THE LIKELY EFFECT ON THE MARINE ENVIRONMENT OF THE PROPOSED DEVELOPMENT AT SITE 10 KUMUTOTO AND LANDSCAPING AT WHITMORE PLAZA, THE LANEWAY AND SITE 8

Dr Jeremy G Helson

BSc (Hons), PhD, LLB

August 2014

EXECUTIVE SUMMARY

1 The proposed development at Site 10 at Kumutoto consists of the construction of a new building on a vacant lot. This is not likely to significantly affect the marine environment.

2 Also proposed is some modest landscaping work along the existing foreshore at Whitmore Plaza, the laneway, and Site 8. This landscaping is not likely to significantly affect the marine environment.

New Construction on Site 10

3 The site of the building construction is landward of the shoreline. No change to the seabed or foreshore is proposed during the development of Site 10. As such, there will be no direct effect on the marine environment.

4 It is proposed that some of the reclamation fill will be excavated during this development. This fill has been shown to contain contaminants such as hydrocarbons and asbestos. As such, there is potential for indirect effects on the marine environment by contaminants associated with the development leaching into the sea.

5 The marine environment in the vicinity of the development has been the source of storm water discharge and is a working commercial wharf. This has resulted in contaminants being introduced into the marine environment and elevated levels of heavy metals have been detected as a consequence of these uses.

6 I consider any further and indirect contamination as a result of the proposed development is not likely to have a significant effect on the marine environment. This is due to the relatively low likelihood of contamination occurring, the already contaminated nature of the receiving environment and the capacity to mitigate such effects.

Landscaping

7 The proposed landscaping involves re-contouring, excavation and filling to prepare open spaces. Also proposed is a re-alignment of an existing rip-rap and a minor extension to an existing wharf.

8 The effect marine environment is likely to be negligible as a result of this work.

PROPOSED DEVELOPMENT

9 The proposed development at Site 10 Kumutoto consists of the construction of a new building on a vacant lot and some associated landscaping in the immediate surrounds. This report has been prepared in two parts which addresses the new construction and landscaping in turn.

PART 1: BACKGROUND – NEW CONSTRUCTION

10 The proposed development at Site 10 Kumutoto involves the construction of a building on currently-vacant land to the east of Waterloo Quay. At the closet point, the foreshore is approximately 10 metres further to the east of the proposed development. No works are proposed in the marine environment.

11 The top six to eight metres of the site is reclamation fill that is prone to liquefaction and lateral spreading during a seismic event.[1] A process known as deep soil mixing will be used to stabilise this fill. Deep soil mixing involves combining cement with underlying soils via an auger drill. This process results in a series of auger piles being placed side by side to form continuous subterranean walls.

12 The maximum depth of excavation will be 3.7 metres. The auger piles will be terminated approximately 3-4 metres from current ground level and the overlying fill removed. The new building will then be constructed on top of the grid of concrete walls.

Fill and groundwater

13 The reclamation fill to be excavated, approximately 7,600 cu m, has been shown to contain contaminants (Tonkin and Taylor, 2014). The extent and type of contamination differs across the site and includes elevated metals, polycyclic aromatic hyrdocarbons (PAH) and bundles of loose asbestos fibres (Tonkin and Taylor, 2014).

14 Similarly, there is the potential for elevated concentrations of metals and PAH in groundwater (Tonkin and Taylor, 2014).

15 This material is expected to be suitable for disposal at landfill although that containing asbestos may need to be disposed at landfill as special waste (Tonkin and Taylor, 2014).

CURRENT MARINE CONTAMINATION

Nature of Contamination

16 Bolton-Ritchie (2003) examined sediment contamination associated with storm drains in Wellington Harbour and found elevated metal

[1] Adam Thornton, pers comm.

concentrations associated with all storm drains studied. One sample site was at Queens Wharf and located some 50 metres to the south of the proposed development at Site 10. For all metals, the sample sites associated with storm drains in the vicinity of Queens Wharf were enriched with heavy metals (Table 1).[2]

17 Bolton-Ritchie (2003) primarily attributed this contamination to outflow from storm water drains. However, with respect to the Queens Wharf site, Bolton-Ritchie considered the proximity of the site to a refuelling pump and the commercial nature of the wharf area, is likely to also have contributed to elevated heavy metals in associated sediments.

Table 1: Maximum enrichment of sediments in front of the storm drain at the Queens Wharf

	Copper	Zinc	Chromium	Nickel	Lead	Arsenic
Max EF[3]	3.13	1.95	1.29	1.03	3.85	3.4

General effect of contamination

18 The effect of toxic metals on marine biota is not straightforward. Metals found together in sediments can act synergistically or antagonistically in relation to the biota (Ahsanullah et al., 1988; Long et al., 1995; Rule and Alden, 1996; Eisler, 1997). In field conditions, examples of deleterious effects of a specific metal on macrobenthos are comparatively rare (Bryan and Langston, 1992).

19 It has therefore been argued that no chemical measurement reliably predicts sediment toxicity and the use of chemical data to imply a biological effect should not be used except in cases of extreme contamination (O'Connor and Paul, 2000). Nevertheless there is potential for a biological effect where sediment metal concentrations are elevated above natural levels (Long et al., 1995).

Potential effects

20 To some extent, contaminants associated with the excavation fill will be mobilised, and may have already been introduced into the marine environment, where these are above the water table. The excavation may result in further mobilisation of contaminants, or exposure to the elements, which increases the potential that contaminants could leach into the marine environment.

21 Given the marine environment in the vicinity of Site 10 is already contaminated with heavy metals, should any groundwater enter the marine environment this would merely introduce additional contaminants into an

[2] Queens Wharf x 2, Evans Bay x 2, Aotea Quay x 2, Frank Kitz Park and Overseas Passenger Terminal.

[3] Enrichment Factor = mean metal concentration in treatment / mean metal concentration in control.

already-contaminated environment. Given that animals in the vicinity of Queens Wharf already live within and on top of contaminated sediment, and are likely to have adapted to some degree to this environment, the biological effect is likely to be negligible.

22 I consider any further and indirect contamination is not likely to have a significant effect on the marine environment due to the low likelihood of this occurring, the already contaminated nature of the receiving environment and the capacity to mitigate such effects.

POTENTIAL MITIGATION MEASURES

23 The construction of subterranean concrete walls via deep soil mixing is proposed to stabilise the current fill. These concrete walls will form a relatively impermeable barrier that will reduce lateral flow of groundwater that has the potential to add contaminants to the marine environment.[4]

24 Forming these subterranean walls first to the seaward side of the site would effectively dam the flow of any containment into the sea and thereby largely eliminate any contamination entering the marine environment.

25 While this additional mitigation would reduce the likelihood of contaminants entering the marine environment, I do not consider that the proposed development would have a significant effect on the marine environment if it is not employed.

PART 2: BACKGROUND – LANDSCAPING

26 The proposed landscaping primarily consists of a number of enhanced public spaces and thoroughfares in the area adjacent to marine space, the re-alignment of an existing rip-rap and a small extension to an existing wharf area on the foreshore.

27 The required earthworks consist of land contouring to enable the site to be formed for the proposed public spaces and to achieve appropriate accessibility. The earthworks are relatively minor and the cut required is generally less than 1 metre and restricted to Site 8 (Isthmus, 2014).

28 The earthworks and site contouring would result in approximately 1,000m^3 of cut material being removed from the site. It is anticipated that approximately 750m^3 of fill would be required within Whitmore Plaza and the Wool Store Plaza with the maximum depth being less than 1 metre.

29 It is proposed to retain as much of the cut material from Site 8 as possible on site. However, as detailed above in paragraphs 13-14, this material may be unsuitable for use as fill. Should that be the case, this will be

[4] Adam Thornton, pers. comm.

disposed of in a suitable landfill as proposed for the building construction (refer paragraph 15 above).

30 Further excavation is also anticipated where the rip-rap alignment is to be altered next to adjacent to the Tug Wharf. A small extension will also be made to the existing wharf structure immediately to the north of the existing old ferry building that is located directly seaward of the site of the proposed new building at Site 10.

EXISTING ENVIRONMENT

31 The marine environment in the vicinity of the proposed landscaping is a relatively small area of intertidal substrate and shallow subtidal seabed at a depth of approximately 1-2 metres below chart datum. The sea floor environment that would be affected is typical soft bottom substrate comprised of primarily mud and sand.

32 The intertidal and shallow subtidal fauna inhabiting the rip-rap are species common to most hard substrates in Wellington Harbour and similar temperate environments throughout New Zealand. These include the common periwinkle, barnacles, limpets, chitons, bivalves, top shells, seaweeds, porcellanid crabs and star fish.

33 The species that inhabit the subtidal sediments are considered to be common to those found in similar soft sediment environments. The area of the proposed development is not considered to be pristine and has undergone significant alteration as a result of the development of surrounding port facilities and the regular passage of vessels.

POTENTIAL EFFECTS

34 The effects of increased sedimentation on benthic organisms are likely to be negligible. Sediment movement is a key feature of the ecology of shallow soft sediment environments; as such, resident communities generally consist of organisms that are able to adapt naturally to increased sediment loads from time to time. Increases in sediment load occur due to natural events such as turbulence from surface waves and tides and human-induced activities like the passage of ships and storm water discharge.

35 Any loss of intertidal or shallow subtidal organisms from the re-alignment of the rip-rap and wharf extension will be replaced relatively quickly by settlement of juveniles from nearby communities.

36 As is evident from similar developments in the adjacent area outside Shed 5 and Dockside, new substrate is readily colonised by typical biological communities. It is noteworthy that similar developments such as the removal of the rip-rap and the addition of the balcony at the Union Steamship Building (formerly the Greta Point Tavern) have not had any noticeable, long-term, deleterious effects on the biological community.

37 The potential effects outlined above are not likely to have more than a negligible effect on the marine environment. This is due to several factors including:

- the very small scale of the proposed work
- the nature of the marine environment; the seabed fauna being naturally adapted to small-scale disturbance and such disturbance occurring as part of everyday use of the wharf area
- the common nature of the marine biota inhabiting the rip-rap and seabed in the vicinity
- no evidence of deleterious biological effects as a result of similar works in the area immediately south of the proposed development

REFERENCES

Ahsanullah M, Mobley MC, Rankin P. 1988. Individuals and combined effects of zinc, cadmium and copper on the marine amphipod *Allorchestes compressa*. *Australian Journal of Marine and Freshwater Research*, 20: 661-663.

Bolton-Ritchie LA. 2003. The effect of storm water discharge on the nearshore benthic environment of inner Wellington Harbour. Unpublished PhD thesis, Victoria University of Wellington, 255pp.

Bryan GW, Langston WJ. 1992. Bioavailability, accumulation and effects of heavy metals in sediments with special reference to the United Kingdom estuaries: A review. *Environmental Pollution*, 76: 89-131.

Eisler JB. 1997. Copper hazards to fish, wildlife and invertebrates: A synoptic review. US geological survey, Biological Resources Division, Biological Science Report USGS/BRD/BSR – 1997-0002, 98pp.

Isthmus, 2014. North Kumutoto Landscape Design Statement for Wellington City Council. 19 September 2014.

Long ER, MacDonald DD, Smith SL, Calder FD. 1995. Incidence of adverse biological effects within ranges of chemical concentrations in marine and estuarine sediments. *Environmental Management*, 19(1): 81-97.

O'Connor TP, Paul JF. 2000. Misfit between sediment toxicology and chemistry. *Marine Pollution Bulletin*, 40(1): 59-64.

Rule JH, Alden RW. 1996. Interactions of Cd and Cu in anaerobic estuarine sediments. I. Partitioning in geochemical fractions of sediments. *Environmental Toxicology and Chemistry*, 15(4): 460-465.

Tonkin and Taylor, June 2014. *Ground Contamination Assessment Wellington Waterfront Site 10*, 41pp.

Qualifications and Experience

My name is Jeremy Graham Helson. I hold a Doctor of Philosophy in Zoology, a Bachelor of Laws and a Bachelor of Science with Honours (First Class).

I gained my PhD in 2001 and was a Japan Society for the Promotion of Science (JSPS) postdoctoral fellow at Tokyo University of Marine Science and Technology in 2002 – 2003.

I am the author of a number of academic publications; these are detailed below.

I work intermittently as a consultant marine biologist; details of reports that have resulted from such work are listed below.

I have approximately 15 year's experience working in and around Wellington Harbour on a variety of projects concerned with the biology and ecology of both intertidal and subtidal organisms.

Academic Publications

Helson, J.G., Leslie, S., Clement, G., Wells, R., Wood, R. 2010. Private rights, public benefits: Industry-driven seabed protection. *Marine Policy*, **34**: 557-566.

Helson, J.G., Gardner, J.P.A. 2007. Variation in scope for growth: a test of food limitation among intertidal mussels. *Hydrobiologia*, **586**(1): 373-392.

Helson, J.G., Pledger, S., Gardner, J.P.A. 2007. Does differential particulate food supply explain the presence of mussels in Wellington Harbour (New Zealand) and their absence on neighbouring Cook Strait shores? *Estuarine, Coastal and Shelf Science*, **72**: 223-234.

Helson, J.G., Gardner, J.P.A. 2004. Contrasting patterns of mussel abundance at neighbouring sites: does recruitment limitation explain the absence of mussels from Cook Strait (New Zealand) shores? *Journal of Experimental Marine Biology and Ecology*, **312**: 285-298.

Gribben, P. E., J. Helson and R. Millar. 2004. Population abundance estimates of the New Zealand geoduck clam, *Panopea zelandica*, using North American methodology: Is the technology transferable? *Journal of Shellfish Research*, **23**: 683-691.

Gribben, P.E., Helson, J.G., Jeffs, A.G. 2003. Reproductive cycle of the New Zealand geoduck, *Panopea zelandica*, in two North Island populations. *The Veliger*, **47**(1): 53-65.

Helson, J.G., Gribben, P.E., Gardner, J.P.A. 2007. Effects of poor natural seston quality on clearance rate and absorption effeciency in *Perna canaliculus*, *Aulacomya maoriana* and *Mytilus galloprovincialis* from Cook Strait (New Zealand) shores. In preparation.

Selected Consulting Reports

Helson, J.G. 2007. The Likely Effects on the Marine Environment of the Proposed Development of the Overseas Passenger Terminal. Prepared for Willis Bond Ltd. 18 p.

Helson, J.G. 2006. Report on the Likely Effects on the Marine Environment of the Proposed Development of the Hilton Hotel at Queens Wharf. Prepared for Urban Perspectives Limited. 9 p.

Helson, J.G. 2005. Report on the Effects on the Marine Environment of the Proposed Development at North Queens Wharf (Kumutoto Stream). Prepared for Wellington Waterfront Limited. 11 p.

Helson, J.G. 2004. Description of the soft sediment environment in the area of a proposed seawall along Castlepoint beach. Prepared for Boffa Miskell Ltd. 11 p.

Helson, J.G. 2002. The relocation of the Union Steamship Building (Greta Point Tavern). Brief of evidence prepared for Simpson Grierson, 4 p.

Helson, J.G., Gardner, J.P.A., Reyes, A. 2002. Potential sites for finfish and shellfish aquaculture in the Falkland Islands. Report prepared by The Centre for Marine Environmental and Economic Research for the Falkland Islands Development Corporation. 85 p.

Helson, J.G., Gardner, J.P.A., Reyes, A. 2002. The environmental impacts of aquaculture: a literature review. Report prepared by The Centre for Marine Environmental and Economic Research for the Falkland Islands Development Corporation. 54 p.

Helson, J., Gribben, P.E. 2001. Assessment of the benthic environment underneath two proposed mussel farm leases in Omokoiti Bay, Kaipara Harbour. Prepared for Fisheries Consultancy Services. 16 p.

Gribben, P.E., Helson, J., Bell, A. 2001. Assessment of the benthic environment within Area B of the Wilson's Bay marine farming zone. Prepared for Fisheries Consultancy Services. 19 p.