20 January 2010
109 -165 Kimta Road
Victoria, BC V9A 7P1

Mr Andrew Whale
Crown Land Adjudication
Integrated Land Management Bureau
Suite 142, 2080 Labieux Road
Nanaimo, BC V9T 6J9

Re: File #1405848 (Victoria International Marina)

Dear Mr. Whale,

The alterations in the Victoria International Marina layout announced (to everyone's surprise) at the public meeting on September 22 raise a number of questions which should be addressed with public input. The storms in November also reminded us of additional problems that will be associated with the marina.

1. What is an adequate, safe clearance under the marina buildings for paddlers?
2. Has the need for access under the buildings by Harbour patrol vessels and/or emergency vessels been considered?
3. Prevailing winds and storms drive a lot of debris towards the north shore of the harbour:
   a. How will debris trapped on the south wall of the marina affect seaplane movement?
   b. Debris will be driven behind the marina. Who will be responsible for keeping the paddler access route open?

I also have other comments related to documents that I have recently seen which pertain to wave reflections from the attenuator and interpretation of the ASL Environment studies.

Question 1: What is an adequate, safe clearance under the marina buildings for paddlers?

The new proposal from the developers has the deck surface for the restaurant and marina office at grade level with an elevation of 3.2 m. The thickness of the platform appears to be about 20 cm. Is this really adequate? The developer's documents show the avg. high tide at 0.6 m (geodetic) and the claim is that there is 1.5 m clearance at all times. They use 3.0 m geodetic for the underside of the platform.

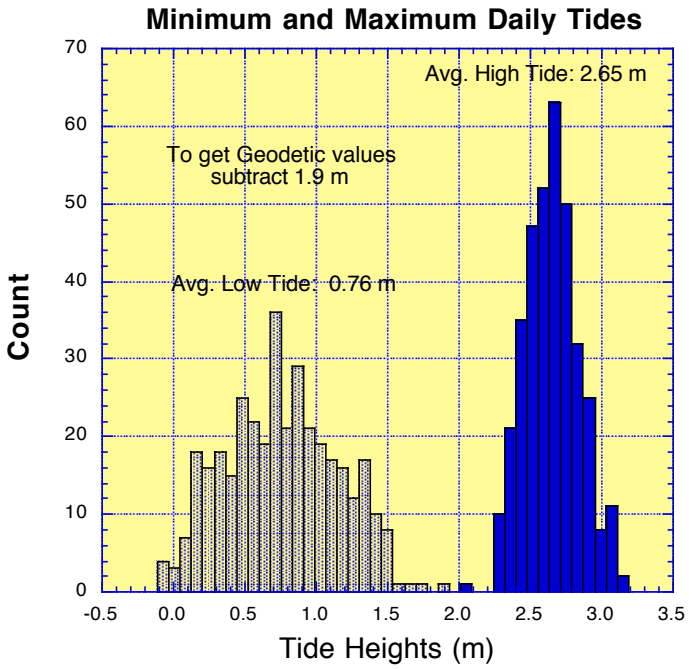

Fig. 2. Plot of the Minimum and Maximum daily tides predicted for 2010. The grade level of the walkway (2.41 m geodetic) would be at 3.75 m above MLLH at the corner

The plot of high tides in Fig. 1 shows that the highest tides are 3.2 m. Transport Canada has requested that the building platform be raised by 2 ft (0.6 m). The walkway slopes down by 0.8 m from the east part of the platform (3.2 m geodetic) to its west corner (2.41 m geodetic). The effect of this

(see Fig. 2) would be to raise the BOTTOM of the platform to a few inches ABOVE the stanchions (1.07 m tall) at the corner of the walkway. The 'inserted' stanchions show water levels for the actual tide of 2.68 m on Nov 20 (close to the average high tide) and the highest tide of 3.2 m. Clearance with a raised structure for the average tide would be about 7 ft (2.1 m) and 1.6 m at the highest tides.

The marina proposed is a long-term development, certainly more than 30 years. Climate change is a concern because the sea level at Victoria may be rising as fast as 3 mm per year. Consensus changes in sea level over the next 100 years seem to be about 1 m. Surely some additional allowance for clearance must be made to allow for another 30 cm increase in sea level over the life of the marina.

Fig. 2. Location of the marina restaurant building at high tide of 2.68 m. The water is 1.07 m (3.5 ft) below the surface of the walkway. At the highest tide the water is 0.55 m (1.8 ft) below the walkway.

Raising the level of the platform is necessary to give adequate headroom for paddlers, but a 4-5 ft gap above the walkway surface poses its own safety concerns and it is not clear that such a solution would get past city planning requirements. The photo itself shows why there is so much opposition to the marina. The park-like aspect of the walkway is completely destroyed by the presence of the marina.

Consultation with the city is warranted before any Transport Canada or ILMB approval is given to see if raising the platform is acceptable and from what grade the building height will be determined.

Question 2. Has the need for access under the buildings by Harbour patrol vessels and/or emergency vessels been considered?

In the event that debris must be removed from behind the marina by harbour authorities will powered vessels (i.e. zodiaks) be required? Fig. 2 shows how debris is driven to the north shore. In this case how much clearance is required under the buildings? A similar question is raised if an emergency vessel needs to go under the buildings. Is the 2.1 m clearance at the average high tide adequate?

Prevailing winds, storms and tides drive a lot of debris towards the north shore of the harbour:

a. How will debris trapped on the south wall of the marina affect seaplane movement?

b. Debris will be forced behind the marina. Who will be responsible for keeping the paddler access route open?

Substantial winds on several days in November 2009 carried debris into the harbour. This is a common occurrence although one of the November events was worse than usual. See Figs. 2 and 3. The debris in Fig. 3 is partially overlapping the outer edge of the marina. Most was driven to the north shore. The presence of the marina would cause two problems: (1) The attenuator walls would tend to hold debris in the seaplane and taxiway regions, and (2) much debris reaching the north shore could likely be driven into the space behind the marina, blocking access by paddlers.

Fig. 3. Debris in the harbour after a winter windstorm. The debris is at the east of the location of the marina, partially overlapping the east end.

Have the potential safety questions regarding seaplane operation been addressed? Who will be responsible for keeping the paddler access route clear.? Technically it looks like it would be the responsibility of the marina operators since it would be in the crown water lot which they will have leased, and in the water lots owned by the developer. How can the rights of paddlers be guaranteed

Finally I have some comments pertaining to documents I recently obtained and I want to reiterate my opinion that the reflected wave heights are not being adequately considered in spite of the Triton and NHC comments.

Lachlan MacLean Comment re: Sept 22 Meeting

In his letter of September 28, 2009 to Wayne Marsden, Lachlan MacLean states:

"*At the public information meeting held in Victoria last Tuesday regarding the marina, Gordon Greeniaus (the Professor Emeritus who first wrote to TC with concerns about our wind and wave modeling) stood up at the microphone and stated that he now accepted the data from the ASL Environmental modeling....*"

I object strongly to the use of this statement by the developer to imply that I no longer question the conclusions of the ASL Environment report.

At the September 22 meeting I stated publicly that I was prepared to accept the gist of the calculation of significant wave height (SWH) by ASL. However, Mr MacLean has conveniently omitted to quote my qualification of that statement – that I had much difficulty with the INTERPRETATION of the results, that the devil is in the details, and that the ASL results do NOT adequately represent the wave heights when incoming waves are combined with the large reflected waves. This misrepresentation of my comments is typical of the misinformation that one has to put up with from the developers. I cannot convey enough my frustration that my words are being used to support the developers position when I continue to believe the effects of the wave reflection are being seriously underestimated.

Note that I had discussions with David Fissel much earlier in the summer to clear up misconceptions that had been created by statements by both Mr. MacLean and Mr Fissel at earlier public meetings. Mr Fissel has been well aware that I would accept at face value their DATA for the purposes of discussion, that I disagreed with the interpretation, but we also talked about some apparent defects in the results.

ASL Calculations and Comments

Dr Nico Booij, one of the developers of the SWAN program used by ASL for the calculations, stated in a communication to me that the SWHs of the two (incident and reflected) wave trains are effectively added in quadrature. This concept allows one to use the ASL results to estimate the SWH of the reflected waves. For example, using the 30 knot results for a sample calculation (see fig. 4)

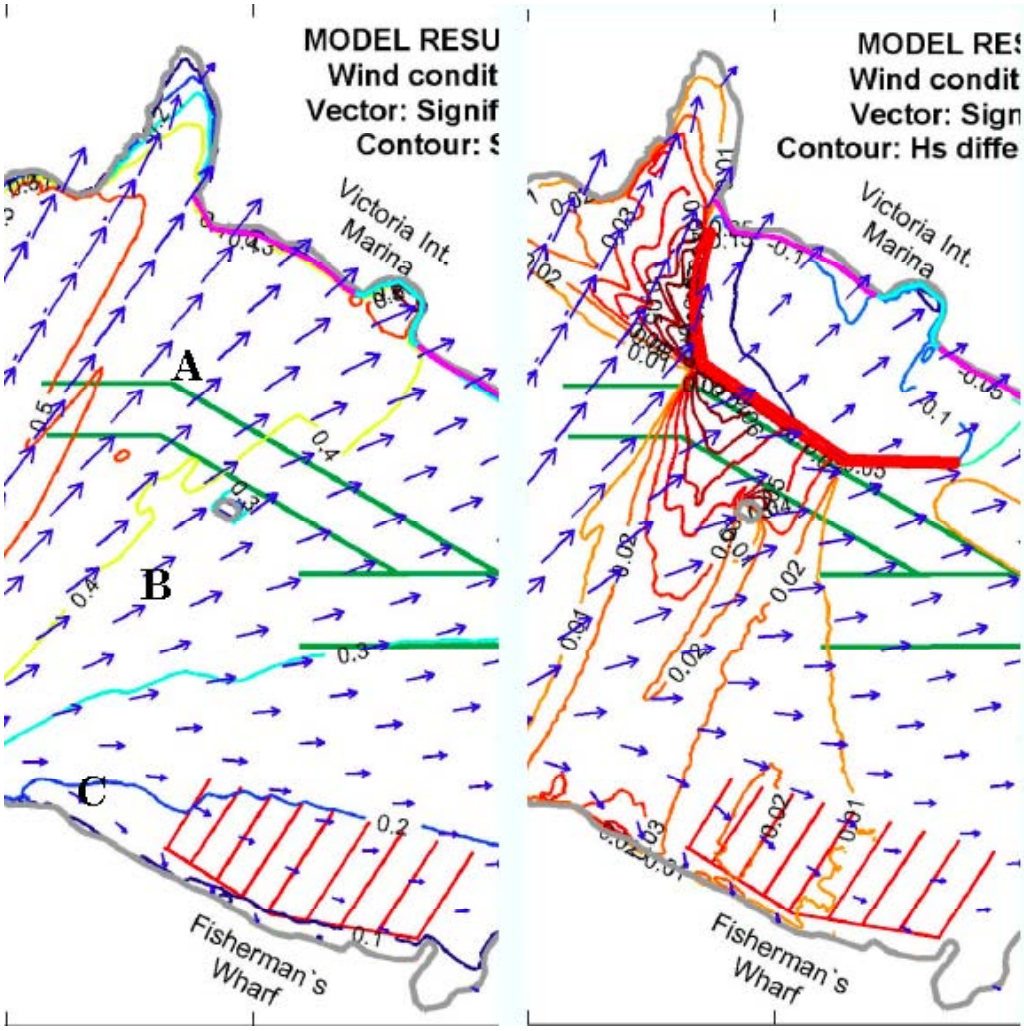

Fig. 4. ASL Significant Wave Height distributions for 30 knot winds without (left) and with (right) the attenuator. The right hand distributions are the differences in SWH.

Pt. A Close to west end of Attenuator

Initial SWH: 45 cm (somewhere between 40 and 50 cm)
Change in SWH: 0.07 cm
SWH of reflected wave component: $\sqrt{(52)^2 - (45)^2} = 26cm$

Pt. B Runway just west of Pelly Island

Initial SWH: 38 cm (somewhere between 30 and 40 cm)
Change in SWH: 0.03 cm
SWH of reflected wave component: $\sqrt{(41)^2 - (38)^2} = 15cm$

Pt. C Fisherman's Wharf area

Initial SWH: 15 cm (somewhere between 10 and 20 cm)
Change in SWH: 0.03 cm
SWH of reflected wave component: $\sqrt{(18)^2 - (15)^2} = 10cm$

Using the ASL results at points A:B:C to check for consistency at other wind speeds

30 knots : Initial SWH at A:B:C are 45:38:15 cm → reflected SMH 26:15:10 cm → ratio (2.6 : 1.5 : 1)
40 knots : Initial SWH at A:B:C are 68:60:25 cm → reflected SMH 40:25:14 cm → ratio (2.9 : 1.8 : 1)
50 knots : Initial SWH at A:B:C are 95:80:30 cm → reflected SMH 53:36:21 cm → ratio (2.5 : 1.7 : 1)

These numbers indicate

– average reflection coefficient of about 55% from the attenuator – consistent with the input data for the ASL calculations.

– reflected waves appear to decrease in height by a factor of 2.5 – 3 as they cross the harbour. This is reasonable compared to the waves I have seen reflected back to Songhees Point from the far side of the inner harbour.

MY estimate of the increase in the chop height in the runway area is 40% (ratio of the initial and reflected SWH values for point B in the sequence), not the typically < 10% given in the ASL report. This uses the calculated SWH with and without the attenuator in the ASL document.

How frequent are these high waves? Waves at or exceeding the SWH occur about 15% of the time. Waves reflected back into the harbour (SWHr) encounter *independent* waves (SWHi) which will have heights > SWHi about 15% of the time. If an observer sits at a given location he will observe a height > (SWHi + SWHr) approximately $(0.15)^2 \approx 2\%$ of the time (product of the two probabilities).

Critical note concerning the ASL calculations.

I would like to point out apparent defects in the ASL calculations.

A simple glance at the reflected wave pattern in Fig. 4 shows that there are difficulties in matching the shape of the attenuator walls to the grid used in the calculation. This is seen in the wavy pattern of the reflections on the west-facing wall on the left part of the attenuator. It is not a physically realistic pattern. Technically, a similar pattern should have appeared on the east wall as well. Of a more serious consideration, it appears that there is little reflected wave energy from any part of the east half of the marina – 7 cm SWH reflected at the left end vs 2-3 cm at the right end. Almost all the reflected energy appears to come from the part west of Pelly Island. However the input wave pattern only shows a small decrease in wave height due to shadowing by Pelly Island and the wave energy incident along the main wall should only vary only by about 25% based on the input SWH values. Using the 50 knot example, it is unreasonable that the SWH reflection at the east part of the wall is just 1 cm while it is 13 cm from the west side. In fact the reflected wave appears bigger at Laurel Point than it does at the marina itself.

Criticism of my initial Comments

In a letter to Lachlan MacLean on March 21, 2009, Mr Fissel criticised statements I had made regarding the absolute wave heights. This misunderstanding was triggered by the careless mixing of the terms by the developer's representatives amplitudes and heights in presentations at city hall and the Delta Resort. This was cleared up once I had seen the ASL report.

The question of spectral distribution is one of interpretation. In Fig. 5 one can see what I would call a fairly regular wave pattern for the larger waves. I interpret this as a 'narrow' spectral distribution as the dominant wave pattern appears to be limited in wavelength. We can disagree on this point without affecting any of my conclusions.

Fig. 5 Regular Wave Pattern?

Mr Fissel queried the range of amplitudes when the reflected and incoming waves combine. He quoted a formula from Dean & Darymple and introduced the question of phase lag. Mr Fissel's comments are just plain wrong. The correct equation to describe standing wave patterns which I also took from the same book (different edition?) is given here (slightly different notation – the factor of 2 with the *H*'s can be ignored).

$$[\eta_t(x)]_m = \pm \sqrt{\left(\frac{H_i}{2}\right)^2 + \left(\frac{H_r}{2}\right)^2 + \frac{H_i H_r}{2} \cos(2\,kx + \epsilon)} \qquad (4.53)$$

What Mr. Fissel omitted was the *2kx* term. The phase lag ε affects the amplitude of the oscillation at the toe ($x = 0$) of the reflecting surface and shifts the location of the nodes and anti-nodes. The amplitude at the node is $(H_i - H_r)/2$ and at the anti-node is $(H_i + H_r)/2$. Furthermore, as stated by Dr. Booij, for oblique incidence the reflection coefficient gets bigger. The angle of incidence has nothing to do with the phase lag. In any case, for vertical surfaces the phase lag should be close to zero.

As I have estimated above, the reflected waves as determined from the ASL plots, appear to decrease by a factor of 3 as they cross the harbour. I do agree that with this drop in wave height there probably will not be any serious impact at Fisherman's Wharf

Sincerely, Gordon Greeniaus