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# RESOURCE CONSENT APPLICATIONS FOR PROPOSED LYTTELTON HARBOUR/WHAKARAUPU RECLAMATION ACTIVITIES

## Review of Assessment of Effects on the Coastal Marine Area

**Submitted to:**  
Canterbury Regional Council  
PO Box 345  
Christchurch

REPORT

**Report Number.** 0978107325



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## 1.0 INTRODUCTION

### 1.1 Background

Lyttelton Port Company Ltd (LPC) has applied to the Canterbury Regional Council (CRC) for resource consents for activities associated with the proposed reclamation of land at Te Awaparahi Bay, Lyttelton. The proposed reclamation is to provide for port activities, including the expansion and on-going use of the existing coal stockyard facility.

LPC has applied for the following coastal permits associated with the proposed reclamation activities in the Coastal Marine Area (CMA):

- **CRC101530** – to construct a piled wharf in the coastal marine area at Te Awaparahi Bay.
- **CRC101531** – to reclaim and deposit seabed material in the coastal marine area at Te Awaparahi Bay.
- **CRC101532** – to dredge approximately 100,000 cubic metres of seabed material at Te Awaparahi Bay and deposit seabed material in the coastal marine area between Battery Point and Godley Head.
- **CRC101574** – to occupy 10 hectares (ha) of reclaimed area at Te Awaparahi Bay.

Golder Associates (NZ) Limited (Golder) was engaged by CRC to review these resource consent applications in relation to the assessment of effects of the proposed reclamation activities on the coastal marine area. This review has been prepared following:

- Lodgement of the resource consent application (with supporting documentation) by LPC in November 2009.
- Initial review of the application and documents.
- Request for further information about the proposed activities and effects.
- Meetings between Golder staff and the applicant to discuss the further information requested.
- Provision of further information by LPC in July 2010.

### 1.2 Scope of Report

This report<sup>1</sup> provides a review of LPC's assessment of the effects of the reclamation activities on the coastal marine area.

This report is supplementary to the overview report prepared for all regional council resource consent applications (hereafter referred to as the Officer's Report) associated with the proposed reclamation. Full details of the applications are provided in the Officer's Report. This report focuses on the assessment of effects on the coastal environment and includes a review of the proposed mitigation and monitoring in relation to coastal effects. LPC also proposes to discharge stormwater into the coastal marine area during the construction of the reclamation, and from the on-going operation of the coal stockyard facility. The review of the assessment of the effects of the stormwater discharges is covered in a separate report, which is included as Appendix 4 to the Officer's Report.

To carry out this review we have considered the following documents:

- The Assessment of Environmental Effects (AEE) provided by LPC in November 2009 referenced in this report as LPC (2009).

<sup>1</sup> This report is subject to Golder's report limitations which are provided in Appendix A.



- Ocel (2009) (Appendix 13 to LPC 2009).
- Cawthron (2009) (Appendix 14 to LPC 2009).
- The response to requests for further information submitted by LPC on 30 July 2010.
- The Regional Coastal Environment Plan for the Canterbury Region (2005).

We have also taken into account issues raised by submitters in relation to coastal ecology. As summarised in the Officer's Report submitters raised concerns about effects on marine mammals, loss of seabed and marine life, and effects of dredging on coastal ecology.

### 1.3 Qualifications

This report was prepared by Emily Jones and Michelle Lee.

Emily Jones is a Marine Scientist at Golder. She has an MSc (Distinction) in Marine Science from the University of Otago and has over 5 years experience as a marine science consultant.

Michelle Lee is a senior noise specialist at Golder. She has a BEng (Hons) in Engineering Acoustics and Vibration from the University of Southampton and over 16 years consulting experience.

## 2.0 STATUTORY FRAMEWORK

In considering the effects of the coastal reclamation activities we have been guided by the statutory framework provided by Chapter 6 and Chapter 8 of the Regional Coastal Environment Plan for Canterbury (RCEP), which is covered in detail in the Officer's Report.

In brief, the RCEP seeks to enable people to use the CMA and its resources while avoiding, remedying or mitigating effects on the environment (Objective 8.1). This includes effects on natural character, ecology, amenity value, Tangata Whenua, and historic and cultural values of the coastal environment. Sites and habitats of natural value are to be protected and where appropriate enhanced (Objective 6.1).

The RCEP does recognise the importance of commercial activities such as the Port of Lyttelton operation, and provides for such activities to occur provided the adverse effects of these activities are avoided, remedied or mitigated.

## 3.0 ASSESSMENT OF CONSTRUCTION EFFECTS

### 3.1 Introduction

The proposed reclamation involves the following key elements:

- The construction of a piled wharf.
- Dredging of the seabed.
- Deposition of rocks and other material to create the reclaimed area.
- Disposal of surplus dredging material to existing dredge spoil disposal areas in Lyttelton Harbour.



These activities have the potential to affect marine ecology in the area, including benthic organisms, fish, marine mammals and seabirds, as discussed below.

### 3.2 Construction Effects on Benthic Habitat

#### 3.2.1 Summary of the applicant's assessment

A description and summary of the benthic ecology in the immediate vicinity of the proposed reclamation was provided in the AEE and Cawthron (2009), including results from a field survey that examined intertidal and benthic ecology, water quality, and sediment characteristics for the purposes of preparing the AEE. Current information was compared to previous reports on the Lyttelton Harbour / Whakaraupo (the Harbour) marine environments.

As a general summary, the seafloor sediments in the vicinity of the proposed reclamation are largely uniform and featureless, and are made up of sandy mud and gravel leading into soft muds at 50-80 metres (m) from the current shoreline. It was noted that the harbour experiences periods of very high volumes of suspended sediments during storms and high-wave conditions, and that benthic habitats are subjected to a continual state of disturbance (including high levels of turbidity) due to the high degree of sediment mobility, swells and wave fetch characteristics. Te Awaparahi Bay was described as a relatively high-energy shoreline and as a tidal backwater where tidal circulation resulted in weak vortices spinning off the main tidal flow passing across the bay.

It was stated that no organisms or communities of special scientific or conservation interest were identified in the intertidal or benthic subtidal environments of Te Awaparahi Bay.

Taxa identified from the subtidal environment of the bay were considered to be tolerant of high turbidity conditions and capable of relatively rapid recovery following disturbance.

The intertidal community of the Te Awaparahi Bay shoreline was described as typical of rocky shorelines in inlets and harbours, and was comprised of species that were considered to be tolerant of elevated turbidity and moderate to high-energy conditions.

Effects from construction activities were classified as resulting from the direct physical disturbance of habitats and from indirect processes such as the escape or resuspension of fine sediments and changes in water quality. It was stated that the current state of the environment under the existing operations was used as a starting point for the assessment of the degree of change resulting from the proposed activities. The greatest single impact on benthic ecology was deemed to be the direct removal and disturbance of the soft sediment benthic habitats in the footprint of the proposed reclamation. The implications of this disturbance were discussed further in the report with regard to the occupation of benthic habitat.

Construction of the rock platform to support the bund of the new reclamation was considered to result in the greatest physical disturbance to benthic habitats outside the reclamation area, as a consequence of physical displacement of soft sediments through the weight of the platform and potential scatter of rock material. It was concluded that this would only occur in the narrow zone along the edge of the proposed reclamation, and that the benthic species in the area are highly tolerant of deposition impacts and capable of a rapid recovery which would probably occur within a period of months.

Turbidity generated during the construction of the reclamation bund was expected to be minimal. The applicant's marine ecological assessment (Cawthron 2009) highlighted that construction methods emphasised avoidance of significant sediment resuspension through: bunding, the type of material used (i.e., clean rock rubble), the techniques for placing materials, and the use of geotextile to line the seabed. The assessment described the area between the proposed reclamation and the channel (i.e., the potentially affected area) as already subject to turbidity plumes generated by ongoing activities (such as maintenance dredging) and that there are substantial resuspension processes and benthic sediment fluxes operating naturally within the Harbour. Therefore, the resident benthic communities would be tolerant of the turbid conditions experienced during the construction phase. Furthermore, it is suggested that dredging for reclamation would not add significantly to plume exposure and would be reduced by dispersive tidal flows.



The applicant also discussed the potential effects arising from the release of fine sediment from loess used to backfill the reclamation. The use of filtration geotextile was described as mitigation to limit the flow of fine sediments through the seawall bund, although it was noted that this would not capture everything from the tidal displacement of seawater from within the reclamation fill area. It was concluded that sediment plumes from the reclamation fill area would be rapidly dispersed by tidal currents and indistinguishable from natural background turbidity within a short distance from the source. Therefore, this potential effect was expected to be highly localised to the margins of the reclamation and would be temporary.

With regard to the construction of the piled wharf, the disturbed benthic area was considered to be small and effectively limited to the offshore piled structures. The benthic habitat was described as already modified by the presence of the breakwater and subject to ongoing disturbance from dredging in the berth pocket and vessel movements. In view of the lower ecological value of the area and given the modified and disturbed nature of the environment, as well as the limited area of additional disturbance, the effect on benthic ecology was stated to be less than minor.

In respect to the timing of construction, the further information response documentation provided some detail on the expected duration of the construction period such that "if staged, it is estimated that the construction period of Stage 1 and Stage 2 reclamation is each about 18 months. However, Stage 2 would take an additional 18 months to fill the reclamation and would take longer to consolidate. It is not known what time of year construction would commence for any option."

The potential impacts on benthic environments resulting from incidents of equipment failure or accidents during construction (such as the loss of hydraulic fluid or fuel spills) were discussed in the applicant's further information response. It was indicated that refuelling of vehicles would be undertaken away from coastal marine areas where practicable; that all machinery would need to be maintained to minimise the potential for equipment failure; that standard cleanup procedures would be employed by LPC; and that these measures would form part of contractual arrangement matters between LPC and contractors employed to carry out construction activities.

### 3.2.2 Review of the applicant's assessment

The proposal supplied sufficient detail of the current state of the benthic habitat in the direct vicinity of the proposed reclamation and there was some discussion of how this habitat compared to other areas of the Harbour using well-known reference material.

We agree with the applicant's assessment of the value of this environment in its current state, and that the benthic community is likely to be represented elsewhere throughout the Harbour. Although the benthic ecological community has values in its own right, the community is not considered to have uniquely local value or contain any particular species that provide specific values. Overall, it is a community that has developed a tolerance of turbid and moderately disturbed water conditions.

Although there will be a complete loss of benthic habitat within the reclamation footprint, we are in general agreement with the conclusions that there would be minimal effects on the benthic habitat of Te Awaparahi Bay (outside of the reclamation footprint) and that recovery in any benthic areas affected by construction activities would be relatively rapid, if environmental conditions resulting from the proposed construction are as described in the application (i.e., limited sediment resuspension, low sediment contamination, minimal escape of fines from infill). There is, however, lack of certainty in some aspects of the proposed construction methodology that should be elaborated on to better determine the level of potential impact. The key points are discussed below.

The reclamation bund will be constructed through the use of bottom-dump barges. Although, this is a common method of construction, the applicant has not provided clear information on the impact of dumping on sediment loss and movement. Initially the first deposits would impact on the seabed – depending on the water depth at the time of barge opening. Further dumping would result in different disturbance as the rock fill is layered on top or spills into adjacent seabed. No comment on the loss of sediment from the rock likely to be used for construction was provided.



There are minimal specific details on the predicted effectiveness of the filtration geotextile and / or silt curtain to be used to mitigate the escape of fines from the reclamation infill. While we agree that the effectiveness of these mitigation options would be appropriate under normal conditions, it would be beneficial to determine the extent to which these methods would function under adverse conditions such as extremely rough sea states. For instance, how far would a sediment plume extend into the Harbour should a sudden, uncontrolled release of sediment-laden seawater escape from the reclamation paddock following damage to the silt curtain or geotextile. While it is considered acceptable that the effect on the nearby benthic habitat would be as described in the applicant's AEE, it may be possible that such an influx of heavy suspended sediment load would impact on other areas outside of the immediate vicinity of the proposed reclamation. Such an incident could also impact on other marine fauna such as marine mammals and seabirds as described further in this report.

Furthermore, there are conflicting conclusions as to how increases in suspended sediment load (i.e., seepage from the reclamation paddock or by dredging activities) would be naturally dispersed. The applicant states on page 48 of the AEE (LPC 2009) that "*any escape of sediment would be largely confined to the tidal backwater in Te Awaparahi Bay and would be indistinguishable from seabed sediment disturbed by natural wave action.*" They further state that the existing navigation channel also acts as a sink for suspended sediment. However, further in the assessment (also on page 48) it is indicated that the additional resuspended material would be minimised by "dispersive tidal flows", which suggests that the additional sediment load would be dispersed by the tidal flow that passes the bay, rather than contained within the backwater vortices. While the applicant has discussed the effects on increases in suspended sediments and turbidity on the immediate benthic habitat, there is little information to confirm that wider-spread impacts on benthic habitats may not occur as a result of construction activities, and / or whether there are significant species, communities or habitats that occur elsewhere in the Harbour which could come under the influence of water quality changes further afield.

The cumulative effects of this activity, in combination with other activities occurring in the Harbour, have not been considered. The overall assessment of the proposal was based on the current state of the marine environment of Lyttelton Harbour, which has already been impacted, and continues to be impacted, through port operations, other discharges to the coastal marine area, and other marine-based activities such as recreational fishing and boating. While we agree that the degree of impact and change on the current benthic community may be minimal and recovery is likely to occur within several years, there has been no consideration given to the cumulative effects of minor activities throughout the life of the Port. The cumulative effects of the proposed activities, in combination with other activities occurring in the vicinity of the Port, may lead to an incremental decline in the state of the marine environment, and this has not been assessed. The Department of Conservation also noted in its submission that the applicant had failed to adequately address impacts that included cumulative effects.

### 3.3 Construction Effects on Fish

#### 3.3.1 Summary of the applicant's assessment

The fishery resources of Lyttelton Harbour were described in the applicant's response for further information. The benthic habitat in the vicinity of the proposed reclamation was not considered to possess any ecological characteristics of specific importance to feeding or spawning activity for local fish populations (i.e., faunal communities, biogenic structures). The reclamation was not considered to present a barrier to fish passage either during construction or in subsequent operation and there would be no effect from any changes in harbour tidal flows and circulation, which were described as negligible. Overall, effects on fisheries and other ecological resources resulting from direct disturbance to habitats during construction were expected to be minimal.



### 3.3.2 Review of the applicant's assessment

The description of fish fauna in the vicinity of Lyttelton Harbour concentrated on populations that were targeted for recreational fishing or were common harbour species. The detail provided on these populations was sufficient for an assessment of the likely effects on these species and we concur with the overall conclusions in the applicant's assessment. However, the presence (or absence) of commercial fisheries was not commented on in the application. It may be that there is little or no commercial fishing carried out in Lyttelton Harbour, although it would be beneficial to confirm that this is the case and to ensure that changes in water quality or other environmental conditions will not impact on such practices.

As suggested earlier, the cumulative effects of the proposal have not been considered, and little consideration has been given to the incremental or cumulative changes in fish species populations.

## 3.4 Underwater Noise Effects on Marine Mammals and Fish

### 3.4.1 Summary of the applicant's assessment

The effects of underwater noise from the reclamation and wharf construction activities were assessed by the applicant in the response to the further information request, specifically Appendix E of the response letter, which is a report prepared by Hegley Acoustic Consultants (Hegley (2010)). This assessment was provided in response to question 41 of the request for further information.

The first section of Hegley (2010) sets out the results of the existing ambient noise measurements undertaken in Te Awaparahi Bay. The report identifies the equipment to be used during piling activities and provides references for source levels of underwater pile drivers and the predicted level at various distances including 200 m, 500 m and 1000 m. The report then sets out the characteristics of a typical pile driver, audiograms of various dolphins and whale species and the hearing thresholds for bottlenose dolphins and white whales (Beluga) and assessed the potential underwater noise effects on the Hector's dolphin. They note that there is no evidence to suggest that the proposed reclamation area serves as an important, unique or rare habitat for any marine mammal species and that it is unlikely that any sea mammals would remain in close proximity to a high noise environment. They conclude that the piling activities are unlikely to induce temporary threshold shift (TTS) in the hearing of dolphins.

The potential underwater noise effects on fish are also assessed in Hegley (2010), and it is concluded that there are unlikely to be any adverse behaviour effects on fish unless fish are very close to the piling (within approximately 30 m).

Overall the applicant concludes that they do not expect there to be anything more than a temporary alteration to the behaviour of sea mammals and fish in the vicinity of the proposed piling.

### 3.4.2 Review of the applicant's assessment

We agree with the position of the measurement location and the equipment used to undertake the ambient noise measurements in Te Awaparahi Bay and the measured levels are considered to be representative of a typical harbour area. We note that standard methodologies have been adopted in predicting the noise levels and agree that the source level of the pile driver adopted in the assessment is conservative.

We agree with the assessment approach and that the piling activities are unlikely to induce TTS in the hearing of dolphins. However the assessment provided does not address the potential effects of behavioural modifications on marine mammals, such as short-term or long-term displacements from noisy areas and mitigation options have not been considered for this effect. Given that Hector's dolphins are a nationally endangered species and are an inshore species previously noted in nearby Gollans Bay, mitigation options would be beneficial to minimise the risk of disturbance on these marine mammals. Mitigation options such as monitored exclusion zones during marine percussive piling work, careful selection of the timing / seasonality of piling, acoustic decoupling and "ramping-up" of the piling hammer and installation of bubble



jacket and / or bubble curtain should be considered. These options are discussed in more detail in the mitigation and monitoring section of this report.

In relation to noise effects on fish, we agree with the assessment approach and that the piling activities are unlikely to have any adverse behaviour effects on fish unless they are very close to the piling. However, we recommend mitigation measures to further minimise the potential effects on fish in close proximity to the piling works. Therefore, the acoustic decoupling and piling hammer mitigation measures which are recommended for marine mammals are also recommended to address the potential effects on fish.

### 3.5 Other Construction Effects on Marine Mammals

#### 3.5.1 Summary of the applicant's assessment

The marine mammals known to frequent Lyttelton Harbour or its entrance waters were described in the response for further information request, which highlighted that there were seven cetaceans (whales / dolphins) and one pinniped (seal) species that had been seen in the Harbour. Further effects assessment focussed on three main species that would potentially be found in the vicinity of the proposed reclamation, including Hector's dolphin (*Cephalorhynchus hectori hectori*), New Zealand fur seals (*Arctocephalus forsteri*) and southern right whales (*Eubalaena australis*). Hector's dolphin has been previously observed in Gollans Bay. It was noted that detailed information of the distribution and habitat usage of marine mammals was only available for a small number of species in New Zealand and that much of the information has been estimated from opportunistic sightings and stranding records, tourism reports and research in nearby areas.

Factors influencing marine mammal populations as a result of the proposed reclamation activities included a potential increase in vessel traffic, potential habitat loss, and exposure to port activities that could lead to long-term avoidance behaviour. Indirect effects that were considered included physical changes in the habitat that could affect the health of the ecosystem and / or impinge on important prey resources.

It was stated that the proposed construction is not expected to result in any direct effects (i.e., physical injuries, direct mortalities, significant habitat loss or long-term avoidance) by the three species under consideration. It was determined that there was a low probability of construction vessels encountering southern right whales, that fur seals were typically neutral in their response to boats and that Hector's dolphins may be attracted to vessels. The area of habitat loss or disturbance was considered to be very small to insignificant in relation to the species' overall home ranges and was not thought to serve as important or rare habitat for any marine mammal species. Furthermore, it was stated that there had not been any known long-term avoidance behaviours noted for these species despite the previous level and type of port and construction activities occurring in the Harbour (i.e., maintenance dredging). It was also concluded that effects from the proposed construction were expected to be temporary and limited to within the immediate area of the reclamation only.

Potential effects resulting from physical changes in the local ecosystem were not expected to occur as the disturbed sediments were relatively uncontaminated, any habitat loss was a small percentage of the overall area, and any increase in turbidity was expected to be similar or less than those currently resulting from on-going maintenance dredging of the nearby shipping channel. Furthermore, the potential effects on prey species were also considered to be temporary and localised with no effect on species recruitment.

#### 3.5.2 Review of the applicant's assessment

The applicant has provided a reasonable account of the marine mammal fauna present in the wider harbour area, particularly given the limitations on available data as noted. In general, we agree with the conclusion that the loss of habitat and subsequent local ecosystem changes as a result of reclamation would have little effect on marine mammal populations in the Harbour. Similarly, marine traffic relating to construction (i.e., slow-moving barges) is unlikely to adversely impact on these species.



The potential effects of sediment plumes resulting from escaping fine sediments during construction has not been considered as a direct impact on marine mammal species. Although there is a brief statement to the effect that marine mammal populations have not displayed avoidance behaviours when previously exposed to similar types and level of port activities (i.e., dredging), the nature of the sediment plume has not been sufficiently described to confirm that the suspended sediment load and turbidity levels will be within the tolerance limits of these animals. Furthermore, the potential effects on marine mammals would be different to those on benthic species, particularly if the influx of the sediment plume were to occur in a rapid fashion (i.e., a pulse of suspended solids rather than slow seepage). Given that Hector's dolphins are a nationally endangered species but are also a particularly iconic species in the area, are an inshore species (especially during the summer / autumn calving period) and have been noted previously in Gollans Bay, further investigation of mitigation options for these species during construction would be beneficial to serve as a precautionary approach, and could potentially be incorporated in the recommended monitoring in relation to noise effects on marine mammals.

### 3.6 Construction Effects on Seabirds

#### 3.6.1 Summary of the applicant's assessment

The applicant's response to the request for further information states that the seawall currently provides suitable roosting habitat for seabirds (gulls, terns, shags), but that the seawall is not a significant or valuable habitat for seabirds.

It was also noted that the local white-flippered penguin (kororā; *Eudyptula minor albosignata*) was found in the Harbour but the reclamation site was not considered to be suitable habitat for this species. It was concluded that the reclamation will have no adverse effects on terrestrial ecological values (note that in relation to marine coastal areas this refers to bird roosting areas) within the site, based on the statements that the seawall supports essentially no terrestrial ecological values and will be replaced by a similar structure as part of the new reclamation.

#### 3.6.2 Review of the applicant's assessment

The applicant has provided information on the avifauna and relevant ecological values for the proposed reclamation site only. The description is largely comprehensive and the detail provided is generally in accordance with the scale and significance of the activity. We concur that the current coastal environment within Te Awaparahi Bay itself does not provide significant or valuable seabird habitat, and that similar habitat will be provided by the construction of the new seawall.

It is noted that the applicant's assessment does not investigate indirect effects of changes in the local ecology (i.e., benthic communities) as a potential impact on seabird populations. However, if the effects to seabed ecology are minimal and rapid recovery is likely, as described for benthic habitats throughout this report, then the indirect effects on avifauna should also be of no significance.

As highlighted elsewhere in this report, should construction activities result in the sudden input of heavy suspended sediment loads, there is the potential to create water quality changes further afield than the reclamation site itself. Effects associated with potential loss of sediment will be related to the scale of such events.

In terms of completeness of the assessment, if the scale of a sediment loss event was large enough, seabird populations in adjacent areas of the coastline outside of Te Awaparahi Bay could be influenced by any changes associated with the event (sediment release / loss). The effects may relate to effects on feeding (through visual changes in water) or effects on food sources in shallower areas.

It may be beneficial as a precautionary approach to confirm whether any significant seabird and shorebird populations occur nearby and whether their location would be in proximity to the path of potentially high suspended sediment loads. However, it is noted that this area of the Harbour generally has limited



ecological value for avifauna owing to its highly modified coastline and the current port operations; and thus, it is possible that there may be a paucity of information about these environments in regard to bird habitat values.

### 3.7 Effects of the Deposition of Sediment on Marine Ecology

#### 3.7.1 Summary of the applicant's assessment

Seabed material will require removal from the vicinity of the reclamation prior to construction. The applicant proposes to dispose of the dredge material to the existing consented dredge spoil ground (as mapped in the RCEP) between Battery Point and Godley Head. The dredged material is mainly from loess that has eroded from the surrounding hillsides, and is dominated by fine mud. The quantity of material is expected to be in the order of 100,000 m<sup>3</sup>, which falls within the consented volume limits for the maintenance dredging programme (CRC930648.1).

As such, there is no direct assessment of the effects within the applicant's AEE documentation for the disposal of dredge spoil from construction activities within the current disposal ground.

#### 3.7.2 Review of the applicant's assessment

The applicant has not provided any detailed assessment of the likely effects on the marine receiving environment in the vicinity of the current spoil ground other than to note that it will be deposited in the existing spoil dumping grounds in an amount that is within the currently consented volume limit for LPC's annual dredging programme.

Although the purpose of the dredging is different to that of maintenance dredging, we have assumed that the effects will be similar to those already authorised under the existing consent for the deposition of maintenance dredge spoil, and anticipated in this area when the spoil dumping grounds were incorporated into the RCEP. If the cumulative amount of dredge spoil from the reclamation activities and maintenance dredging is within the current consent limit for maintenance dredging, then the effects on the spoil ground itself should be no more than those currently occurring, and authorised under the existing consent. There is the potential for impacts just beyond the defined boundary of the spoil area; although, given the marine origin of the spoil and its high degree of similarity to benthic sediment in the wider Harbour area, it is likely that the small amount of deposition or increased sediment flux will have negligible ecological effects. Therefore subject to consent conditions which ensure that the amount of dredge spoil deposited under this consent and the existing consent is no greater than what is currently deposited, Golder agrees that the effects of the dumping of dredge spoil are likely to be minor.

## 4.0 OPERATIONAL EFFECTS

### 4.1 Introduction

LPC requires a resource consent for the occupation of the reclaimed area, and this on-going occupation of the coastal marine area will include the stockyard reclamation that requires the removal of a portion of the seafloor and possible changes in local hydrodynamics and sedimentation processes. The potential effects of these activities are considered below.



## 4.2 Effects of the occupation on benthic habitat

### 4.2.1 Summary of the applicant's assessment

Cawthron (2009) discusses the effects of the occupation of the seafloor by the proposed reclamation. The installation of the proposed reclamation represents the direct displacement of up to 13 ha of soft sediment benthic habitat (that is, 10 ha of reclamation plus the edge area to the toe of the rock platform and the existing hard substrate shoreline). The loss of soft sediment represents approximately 0.3% of the total benthic area of Lyttelton Harbour.

No organisms or communities of special scientific or conservation interest were identified in the intertidal or subtidal environments of Te Awaparahi Bay, based on benthic ecological information collected for LPC's assessment or from previous literature, and were considered to occur throughout the wider Harbour area. In view of the type of habitat involved and its distribution throughout the wider Harbour area, the loss of the reclamation area was expected to have a less than minor effect on the functioning and productivity of benthic ecosystems in the Harbour as a whole. It was also noted that there would be a loss of hard substrate for the intertidal community along approximately 800 m of artificial rock wall of mostly recent man-made origin. This will be replaced by a similar shoreline, and is expected to be rapidly colonised by a similar marine assemblage over a period of 2-3 years. This was considered to be an incremental expansion of an existing activity and assumed that the quantity of coal moving through the Port will increase with corresponding increase in loading activity and shipping traffic.

Further effects relating to the occupation of the seafloor were discussed in Appendix 13 of the applicant's AEE (LPC, 2009). It was concluded that the tidal regime would not be noticeably affected by the additional reclamation, despite a reduction in the size of Te Awaparahi Bay. The effect on tidal circulation would also be minimal as the reclamation does not intrude into the main tidal flow. For the same reason, there would be no effect on waves passing up the Harbour to the upper harbour area. The applicant's assessment noted that there would be a slight change in the slope of the rockwall in that the wall would be of a lower gradient, and that this would lessen the reflection of wave energy, but was considered to be of little practical significance. Overall, it was concluded that the net effect on the wave environment would be minimal.

The applicant concluded that there would be no impact on the existing sedimentation regime as tidal flows would remain unchanged. It was noted that there may be a small change in seabed characteristics in the immediate vicinity of the reclamation where gravel and small stones from the wall may settle, but this effect would be the same as that for the existing rockwall.

Overall the applicant concluded that the effects on the harbour tidal current, wave and sediment regimes would be less than minor. The seaward face of the reclamation will be similar to the existing shoreline but with more energy absorption capacity.

In the area of the piled wharf, the benthic habitat was described as already modified by the presence of the breakwater and it is subjected to ongoing disturbance from dredging at the nearby berth and by vessel movements. Furthermore, the disturbed benthic area was considered to be small and effectively limited to the offshore piled structures. In view of the lower ecological value of the area, the effect on benthic ecology was stated to be less than minor.

### 4.2.2 Review of the applicant's assessment

The information presented on the nature of the current benthic habitat and physical characteristics of the marine environment in the vicinity of the proposed reclamation and wharf structure are sufficient for the scale of assessment for effects resulting from occupation of the seafloor. We agree with the conclusion that the benthic community present in the area is largely ubiquitous throughout the wider harbour and that there is little ecological value attributed with this area of the Harbour. The assessment of changes in hydrodynamic or sedimentation regimes also appears to be reasonable given the detail provided in the appendices for the applicant's AEE.



As noted above, this assessment is based on the current state of the harbour's biological communities and on the fact that these environments are already highly modified. The cumulative effects and potential for incremental decline of the marine environment as a result of the proposed activities occurring in addition to other activities in the harbour have not been considered by the applicant and therefore this issue remains outstanding. It is noted that these effects could be difficult to measure if sufficient historical data is unavailable; however it would be beneficial to investigate whether suitable data exists and to provide comment on the degree to which the proposed activities may impact on the harbour environment from a broader perspective over time.

### 4.3 Effects of the Occupation on Marine Pest Species

#### 4.3.1 Summary of the applicant's assessment

The proposed reclamation will create new artificial substrate that may be colonised by marine pest species, which could negatively impact on recolonisation of the area by native species.

The applicant's response to further information included discussion of three key marine pest found previously in Lyttelton Harbour. The species were:

- The Japanese seaweed *Undaria pinnatifida* was considered to be of little interest in the context of the reclamation as it is already well-established in natural and artificial habitats throughout the Harbour and elsewhere in Canterbury, and there have been no significant ecological impacts documented previously. This species is likely to recolonise the new rip rap substrate, but is already present on the existing rip rap and adjacent habitats.
- The clubbed sea squirt *Styela clava* was not considered to be of any specific concern from a biosecurity perspective as it is already spreading uncontrolled around New Zealand.
- The Mediterranean fan worm *Sabella spallanzanii* has been recently detected in the harbour and funding for continued management of this species is presently being decided by Cabinet. Under the assumption that population management continues (as administered by the Ministry of Agriculture and Forestry – Biosecurity New Zealand (MAFBNZ)), this species was considered to be of interest in terms of the reclamation. However, this fanworm is not known to colonise rip rap habitats in the Harbour and was therefore not of significant concern in relation to the new habitat provided by proposed reclamation.

With regard to the general spread of pest species, changes in vessel traffic resulting from the proposal were considered to be of little consequence in regards to biosecurity. However, slow moving vessels such as barges are considered favourable for survival of associated biofouling. Thus, factors of potential concern with the proposed construction include the use of structures / vessels from source regions outside the Harbour, particularly from overseas source regions with known marine pest populations. It was noted that MAFBNZ are working towards developing pre-border vessel hull fouling requirements to reduce risks. In addition, it was suggested in Annexure E of the request for additional information response that mitigation of marine pests could be through consent requirements for the applicant to develop a biosecurity risk assessment and management plan, to identify risks from structures / vessel activities and associated management strategies to minimise biosecurity risk.

#### 4.3.2 Review of the applicant's assessment

The applicant has provided a suitable synopsis of the marine biosecurity issues associated with Lyttelton Harbour and the current Port facilities. We note that MAFBNZ are currently involved in management of Mediterranean fanworm populations within the Harbour, which would provide some mitigation for potential spread of this species as a result of the proposed reclamation activities. We also agree with the suggestion that a marine pest management plan is prepared, particularly to ensure that the potential introduction and spread of marine pests on vessels and equipment used for construction are managed appropriately.



## 5.0 RECOMMENDED MITIGATION AND MONITORING

### 5.1 Monitoring

There is no marine ecological monitoring proposed in relation to the construction activities. While it is unlikely that useful information will be gained from biological sampling, we suggest that water quality monitoring be carried out during the construction phase to provide information to:

- Verify the predicted small scale of water quality effects.
- Assess the actual water quality effects during key activities (e.g., barge dumping, dredging).

During the construction phase it would be beneficial to determine whether input and dispersal of suspended sediments are within the tolerance limits of nearby marine ecosystems, and to trigger appropriate mitigation actions should acute water quality changes occur (i.e., sudden, large sediment plumes from the reclamation area).

Marine environmental monitoring is recommended in relation to the stormwater discharges, which should also be suitable for the assessment of effects on marine biota resulting from the operation of the extended coal stockyard. See Appendix 4 of the Officer's Report for further discussion on marine ecological sampling considerations.

### 5.2 Mitigation

Mitigation options have been included into the design and methodology of the reclamation construction. The applicant highlighted that construction methods emphasised avoidance of significant sediment resuspension through bunding by the seawall, the type of material used (i.e., clean rock rubble), the techniques for placing materials, and the use of geotextile to line the seabed.

Further mitigation (to that proposed by the applicant) to reduce sediment escape from the infill would be achieved through the placement of filtration fabric on the inner side of the rockwall and / or the use of a silt curtain.

The applicant stated that the practical options for further mitigation of sediment resuspension appear to be relatively limited. Further discussion on the probability of large-scale failure of the mitigation options (especially in the use of a silt curtain and geotextile to manage suspended sediment escape) would be beneficial to confirm the appropriateness of these mitigation techniques.

The discussion on potential spread of marine pests resulting from the proposed activities included the suggestion that in the event that vessels were sourced from outside of New Zealand, the possibility of introducing or spreading marine pests could be mitigated by a requirement to develop a biosecurity risk assessment and management plan. A recent example given was the plan developed for a drilling rig operating in waters under the jurisdiction of Marlborough District Council (Forrest & Hopkins 2009).

The following mitigation measures are recommended to minimise the potential effects of underwater noise effects on marine mammals and fish:

- Exclusion zone around the piling barge: an exclusion zone of 500 m radius to be scanned around the work area for at least 30 minutes prior to the start of piling from the barge or an elevated observation point on land. If marine mammals are observed in the exclusion zone, piling is to be delayed until they have left the area. This measure will ensure the area in the vicinity of the piling is clear of marine mammals prior to the commencement of works and will serve to reduce any disturbance to marine mammals.
- Seasonality of piling: The construction of the piles should not be undertaken during the peak calving season of the marine mammals or periods of peak local abundance (e.g., during migratory or breeding seasons).



- Acoustic decoupling: Air compressors and other noisy equipment mounted on the steel piling barge should be acoustically-decoupled to the greatest practicable extent.
- “Ramping-up” of piling hammer: The piling hammer should be “ramped-up” to gradually increase the noise levels after the 30 minute visual inspection had been completed. Activities should be continuous without short-breaks and avoiding sudden random loud sound emissions.
- Installation of bubble jacket and / or bubble curtain: ‘Isolating’ the acoustic sources by the use of bubble jacket and / or bubble curtain around the perimeter of the pile. To be effective, the design of the bubble jacket and / or bubble curtain system should ensure that air bubbles are distributed 100% around the perimeter of the pile and over the full depth of the water column.

## 6.0 CONCLUSION

The applicant has provided a generally good level of detail on the receiving environment, including biological, hydrological and sediment characteristics. The key points arising from the assessment are:

- The assessment was limited to the immediate vicinity of the proposed reclamation and only minimal consideration was given to potential effects further afield.
- There was a lack of detail to adequately assess the possible effects resulting from construction activities in areas further afield than the immediate area of Te Awaparahi Bay, i.e., the distance and profile of sediment plumes from the reclamation area, the efficiency of filtration fabric or silt curtains for preventing sediment escape. If the effects of such activities are likely to extend further than Te Awaparahi Bay and the navigation channel, it would be beneficial to determine whether this would impact on any specific habitats or population, such as bird roosting or feeding areas, and commercial fisheries.
- The cumulative effects of the activities in the coastal marine area and the potential for incremental decline of the coastal marine environment have not been considered. It would be beneficial as a precautionary approach to investigate whether suitable data exists to provide comment on the degree to which the proposed activities may impact on the harbour environment from a broader perspective over time, should suitable historical data be available.
- The presence of Hector's dolphin in the area was noted, however no monitoring of these animals in close proximity to construction activities was noted. Given the iconic nature and nationally endangered status of this species, it would be beneficial for develop conditions that enable better avoidance and management of the potential impacts of the construction (especially noise and suspended sediment effects) on these animals.
- In relation to noise effects on fish, the piling activities are unlikely to have any adverse behaviour effects on fish unless they are very close to the piling. However, we recommend mitigation measures to further minimise the potential effects on fish in close proximity to the construction activities. We concur with the overall conclusion that fish populations will be unaffected by the proposal; however, the effects on commercial fisheries (if present) was not included in the assessment. It may be that there is little or no commercial fishing carried out in Lyttelton Harbour, although it would be beneficial to confirm that this is the case.
- We concur that the current coastal environment within Te Awaparahi Bay itself does not provide significant or valuable seabird habitat, and that similar habitat will be provided by the construction of the new seawall.



- There is a possibility of introducing or spreading marine pests in the event that vessels were sourced from outside of New Zealand; however this could be mitigated by a requirement to develop a biosecurity risk assessment and management plan.
- The applicant has not provided any detailed assessment of the likely effects on the marine receiving environment in the vicinity of the current spoil ground; however it may be reasonably assumed that the effects will be similar to those that can already occur under the existing consent for maintenance dredging (CRC930648.1).



### 7.0 REFERENCES

Forrest, B. M.; Hopkins, G. A. 2009: Assessment of Marine Biosecurity Risks from Exploratory Drilling at the Tuatara Site. Cawthron Report No. 1632. 42 p.

Hegley Acoustic Consultants, 2010: Response to Further Information request – Noise Matters. Lyttelton Port of Christchurch Coal Stockyard Expansion Project. July 2010.

Lyttelton Port Company Limited (LPC), 2009: Application for Resource Consent and Assessment of Environmental Effects. Proposed Coal Stockyard Expansion, Te Awaparahi Bay. November 2009. 91 p. + appendices.

Ocel Consultants NZ Limited, 2009: An Assessment of the Effect of the Reclamation on the Harbour Tidal Current, Wave and Sediment Regime. LPC Coal Yard Expansion Project Reclamation. Report prepared for Lyttelton Port of Christchurch. 45 p. (Appendix 13)

Cawthron Institute, 2009: Assessment of Benthic Ecological and Water Quality Effects for a Proposed Reclamation in Te Awaparahi Bay, Lyttelton. Cawthron Report No. 1509. Prepared for Lyttelton Port Company Limited. June 2009. 54 p + appendices. (Appendix 14).



# APPENDIX A

## Report Limitations



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