Asset Management at the Port of Vancouver

Vancouver Fraser Port Authority
Engineering Department

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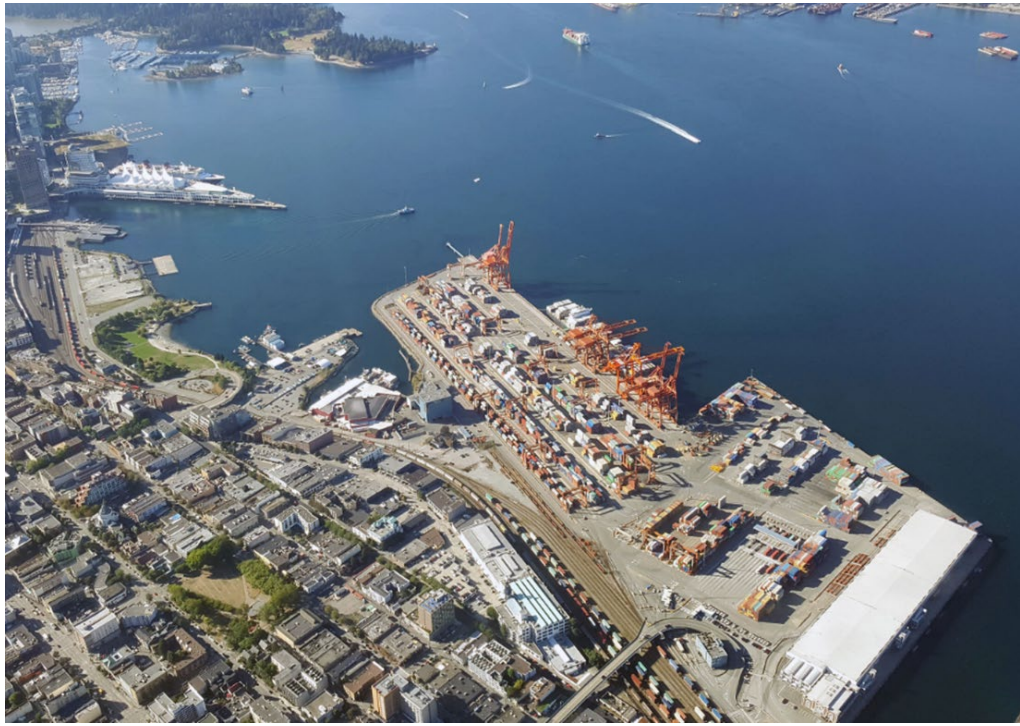
Infrastructure – What we own and manage

Over 800 Infrastructure Assets, including:

- 13 km of dock faces
- 30 km of slope protection
- 9 overpasses.
- 25 centreline km of roadways.
- 2.8 million m² of paved surface (parking, storage areas).
- 270 km of underground pipe utilities. (water, storm, sanitary)



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How the Port defines "Infrastructure Assets"

Must be:

- Owned by VFPA (not a tenant), on VFPA property.
- Original cost of at least $10,000
- Any of 15 established Asset Classes:

A – Roads
B – Bridge/Overpass
C – Paved Areas
D – Dock Structures
E – Buildings
F – Water Systems
G – Storm Sewer Systems
H – Sanitary Sewer Systems
I – Communications Systems
J – Electrical Systems
K – Gas Supply Systems
L – Large Equipment
M – Other
N – Slope Protection
O – Rail

Each "asset" is often a network, such as a water supply for a site, made up of pipes, valves, manholes, pumps, etc. (the components).

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How did we get into Infrastructure Asset Management?

- In 2011, unexpected & costly infrastructure repairs was identified as a Key Risk to the Port.
- Infrastructure Asset Management Directive (C-018) was drafted.
- A three-person Asset Management Group was established.
- Goals defined:
  - Establish relevant **Infrastructure Classes**
  - Research, locate, and define assets, and assign a **unique ID** to each.
  - Record location of these assets in a **GIS** system (**Maps On Request**)
  - Develop an **Asset Management Database (AMDB)**, tracking basic information such as age, type, condition, etc.
  - Introduce a basic **Condition Inspection** methodology (Level 1).

Level 1 Inspections

- Conducted by trained staff on most asset types.
- Quick inspection to assess general condition, look for any signs of trouble.
- Where possible, interview on-site maintenance staff and discuss service history.
- "Poor" or "Very Poor" L1 rating will trigger an L2 or L3 assessment.

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L1 Inspection – Sanitary System

Date: July 24, 2015	Inspected by: Peter Briglio
Asset ID: 64-H-123	Year Built: 2001
Location: Waterfront Road D	

GRADE	DESCRIPTION
VERY GOOD	Little to no wear visible. Reliability is of minor to no concern for intended functionality. 0 to 40% of useful life used.
GOOD	Minor deterioration or defects are evident. Reliability is a minor concern for intended functionality. 41 to 65% of useful life used.
FAIR	Moderate deterioration in one or more portions of the asset. Reliability is a moderate concern for intended functionality. 66 to 85% of useful life used.
POOR	Moderate to high levels of deterioration in the asset. Reliability is a concern for intended functionality. 86 to 95% of useful life used.
VERY POOR	Higher levels of deterioration in the asset. Reliability is a serious concern for intended functionality. 96 to 100% + of useful life used.

INSTRUCTIONS: Put a check mark under the relevant grade for each component type. Take photos and make notes of deficiencies. Give an overall condition. More room for details on reverse.

COMPONENT	GRADE					PHOTO #/NOTES
	V. Good	Good	Fair	Poor	V. Poor	
Main Branch		X				See photo # 1
Branch Lines		X				
Manholes		X				
Lift Station		X				Pump replaced in 2008 in south lift station. Maintenance Facility has a spare as well.
OVERALL CONDITION		X				(2015)
PREVIOUS REPORT		X				(2012)

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Level 2, 3 Condition Assessments, Field Inspections

- Roadway surveys
- Bridge surveys
- Dock Structure surveys
- Pipe inspections

- Ultrasonic Thickness (UT) measurements
- Diving inspections
- Bathymetric data surveys
- Core sample lab testing

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Good Asset Management Practices

Life Cycle Cost Analysis (LCCA)

- What is it?
- Where is it?
- What condition is it in?
- When should it be repaired or replaced?
- By what method and cost?

Geographic Information System (GIS)

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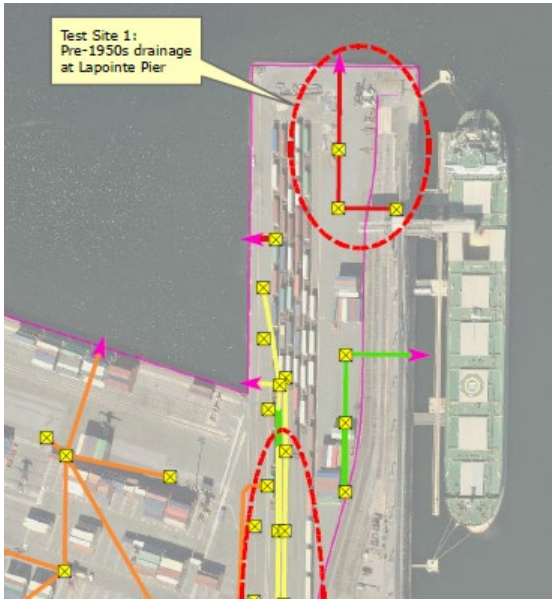

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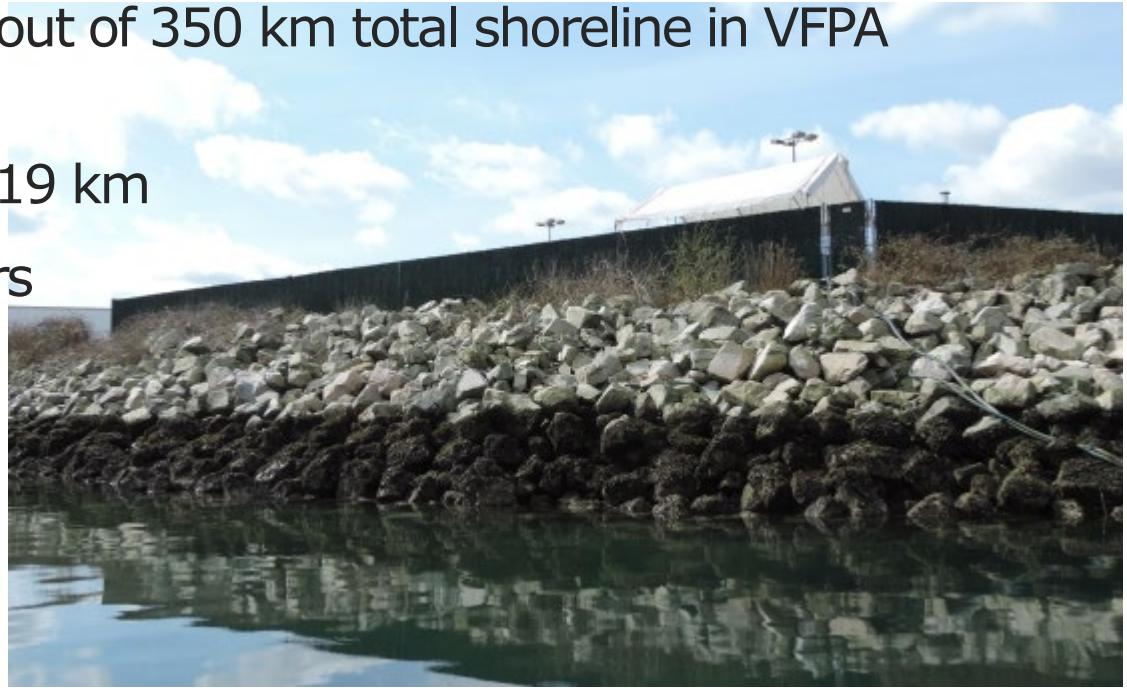
Example Asset Class: Shoreline Protection

- For the most part, also known as "rip-rap", or sometimes "rock armouring".
- Used to protect shorelines from erosion & loss of usable land.
- ±100 defined VFPA Shoreline Protection assets
- Total length: 33 km (out of 350 km total shoreline in VFPA jurisdiction)
- Condition Surveyed: 19 km
- Average age: 33 years



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Why Shoreline Protection?

Back Then…

- Poorly graded stone fill
- Concrete demolition refuse
- Old sidewalk slabs
- No-post barriers, etc.

No filter stone or geotextile. Loss of fines over time.

Over-steep slopes, resulting in crest erosion, slumping, dangerous edges.

No consideration for marine environment. Harbour considered a dumping ground.

Cost: Free (almost)

Why Shoreline Protection?

Back Then…	**Today**
• Poorly graded stone fill • Concrete demolition refuse • Old sidewalk slabs • No-post barriers, etc.	Properly sized and graded stone, placed so as to be interlocking. Dissipates wave energy.
No filter stone or geotextile. Loss of fines over time.	Filter stone layer and geotextile helps retain fines, prevent slumping.
Over-steep slopes, resulting in crest erosion, slumping, dangerous edges.	Properly engineered slopes, usually 1.5H:1V or 2H:1V
No consideration for marine environment. Harbour considered a dumping ground.	Marine environment must be considered. Habitat enhancing benches & other designs encouraged.
Cost: Free (almost)	**Cost: Expensive!**

Condition Rating System

Rating	Description	Remaining Life
Very Good	*Little to no wear visible. Reliability is of minor to no concern for the intended functionality.*	Over 25 years
Good	*Minor deterioration or defects are evident. Reliability is a minor concern.*	15-24 years
Fair	*Moderate deterioration in one or more portions of the asset. Reliability is a moderate concern.*	8-14 years
Poor	*Moderate to high levels of deterioration in portions of the asset. Reliability is a concern for the intended functionality.*	3-7 years
Very Poor	*Higher levels of deterioration. Reliability is a serious concern.*	0-2 years

- Slope
- Crest Erosion
- Stone size/characteristics
- Threat to upland property or assets?
- Outfalls (unsupported or covered)

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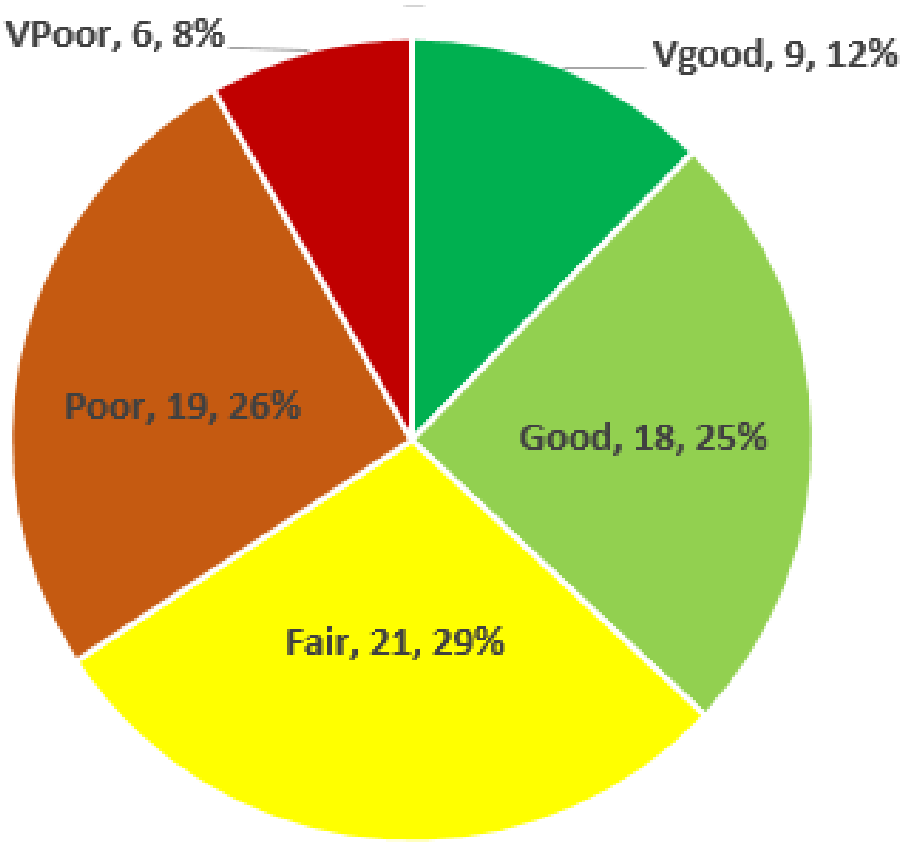
Current picture



As of Jan/2019

Average replacement cost, per linear metre: **$5,000**

Total estimated replacement cost for all Shoreline Protection assets:

$165,000,000

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Shoreline Protection Condition – The "Good"

Recent repairs along Commissioner St, 2015:

- *Well-graded stone size*
- *Engineered slope*
- *Appropriate crest height*

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Shoreline Protection Condition – The "Bad"

- *Broken slabs & waste material*
- *Non-interlocking*
- *Steep slopes*
- *Erosion at top of slope*
- *Heavy vegetation*
- *Low crest height*

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Shoreline Protection Condition – The "Ugly"

- *Loss of land*
- *Potential contaminants exposed*
- *Structures & stored items threatened*
- *Trees falling into water*

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More "Ugly"

How much longer before this becomes a problem?

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Modeling the "Do-Nothing" approach

Consequences of doing nothing:

- Customer complaints
- Loss of land (Can be up to 0.5m / year in worst case)
- Lost Revenues
- Threat to storage areas, roads/rail, buildings (safety hazard)
- Expose potential contaminants in soil
- Regulatory difficulties involved in regaining lost land
- Replacement costs can be much higher than timely maintenance repairs.
- ***Not Sustainable!***

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Repair Options

Type	Description	$ per m	Lifespan
Emergency Repair	Small sections repaired on emergency basis only. Not cost-effective in the long run.	$3,000	5 years
Basic Repair	Repair/supplement existing rip-rap, with a similar design, no substantial changes.	$2,000	15 years
Enhanced Repair	Similar to above, but adding Envision principles, or habitat enhancement.	$2,400	15 years
Basic Replace	Rebuild to new design standard, including raising crest, shallower slope, better stone sizing, etc.	$4,500	>25 years
Enhanced Replace	As above, but adding potential habitat enhancement, Sea Level Rise adaptation, other sustainability principles.	$5,400	>25 years

As of Dec 2016. Actual mileage may vary!

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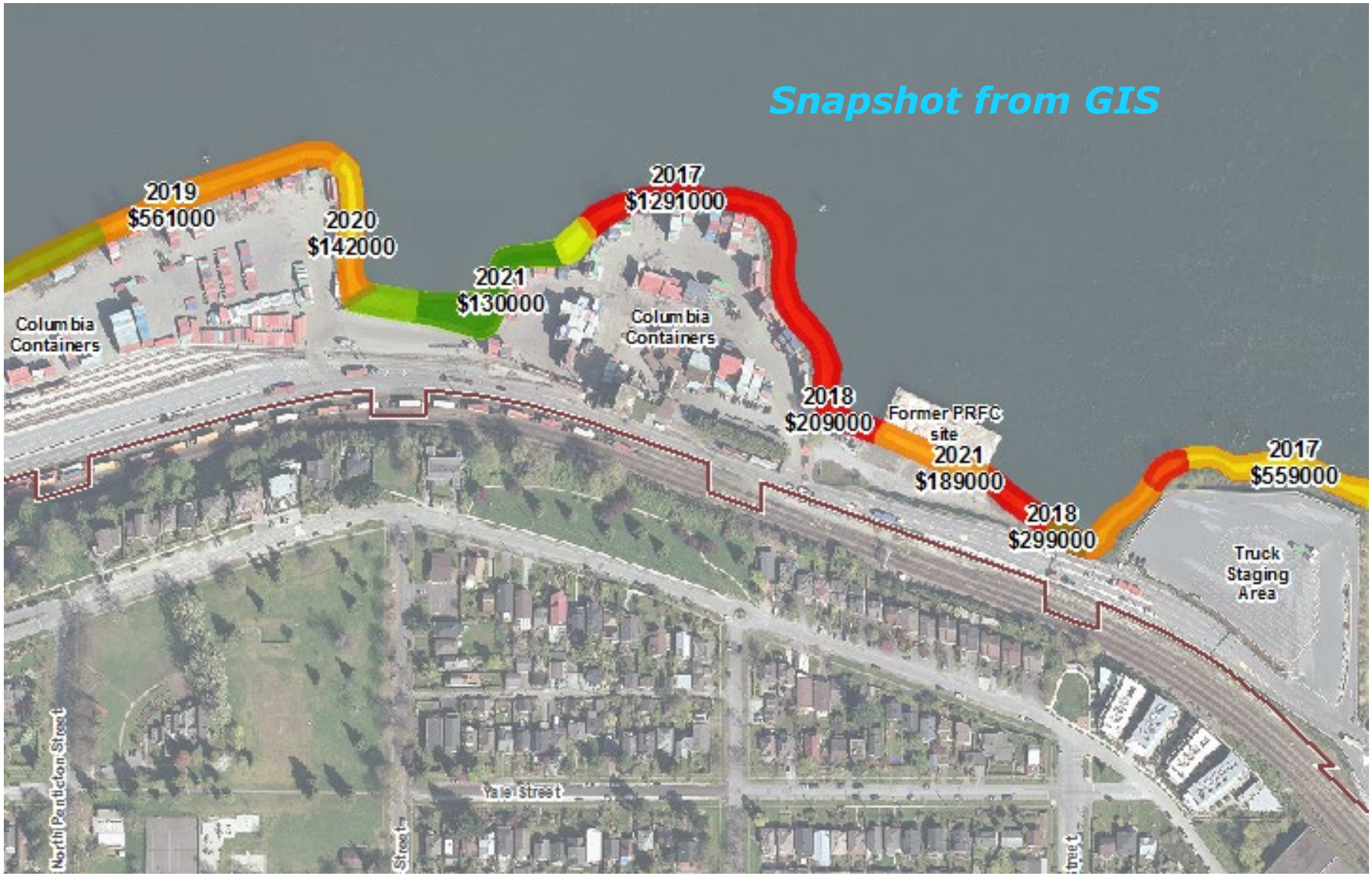
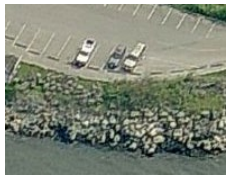
Multi-year Program



How to prioritize repairs? By examining Upland Use

	Upland Use	Consequence if land lost
	Vacant site	Minor, but loss of potential future revenue
	Parking	Inconvenience to customer
	Transport (Road/Rail)	Road closure, derailment, business interruption
	Commodities Storage (Containers, Bulk, etc)	Loss of goods, spills, contamination
	Offices & Workshops	Structural damage, safety of life

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Monitoring Programs: SeaView (Version 1)

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Work boat and GPS camera

SeaView (Version 1, 2014)

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Photos taken during low tide periods

SeaView, Version 2 – using a UAV (2018)

Harbour patrol boat

aka Aircraft Carrier

Landing the UAV

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SeaView, Version 2 – UAV (2018)

Photos taken during low tide periods

Building SeaView

2014	2018
Used own forces: 2 staff, inspection boat, GPS camera.	Used own Patrol Boat, contractor to fly UAV and process photos.
Covered 20 km of shoreline over 8 separate days, schedule permitting.	Covered 60 km of shoreline over 3 successive days.
Many hours to correct low-quality GPS positions from camera	GPS positions extremely accurate.
Cannot view areas obscured by moored vessels, barges, other off-shore obstructions.	UAV can fly over obstructions and get better view angle.
3,000 photos	10,000 photos (but about same spacing overall)

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