Q1. What are the primary causes/contributors to coastal erosion at Westshore and the concept of longshore / littoral drift.

In order of (timing related) contribution to present problem

1. Beach is too far seaward for prevailing conditions, due to
   - earthquake uplift (2nd ebb delta collapse)
   - Ahuriri walls legacy (1st ebb delta collapse): subdivision of temp land

2. Beach nourishment paradox (artificially maintained misalignment)

3. Port breakwater & dredged channels:
   initial and continued...
   - cessation of gravel supply to upper beach
   - disturbed/deflected sand supply to sub tidal beach & nearshore causing deficit in wave drive alongshore transport of sediments
     (*i.e.*, positive transport gradients alongshore)
5. Port breakwater wave sheltering: protective effect against severity of storm erosion at Westshore

? Port breakwater alteration to wave refraction/diffraction patterns contributing to altered effects on beach alignment alongshore (no Unibest / Mike21 type modeling undertaken)

Χ. Storm erosion
Q1. further continued...

n. Legacy effects - detritus and culture:
   early (pre-moles Ahuriri) erosion due to minor dredging of harbour,
   ship ballasting, natural inlet instability, event-related bursts in littoral
   sediment supply (river flooding, cliff collapse)
volume change between successive surveys

shoreline displacement

storm erosion is more cosmetic than significant

derived from data in Smith 1993, Gibb 1995
Q2. What role did the earthquake play both in the short term and long term and are there still any lingering effects from that event?

- Dominant role in present problem – beach is in wrong place
- Bigger effect in vicinity of Ahuriri than further north due to shallow ebb delta emergence causing ‘Westhore bulge’
- Re-adjustment due to littoral transfers take many decades including 2
  nd ebb delta collapse and alongshore reworking) (US Pacific Columbia River coastal cell lesson)
- Ridge legacy: - prevents sediment loss inland due to overwash - but reduced effectiveness of beach as wave absorber’ trapping sediments in the high intensity littoral transport zone
Beca, 2007
from Worley (2002b)
Q3. What influence the port breakwater, training moles and shipping channel have on Westshore – particularly what Impact of deepening the port shipping channel on Coastal Erosion, both in the past and the proposed future deepening by a further 3+ metres... professional opinion

• Breakwater and Ahuriri moles
  - interruption of sediment supply / imbalance in littoral budget

• shipping channels
  sediment sharing system with sources and sinks
Q4. What is the influence of the predominant wave angle/direction in relation to the coast and what this means in terms of erosion, specifically at Westshore

Komar
Headland attached spit
Q5. My analysis on the erosion / accretion phases at Westshore, particularly the point that erosion has been occurring from earlier than the mid 80’s.
Shoreline displacement
Westshore
volume

survey data at HB15

post Ahuriri inlet wall, depleting feed from Westshore?

post uplift response incl. longshore feed from Westshore?

natural feed depleted from Westshore?

feed from Westshore nourishment?

- dominance

+ dominance
Shoreline displacement
survey data at HB15


cumulative MWL-shoreline displacement (metres)

-10
-8
-6
-4
-2
0
2
4
6
8
10

Westshore nourishment begins

Ahuriri ebb delta
collapse declining feed
split response?

+57?
Q6. What is the near shore deficit and what effect that has had on Westshore
Q7. The importance of addressing the nearshore deficit and what will happen if it is not. (and does it have to be sand from the shipping channel). Once the nearshore deficit has been addressed discuss the need to maintain sediment balance

- Without nourishment of submarine beach and with further reduction in sand supply as well as losses due to shipping channels
  ... submarine beach will continue to lower and recede

- Like the upper beach, the submarine beach will require ongoing nourishment to offset losses alongshore and to sinks such as the navigation channels
Q8. Different types of solutions, retreat, soft, hard engineering and the effects they might have on the coastal environment – what provides the best /bang for buck’ solution.

- greater stability and lower nourishment achieved the further landward the beach is permitted to relocate - how far is the question
- low to moderate value assets near to the beach at present relocated landward... money saved on reduced nourishment probably would offset this investment
- nourishment vs seawalls and groynes both viable if designed correctly
- seawall design standard challenging
  - expensive to build for say 100 year design life
  - wall failure and maintenance common because construction defects
- detailed costings and risk assessment required for options but intuitively nourishment is best bang for back
Q9. Finally, is it possible for Westshore to become a sandy beach again as this is something people often say should happen.

- If nearshore was ‘flooded’ with sand...
  If volume of nearshore sand is sufficient, the possibility of a sandy beach exists
- More likely that the intertidal beach would experience periods of sandier character during prolonged fair-weather conditions
- Gravel during periods dominated by storms