Offshore Disposal Ground Sediment Quality

4Sight reported surveys of the sediment quality and texture at the OSDG (4Sight, November, 2019)[54] and in November 2020[55]. Neither survey was consent driven but surveys were undertaken by Eastland to assist with environmental baseline and background information.

4Sight, 2019

Benthic samples were analysed for total recoverable heavy metals (As, Cd, Cr, Cu, Ni, Pb, Zn, Hg), Dry matter (Ash), Total Organic Carbon (TOC) and particle size distribution. The OSDG seabed sampling sites (OSG 1-4) and reference sites (East and West control) for the 2019 survey, are shown in Figure 27 (the Kaiti Reef sampling sites referred to in section 3.4 4 of this report (P1, P6, P7, P16 and P17) are also shown to the north).

Results from the survey are presented in Appendix B: to this report.

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[54] 4Sight Consulting Ltd, November 2019. Outer spoil ground and Kaiti reef sediment quality assessment. Prepared for Eastland Port by 4Sight Consulting

[55] 4Sight Consulting Ltd, November 2020. *Offshore Disposal ground For Dredged Sediment. Sediment Quality Survey.* Prepared for Eastland Port by 4Sight Consulting

All sediment metals concentrations, except nickel, fell below (that is 'complied with') the relevant guideline values. Nickel concentration was equivalent to or exceeded the ANZG DGV by a small margin at four sites. Nickel exceeded the TEL at all sites including the east and west control sites which may suggest that background levels of Nickel in Poverty Bay are somewhat elevated. Nickel concentrations were well below the ANZG GV-high at all sites[56].

The site with the highest Nickel concentrations (OSG 2) also had the highest organic carbon and mud content. Increased mud content and organic enrichment are typically associated with increased heavy metal concentrations, as the binding capacity of sediments increases with decreasing grain size, and the partitioning of metals to sediments is also increased with increasing organic carbon content (ANZG 2018). As such, this may be a factor explaining the variation in metals concentration between samples and for example, the slightly increased zinc concentrations at OSG 2.

All 2019 OSDG and background samples showed low TOC (<1%) and would be classified as 'Very Good' in the enrichment classification system of Robertson and Stevens (2007). Grain size analysis presented earlier (Figure 14) of this report confirms the dominance of Very Fine Sand and Mud particle sizes at the OSDG and 'Control' sites.

Figure 27: 2019 sediment quality sampling sites at and near the Offshore Disposal Ground.

<u>4Sight, 2020</u>

The 2020 survey (part of five yearly survey of the benthic ecology of the OSDG) sampled the eleven sites shown in Figure 28. Results are also presented in Appendix B.

Figure 28: 2020 sediment sampling locations.

Results were similar to the 2019 survey. All sediment metal concentrations, except nickel, were below the recommended ANZG DGV and remained at relatively similar levels across all sites. Nickel was at or above the ANZG DGV (21mg/kg) at all sites except one, although only marginally so at five of the sites. Nickel concentrations were well below the ANZG GV-high at all sites.

Summary

In summary, metals concentrations at the OSDG are consistent with values documented in the source material at the port. Concentrations for metals other than Nickel are low and consistent and do not show indications of an increasing trend. Nickel is somewhat elevated in the port sediments although concentrations remain below the DGV and the monitoring occasions since 2014 are not suggestive of an increasing trend in concentration. More data is required on background levels in the Poverty Bay basin to determine if the elevated Nickel at the OSDG reflects wider catchment influences.

4 ECOLOGICAL AND WATER QUALITY EFFECTS ASSESSMENT

4.1 Overview and Approach to Assessment of Effects

The actual and potential effects of the different elements of the Twin Berths on the existing environment are discussed below as well as the potential for future cumulative effects on ecological and water quality values.

Sections 4.2 to 4.6 present an assessment of effects of the different components of the Twin Berths on a 'first principles' basis. First principles in this context assesses the data and information on its merits with a minimal overlay of assumptions or interpretations. Most of the Twin Berths elements are activities that will (or currently) occur within or very close to the existing port operational area and its zone of influence. To that extent the Wharf 8 extension, outer breakwater upgrade and the capital and maintenance dredging are to a large extent 'business as usual' for Eastland. Individually and collectively these activities generate adverse effects on the existing environment (within the RMA context) which are at worst minor. One element that warrants extra consideration and which benefits from an additional consideration under the EIANZ approach discussed below is the proposed reclamation.

Section 4.7 considers the Twin Berths against an alternative approach which acknowledges that there are no formally accepted marine specific national guidelines for assessing marine environment ecological values. However, an approach can be used which is consistent with the Ecological Impact Assessment Guidelines for New Zealand (EIANZ, 2018)[57]. Although the EIANZ guidelines were not developed for marine environments they have been adapted for that purpose in several significant projects (for example de Luca -Boffa Miskell, 2018)[58].

EIANZ, 2018 states to the effect that an assessment at the scale of the 'feature' should be done. In this case the 'feature' is the harbour ecosystem at Eastland Port plus the wider coastal setting of Poverty Bay, or at least some significant portion of it which includes the extended Kaiti reef system.

EIANZ 2018 further comments that 'assessing the magnitude of the effect at the spatial scale of the effect is not recommended' (i.e., at the scale of just the footprint effect of the different development components) since it does not assist in developing impact management options' (EIANZ, 2018, pages 79/80). We interpret this to mean that contextualising the local footprint effects at an appropriate broader spatial and temporal scale is important.

The Twin Berths involves activities that will affect the marine environment in various ways and at varying temporal and spatial scales. By way of illustration, the proposed reclamation and the loss of seabed beneath the expanded breakwater will cause an obvious irreversible long-term impact. That is a footprint scale effect.

A second important effects context is the impact Twin Berths might have on identified values of indigenous biodiversity and habitat availability beyond the immediate footprint, that is at a greater and perhaps system wide scale. This 'effects-context' needs to establish an appropriate larger scale at which to consider impacts on habitat and such biodiversity values. The scale needs not to be convenient or arbitrary but to reflect considerations such as the spatial scale of habitat types in an ecosystem and the scale required by taxa that occur in the community type, to maintain life histories and ultimately generate the ecosystem services that derive from healthy habitats and biodiverse communities. As noted above an appropriate broader scale is the Kaiti Reef system and the broader Poverty Bay.

Section 4.8 considers cumulative effects.

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[57] Roper-Lindsay.J.,Fuller,S.A., Hooson,S., Saunders,M.D., Ussher,G.T. 2018 'Ecological Impact Assessment (EcIA) EIANZ guidelines for use in New Zealand: terrestrial and freshwater ecosystems. 2nd Edition. May 2018'.

[58] Boffa Miskell Ltd, 2018. 'Queens Wharf Dolphin: Marine Ecology Assessment'. Report prepared by Boffa Miskell ltd for Panuku Development Auckland

4.2 Proposed Outer Breakwater Upgrade

The new breakwater will be constructed around the existing structure and will be of an elevated height with a concrete capping. However, it will be designed still to be overtopped under some sea states. As identified in section 3.2.1 of this report, parts of the existing structure present as a rocky reef type community which includes habitat used by post juvenile crayfish. It also contains elevated areas currently used as roosting/resting areas by seabirds and on an itinerant basis by at least one marine mammal species.

Effects During Construction

The removal and repositioning of some of the existing structure and the new concrete units to be added will destroy most of the habitat and its associated ecology at the time of construction. Recolonisation of the new surfaces and voids in the structure will begin as soon as the new concrete armouring is completed and therefore recolonisation values will restore progressively over the construction period which may extend for up to 24 months.

As previously noted, there will also be a loss of seabed of about 2,700m^2. On the northern side of the breakwater the seabed that would be lost appears to be the soft sediment area that slopes to the PNC. On the southern side, the seabed in the zone is sand overlying the bedrock and does not include or encroach upon the pockets of exposed reef which occur nearby to the south. This benthic area marginal to the existing structure, as has been noted, is highly exposed to wave energy on its southern side. It is likely to be quite mobile and unlikely to host a notable invertebrate fauna. Benthic areas lost on the channel side of the structure are finer grained and marginal to the dredged navigation channel and the ecological values are similarly limited.

There will be intermittent localised water quality effects associated with construction activity mainly due to sediment disturbance at the seabed as new core and armouring material is positioned. These effects should be minor, temporary and not be of importance as sediment generation from shipping movements and river discharges largely governs local water quality.

Effects Post Construction

The upgrade will effectively restore the existing structure to a more functional state and on completion it will occupy a slightly larger area of seabed. There are several aspects to the new structure which will change and probably improve its ecological potential compared to the existing breakwater.

The elevated height and concrete cap should offer more rather than less habitat suitable for resting/roosting seabirds which have been observed on the end of the outer breakwater. It is noted that the inner breakwater presently sits at a height well above MHWS and is a large area of mainly flat concrete which also provides potential resting/roosting area. Structures are widely available locally that provide such areas which are unlikely to be ecologically limiting to seabirds.

The area between the MHWS and the top of the new breakwater, being proposed as large interlocking concrete unit construction, may also provide opportunities for haul out resting areas for NZ fur seal, one of which has been observed on the existing structure.

The intertidal zone on the breakwater is presently very limited. The new structure and its concrete unit armouring will create an expanded intertidal area which should increase by some 1400m^2 (Worley, March 2022-Table 8.). This intertidal zone will in time be colonised by marine life which is likely also to occur on nearby intertidal shores along the Kaiti reef.

The subtidal parts of the new breakwater should redevelop a similar reef type community to that which presently occurs. Crayfish, which have been shown to occur in the present structure should recolonise the new structure which will offer an increased area of refuge habitat. Effects on subtidal ecological values are therefore temporary and should be restored and increased due to the larger area of the new structure.

In time, due to natural processes of recolonisation, the net ecological effect of the Outer Breakwater Upgrade is likely to be at least neutral and probably positive. Long term ecological effects can be considered to be minor.

4.3 Wharf 8 Extension

The existing area which is to be part of the Wharf 8 extension is shown in Figure 29 below. The extension is to be approximately 140m long and consists of an outer piled concrete structure with a concrete capping beam. The extension is to include 130m of the Inner Breakwater.

Figure 29: Photograph of Inner Breakwater and Wharf 8 extension area.

On its northern (channel) side this extension will maintain the line of the existing wharf and it will abut a new berth pocket (which is considered as part of the dredging section of this report). On its southern side, it is presently a vertical sided concrete structure with a revetment of large rock spalls as wave protection. This section will be incorporated within the proposed reclamation.

Effects During Construction

On the channel side the replacement of the present concrete structure which has negligible habitat or biota value, with vertical concrete piles will not cause associated adverse habitat effects. It will largely be a like for like replacement.

On the southern side, the piling and new fill, will effectively fall within the new reclamation area. There will be a loss of a small subtidal section of revetment which has some of the 'rocky reef' character, similar to that which occurs further out along the Outer Breakwater. However, this part of the Inner Breakwater near to the southern logyard revetment, is shallower and is a very high impact zone for wave energy. It has a more limited ecology than the seaward parts of the breakwater.

The placement of the new vertical steel piles, backfill and other works associated with the Wharf 8 extension, will effect a small area of marine habitat which has a limited ecology. Loss of this is a minor ecological effect. Water quality effects from the construction will similarly be localised and should be limited to minor sediment disturbance and sediment losses from the fill operation. These effects are inconsequential in terms of effects on local water quality.

Effects Post Construction

The only long-term effect of any note is the loss of the habitat associated with the short section of revetment on the southern side of the existing Inner Breakwater. However, this effect is more than mitigated by the increased availability of this habitat type as part of the new reclamation seawall to be constructed in this corner. That will effectively replace like for like habitat and ecological value as the subtidal ecology re-establishes over time.

Overall, the impacts of the Wharf 8 extension will have a negligible effect (less than minor) on local ecological and water quality values.

4.4 Outer Port Reclamation

Figure 30 contains an aerial photograph of the site showing the approximate extent of proposed reclamation in relation to the existing breakwater and Southern Logyard. The reclamation, including the outer revetment wall, will occupy a seabed area of approximately 0.89ha of which 0.26ha is existing revetment footprint. Therefore, the area of seabed lost to new reclamation is some 0.63ha. It will sit between the existing inner breakwater (to be redeveloped as part of the Wharf 8 extension) and the northern third of the existing Southern Logyard revetment (it is noted that it will not extend to closer than about 5m of the Heritage Boat Harbour which is approximately delineated by the two northeast/southwest parallel projections of reef which can be seen in Figure 30).

The aerial image shows the location of the small, isolated patch of subtidal rock that would fall within the reclamation footprint.

Figure 30: Outer Port Reclamation footprint: aerial photograph site plan.

As previously noted, little penguin may use the existing seawall. This aspect, plus the potential for and significance or otherwise of impacts on penguin and the mitigation of potential effects through management, is specifically covered by a separate specialist report (4Sight, July 2022).

The construction and operational phases of the new reclamation are considered below in terms of ecological and water quality effects.

4.4.1 Ecological Effects During Construction

Intertidal Zone

Presently along this section of the seawall the low tide mark is very near the base of the existing revetment, so the intertidal zone is effectively located on the seawall itself and does not include any significant area of natural reef substrate. Consequently, ecological values are presently very limited and construction related intertidal impacts will be negligible.

Sub-Tida Zone

The seabed to be lost to reclamation comprises a layer of medium to coarse sand and fine shell over the underlying bedrock. Being shallow and exposed to high wave energy, the substrate is likely to be mobile and unstable. It is unlikely to host significant benthic biota.

The biota associated with the isolated patch of kelp covered rock within the reclamation revetment footprint is likely also to be limited by the severe wave climate.

The loss of this seabed during construction of the reclamation does not involve the loss of any significant or otherwise notable marine habitat or biota. Therefore, although there is a net loss of benthic habitat, it is not an ecologically significant effect.

4.4.2 Ecological Effects Post Construction

The long-term loss of this sandy substrate area will not affect significant marine biodiversity values and its loss is considered to be minor in that respect.

The loss of rock habitat will be more than offset by the subtidal part of the new revetment protecting the new reclamation. That will sit in deeper water than is presently the case and should over time develop a similar ecology to that on the surrounding patch reef and subtidal parts of the southern side existing Outer Breakwater which has been shown to be relatively diverse. This prospect of ecological recovery associated with a new area of subtidal revetment habitat is supported by the engineering information which indicates that the new concreate armour will be approximately 2m deep and 60% voids by volume. This will create opportunities for marine life including crayfish.

Overall, adverse ecological effects from the completed reclamation are minor and in terms of hard substrate ecology, is offset by that which should develop on the subtidal parts of the new seawall.

4.4.3 Water Quality Effects During Construction

Preliminary information from potential contractors has been reviewed and suggests that the methodology for reclamation construction is not resolved at this point. The information indicates that all contractors are aware of the prospect of sediment generation and the need for appropriate levels of control. There appears to be no requirement from the available construction options, for turbid water which is present or accumulating within the zone being progressively reclaimed, to be discharged as a point source to the sea beyond the construction area. Rather it is anticipated that such water will exit via diffuse penetration through the developing structure.

MetOcean (March, 2022) have modelled the fate of fine sediment (silt) released in suspension during the reclamation works. Sediment can potentially be released during the construction of the reclamation areas from either release of fine sediments present on the rock and crushed rocks used for the reclamation revetment or from seabed disturbance of the reclamation area which may contain unconsolidated alluvial material.

MetOcean summarises the situation as follows:

> *Results of the 50th percentile* [sediment fractions <75um] *concentrations are well below 0.02 kg.m^3 and occur mostly west of the reclamation area, port channel, and towards Waikanae beach. Plumes of low concentration occur along the coast and south of the reclamation area for 10% of the simulation time (90th percentile), with concentrations above background slightly above 0.02 kg.m^3 restricted to the reclamation perimeter*.

The MetOcean report further comments that in the Kaiti reef area, the predicted concentrations are '…*approximately 0.002 kg.m-3 (10x less the background concentration beyond the port working area)…*'. The report concludes '…*The plume represents a minor increase comparatively, corresponding to 5x to 10x less the background concentration range within the port area…*' and outside of the Port area '…*the plume might have a minor contribution to the background suspended sediment concentration*…'

In respect of fine sediment deposition, the MetOcean report indicates very minor deposition (1-3mm) and notes this is '…*mostly west of the reclamation site, along the southern side of the breakwater, and at the entrance of the port and navigation channel* …'. The higher rates of deposition are along the southern side of the breakwater.

Increased suspended sediment concentrations to the north during the works period, may impact the ecology that exists on the southern side of the Outer Breakwater. It is understood the reclamation is likely to happen before the breakwater upgrade. Therefore, any associated effects on this ecology will be of limited relevance given that the breakwater habitat itself will be lost in the short term due to the subsequent breakwater upgrade. As previously noted, this subtidal ecology is predicted to recover naturally over time.

The MetOcean predictions suggest there will not be significant sediment transport in the direction of the Kaiti reef system. As noted earlier in this report, the Kaiti Reef system hosts a moderately diverse invertebrate and algal community (see Figure 31 below). On this basis, the Kaiti reef is not likely to be exposed to sustained, if any, effects from the sediment discharge from the reclamation works area and therefore there should be no risk of adverse sediment related effects to the intertidal or subtidal ecology in that direction.

Figure 31: Low Tide Photograph of Kaiti Reef area adjacent to (south) the reclamation area.

In terms of visible plumes, it is expected that because the reclamation works progress slowly in stages, water quality effects beyond the reclamation, should be localised and intermittent. Given the open coastal aspect to the site, and its high energy, it is a well flushed locality. Any plumes should rapidly dissipate and not cause off-site adverse ecological or significant water quality related impacts.

Notwithstanding the low risk, sediment discharges from the reclamation works area should be visually monitored. A conservative approach should be taken to limit any risk should significant plumes disperse in the direction of the Kaiti reef. That may involve some specific management within the reclamation as it progresses. This contingency should be part of the Erosion and Sediment Control Plan (ESCP) which is to be prepared by the contractor. These requirements should be part of consent conditions for the construction phase.

Overall, it is considered that any discharge from the reclamation during construction can be managed and will not impact the ecological health of the local reef system or cause significant visual impacts beyond the port working area.

4.4.4 Water Quality Effects Post Construction

Stormwater Drainage and Upgraded Treatment Facilities

Stormwater from the completed reclamation will be directed to and integrated with the existing reticulation system for the southern logyard's northern catchment unit and discharged after treatment via the existing outlet. The SLY treatment system is to be upgraded and this is discussed below.

The method for the stormwater treatment upgrade has been based on the completed upgrades for the Eastland Upper Logyard (ULY) and Wharfside Logyard (WLY) which experienced similar difficulties in capturing fine particulates in the discharge prior to the upgrades.

The ULY stormwater system has been upgraded to an integrated chemical flocculation/lamellar clarifier system. Following this upgrade, stormwater quality greatly improved and regular monitoring shows it now meets consent requirements. For example, in respect of the ULY, eleven quarterly surveys show a range in TSS concentration prior to discharge to the Kopuawhakapata Stream of 8-320 g/m^3 with a median of 35 g/m^3 [59]. This achieved compliance with receiving water requirements after mixing (specified as an increase of not more than 100g/m^3 of TSS greater than background concentrations) on all but one occasion.

The recent WLY upgrade has similarly installed the same type of stormwater treatment system. Early monitoring data also suggests a high-quality discharge which meets consent requirements.

It is expected that the upgraded SLY system, which will involve a treatment train for both the MH1 and MH11 discharges, will significantly improve the quality of stormwater discharged from the SLY by reducing suspended sediment concentrations. The resultant discharge quality will reduce the volume of sediment lost to the coastal marine area from the logyard activities to the extent that after mixing there is no appreciable change in background concentrations. This is expected to maintain the applicable water quality standards and in particular resolve the current intermittent visual impacts on the receiving waters that have caused water quality standard (d) (see Table 4) not to be met at times.

Monitoring conditions are not proposed as part of this report but are expected to be guided by and similar to the existing monitoring regimes undertaken on stormwater and local mixing zone environments for the SLY and other port logyard discharges. The existing SLY monitoring regime will need minor modification to ensure that sampling sites pre and post coagulant dosing/lamellar clarifiers is achieved. Parameters and specified thresholds can remain the same as for the existing approved monitoring regime at least pending a period of monitoring and subsequent review.

4.5 Dredging & Disposal

The sections below discuss the following:

- The effects of capital and maintenance dredging on the existing port habitat and biota. It is noted that the capital dredging effectively includes any maintenance dredging that would otherwise be required in the dredged area over the period of the works;
- Dredging effects on water quality;
- Effects of disposal of all dredged material on the habitat and biota of the Offshore Disposal Ground (OSDG).
- Dredging related effects on marine mammals.

In terms of context for this assessment, dredging and disposal of dredged material in the period from the creation of the port through to the 1980's was not accompanied by detailed ecological or water quality assessment. As contended in the Cultural Impact Assessment, it is very likely that significant impacts were sustained because of those activities in that period and some such effects may have been permanent. Other than in respect of cultural knowledge and anecdotal information, an ecological baseline against which to assess present day impacts must rely on the relatively recent studies (post 1990) reviewed in this report. These form the basis of our knowledge and understanding of the existing environment as it applicable in an RMA context.

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[59] 4Sight, June 2021 'Eastland Port Upper Logyard Water Quality Sampling Report-Quarter 2 2021' Prepared for Eastland Port Ltd, June 20121

4.5.1 Effects on Habitat and Biota of the Vessel Turning Basin and Berth pockets

Other than in respect of the investigations undertaken as part of the expansion of the port pre-year 2000, a review of ecological consenting documents for capital and maintenance dredging at the port since that time, indicates there have only been limited biological investigations undertaken of the seabed area affected by dredging. This is assumed to be because the area is recognised as a modified commercial port zone within which dredging is a mandatory requirement to maintain gazetted port depths.

The biologically active part of any seabed, even in such a disturbed area, is typically limited to the near surface 20 cm of seabed sediment. The benthic fauna in that zone is described in section 3.2.3 of this report.

Due to the ongoing operations of vessels accessing the port and natural water quality variation as described in section 3.5 of this report, the seabed area is likely to host a limited diversity and abundance of benthic macroinvertebrate fauna. The community will be dominated by common species found in the primarily soft silty substrate.

Because this area is maintained in a near continual state of disruption due to permitted or consented port operations that form part of the existing environment, the biology of the VTB and berth pockets directly affected by dredging is not of ecological importance. The direct ecological effects of dredging on seabed habitat and macrobenthos are considered to be minor and not of ecological significance. There will be no impact on the limited biodiversity values as they currently occur in the dredged areas. Earlier assessments have drawn similar conclusions.

In addressing capital dredging, an assessment of effects prepared by Insight Resource Management Consultancy (2008)[60] refers to a peer review by NIWA dated July 1998 which was reported to state:

'…the impacts of capital dredging in the harbour (increase in water depth and alteration of the seafloor) would not have any significant impact on the rock lobster populations in the harbour…,'

4Sight draw the same conclusion in respect of the Twin Berths related dredging effects on crayfish habitat inside the harbour.

<u>Areas Not Previously Dredged</u>

The only area within the proposed dredging footprint which has not been previously capital dredged is an approximately 1300m^2 zone which forms part of the area to be excavated to create the new Wharf 8 berth pocket. The anticipated volume of 3,500 m^{3}represents 2.5% of the total estimated capital dredging volume of 134,200 m^3. The area is only 0.6% of the total dredging area (Worley, June 2021, section 4.3).

The near surface material in this zone is soft muds and fine sands with deeper material including rock expected to be unweathered sandstone or slightly weathered mudstone.

The Wharf 8 berth is one of the most frequently disturbed areas of the port as ships berth and depart. It is unlikely the surface material in the Wharf 8 berth pocket hosts other than a minimal biota.

Overall, the ecological effects of capital dredging areas not previously dredged is considered to be minor.

4.5.2 Effects on Habitat and Biota of the Port Navigation Channel

Dredging of the near-surface material in the PNC will be predominantly poorly consolidated clays and unconsolidated silts and sands which occur in a highly mobile and transient environment that are not conducive to the establishment of diverse benthic communities. The ecology of these substrates in the PNC is of low ecological value and associated dredging effects on benthic habitat and biota are minor and not of ecological importance.

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[60] Eastland Port Limited (2008). 'Capital Dredging of Harbour Waters and Marine Disposal of Dredge Spoil'. Insight (Gisborne Ltd), December 2008

Rock

The rock which either outcrops or which lies very near to the surface in parts of the PNC is proposed to be 'dredged' to 0.6m deeper than is currently authorised subject of the 2015 coastal permits and a 2020 renewal application. This is likely to be achieved by a combination of breaking up the rock with rippers and raking of the fractured material beyond the PNC. No blasting of rock is required (Worley, June 2021-section 6.4).

The deepening in this substrate will remove any ecology which has established on any exposed hard substrate. The ecological significance of this effect is likely to be limited by the following factors:

- As described earlier, the ecology is likely to be limited in its biodiversity due to natural conditions.
- The outcropping rock is a small part of a wider feature of reef habitat which extends to the south-east ('Foul Grounds') and which is likely to host a similar but more diverse assemblage. This area is known to host a population of crayfish as identified in the CIA. This community is also likely to be well represented in the wider subtidal Kaiti reef system.
- The new channel depth will likely expose a greater area of the underlying bedrock than is presently the case which will increase the area of potential hard substrate available for future recolonisation.
- No further 'dredging' of the exposed rock outcrops is expected as part of maintenance dredging. In time an ecology should re-develop which is similar in type and value to that which presently exists. On this basis the capital dredging can be considered a short to medium term adverse effect with recovery extending over a period of at least several years to a similar ecological value.

As there is the prospect of ecological recovery of a potentially larger habitat area, adverse effects can be considered short to medium term and at worst minor. Potentially a small positive effect in the long term relative to the existing environment.

4.5.3 Effects on Other areas

Breakwater Crayfish Habitat

The 4Sight investigations of the breakwater have suggested a population of small crayfish in that structure. That population has evidently developed and exists notwithstanding the dredging activities that presently occur. Crayfish which might use that structure after its redevelopment, are unlikely to be affected by dredging activities in the adjacent parts of the navigation channel.

Eastland have initiated a monitoring programme to collect additional data on crayfish use of the structure. This information is to be used as a baseline for future comparisons.

Kaiti Reef

In terms of the habitats slightly more distant from the PNC, the recent 4Sight surveys of subtidal patch reef habitat and the intertidal areas of the Kaiti Reef system are consistent with the earlier work of Coles (1997). They suggest a moderately diverse biota which is evidently robust and capable of withstanding or responding to the high energy conditions which prevail at times. There is no obvious indication of existing water quality effects from dredging, although any effects would likely be subtle and masked by ambient influences. Such effect would likely be inconsequential in terms of the diversity of species to be found and structure of the communities. The ecology of those zones is likely to be governed by substrate type and exposure to wave energy.

Given these applications seek consent for continuation of the same or similar dredging activities as have been undertaken in the past, dredging related influences on those areas are expected to be very limited, if any, and not change relative to the status quo.

4.5.4 Summary of Overall Direct Dredging Effects On Habitat and Biota

In summary, about 99% of the area to be capital dredged is effectively a deepening of areas which are presently routinely maintenance dredged. Dredged material will be mostly muds and sands, semi consolidated material and clays and some rock which sits below the seabed. Being within the existing maintenance dredging footprint, the ecological effects of this dredging are no more than is currently sustained under existed consented activity and are not important in that context.

The approximately <1% of the proposed dredging area that is currently not maintenance dredged is in an area of frequent seabed disturbance due to ship berthing. Effects in that area (the Wharf 8 berth pocket) are similarly ecologically inconsequential.

4.5.5 Dredging Effects on Port (Harbour) Water Quality

Dredging related water quality effects arise largely from associated increases in suspended sediment. Such increases can, either in suspension or in due course following the deposition of such material on natural substrates, cause a range of potentially adverse effects including smothering of biota and habitats, clogging gill surfaces affecting respiration and feeding of marine biota, reduction in light penetration affecting photosynthetic activity. Effects can also be aesthetic such as reduced visual clarity and impacts on colour.

The potential for such impacts on water quality is strongly related to the dredging method which in turn is governed by the type of material to be moved. Methods most likely are trailer suction hopper dredge (TSHD), and barge mounted backhoe dredge (BHD) which is expected to be used in the less accessible areas, especially close to existing port structures and where harder rocky material is to be removed.

An analysis of ecological and water quality effects of dredging has been previously prepared as part of an Eastland maintenance dredging application (Andrew Stewart, 2015)[61]. That report remains relevant as the same or similar dredging methods are proposed for the Twin Berths both for capital and maintenance dredging. Relevant sections of the 2015 analysis as relate to water quality are paraphrased below as applicable.

Trailer Suction Hopper Dredge

The mode of operation for a TSHD is for the draghead to be lowered to the seabed and towed at approximately 1-3 knots. The draghead (in this case by way of jetted water) loosens the seabed material which is pumped from the draghead to the hopper barge as a slurry of about 85% water and 15% solids via the dredge pumps. Sediment in the slurry settles into the hopper, leaving a 'cleaner' layer of water on top. This top layer of 'dredge water' is decanted back to the sea while the dredge operates and until the hopper fills with a sufficient volume of solids. Dredging information indicates the TSHD used mostly in the past (Eastland's TSHD 'Pukunui') at capacity holds around 220 m^3 of solids and 260 m^3 of dredge water in its 480 m^3 of capacity[62]. Similar proportions of solids to water would be expected in other TSHDs.

The dredge suction pump operation is essentially an in/out system. Once the hopper (barge or vessel) is full, the same rate of discharge of dredge water decant occurs as is pumped. It typically takes about 30 minutes to fill the hopper to the point that it starts discharging decant water, then a further 1 to 1.5 hours to fill the hopper with sufficient sediment. The hopper (barge/vessel) then moves to the disposal site at a speed of about 6.5 knots.

By way of example, dredging records for 2013 indicate the Pukunui achieved 1 to 7 loads per day with monthly averages of 3 to 4.5 loads per day notwithstanding significant and at times lengthy periods and entire months of no dredging. Dredging typically occurs during daylight hours, but if necessary due to unusually high dredging demand, operations can also proceed at night. A typical turnaround time to fill, transport, dump and return a load of dredged material is 3 to 4 hours, but it can be as little as 2 hours.

Between 2014 to 2019 the annual number of days dredging at the port ranged from 51 (2016) to 134 (2014) and it averages at about 100 days (Worley, June 2021-Table 4.2 and Figure 4.4)

Photographs, and the modelling carried out by MetOcean, confirms that dredging by TSHD generates plumes of turbidity within the VTB and inner harbour.

[61] Andrew Stewart (2015). 'Eastland Port Ltd. Gisborne Port. Maintenance Dredging and Disposal. Port Navigation Channel, Vessel turning Basin, Wharves 7 & 8. Coastal Permit Application. Ecological and Water Quality Report'. January 2015

[62] Eastland Port Ltd (2014). 'Eastland Port Ltd Maintenance Dredging Liaison Group Annual Report 2013 to the Gisborne District Council'. Prepared by CW Jamieson Marine Manager Eastland Port Ltd, August 2014

The dredging plume modelling makes the following points:

- Modelled scenarios assume a static situation, that is the dredge not moving (MetOcean, April 2018; page 22). This represents a conservative worse case in terms of plume footprints and sediment concentration.
- For a TSHD Pukunui overflow release is expected to be diffuse and comparable to a point source release occurring on the sea surface layer (MetOcean, April 2018; page 40).
- The modelling suggests that dispersion plume footprints associated with fine materials are often associated with suspended sediment concentrations that are in the order of 1-10 mg/l at their leading edge. These can be smaller than background concentrations due to natural river discharges or other sources such as ship movements (MetOcean, April 2018; page 41; para 2; see also Figures 23 and 24 of this EWQR).
- The use of an overflow phase from the TSHD, in addition to continuous dredging, results in the most significant increase of predicted suspended sediment concentration throughout the water column (MetOcean, April 2018; page 41; para 3).
- A moving dredger will allow some dilution of the suspended sediment plume (MetOcean (April 2018) page 41; para 5) and the decant will lose its initial downward momentum.
- In respect of a TSHD, suspended sediment (fine material) plume concentrations more than 10 mg/l at the sea surface, mid depth and bottom, should not extend more than about 120 m in any direction from the dredge in the VTB and inner harbour (MetOcean (April 2018) report, Figures 3.23 and 3.25). That modelling prediction would effectively encompass much of the port area. Predicted high sediment concentrations in excess of 100 mg/l are restricted to a few tens of metres from the dredge throughout the water column.

In summary, a potential for elevated turbidity from TSHD extends throughout most of the VTB and parts of the inner harbour during such operations. The intensity of any visual effect will depend to some extent on background water quality at the time, which as previously noted can be strongly affected by natural events (rainfall) and shipping movements. The SC water quality standard (d) '*The natural colour and clarity of the water shall not be changed to a conspicuous extent'*, may not be met at times. Such effects are likely to be intermittent and short term but will be sustained during the period of dredging.

Back-Hoe Excavator

A backhoe excavator operating from a barge tends to be used in confined spaces or close to port structures. It may also be the preferred method where the in-situ material is more consolidated or perhaps rock, such as is likely to be the case for some of the material to be capital dredged. BHD removes material which, while it remains relatively cohesive as it is moved from the seabed to the barge, does have a potential for loss of material from the excavator bucket. Typically, and compared to the TSHD operation, relatively little water is conveyed with each excavation and much less than suction dredges for each cubic metre of solid material recovered.

The MetOcean (April 2018) report (Figures 3.47 and 3.48) shows a much smaller footprint of increased sediment wherever backhoe dredging is used. Figure 32 below provides a good illustration of the small footprint and localised water quality impact associated with backhoe dredging at Gisborne Port.

Figure 32: Back-Hoe loading TSHD Pukunui at Port Gisborne (Source MetOcean, April 2018; Figure 3.44).

In summary, turbidity effects within or adjacent to the BHD area are typically localised. Allowing for mixing and dispersion of plumes within an operational working area, significant visual plumes of turbid water further afield are unlikely to be generated. The SC water quality standard (d) regarding changes in colour and clarity of waters (Table 4 of this report) should be met in relation to BHD. This is true irrespective of the nature of the material to be dredged and whether it is capital or maintenance dredging.

Dredging Related Water Quality Effects on Juvenile Crayfish and Crayfish Settlement Habitat

Crayfish settlement into the port has been documented to occur mostly beneath in the transition area of Wharf 6 and Wharf 7 (Jeffs, 2018; page 2) as indicated by the yellow arrow in Figure 32 above. The crayfish settlement is in an area that is frequently affected by sediment plumes and high rates of sediment deposition from ship movements and natural storm and rainfall events.

About 33,600m^3 (25% of the Twin Berths capital dredging) over an area of about 0.96ha is in the Berth 7 berth pocket area (Worley, March 2022-Tables 3.1 and 3.2) which is close to the crayfish settlement area. This component of the dredging is expected to be completed over several months principally by backhoe dredge.

Maintenance in the Wharf 7 berth pocket is limited both in terms of dredging days and volume. Records show that average dredging days per month over the peak crayfish settlement period (winter) are 5 to 7. Most dredging in the port is undertaken in the September to April period (Worley, March 2022; Figure 4.5). Records also show that the actual average volume removed annually by maintenance dredging from the Berth 7 area over the period 2014-2019 was less than about 1000m^3 (Worley, March 2022-Figure 4.6)

Existing consents have dealt with what are largely perceptual risks to crayfish settlement by limiting dredging to between April and September inclusive without the prior written approval of the Council (for example Wharf 4, 5 and 6 work berths (CP 2013 105825), -Condition 4).

The long planktonic life cycle (in the order of 18 months or more) and the vagaries of environmental influences such as currents acting over the continental shelf means that crayfish can settle over much of the year although there are usually peaks in settlement.

Crayfish values within the port have previously related to research and commercial collections for experimental aquaculture. We are unaware that this is still the case or relevant. One reason recently advanced for consideration to be given to the value of juvenile crayfish in the port, is the potential for the juveniles to be easily accessed and or observed by scientists for research purposes. In this context there is a body of scientific literature which has used or relied on access to these juvenile crayfish [63] although we note this research is not recent. Also, the writer is aware of regular collections of juvenile crayfish made by NIWA on the Wairarapa coast for research reasons. The earlier rationale for mitigation is likely not applicable.

[63] Kelly, S. Section 42A Report - Appendix 5.1 Memo Eastland Port Ltd: Application to redevelop the slipway and Wharves 6 & 7. 18 April 2018

Although existing consent conditions restricting dredging between April and September are intended to mitigate water quality related effects on crayfish juveniles, the beneficial effect of the dredging restriction (if any) is unknown. It appears to reflect a precautionary and largely perceptual approach taken by Council in the past to limit potential exposure of the newly settled crayfish to sediment at a vulnerable life history stage. This seems a poorly based rationale when viewed against the frequent influence of other sources of sediment in the port (as illustrated in Figure 23 of this report).

The most recent consent which dealt with effects on crayfish habitat is that authorising the Wharf 7 upgrade. This gave a strong weighting to cultural values and perceptions. Specifically, mitigation of effects was required, the primary driver for which was impacts on cultural values. The Decision Report noted in its Effects on Cultural Values section '...*The applicant, submitters and the section 42A RMA report* [the Council's report] *all directed our attention to the provisions of the Tairawhiti Regional Marine Plan that require particular attention to the interests of tangata whenua…*'. The Decision Report further noted that submissions from Māori comprehensively addressed their concerns. These concerns were recorded as including the need for the resource consent to demonstrate regard to protecting the mauri (i.e., life force or essence) of coastal resources; the need to develop a cultural assessment framework for doing so; and, **protection for the juvenile rock lobster resource beneath the present wharf structures** [emphasis added].

It is evident from the example illustrated in Figure 32, that a backhoe dredger can operate with limited impact and sediment plumes are unlikely much beyond the immediate works zone. Such plumes are unlikely to be significant in terms of juvenile crayfish settlement or survival. No restriction to dredging method or timing is required in relation to crayfish settlement habitat.

Overall, it is concluded that the Twin Berths dredging will not change the current situation significantly. Any water quality risks to crayfish settlement habitat or to post juvenile success, are short term, likely to be minor and not of ecological importance in terms of providing crayfish for the wider fishery.

Effects From Potential Mobilisation of Metals

The concentrations of heavy metals in the dredged sediments have been documented from annual sediment monitoring as low. Further assessment has been undertaken of any risk associated with mobilization of dissolved contaminants during the dredging process. Specifically, as part of the 2017 and 2020 annual sediment testing, the toxicological risk associated with an increase in dissolved contaminants entering the water column due to dredging was assessed by elutriate testing[64] and reported to Council[65,66]. Elutriate testing is a standardised laboratory based analytical procedure which agitates a sample of the sediments to be dredged and then measures the concentration of dissolved metals in a filtered sample of the elutriate. This analytical procedure mimics the possible effect of dredging on the water column in terms of contaminant mobilisation.

The elutriate analysis indicated that dredging may cause a small increase in copper concentration in the water column, but the concentrations of other metals are unaffected. The increase in copper is likely to remain small and indicates that water quality will remain within the ANZECC (2000) 90% species protection threshold for marine waters in a 'slightly to moderately disturbed ecosystem'. This level of marine water protection is routinely applied in similar consent conditions and has specifically been imposed by GDC in relation to previous discharge consents issued by GDC.

The elutriate testing suggests that there will be no adverse water quality affect relating to mobilisation of heavy metals associated with the dredging.

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[64] Vicinie, A., Palermo, M and Matko, L (2017). 'A Review of the Applicability of Various Elutriate Tests and Refinements on These Methodologies'. Proceedings, WEDA XXXI Technical Conference & TAMU 42 Dredging Seminar

[65] 4Sight, April 2017. 'Maintenance Dredging Annual Monitoring. For Eastland Port. Sediment Monitoring and Elutriate Testing'. April 2017.

[66] 4Sight, July, 2020. 'Maintenance Dredging Annual Sediment Quality Monitoring and Triennial Elutriate Analysis. For Eastland Port Ltd'. July 2020

4.5.6 Water Quality Effects from Dredging the Port Navigation Channel

Trailer Suction Hopper Dredge

TSHD is likely to be used for the dredging in the PNC.

The MetOcean (November 2019) modelling report (which used TSHD 'Pukunui' operations as a reference point) indicates small plume fields with increases in suspended sediment concentration above 10 mg/l confined for the most part to the PNC or its immediate vicinity (see MetOcean November 2019) report Figures 3.22 and 3.24). This is well illustrated in the photograph presented below in Figure 33.

The MetOcean plots do suggest that the patch reefs and stacks to the south and which are closer to the PNC, could be influenced by the lower concentration range from the dredging plume fields. However as is evident from the photographs presented earlier in this report (Figures 7 and 11), these discrete ecologies appear to be healthy and not to have been unduly affected by historical and current dredging. It seems likely they will not be adversely affected by the proposed dredging.

The SB water quality standard (d) '*The natural colour and clarity of the water shall not be changed to a conspicuous extent'* which applies to the PNC and adjacent areas cannot be met during dredging. This effect needs to be accommodated in the consent to allow for dissipation of temporary and intermittent plumes and a return to background conditions at which such plumes cease to be 'conspicuous'.

Given the relatively benign quality of the material to be dredged, it is most likely that water quality standard (e) '*The water shall not be rendered unsuitable for bathing by the presence of contaminants'* that applies to SB classified waters can be met. Moreover, while bathing suitability is a relevant measure for assessment, the likelihood of any recreational bathing in or adjacent to the PNC is presumably low. It is also noted that just beyond the PNC to the west is the Gisborne City treated wastewater outfall. That discharge, along with intermittent high rainfall event overflows from the urban area wastewater and stormwater system, is likely to govern the suitability of waters for bathing in the general vicinity.

To the south of the PNC the SA Water Quality standard also applies nearshore. The MetOcean modelled sediment concentration fields appear not to impact the Kaiti Reef system, or at least suggest that any intermittent dredging derived plume of residual sediment that does impinge on this area, would be at concentrations in the order of less than 5 mg/l.

On this basis, and also considering the likely innocuous quality of the material to be dredged (ie the low concentrations of bioaccumulative compounds such as metals, or other compounds such as phenols which might taint seafood) the water quality standard (e) as above, and the additional standard (e) applicable to SA waters '*Aquatic organisms shall not be rendered unsuitable for human consumption by the presence of contaminants'* should be met.

Figure 33: TSHD Pukunui operating within the outer PNC (Source MetOcean (November, 2019 Figure 3.9).

Back-Hoe

BHD operations are likely to be used to excavate the rock outcrops in the PNC which may also need to be equipped with a hydraulic hammer/ripper. These operations may generate localised turbidity but are unlikely to generate significant offsite water quality effects or issues.

As already discussed in relation to the inner harbour area, water quality effects associated with backhoe dredging of material in the PNC will be localised and not significant in water quality terms.

4.5.7 Disposal of Dredged Material

The dredge spoil disposal operations associated with the proposed dredging operations will be the same or very similar to those undertaken currently in respect of equipment used, the volume and characteristics of sediment released; duration and frequency of each disposal event.

4.5.7.1 Effect on Habitat and Biota

Based on the most recent biological surveys of the OSDG, changes in benthic community composition since 1996 are minimal, and impacts associated with the disposal of dredged material in the past do not appear to be significant (NIWA, 2014; 4Sight, March 2021). This is consistent with expectations derived from physical modelling. MetOcean, (November 2019) modelling predicts the morphological responses of disposal of dredgings at the OSDG. Section 3.2 Disposal Ground Dynamics of that report (page 20) comments

'…*Simulations of "La Niña" conditions suggest an overall erosion of the sediment mound and dominant north and northwest inshore deposition of sediment, with maximum sediment accretion of 0.05 m. Sediment transport for "El Niño" simulations are predominantly south and southwest with peak sediment accretion of 0.15 m expected within confined region. Between 68% – 83% of the disposed material associated with maintenance dredging is expected to be eroded and transported. This corresponds to between 50,000 m3 and 100,000 m3 of sediment being advected from the disposal ground over a 1-year period (for "La Niña" and "El Niño" respectively). Most of the eroded material consists of the weakly-consolidated silt in the disposed sediment which is predicted to be winnowed from the disposal ground, diffused through the lower water column, and transported towards the shore or continental shelf by suspended-load transport* …'.

Coastal process information reviewed by Worley Parsons (2015) further notes that for typical winter wave conditions, the OSDG is in a location experiencing net offshore sediment transport.

The dredging disposal induced scale of deposition can be viewed against the likely ambient flux caused by episodic events at this site (e.g. riverine discharges during and following large floods; cyclonic weather systems which can produce large waves from an easterly and south-easterly quarter). As noted previously, it is estimated the Waipaoa River discharges some 12 million tonnes of fine sediment into Poverty Bay and the Turanganui River a further 0.7 million tonnes annually (MetOcean, December 2017, page 27)[67]. The OSDG is within the footprint of these riverine discharges. The seabed sediments at the site are reported as being influenced (resuspended) relatively frequently by wave energy from severe storms and occasionally also subject to the influence of gravity flows of fine mud following major riverine discharges (Worley Parsons, 2015).

The benthic biology is as Coles et al (1997) concluded, likely to be adapted to this scale of natural disturbance against which the proposed disposal volumes are a small percentage in annual terms.

On this basis, potential impacts on the habitat value and benthic ecological communities within and near the OSDG, from the predicted future disposal of dredged material, is likely to be small and not of ecological importance. There should not be any effects on the relatively distant intertidal and subtidal reefs near to the port, or elsewhere, from the disposal of dredgings to the OSDG.

There appears to be nothing special about the location or dimensions of the OSDG. These boundaries appear not to have been set to protect any nearby potentially sensitive ecology. Overall, the OSDG is a soft sediment habitat which sits within a much broader basin of similar habitat and which is similarly exposed to the predominating natural influences which are likely to control overall ecological potential.

[67] Met Oceans Solutions Ltd (2017). Eastland Port Dredging Project. Morphological Model Validation. December 2017

The potential impacts on the habitat and benthic ecological communities within and near the OSDG, from the disposal of dredged material, are considered small and unlikely to be ecologically important within the context of background influences.

Recent physical modelling studies predict a large volume of material is exported from the site and emphasizes that the larger picture with respect to sediment sources and mobility in Poverty Bay is likely the more important consideration. The combined Waipaoa and Turanganui sediment discharges into Poverty Bay are likely to greatly exceed dredging disposal inputs by at least 2 orders of magnitude in an average year. This should be taken into consideration when drawing conclusions about the possible impacts of dredge spoil disposal or its potential significance.

On the above basis it is unlikely that there are adverse effects on marine resources such as fisheries and the inshore areas which may continue to support surf clam species (for example as identified and discussed in the Cultural Impact Assessment). Overall ecological effects at the OSDG from the disposal of dredgings are predicted not to be of ecological importance.

4.5.7.2 Effect on Water Quality

Coastal process engineering reviews (Worley Parsons, 2015; MetOcean, December 2017) have confirmed the water quality of the OSDG is also governed primarily by the physical processes that influence the wider Poverty Bay. The area is strongly influenced by riverine discharges from the Waipaoa River and the Turanganui River). The engineering reports also review the wave and current climate and confirm that the OSDG location is high energy and strongly dispersive. Sediment which enters the area, either naturally or by dredging sediment disposal, is for the most part moved offshore into deeper waters and ultimately to the continental shelf

The water quality classification at the OSDG is SA in the Tairāwhiti Marine Plan. The requirements for SA waters have been described in Table 4. Classification standard (e) states:

> *'Aquatic organisms shall not be rendered unsuitable for human consumption by the presence of contaminants and the water shall not be rendered unsuitable for bathing by the presence of contaminants ….'*

This EWQR has concluded that the material to be dredged is unpolluted and does not contain contaminants which might have a toxicological or bioaccumulative effect. Contaminants such as some heavy metals are present at low or trace levels but they are below concentrations that would be of water quality concern. Also, the OSDG is distant from reefs or intertidal areas potentially used for harvest of seafood and is well beyond bathing areas. On this basis, this classification standard (e) will be met.

The MetOcean (April 2018; section 2.3.3; page 23) report, describes the behaviour of sediment released from a hopper. The literature cited indicates that about 10% of the material is entrained in the water column and 90% rapidly settles to the seabed. The modelled suspended sediment concentration plumes, indicate a relatively constrained plume at the surface and mid depth layers, becoming more dispersed in the bottom layer due to a density current.

Using the Pukunui example, predictions suggest sediment concentrations will generally fall below 10 mg/l within 50 m of the release at the surface and mid depth layers and within 150 m of the release at the bottom water layers.

It is the near surface turbidity that is most likely to impact the water classification standard SA (d). Here turbidity is used as a proxy for changes in suspended sediment concentration which as discussed previously can have a range of potential ecological effects. Turbidity is also a commonly used proxy for changes in visual clarity. The extent of the colour/clarity effect appears to be relatively localised based on the MetOcean modelling.

It is inevitable that the SA water quality standard will be breached for a short period over a localised area during disposal of material at the OSDG. This has been dealt with in previous consents in a pragmatic way by acknowledging that the OSDG is well removed from locations of public view, and localised turbidity is unlikely to be conspicuous. Also, there is an intermittency of discharge due to the load/transport/dump cycle and previous and present consents provide an allowance of 6 hours after each dumping episode for the waters to clear. This period appears to be arbitrary, although it does imply that there will not be incremental visual deterioration of water quality in successive dump episodes.

Overall water quality effects at the OSDG from the maintenance dredging are predicted to be low (minor) and not important to the prevailing water quality in Poverty Bay.

4.5.7.3 Dredging and Disposal Related Effects on Marine Mammals

There is no historical information suggesting interactions between dredging activities and marine mammals. It is unlikely that dredging in and close to the port poses a potential risk to marine mammals.

The disposal of material to the OSDG may have a greater potential for such interaction between for example dolphins passing through the area and the bottom dump dredge /barge activity. However even that occurs over a short window of time and in a largely open coastal setting where such animals would not be confined in any way. It is concluded that any risk to marine mammals is of low probability and low impact.

4.6 EIANZ Based Assessment

As previously noted, a derivation of Ecological Impact Assessment Guidelines for New Zealand (EIANZ, 2018) can be used to assist with the assessment of ecological effects. Although these Guidelines have been developed for terrestrial and freshwater ecosystems the underlying principles are applicable. The framework they provide has been adapted for use in estuarine environments (by de Luca -Boffa Miskell, 2018) Although that iteration does not apply to all the environments affected by the Twin Berths, it provides a useful structured regime to assist with assessing values and effects. The EIANZ assessment has been used to corroborate or otherwise, the findings of the first principles approach.

This classification system includes descriptors for assessing the 'ecological value' of estuarine species and habitats separately and uses the descriptors from EIANZ (2018) to assess the 'magnitude of ecological effects'. It uses both these metrics (value and magnitude) to derive an overall 'effects level' based on a matrix that is closely aligned with EIANZ, 2018. This analysis is detailed below.

4.6.1 Ecological Value of Port Biota and Habitat

4.6.1.1 Species

There are some assumptions to be applied in assessing ecological value of **species** under Table 6 below. The majority of the New Zealand marine invertebrate fauna (over 95%) remains unassessed in the New Zealand Threat Classification System (Freeman et al,2013)[68]. The species recorded in the Twin Berths footprint appear to be commonly encountered in similar estuarine harbour environments including those elsewhere in the port, the lower tidal sections of the Turanganui River and nearshore coastal areas. The recent 4Sight monitoring suggests this is also true of the OSDG benthic community. It is a reasonable assumption that the species are not rare or threatened nationally or have a distribution limited to or dependant on the Twin Berths footprint.

Penguin are excluded from this assessment as they are being dealt with in reporting by appropriately qualified and experienced specialists in penguin biology and management.

On this basis, the Ecological Value (Species) of all Twin Berths components is assessed as **Low**.

Table 6 : Criteria for assigning ecological value to species (based on Table 10 in EIANZ, 2018).

ECOLOGICAL VALUE (Species)	Species (Descriptor applicable to the Twin Berths footprint is italicised in bold)
Very High	▪ Nationally Threatened
High	▪ Nationally At Risk-Declining.
Moderate-High	▪ Nationally At Risk.-Recovering Relict, Naturally Uncommon
Moderate	▪ Locally uncommon/rare, not nationally threatened or at risk
Low	▪ **Not threatened nationally, common locally**

[68] Freeman, D.; Schnabel, K.; Marshall, B.; Gordon, D.; Wing, S.; Tracey, D.; Hitchmough, R.: *Conservation status of New Zealand marine invertebrates, 2013*. New Zealand Threat Classification Series 9. Department of Conservation

4.6.1.2 Habitat

Table 7 presents three levels which can be used to assess the ecological value of the **habitat**. These levels are: Low, Moderate (=Medium) and High. Each Level has eight descriptors covering biological, biophysical, quality and habitat modification criteria. Not all descriptors are relevant to any particular Twin Berths element, or are required to trigger a particular level, or need be confined to just one of the three levels.

The applicability of the descriptors to the various habitat zones are identified below Table 7. The assignment of a particular value is derived from the description of the existing environment presented in Section 3 of this report. In summary of Table 7:

Outer breakwater upgrade: notwithstanding that the structure itself is a highly modified habitat element, the areas affected by the breakwater upgrade, including the structure itself, are best described as 'man-made reef type habitat' which trigger descriptors mostly from the Medium and High categories. It is considered it most appropriately fits the Medium Ecological Value category.

Wharf 8 extension and upgrade: This upgrade covers habitat area that is much more limited in physical area and substrate diversity. It includes a vertical sided concrete structure and a small area of revetment (rock spall) protection which is very highly exposed to storm energy and which appears to hold little biota. On this basis this component best fits the Low Ecological Value category.

Reclamation: Most of this habitat is not degraded per se but it is likely to have a low species richness, diversity and abundance due to the high mobility of the surficial material in this exposed location. It triggers criteria mostly in the Medium and High Ecological Value categories and is assigned a Medium Ecological Value.

Dredging Area: Dredging 'Area' has been separated into Capital and Maintenance Dredging components. The capital dredging component in Table 7 only considers that small area that is beyond the current maintenance dredging footprint as that is the only invertebrate habitat that is at issue (ie the balance already being within the maintenance dredging area). These areas are highly modified by the direct and indirect effects of routine dredging and shipping. Notwithstanding the low contaminant status of the sediments, this component warrants a Low Ecological Value.

OSDG: Benthic surveys of sediment type quality at the OSDG suggest a predominantly muddy environment with low contaminant concentrations. Species richness, diversity and abundance in and around the OSDG is higher than might be anticipated for a locality subject to dredging disposal and close to the discharge of a large sediment laden river (Waipaoa). Overall, the assessment warrants OSDG categorisation as Medium Ecological Value.

Legend:
? = Insufficient information
NA = Not an applicable criteria
X = Characteristic applies

Table 7: Characteristics of estuarine sites with low, medium and high ecological (after Boffa Miskell, 2018).

ECOLOGICAL VALUE (Habitat)		CHARACTERISTICS APPLICABLE TO TWIN BERTHS (from section 3 of report)					
		Outer Breakwater	Wharf 8 Extension	Outer Reclamation	Capital Dredging*	Maintenance Dredging	OSDG
LOW	Benthic invertebrate community degraded and/or with low species richness, diversity and abundance.		X	X	NA	X	
	Benthic invertebrate community dominated by organic enrichment tolerant and mud tolerant organisms with few/no sensitive taxa present.	?	?	?	NA	X	X
	Marine sediments dominated by silt and clay grain sizes (>70%).	NA	NA		X	X	
	Surface sediment predominantly anoxic (lacking oxygen).	NA	NA		NA		
	Elevated contaminant concentrations in surface sediment, above ISQG high or ERC-red effects threshold concentrations.	NA	NA				
	Invasive, or opportunistic and/or disturbance tolerant species dominant.	?	?	X	NA	X	X
	Macroalgae provides minimal/limited habitat for native fauna.		X	X	N/	X	X
	Habitat highly modified.	X	X		NA	X	
MEDIUM	Benthic invertebrate community typically has moderate species richness, diversity and abundance.	X			NA		X
	Benthic invertebrate community has both (organic enrichment and mud) tolerant and sensitive taxa present.	?	?	?	NA		X

	Marine sediments typically comprise less than 50-70% silt and clay grain sizes.	NA	NA	X	NA		X
	Shallow depth of oxygenated surface sediment.	NA	NA	?	?	?	X
	Contaminant concentrations in surface sediment generally below ISQG-high or ERC-red effects threshold concentrations.	NA	NA	X	NA	X	X
	Few invasive, or opportunistic and/or disturbance tolerant species present.	?	?		NA		
	Macroalgae provides moderate habitat for native fauna.	X			NA		
	Habitat modification limited.			X	NA		X
	Benthic invertebrate community typically has high diversity, species richness and abundance.				NA		
	Benthic invertebrate community contains many taxa that are sensitive to organic enrichment and mud.			?	NA		
	Marine sediments typically comprise <50% silt and clay grain sizes.	NA	NA	X	NA		
HIGH	Surface sediment oxygenated.	NA	NA	X	NA	?	
	Contaminant concentrations in surface sediment rarely exceed the respective ISQG-low effects threshold concentrations.	N/A	NA	X	X	X	X
	Invasive, or opportunistic and/or disturbance tolerant species largely absent.	X	?		NA		
	Macroalgae provides significant habitat for native fauna.				NA		
	Habitat largely unmodified.			X	NA		

4.6.2 Magnitude of Ecological Effect

Under the Boffa Miskell (2018) approach, *the Magnitude of Ecological Effects* is assessed by reference to EIANZ 2018 (Table 8, page 83) This regime is divided into five levels: Very High, High, Moderate, Low and Negligible, each of which has its own descriptors. These are shown below in Table 8.

Table 8: Criteria for describing effect magnitude (after EIANZ, 2018).

MAGNITUDE	DESCRIPTION
Very High	Total loss or very major alteration to key elements/features of the baseline conditions such that the post development character/composition/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 baseline (pre-development) conditions such that post development character/composition/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 baseline conditions such that post development character/composition/attributes of baseline 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 baseline conditions. Change arising from the loss/alteration will be discernible but underlying character/composition/attributes of baseline condition will be similar to pre-development circumstances/patterns; AND/OR Having a minor effect on the known population or range of the element/feature.
Negligible	Very slight change from 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

Under this regime the magnitude of the effect for each of the Twin Berth elements is appropriately characterised as follows:

Outer breakwater upgrade: **Low** considering the temporary nature of the effect and the greater area and porosity (60% voids) of the new structure available for recolonisation and ecological recovery.

Wharf 8 extension and upgrade: **Negligible**- on the basis that the habitat affected is man -made, of very limited area and of minimal ecological value due to the paucity of habitat and biota.

Reclamation: **Medium** because there will be an absolute loss of natural benthic substrate and habitat and taking into account the following factors: the susceptibility of this seabed to wave energy and remobilisation of the substrate; the likely limited biodiversity values within the reclamation footprint; the higher ecological values of the extensive contiguous wider areas of shallow benthic habitat with a more stable substrate and diverse ecology; the strong prospects for ecological colonisation of the new southern revetment which will sit in deeper water and which should create enhanced habitat opportunities for development of a 'reef-type' community which will more than offset the loss of the habitat associated with the small rock feature.

Dredging Area: **Low** on the basis that the capital dredging footprint sits almost totally within the existing maintenance dredging area; but acknowledging the potential effects on the exposed rocky outcrops of the PNC which are mitigated by the wider availability of such hard substrate habitat in the 'Foul Grounds' and also the prospect of ecological recovery on any newly exposed hard substrate to a similar state.

OSDG: **Low** based on the benthic surveys which have shown little difference in the biota or habitat within and beyond the OSDG; and in recognition of the dominance of wider coastal processes and riverine discharges in Poverty Bay in determining substrate conditions; habitat potential and community types.

4.6.3 Derived Ecological Effect Level

The *Derived Ecological Effect Level* uses a matrix combining 'ecological value' and 'magnitude of effect'. Using this assessment approach generates two Levels of Effect, one for Species and one for Habitat, based on the analyses above in Table 6, Table 7 and Table 8. The Ecological Effect Level matrix is presented in Table 9.

Table 9: Matrix combining magnitude and value for determining the overall level of ecological effect (after Boffa Miskell, 2018).

EFFECT LEVEL		Ecological and/or Conservation Value			
		Very High	High	Medium	Low
Magnitude	Very High	Very High	Very High	High	Moderate
	High	Very High	Very High	Moderate	Low
	Moderate	Very High	High	Low	Very Low
	Low	Moderate	Moderate	Low	Very Low
	Negligible	Low	Low	Very Low	Very Low

With reference to Table 9, the following summary of Ecological Effect Level for the different Twin elements can be assembled as presented in Table 10.

Table 10: Summary of Overall Ecological Effect Level (vertical column highlight) based on Tables 6 to 9 above.

Twin Berth Element		Overall Level of Effect	Comment
All Elements	Species	Very Low	All elements score low ecological value (Table 6 and 7) and low or negligible magnitude of effect (Table 8) = Very Low Effect Level Table 9
Outer Breakwater	Habitat	Low	A medium ecological Value (Table 7), a low magnitude of effect (Table 8) = Low Effect Level (Table 9)
Wharf 8 Upgrade	Habitat	Very Low	A low ecological value (Table 7), a negligible magnitude of effect (Table 8) = Very Low effect Level (Table 9)
Reclamation	Habitat	Low	A medium ecological value (Table 7), a moderate magnitude of effect (Table 8) = Medium Effect Level (Table 9)
Dredging	Habitat	Very Low	A low ecological value (Table 7), a low magnitude of effect (Table 8) = Very Low Effect Level (Table 9)
Disposal to OSDG	Habitat	Low	A medium ecological value (Table 7), a low magnitude of effect (Table 8) = Low Effect Level (Table 9)

All Twin Berths elements score in the Low to Very Low effects range under this regime.

In applying an EIANZ based approach, the Guideline suggests that levels of effect moderate or greater, may warrant offset or compensation actions (see EIANZ, 2018, page 84). However, moderate levels of effect or greater, have not been derived for the Twin Berths elements.

EIANZ 2018 also notes (page 85, Table 11) an alternate scale for determining the extent of adverse environmental effects at a proposal scale. Although it is not intended for use at an ecological or biological feature scale (although it is not clear why it couldn't be), that alternate identifies and defines six categories of effect. These are: Nil; Less than Minor; Minor; More than Minor; Significant Adverse Effects that could be remedied or mitigated; and Unacceptable.

'Minor Adverse Effects' are defined under that scheme as '*Adverse effects that are noticeable but that will not cause any significant adverse impacts*'. That terminology applied to Twin Berths at a scale that includes the port, the nearshore areas and Poverty Bay, has some value in describing the potential scale and significance of Twin Berth impacts.

4.7 Cumulative Effects

As noted previously, cumulative effects are concerned with future effects that will arise over time and/or in combination with the effects of other activities.

Once consented, constructed and operational, the Twin berth elements should not generate additional adverse impacts that would manifest over time, or act synergistically with the effects of other activities. Specifically:

- There are no proposed structures that, along with the Twin Berths, could cause a cumulative incremental loss of marine habitat or changes in coastal processes that might adversely affect the ecology or water quality. It is acknowledged that there will be a slight expansion to the dredging area within the port which will further limit the reestablishment of biota over a greater area. However, that additional area in its current state is likely to sustain regular exposure to high suspended and benthic sediment load and is unlikely to host any significant ecological values.
- The Twin Berths requires no sustained additional dredging effort that could cause cumulative or incremental reduction in water quality at the port or the OSDG. The upper volume of maintenance dredged material is similar to the current volume.
- The Twin Berths dredging should not cause the ecological capacity of the OSDG to receive material to be exceeded, thus potentially necessitating further areas for disposal to be sought.
- Other proposed activities which are consented but undeveloped (e.g., the slipway redevelopment) or which are proposed but not yet consented (e.g., the inner harbour dredging for the new tugs) are unlikely to occur concurrently with the Twin Berths. There are limitations on plant and equipment and on other activities that can occur concurrently within the port while maintaining adequate port efficiency and the safety of vessels within a confined port area.
- The adverse water quality effects of the Twin Berth projects will largely relate to short term and relatively localised increases in turbidity and suspended sediment. Such effects will not interact in any adverse cumulative way with other discharges to reduce local water quality or cause the applicable standards to be exceeded. These other discharges include the Council's treated wastewater discharge, and the urban stormwater discharges which discharge from the Council's reticulated stormwater system to the Kopuawhakapata Stream and Turanganui River. Rather, given the proposed upgrade to the stormwater discharged from the SLY, there is a long term prospect of improved water quality and a cumulative reduction in adverse water quality events.

4.8 Mitigation of Effects

A definition for 'Mitigation' [of effects] is provided in EIANZ (2018) as: '*the process of preventing, avoiding, or minimising adverse impacts by: (i) refraining from a particular action; (ii) limiting the degree of an action; (iii) repairing, rehabilitating or restoring the affected environment; (iv) providing substitute resources*'.

This definition is broad and identifies the range of potential strategies for managing and responding to the actual and potential effects of the Twin Berth elements.

EIANZ (2018) also states the following order of priority for ecological impact management as: a. Avoid, b. Remedy, c. Mitigate, d. Offset, e. Compensate f. Supporting actions.

For the Twin Berths project elements, the adverse effects arising from replacement or new structures, reclamation and dredging clearly cannot be avoided.

Remediation of the ecological values affected (which include biodiversity values) will occur to a large extent where post construction habitats are of the same or similar type and in the same place, as they will in due course develop a largely similar ecology. This is true of the outer breakwater, the Wharf 8 extension and the dredged areas, all of which provide introduced and heavily modified habitat areas.

Mitigation focuses on limiting the degree of an action, or the intensity of the effect. For the Twin Berths, is mitigation is mostly relevant to water quality effects. For example, adverse water quality effects of dredging can be mitigated by applying best practice in the dredging method, limiting the duration of continuous dredging and allowing for natural dispersion and dilution processes to dissipate the intensity of plumes. The concentration of sediment laden discharges from the reclamation area during construction can be mitigated by implementation of an appropriate Erosion and Sediment Control Plan. The risk of pollutant discharges from the reclamation area and southern logyard will be mitigated by the upgraded stormwater treatment system. Ecological effects of disposal of dredged material are mitigated by placing the material in a hydrodynamically highly active area of similar lithology to the source material and where larger coastal process dominate the factors which govern ecological communities.

Residual effects which are unable to be avoided, remedied or mitigated, and which are deemed to be more than minor in significance should be offset. Offsetting in this context implies a like-for-like replacement of ecological and biodiversity values. Neither a first-principles or an EIANZ analysis concludes that the overall level of adverse effects will be more than minor for any Twin Berth element. Therefore, the need for consideration of other strategies such as compensation in relation to the reclamation is not triggered.

This conclusion is of particular importance in relation to the proposed reclamation, for which offsetting would not be feasible as in any practicable sense, it would not be possible to create elsewhere the natural benthic habitat lost to reclamation.

5 NEW ZEALAND COASTAL POLICY STATEMENT POLICY 11

Policy 11 of the NZCPS is directed at the protection of indigenous biological diversity in the coastal environment. Subclause (a) of Policy 11 requires the avoidance of adverse effects of activities on six biological elements; specifically:

- indigenous taxa that are listed as threatened or at risk in the New Zealand Threat Classification System Lists;
- taxa that are listed by the International Union for Conservation of Nature and Natural Resources as threatened;
- indigenous ecosystems and vegetation types that are threatened in the coastal environment, or are naturally rare;
- habitats of indigenous species where the species are at the limit of their natural range, or are naturally rare;
- areas containing nationally significant examples of indigenous community types; and
- areas set aside for full or partial protection of indigenous biological diversity under other legislation.

In respect of marine ecological habitat and biodiversity values, none of these criteria are triggered in relation to the Twin Berths. Little penguin is noted but the current use of the Twin Berth elements by this species appears to be very limited and can be avoided by the implementation of the proposed Penguin Management Plan.

Subclause (b) of Policy 11 requires the avoidance of significant adverse effects, and the avoidance, remediation or mitigation of other adverse effects in a further six ecological circumstances; specifically:

(i) areas of predominantly indigenous vegetation in the coastal environment;

(ii) habitats in the coastal environment that are important during the vulnerable life stages of indigenous species;

(iii) indigenous ecosystems and habitats that are only found in the coastal environment and are particularly vulnerable to modification, including estuaries, lagoons, coastal wetlands, dunelands, intertidal zones, rocky reef systems, eelgrass and saltmarsh;

(iv) habitats of indigenous species in the coastal environment that are important for recreational, commercial, traditional or cultural purposes;

(v) habitats, including areas and routes, important to migratory species; and

(vi) ecological corridors, and areas important for linking or maintaining biological values identified under this policy.

The applicability or otherwise of Criteria (i) to (vi) of part (b) of Policy 11 are discussed below

Criterion (i): *areas of predominantly indigenous vegetation in the coastal environment*

There are no parts of the Twin Berths footprint that contain a predominance of indigenous vegetation (such as seagrass or kelp beds). Common marine alga occur on parts of the outer breakwater subtidal zone. This algal community has developed on a man-made habitat and is likely to recover following the breakwater upgrade. This criterion is not triggered.

Criterion (ii): *habitats in the coastal environment that are important during the vulnerable life stages of indigenous species*

All indigenous marine life is potentially vulnerable at some point in its life history and therefore the habitats occupied at those times can be considered important. However, at a population scale, the local habitat area encompassed by the Twin Berths is unlikely to be important unless there are specific species which have an obligatory need to use it, rather than any other area beyond or more widely available. Furthermore, the footprint encompassed by the Twin Berths, for the most part is manmade, highly developed or influenced by existing port activities. In this context, no vulnerable indigenous species have been identified in the sampling or are considered likely to be present. The use made by of port structures by post larval crayfish will not be affected relative to the status quo and the post juvenile crayfish habitat that appears to be offered by the Outer breakwater will be replaced and enhanced in the medium term. The outer reclamation breakwater will offer a significantly increased new area of potential habitat to crayfish. This criterion is not triggered in respect of marine species.

The criterion may be triggered in respect of little penguin. The existing southern logyard seawall affected by the Twin berths reclamation would appear to offer limited potential to penguin in its current state. Impacts on the local penguin population can be avoided during the construction stage by appropriate management. This is covered in the penguin assessment of effects (4Sight, July 2022).

Criterion (iii): *indigenous ecosystems and habitats that are only found in the coastal environment and are particularly vulnerable to modification, including estuaries, lagoons, coastal wetlands, dunelands, intertidal zones, rocky reef systems, eelgrass and saltmarsh*

There are no significant natural intertidal zones or significant rocky reef systems within or affected by the Twin Berths. This criterion is not triggered.

Criterion (iv): *habitats of indigenous species in the coastal environment that are important for recreational, commercial, traditional or cultural purposes*

There are no natural habitats within the Twin Berths that are important recreationally or commercially. Notwithstanding that it is a created habitat, the outer breakwater hosts a population of juvenile crayfish. Effects on the crayfish habitat and population are likely to be short term and to recover once the breakwater upgrade is completed. Post development the habitat should be considerably more extensive for crayfish given that subtidal parts of both the outer breakwater and the outer reclamation revetment will have approximately 60% voids which should enhance habitat potential.

Several important habitats near to the Twin Berths have been identified in the CIA. These include the Kaiti reef system (kai moana and seaweed collection); The Foul Grounds (crayfish) and the surf and shallow subtidal zones to the west of the port and shoreward of the OSDG (surf clams). None of these areas should be adversely affected by the Twin Berths, including dredge spoil disposal.

Criteria (v): *habitats, including areas and routes, important to migratory species*

The Twin Berths does not include habitats, areas or routes likely to be important to 'migratory' species in the context of this criterion. It is unknown if the outer breakwater is used by crayfish as a transit route between settlement in the port and wider reef areas. In any event that potential will not be lost as the breakwater will be upgraded and expanded not lost. This criterion is not triggered.

Criteria (vi): *ecological corridors, and areas important for linking or maintaining biological values identified under this policy*

As noted above, the importance, if any, of the breakwater to local crayfish populations is unknown. The upgrade of the breakwater will in any event preserve any corridor or linking role it may have upon completion of the works.

Conclusion:

In summary, there are no areas of significant indigenous vegetation or significant habitats of indigenous fauna within or otherwise adversely affected by the Twin Berths project and therefore section 6(c) of the RMA, which requires the protection of such features as a matter of national importance, is not triggered.

In reference to the above Policy 11(a) matters, adverse effects are avoided for all criteria.

In reference to Policy 11(b) matters Criteria (i) and (iii) are not triggered. Criteria (ii) might be triggered in respect of little penguin. Policy 11(a) (ie avoidance of effects) can still be met through implementation of an appropriate management plan that will avoid adverse effects on the local penguin population and which will provide improved habitat potential and reduced disturbance and predation levels relative to the present situation. Criterion (iv), (v) and (vi) might be triggered in respect of crayfish but habitat prospects are likely stronger than exist for the present environment. Effects are mitigated and are resolved to the extent that they are short term and ecological values and functions are maintained.

6 BIOSECURITY

Part of the consent application process for projects of this nature which involve use of vessels (dredgers and barges) from outside of the region (including from offshore) typically require consideration of the risk of species of biosecurity concern being introduced on vessels. Also, there is a potential for biosecurity species which might already exist within the port, being moved beyond the port on vessels or in dredged material or incidental to construction activities. This latter risk is of less significance if the risk of dispersal by natural means already exists.

Dredging and Disposal Vessels and Barges

Vessels on entry to NZ waters must comply with Ministry of Primary Industries (MPI) border controls, standards and guidelines which address and mitigate biosecurity risk associated with ballast water, residual on board sediments and biofouling. Entry of these and other domestic vessels into the Gisborne coastal region also falls within the biosecurity jurisdiction of GDC[69]. Given the length of the project, the prospect of vessels moving in and out of the region is high and so biosecurity surveillance and certification will be mandatory irrespective of the Twin Berths resource consent application process.

Biosecurity risk associated with vessels involved in the Twin Berths and which are within the port for extended periods, could be assessed and risk mitigated if inspections are undertaken as part of the annual port and harbour biosecurity surveys by GDC, or Eastland. Eastland have agreed to have this aspect included in a Biosecurity Management Plan (BMP) which is proposed as part of the recommended conditions of this consent application.

[69] 'National leadership for marine biosecurity is the responsibility of the Ministry of Primary Industries (MPI), with responsibility for regional leadership sitting with regional councils' http://www.environmentguide.org.nz/issues/marine/marine-biosecurity/

Sediments Excavated and Disturbed During Dredging and Disposal

Investigation of the sediments within the dredged footprint of the port and PNC for hazardous marine organisms is currently not required. No hazardous marine organisms have been reported in the 2014 or 2020 biological surveys at the OSDG.

The risk of transfer of hazardous marine organisms from the dredged area to the nearby OSDG can be assessed by reference to a Lyttleton Port investigation by Cawthron Institute (Sneddon et al, 2016; section 9.4)[70]. That report describes a broadly comparable example in the context of associated biosecurity risk and amplifies some important points which are also relevant to the Eastland maintenance dredging programme.

The Channel Deepening Project (CDP) as the Lyttleton example is known, involves 18 million cubic metres of capital dredging and is therefore a much larger project in terms of the scale of dredging activity. Benthic substrates in the Lyttleton channel extension area and the disposal ground are relatively uniform semi-consolidated muds. The Cawthron report notes:

'…*For any risk to arise as a result of spoil transfer, HMO's* [hazardous marine organisms] *would need to be present in the dredged sediments (including associated water), but not in the disposal area, and not only survive the transfer process but also establish self-sustaining populations in the disposal area. However, such events would only be of biosecurity significance if spoil transfer was the only (or major) pathway by which HMO spread and establishment in the disposal area could occur…*]

The Cawthron report further notes that *Sabella* (fanworm) and two other formally designated species (the sea squirt *Styella clava* and the Asian kelp *Undaria pinnatifida*) has been reported from Lyttleton Port. Of these, only fanworm has been reported at Gisborne port. The Cawthron report notes that fan worm (and *Styella*) is more often prevalent on hard substrates but have the capacity to live in soft sediments, especially where shell material is present. Sediments at Eastland port and the OSDG do not have a significant shell proportion. They are predominantly very fine sands and muds. The Cawthron report also notes that while there is a theoretical risk of transfer of fan worm in dredge spoil, '…*Sabella would not be able to reattach* [in fine substrates] *and would be unlikely to survive…*'.

However, there are mixed opinions on the potential for fanworm to colonise soft substrates and the associated biosecurity risk. Recent information presented in relation to the proposal to dredge the inner Gisborne harbour (not part of the Twin Berths) suggests there are other locations, such as the Hauraki Gulf, where this has been documented albeit on substrates that are not subject to the disturbance associated with busy port environments[71].

The Cawthron report makes some useful comments in the context of future risk of fan worm spread following the species potentially becoming established within a dredged area or being present in the water column at the time of dredging. In that context the report commented '… *the close proximity of the disposal ground* [in the Lyttleton case about 2km offshore at its closest point] *minimises the risk in terms of subsequent spoil transfer. Relative to the life history and reproductive characteristics of marine species, the distance from the dredged channel to the spoil grounds is short. Any species accidentally introduced to Lyttleton Port … that has the capacity to spread via natural dispersal processes to the dredged channel will equally be capable of spreading to the spoil grounds*…'. The Cawthron report comments that none of the hazardous marine organisms considered in the report, including *Sabella*, are likely to thrive in disturbed conditions.

Overall, the Cawthron report concludes that for the Lyttleton Port Channel project, biosecurity risks were negligible from the proposed capital dredging.

The recent biosecurity surveys at Gisborne suggests that there is an active reproducing 'population' of fanworm. Taking the Lyttleton example, similar factors apply in Gisborne Port that should limit future biosecurity risk associated with

[70] Sneddon R, Atalah J, Forrest B, Mackenzie L, Floerl O. 2016. 'Assessment of impacts to benthic ecology and marine ecological resources from the proposed Lyttelton Harbour Channel Deepening Project'. Prepared for Lyttelton Port Co Ltd. Cawthron Report No. 2860a. 190 p. plus appendices

[71] Dr S Kelly. Review memorandum re Eastland Port Ltd, Maintenance Dredging and Disposal Consent Application, CP-2021-110698-00 & others. (Coast & Catchment 19/10/2021)

the presence of fan worm which have to date been documented on hard structures at the port and marina. These are in particular:

- the fine, relatively soft substrates in the dredging footprint at the port and the OSDG;
- the very high levels of physical disturbance within that footprint from dredging and in the case of the PNC, also from waves and littoral transport of sands in Poverty Bay and mud from the Turanganui river;
- the modelled dispersive character of the OSDG and specifically the offshore transport from the OSDG of at least a similar volume of sediment annually from the OSDG as is likely to be placed on it in the form of maintenance dredged material; and
- the proximity of the OSDG to the dredging area and port which makes it more likely that *Sabella* would or could disperse naturally from the port/marina to that area in any event.

These factors support a conclusion that any biosecurity risk associated with the dredging is likely to be small. While a BMP is warranted to deal with matters covered above, further assessment or monitoring of sediments for hazardous marine organisms within the dredging footprint itself is not required. As has been noted, a comprehensive biological survey of the OSDG is already part of the proposed monitoring at 5-yearly intervals. That monitoring provides some sensitivity to any significant colonisation of the OSDG by hazardous marine organisms.

7 PROPOSED MONITORING

This report does not provide detail of the proposed monitoring that is likely to be required to support the construction and operational phases of the Twin Berths other than to note that monitoring will be required of the following:

i. Effects of sediment losses on water quality from the construction of the reclamation

ii. Effects on receiving water quality from the two discharges associated with the upgraded SLY stormwater treatment facilities

iii. Ongoing monitoring of the suitability of maintenance dredged material for disposal to the OSDG

iv. Ongoing biosecurity monitoring as detailed in an approved Biosecurity Management Plan

v. Ongoing little penguin monitoring as detailed in an approved Penguin Management Plan

vi. Ongoing monitoring of benthic communities, sediment texture and contaminants at the OSDG

Draft Consent Conditions which cover these matters will be prepared after lodging the consent applications and are not presented as part of this report.

It is noted that there is a suite of existing consents held by Eastland which provide appropriate scope and wording for most of the required monitoring conditions. Many similar Consent Conditions are part of relatively recently issued consents and these provide a template for the Twin Berth conditions. It is important the Twin Berths are consistent with these earlier consents unless they contain some obvious error or limitation. This is applicable for monitoring under subpoint ii, iii, iv and vi above, where monitoring programmes will be appropriate to adopt much as they currently stand under existing consents, or with only minor modification.

Monitoring under subpoint i above will be best developed once more detail is known of the construction method and timing. However, it is noted that there is a long period of monitoring experience relating to the SLY southern discharge. This has shown the difficulty of monitoring in situ measurements in the marine environment in such an exposed location. On this basis, it is expected that such monitoring will not be routinely undertaken for the reclamation project. Rather, visual based monitoring from land vantage points is envisaged that only needs to ensure that there is not consistent movement of high concentration sediment plumes toward the potentially more sensitive ecology of the Kaiti Reef system.

Monitoring under subpoint iii is recommended to include ongoing annual monitoring of the existing array of potential contaminants at the existing Port monitoring sites which include a background reference site at the Turanganui River bridge. This monitoring also incorporates trigger conditions for monitoring background contaminant levels in Poverty Bay and at the OSDG. These were approved in the Environment Court Consent Notice for the Wharf 6 and 7 Redevelopment.

8 CONCLUSIONS

The following conclusions are drawn with respect to effects of the Twin Berths and associated monitoring.

8.1 Outer Breakwater Upgrade

a. The elevated height and concrete cap will offer more rather than less habitat suitable for resting/roosting seabirds.

b. On completion it will occupy a slightly larger area of seabed. The seabed ‘footprint’ of the structure will increase from about 8,000m^2 to 10,700m ^{2}, constituting a loss of seabed of about 2,700m^2. However, the intertidal area associated with the refurbished structure will increase by 1,400m^2. This intertidal zone should in time be colonised by a variety of marine life which occur on nearby intertidal shores along the Kaiti reef.

c. Although there will be a loss of seabed under the expanded structure, the subtidal parts of the new breakwater should redevelop a greater area of reef type habitat than currently exists. This habitat supports a relatively diverse community which includes small crayfish. It is estimated by the engineers that this habitat will comprise about 60% voids and this should enhance refuge habitat potential for invertebrates, crayfish and small fishes.

d. Although the existing Outer Breakwater habitat is man-made, the presence of a relative diverse reef type fauna and flora subtidally and the good numbers of small crayfish in the sampling, afford it a medium ecological value under an adapted EIANZ based assessment framework (hereafter EIANZ).

e. Subtidal ecological values should be restored, or potentially improved in time due to the larger areas of intertidal and subtidal habitat associated with the new structure.

f. Overall, there will be some short to medium-term adverse ecological effects during and post construction but ecological recovery is likely.

g. There is a potential for localised small scale water quality effects associated with construction.

h. The ecological effect level of the Outer Breakwater Upgrade is assessed as Low under EIANZ. Net longer term effects can be considered at least neutral and probably positive.

8.2 Wharf 8 Extension

i. There are no significant or otherwise notable ecological values associated with the marine areas affected by the Wharf 8 extension.

j. The placement the new vertical steel piles and other activities associated with the Wharf 8 extension will have a small and immaterial effect on the marine habitat and water quality.

k. The ecological effects level associated with the Wharf 8 extension is assessed as Very Low under EIANZ.

8.3 Outer Port Reclamation

l. The proposed reclamation totals an area of approximately 0.89ha of which 0.26ha is existing revetment footprint. Therefore, the area of seabed lost to new reclamation is some 0.63ha.

Intertidal

m. Existing intertidal areas and intertidal ecological values affected by the reclamation are very limited and confined to the existing seawall, the toe of which sits for the most part at or slightly above MLWS. The high exposure of this part of the seawall to wave energy and also the physical form of the substrate limit its ecological potential and value.

n. Ecological impacts on the existing intertidal zone from the reclamation are negligible and no valuable natural habitat will be lost.

Subtidal

o. The subtidal seabed area to be reclaimed is shallow and exposed to high wave energy. It has a mostly mobile and unstable sandy substrate which does not host significant benthic biota.

p. The area that will be lost includes one small, isolated rock feature, and a short section of the innerbreakwater on its southern side. These have some local ecological value as reef type habitat. Loss of this habitat will be more than offset by the new revetment which will protect the new reclamation. That will sit in deeper water than is presently the case and should over time develop a similar ecology to that on the subtidal parts of the southern side existing Outer Breakwater. This community has been shown to be relatively diverse. It is likely the subtidal parts of the new revetment will also be used as habitat by marine life including crayfish, as this structure too is predicted to be in the order of 60% voids. This new subtidal habitat is a positive ecological element.

q. Overall, the ecological effect level of the reclamation is assessed as Low under EIANZ.

Water Quality

r. Water quality effects such as visible sediment plumes, associated with the construction of the reclamation, including any discharges from within the reclamation area, should be localised. Given the open coastal aspect to the site, and its high energy, it is a well flushed locality. Any plumes should rapidly dissipate and not cause off site adverse ecological or significant water quality related impacts.

s. Physical modelling suggests significant plumes or sediment deposition should not move in the direction of or impinge upon Kaiti reef. Such influences are predicted predominantly to be to the north. This prediction notwithstanding, a contingency should be in place in any erosion and sediment control plan, to manage and limit so far as is practical, any period of plume dispersion with a potential to impact the Kaiti reef.

8.4 Stormwater Upgrade

t. The success with the current ULY and WLY stormwater treatment approach provides a template for upgrade of the Southern Logyard stormwater management system. The stormwater from the new reclamation will be integrated into an upgraded treatment train for all stormwater generated by the Southern Logyard. This will involve more retention (storage) time, chemical flocculation and particulate interception through lamellar clarifiers. Discharges will be through the existing northern and southern outlets.

u. Based on a strong body of monitoring data from the other logyards, the upgraded system should significantly improve the quality of stormwater discharged from the Southern Logyard from both existing discharge locations. There should be much reduced concentrations of suspended particulates which are expected to enable the applicable water quality standards to be met.

8.5 Dredging Effects

Habitat and Biota

v. Earlier ecological surveys, biosecurity surveys by GDC over the period 2006 to 2021, combined with recent 4Sight surveys and monitoring since 2015, in combination with recent physical surveys and modelling assessments, provides an adequate baseline of information and data from which to establish the likely present day ecological values and sensitivity in the dredging footprint and adjacent zones.

w. No important habitat or significant biota occurs within the dredging footprint. No 'at risk', 'threatened', or species of conservation significance (as listed on the NZ Threat Classification System[72]), will be affected or occurs within the dredging footprint or at the OSDG.

x. The dredged footprint is dominated by fine, muddy substrate in the port, and unconsolidated substrates in the PNC. The ecology of the latter has been reported to be suppressed by physical scour from littoral sand

[72] D Freeman, K Schnabel, B Marshall, D Gordon S Wing, D Tracey and R Hitchmough. Conservation Status of NZ Marine Invertebrates. Threat Classification Series 9

movement, high concentrations of suspended material, significant wave energy and low light, and modified by past and present port activities.

y. Dredging effects will be the same or similar in scale to that arising from the existing consented dredging activities other than in respect of the dredging of rock which either outcrops or is near the surface in the outer part of the PNC. These areas are a small part of a wider subtidal rocky area (Foul Grounds).

z. A larger area of low relief outcropping rock is likely to be exposed in the PNC following dredging. As these areas will not be subject to further routine maintenance dredging, the prospect of recolonisation of that substrate by similar species as currently occur is likely. Therefore the effects on that part of the dredged footprint are likely not to be long term.

aa. Overall, the ecological effects level of the dredging has been assessed as Very Low under EIANZ.

bb. Marine mammals or birds are not known to specifically aggregate within dredging area (or OSDG) although they may be present unpredictably as itinerants.

Water Quality

cc. The sediments to be dredged are unpolluted and not a significant source of bioaccumulative or otherwise potentially persistent or toxic contaminants that could be mobilised or otherwise be transported at concentrations to affect marine life or water quality within or beyond the port zone. The quality of the dredged material poses no significant concerns with respect to potentially toxic or bioaccumulative contaminants.

dd. Water quality related dredging effects include increases in suspended sediment and turbidity plumes. Based on the local experience with dredging at the port, and as supported by the MetOcean modelling studies, such effects will be relatively localised and will be of a similar scale and intensity to those already arising from historical and the current level of dredging activity.

ee. Shipping movements and storm events frequently increase turbidity within the port and can render dredging related effects on turbidity less intense and conspicuous. The harbour is frequently of low sensitivity to dredging related impacts on colour and visual clarity due to these other and often prevailing background influences.

ff. Modelling from MetOcean suggests that there will not be significant dredging related sediment plumes reaching the Kaiti reef system or local beaches. This is consistent with ecological observations which indicate a relatively diverse intertidal and subtidal biological community in the direction of Kaiti reef notwithstanding historical and current port activity.

gg. Turbidity generated from the use of a backhoe dredger, is highly localised and a small scale/minor effect in terms of water quality.

hh. Water quality classification standards will be met in respect of dredging other than in relation to effects on visual clarity which may be intermittently exceeded during and for short periods after a dredging episode. Relative to other influences on visual clarity, potential dredging effects are small/minor.

ii. Sediment within the port, taking all potential sources into account, is likely to impact habitat quality and survival of juvenile crayfish which settle into the Wharf 7 area. Sediment influences on this area are likely governed by the large plumes generated by ship movements alongside the adjacent wharfs and by storm discharge events. Sediment generated by dredging is likely to be a lesser and small influence on crayfish habitat relative to that arising from these sources. Dredging effects on juvenile crayfish habitat are considered minor and not to warrant specific mitigation. However, if required they can be appropriately managed by consent conditions limiting dredging methods to backhoe dredger adjacent to Wharf 6 & 7.

Biosecurity

jj. At least one notified hazardous marine organism (Mediterranean fanworm) is reported from the port environs and recent biosecurity surveys suggest a viable reproducing population of this species somewhere in the inner port.

kk. An analysis of factors governing the biosecurity risk associated with fanworm, within the context of the proposed dredging and transport and disposal of dredged material, indicates there is likely to be little if any change to the present biosecurity risk. Any biosecurity risk associated with the dredging is concluded to be small and can be managed via the proposed Biosecurity Management Plan.

8.6 OSDG Effects

ll. The coastal process and modelling studies provide important information in interpreting biological values and ecological effects at the OSDG.

mm. The studies suggest that even in the absence of disposal of dredgings, the biology on this flat fine sediment area of seabed, would be limited by and adapted to high natural inputs of sediment. The physical studies have shown that the OSDG is a high energy and highly dispersive environment with a net transport of fine material offshore toward the continental shelf. The recent physical studies have concluded that there will be minor morphological effects on the predominantly muddy seabed within or near the OSDG. There is predicted to be an annual transport of movement of sediment offshore which is greater in volume than the average annual dredging volume.

nn. From the estimates supplied in the coastal process reporting, sediment depositing at the OSDG from the proposed dredging disposal will remain a small proportion of the ambient flux experienced at the area in response to natural events and to riverine sources from the Waipaoa and Turanganui Rivers.

oo. Disposal of dredged material to the OSDG has been shown in successive benthic ecological surveys not to have effects on the soft seabed communities within the OSDG that would differentiate them from those in the wider area. These communities, while assessed as having medium ecological value, are considered likely to be adapted and responsive to, the naturally high sediment regime that prevails in the area.

pp. Information provided in a Cultural Impact Assessment suggests a range of surf clam species occur shoreward of the OSDG. The assessment of effects, and in particular the physical modelling information, supports a view that any such populations beyond the OSDG are unlikely to be adversely affected by the Twin Berths.

qq. The ecological effects level is assessed as Low under EIANZ.

rr. Modelling studies suggest disposal related turbid plumes are relatively short lived and localised at the OSDG.

ss. The water quality classification SA standards will be met in respect of disposal other than in relation to the temporary short-term effects on visual clarity. Such an impact is concluded to be minor.

tt. There is no known or predictable concentration of birds or marine mammals at the OSDG that might otherwise be affected by the disposal operation.

Biosecurity

uu. There is no change to the present biosecurity risk associated with disposal of dredged material to the OSDG. That risk is concluded to be small and probably negligible, and in any event is able to be managed by the biosecurity checks of vessels involved in the Twin Berths and the certification protocols covered in the BMP.

8.7 Mitigation of Effects

vv. Under the EIANZ based regime used to assess ecological value, the magnitude of ecological effect and an overall level of ecological effect, moderate or greater overall levels of effect can be considered as warranting ecological offset or potentially compensation. None of the Twin Berths elements are assessed as reaching an overall moderate level of effect or as requiring these management responses when assessed under the EIANZ regime or on a first-principles basis.

ww. No habitat-based mitigation of perceived potential effects on juvenile crayfish settlement within the port is required given the dominating and regular influence of sediment plumes generated by ship and tug movements and storm events within the port. Risks, if any, to juvenile crayfish in this habitat will not change relative to the status quo.

xx. The porous nature of the proposed Outer Breakwater upgraded structure and the new reclamation seaward revetment, both of which will be an estimated 60% voids, will offer significant enhancement of potential crayfish habitat opportunities in the port.

yy. Existing consented requirements to mitigate visual effects on water clarity in the port and the OSDG are by way of a 2 hours and 6-hour window to allow for plume dissipation following a dredging episode at the port and the OSDG respectively. These time frames appear arbitrary and are of limited practical use. In the port basin, plumes generated by TSHD and ship movements rapidly permeate the entire basin, making conspicuous visual change between port and background waters difficult to detect at times. At the OSDG, the distance from any vantage points makes plume boundaries with background conditions indistinct and probably notional at best.

zz. The highly porous nature of the proposed Outer Breakwater and Reclamation revetment structures is likely to also provide significant mitigation to any short-term impacts on other 'reef-associated' marine life.

8.8 Ecological and Water Quality Monitoring

aaa. It is recommended that a monitoring regime directed at sediment losses and visual water quality associated with the reclamation construction be developed once further clarification is available on the dredging method and timing.

bbb. It is recommended that a regime of monitoring treated stormwater discharges from the upgraded SLY stormwater management system, and for monitoring receiving environment water quality within the existing consented mixing zones for the two discharge locations be developed. This should be based on but rationalise where appropriate, the existing monitoring programmes for the SLY discharges and have reference to recent monitoring regimes approved to the ULY and WLY stormwater discharges

ccc. It is recommended that the present programme of annual monitoring of heavy metals and selected other contaminants at representative sites within the VTB, and PNC be continued and is consistent with existing sediment monitoring in the port area and background sites.

ddd. This monitoring is to reaffirm the quality of the sediments to be maintenance dredged relative to ANZAST, 2018 sediment quality guideline values, and its suitability for offshore disposal and to verify that contaminant increases do not occur at the OSDG relative to background conditions. It is further recommended that background sites are extended to better understand the extent of elevation of Nickel and Poverty Bay.

eee. It is recommended that triennial elutriate testing of sediments from the VTB is continued to confirm that mobilisation of heavy metals during dredging does not occur at levels that would cause toxicological risk in the water column.

fff. It is recommended that an updated Biosecurity Management Plan be prepared to address matters raised in section 6 of this report.

ggg. It is recommended that the OSDG and background sites are monitored at five yearly intervals for biological community metrics and surficial sediment characteristics (texture and chemistry).

8.9 Overall Conclusion

In summary, the Twin Berths for the most part affects areas which are already part of, or impacted by, port structures and operations. The marine ecological and water quality assessment has not identified any impacts or potential for loss of biodiversity values that are concluded to be of a moderate or greater level of ecological or water quality significance and which might warrant consideration of ecological offset strategies. Rather, it is concluded that the Twin Berths development through its construction and operational phases, will have minor effects on the existing ecological and water quality values both within and beyond the port and the OSDG.

Appendix A:

Sediment Metal Concentrations Adjacent To The Kaiti Reef: February 2020

	P1	P6	P7	P16	P17	TEL	ANZG DGV	ANZG GV-high
Arsenic	5.9	4.9	4.5	6.3	14.1	7.24	20	70
Cadmium	0.018	0.017	0.029	0.025	< 0.02	0.68	1.5	10
Chromium	4.7	4.2	4.4	4.9	3.5	52.3	80	370
Copper	3	2.6	2.7	3.6	2.6	18.7	65	270
Lead	2.9	2.3	2.3	3.3	3.3	30.2	50	220
Mercury	< 0.02	< 0.02	< 0.02	< 0.02	< 0.04	0.13	0.15	1
Nickel	5.1	4.7	5	5.6	3.5	15.9	21	52
Zinc	28	22	27	26	15.5	124	200	410

From '4Sight Consulting Ltd, November 2019 'Outer spoil ground and Kaiti Reef sediment quality assessment'. Prepared for Eastland Port.

Appendix B:

OSDG Sediment Metal Concentrations:

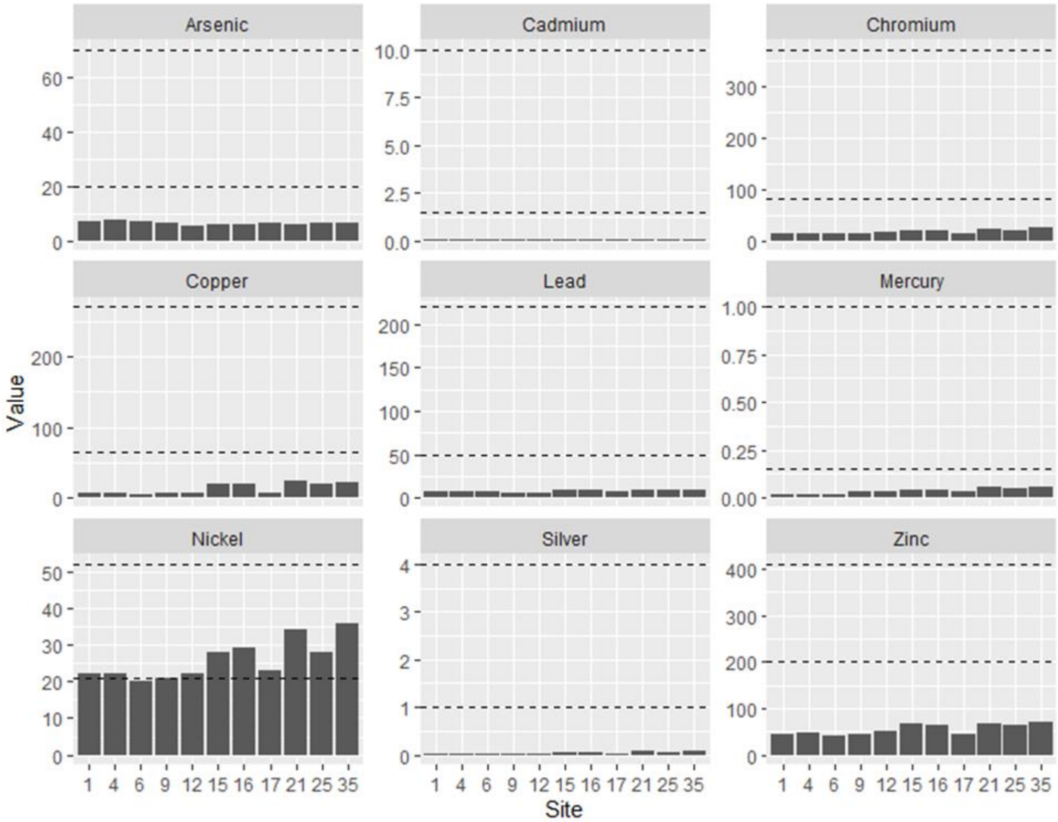
AUGUST 2019 SURVEY

(from 4Sight Consulting Ltd, November 2019. Outer spoil ground and Kaiti reef sediment quality assessment. Prepared for Eastland Port by 4Sight Consulting)

	OSG 1	OSG 2	OSG 3	OSG 4	OSG 4 - 1	OSG East Control	OSG West Control	Average	TEL	ANZG DGV	ANZG GV-high
Arsenic	5.3	6.4	5.8	4.6	4.9	6.1	5	5.4	7.24	20	70
Cadmium	0.026	0.038	0.026	0.031	0.034	0.02	0.034	0.0	0.68	1.5	10
Chromium	11.7	17	13.6	13.8	13.8	13.5	13.3	13.8	52.3	80	370
Copper	5.4	13.2	7.9	6.9	7.4	6.4	6.9	7.7	18.7	65	270
Lead	5.5	7.3	6.3	5.3	5.7	6.4	5.6	6.0	30.2	50	220
Mercury	0.02	0.05	0.03	0.03	0.03	0.02	0.02	0.0	0.13	0.15	1
Nickel	16.8	24	23	20	21	21	20	20.8	15.9	21	52
Zinc	41	55	45	44	45	43	43	45.1	124	200	410

JULY 2020 SURVEY

Sediment heavy metal concentrations at eleven sites sampled in July 2020. The dashed horizontal lines denote the DGV (lower) and DV-High (upper) ANZG guidelines 2018 (from 4Sight Consulting Ltd, November 2020. *Offshore Disposal ground For Dredged Sediment. Sediment Quality Survey.* Prepared for Eastland Port by 4Sight Consulting).



Appendix C:

Southern Logyard Stormwater Monitoring Summary

LAND. PEOPLE. WATER.

Southern Logyard Stormwater Monitoring Summary

Eastland Port

December 2020

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List of Figures

Dr Pete Wilson – Senior Coastal Scientist (4Sight Consulting)

Notes Prepared December 2020

All calculations conducted using results for MH1 in the discharge or surface measurements at mixing zone or background sites. Results that were below the laboratory reporting level were assumed to be the concentration of the reporting level (i.e., <0.01 was assumed to be 0.01).

1 PIPE TSS VS PIPE TURBIDITY

- Is turbidity an appropriate proxy for total suspended solids?
- Strong correlation between total suspended solids and turbidity (R^2 = 0.68; Figure 1)
- Relationship strongest for TSS concentrations less than 750 g/m^3 and turbidity values less than ~1000 (R^2 = 0.9) and close to a 1:1 relationship (i.e., 1 g/m^3 total suspended solids = 1 NTU).
- Above these concentrations, turbidity measurements typically overestimate the TSS concentration (i.e., 5 out of 7 results) based on the linear fit of the data.
- Based on these data, TSS could be estimated using turbidity measurements noting that this is less reliable at turbidity levels > about 1000 NTU.

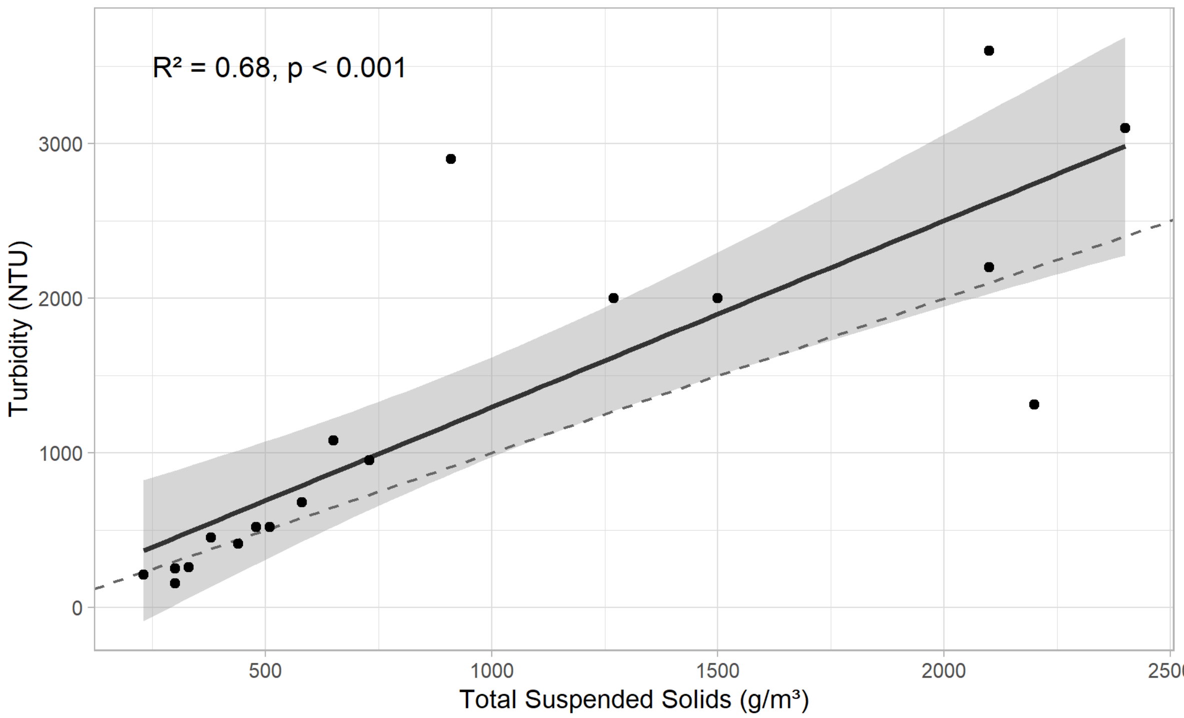

Figure 1: Total suspended solid concentration vs. turbidity in the MH1 stormwater discharge. The solid line is a linear fit through the data and the shaded area the 95% confidence interval of the fit. The dotted line denotes a 1:1 relationship.

2 PIPE TSS VS PIPE TANNIN

- No significant correlation ($p > 0.05$)
- Similar observation for turbidity vs. tannin ($p > 0.05$)

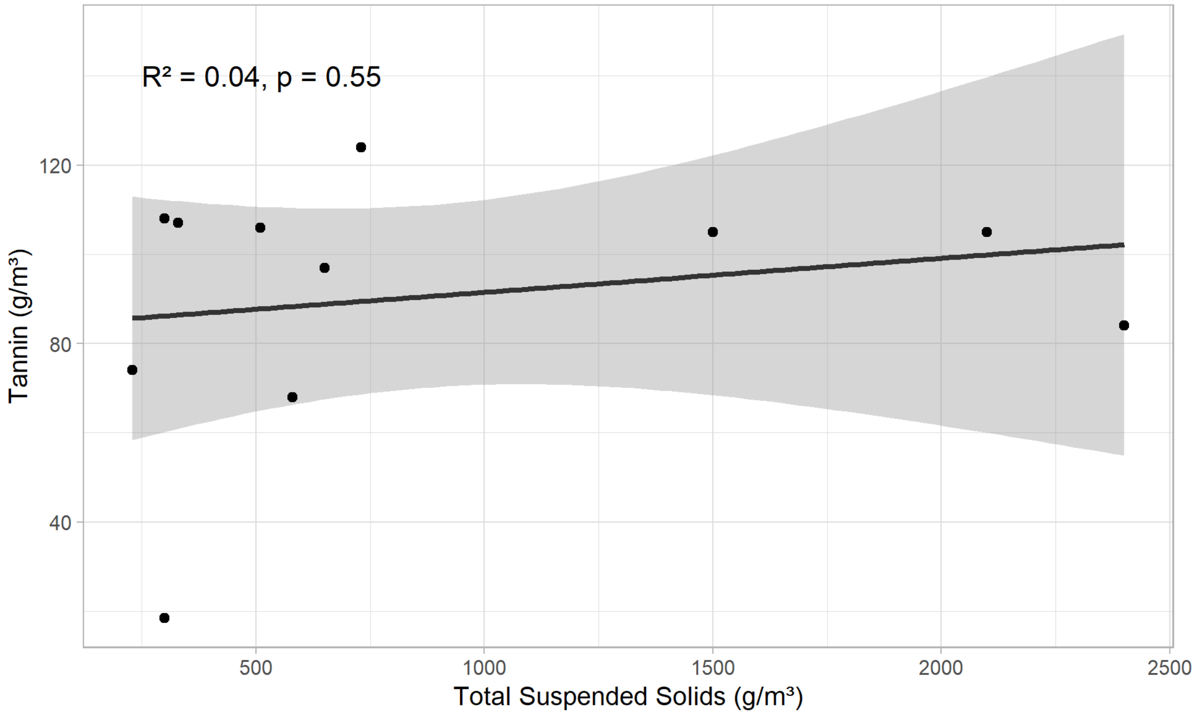

Figure 2: Total suspended solid concentration vs. tannin concentration in the MH1 stormwater discharge. The solid line is a linear fit through the data and the shaded area the 95% confidence interval of the fit.

3 PIPE TANNIN VS RECEIVING ENVIRONMENT SURFACE TANNIN

- No significant correlation ($p > 0.05$)
- Mixing zone sample is a composite surface sample from the three monitoring locations

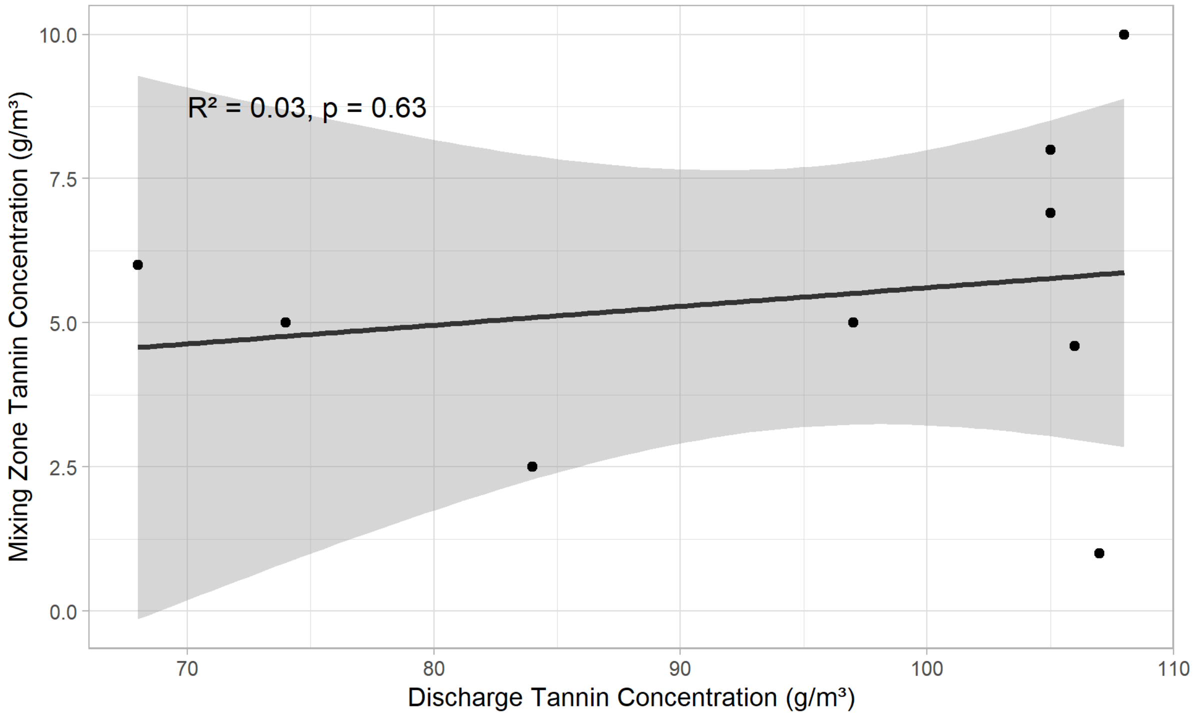

Figure 3: Tannin concentration in the MH1 stormwater discharge vs. tannin concentration measured at the boundary of the mixing zone. The solid line is a linear fit through the data and the shaded area the 95% confidence interval of the fit.

4 PIPE TSS VS MAX MIXING ZONE SURFACE TSS

- Discharge TSS concentrations vs. maximum TSS concentration from the three mixing zone locations
- No statistically significant correlation ($p > 0.05$)
- However, in general, higher TSS concentrations were measured in the mixing zone when there were higher TSS concentrations in the discharge
- The correlation will likely become statistically significant with additional results.

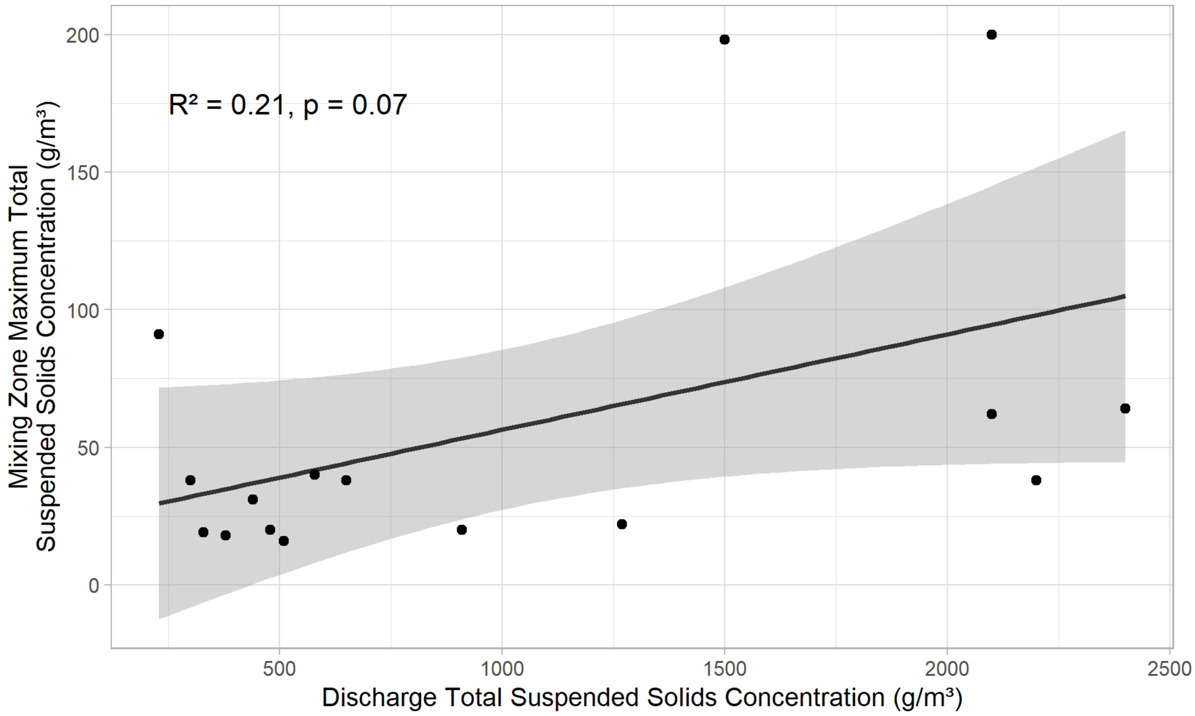

Figure 4: Total suspended solids concentration in the MH1 discharge vs. maximum total suspended solids concentration measured at three mixing zone locations. The solid line is a linear fit through the data and the shaded area the 95% confidence interval of the fit.

Correlation is poorer when the discharge concentration is assessed against each of the mixing zone locations. That is, there is a better relationship between the discharge concentrations and the maximum mixing zone concentration than there is between the discharge and each of the mixing zone monitoring locations on their own. The individual correlations are shown in Figure 5.

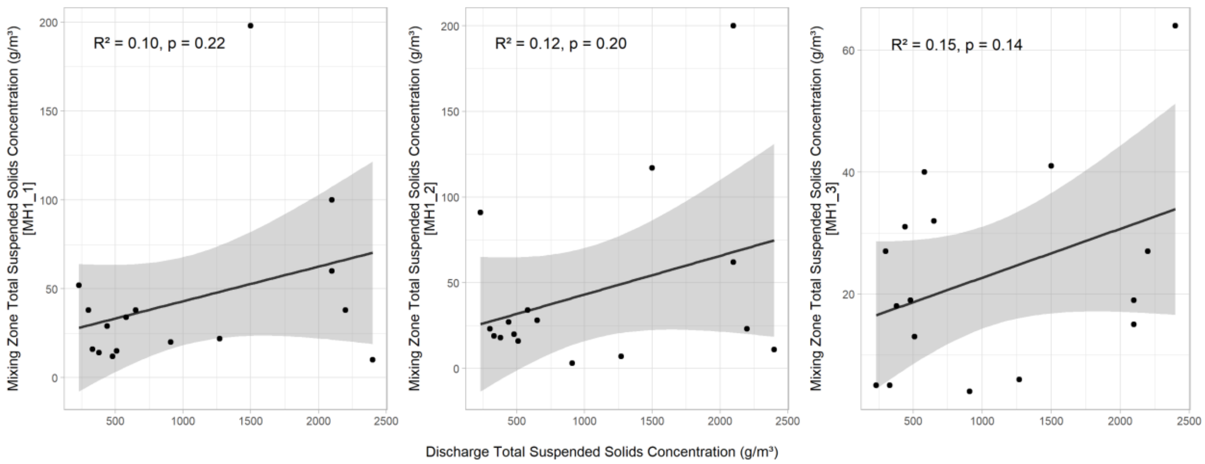

Figure 5: Total suspended solids concentration in the MH1 discharge vs. total suspended solids concentration at each of three mixing zone locations. The solid line is a linear fit through the data and the shaded area the 95% confidence interval of the fit.

5 PIPE TSS VS MIN BACKGROUND TSS

- Does it look as though pipe TSS influences so-called background conditions?
- No statistically significant relationship ($p > 0.05$ and very low R^2 value)
- Based on these data, the minimum background TSS concentration does not appear to be influenced by the discharge from SLY.

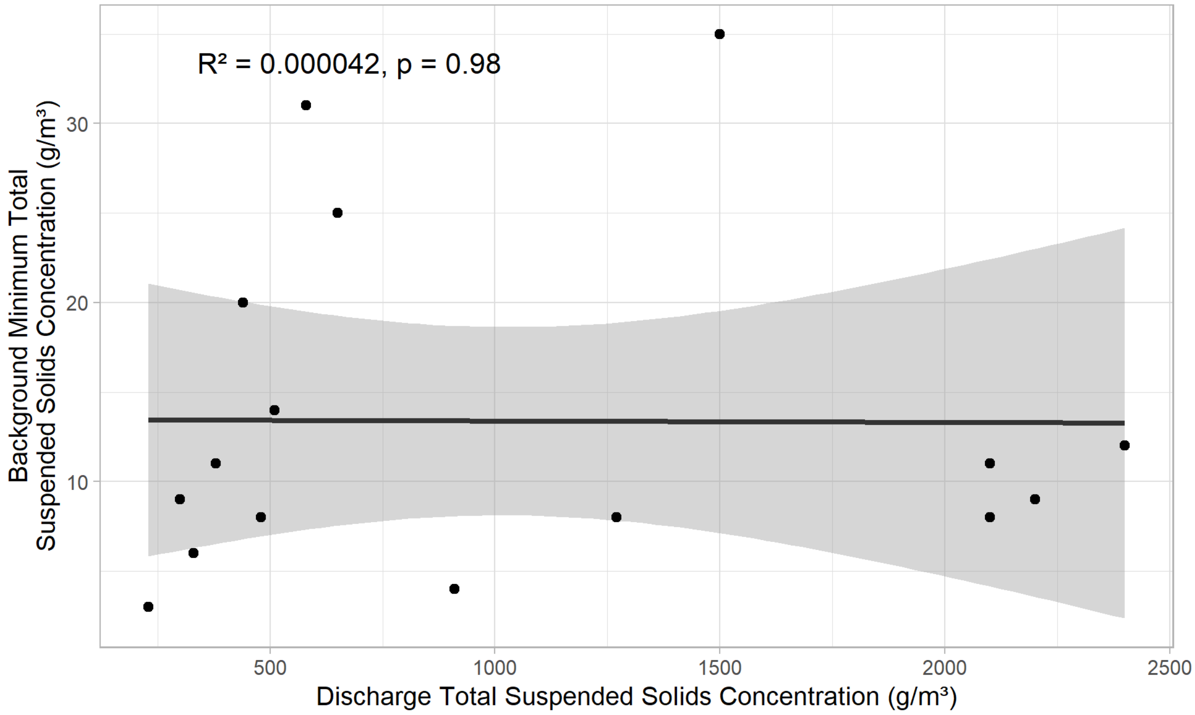

Figure 6: Total suspended solids concentration in the MH1 discharge vs. the minimum total suspended solids concentration from the three mixing zone locations. The solid line is a linear fit through the data and the shaded area the 95% confidence interval of the fit.

6 PIPE TSS VS INDICATIVE TSS DILUTION FACTOR (THE LATTER BEING A CALCULATION OF PIPE TSS/MAX MIXING ZONE SURFACE TSS

- No statistically significant relationship between the TSS concentration in the discharge and the amount of dilution that occurs at the boundary of the mixing zone based on the maximum TSS concentration in the mixing zone. (i.e., dilution = discharge TSS concentration / maximum mixing zone concentration)
- Dilution of TSS at the boundary of the mixing zone is highly variable when the TSS concentration in the discharge is higher.

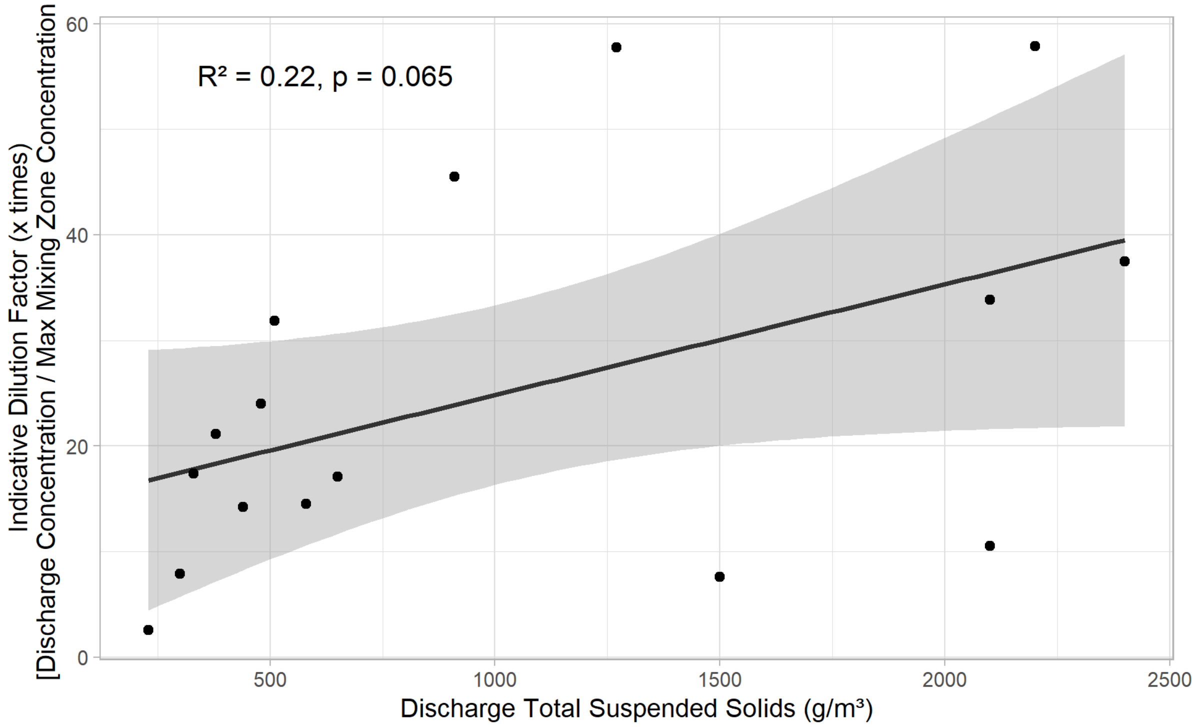

Figure 7: Total suspended solids concentration in the MH1 discharge vs. the indicative dilution of TSS at the boundary of the mixing zone. The solid line is a linear fit through the data and the shaded area the 95% confidence interval of the fit.

7 PIPE TSS VS PIPE DISSOLVED CU

- No statistically significant correlation between TSS and dissolved copper in the discharge.

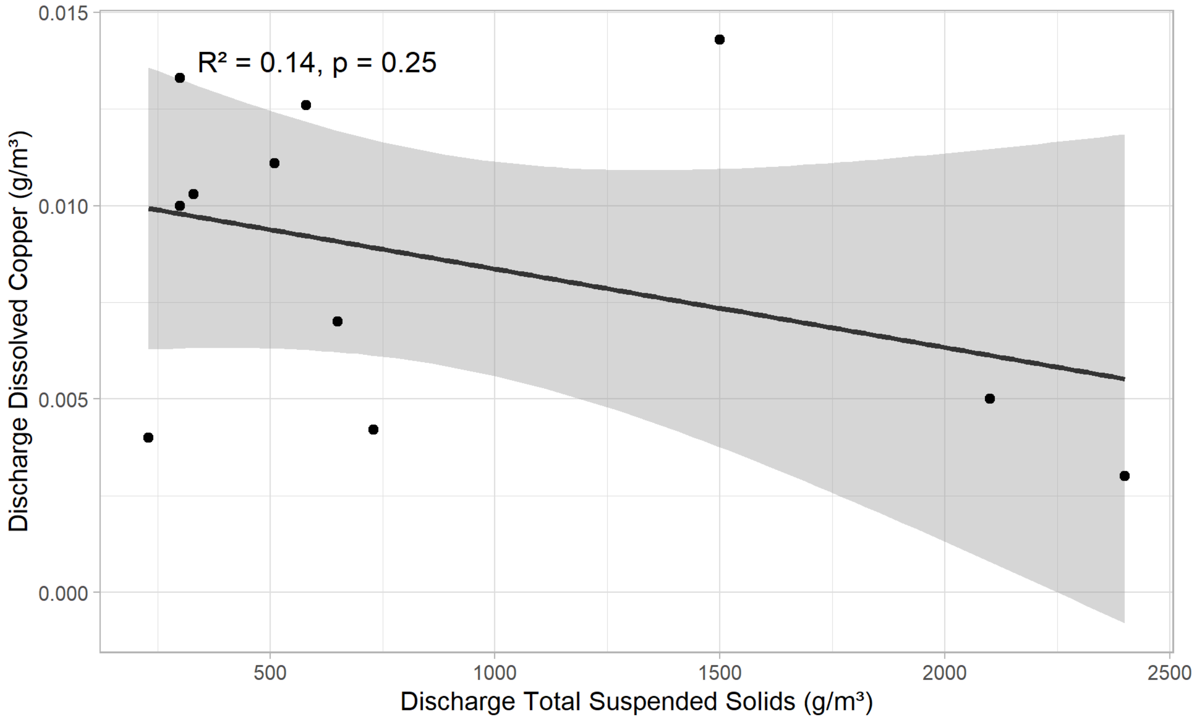

Figure 8: Total suspended solid concentration vs. dissolved copper in the MH1 stormwater discharge. The solid line is a linear fit through the data and the shaded area the 95% confidence interval of the fit.

8 PIPE TSS VS MAX RECEIVING ENVIRONMENT SURFACE DISSOLVED CU

- No statistically significant relationship between TSS in the discharge and the maximum dissolved copper concentration measured at the three mixing zone sites.

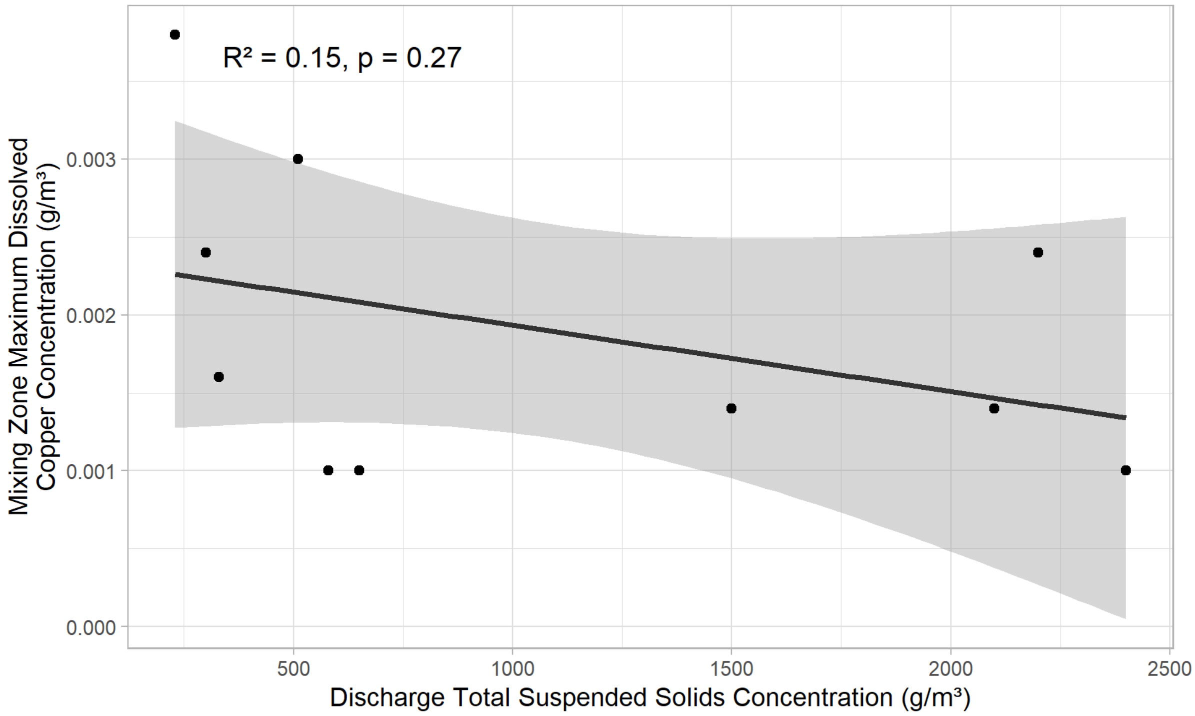

Figure 9: Total suspended solids concentration in the MH1 discharge vs. the maximum dissolved copper concentration from the three mixing zone locations. The solid line is a linear fit through the data and the shaded area the 95% confidence interval of the fit.

9 PIPE DISSOLVED CU VS MAX RECEIVING ENVIRONMENT SURFACE DISSOLVED CU

- No statistically significant relationship dissolved copper concentrations in the discharge and the maximum dissolved copper concentration measured at the three mixing zone sites.

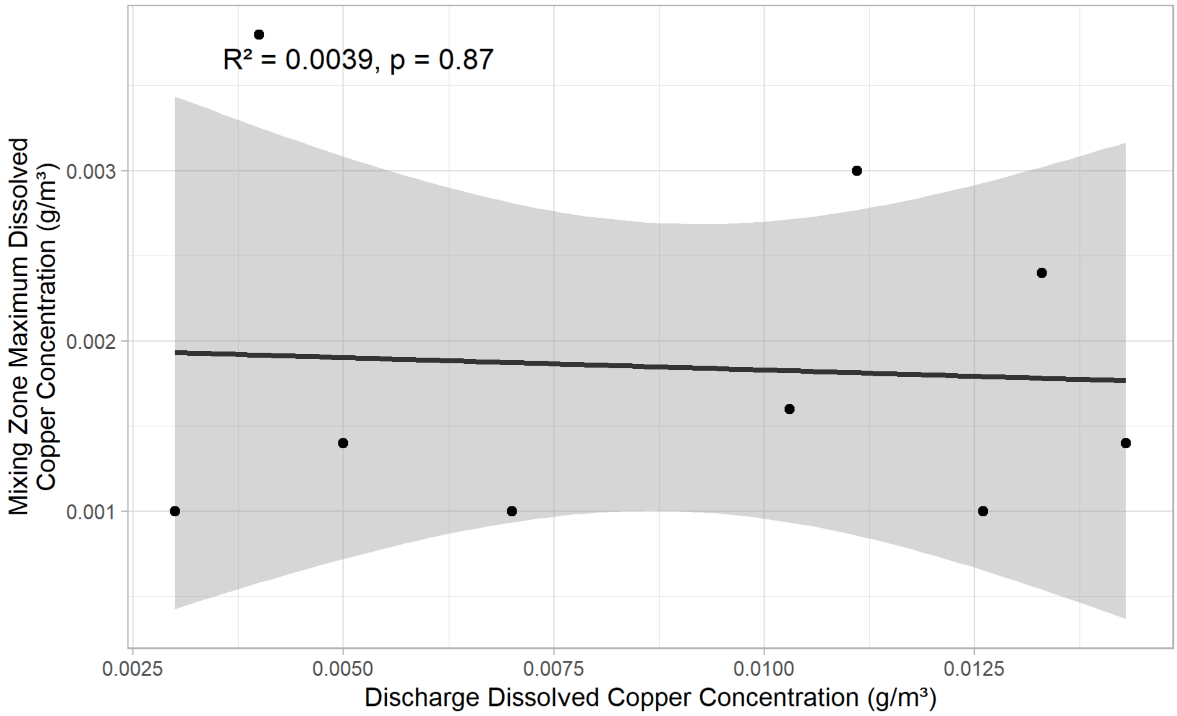

Figure 10: Dissolved copper concentration in the MH1 discharge vs. the maximum dissolved copper concentration from the three mixing zone locations. The solid line is a linear fit through the data and the shaded area the 95% confidence interval of the fit.

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