Apr 4th, 1:30 PM - 1:45 PM

3D hydrodynamic modeling of Lower Fraser River

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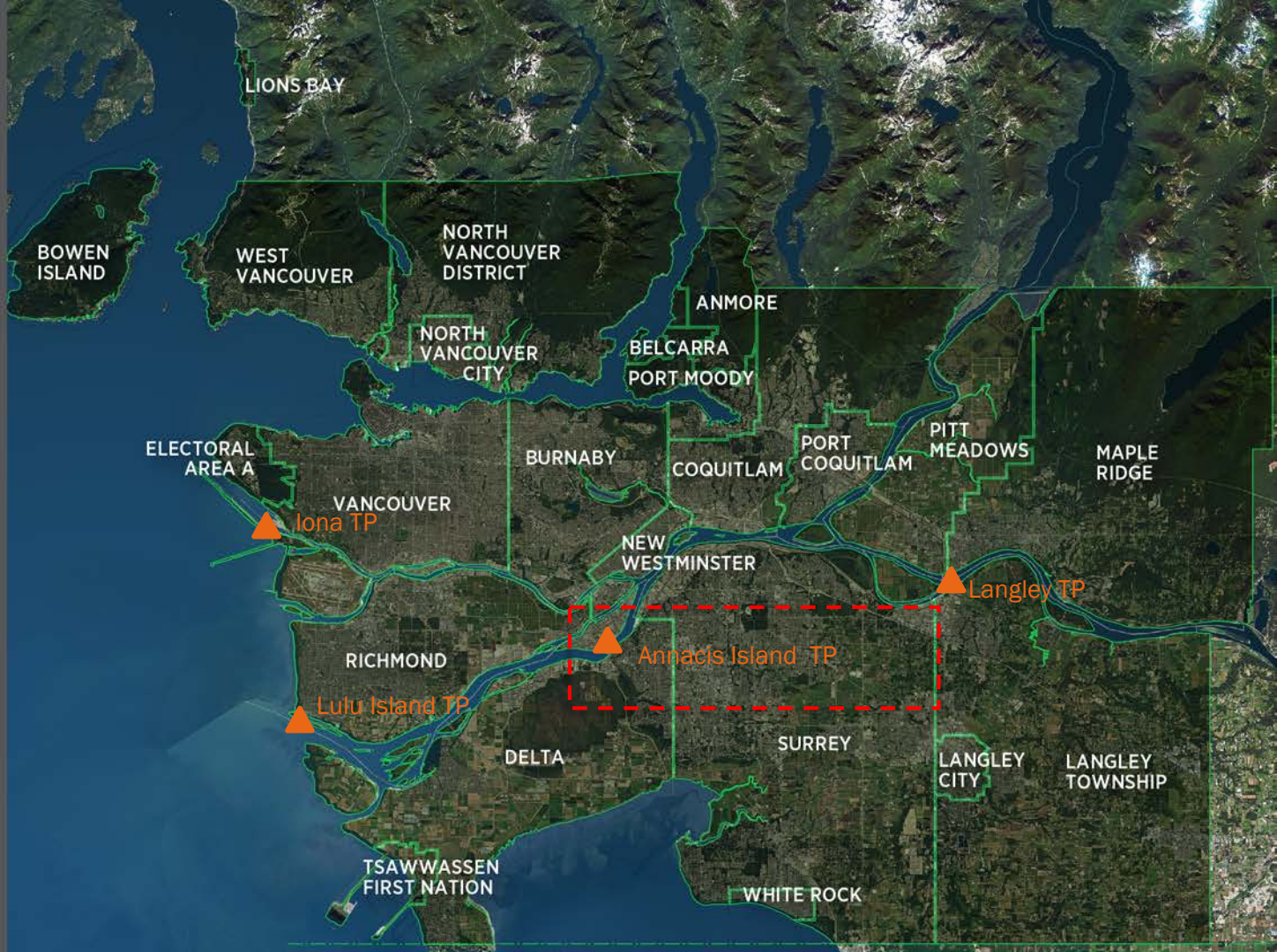
metrovancouver

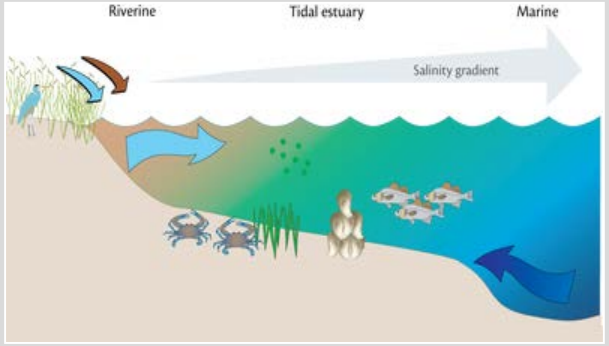
SERVICES AND SOLUTIONS FOR A LIVABLE REGION

Metro Vancouver

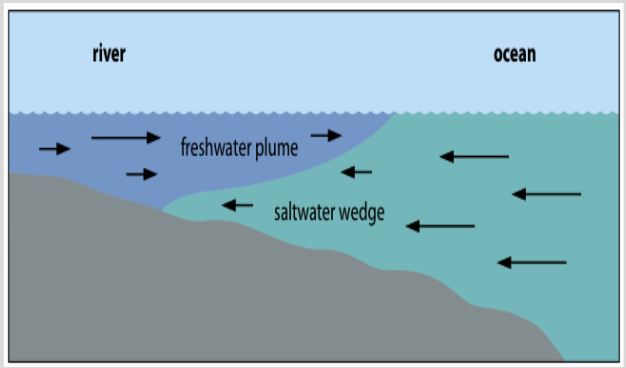
21 municipalities one Electoral Area and one Treaty First Nation working together for a livable region



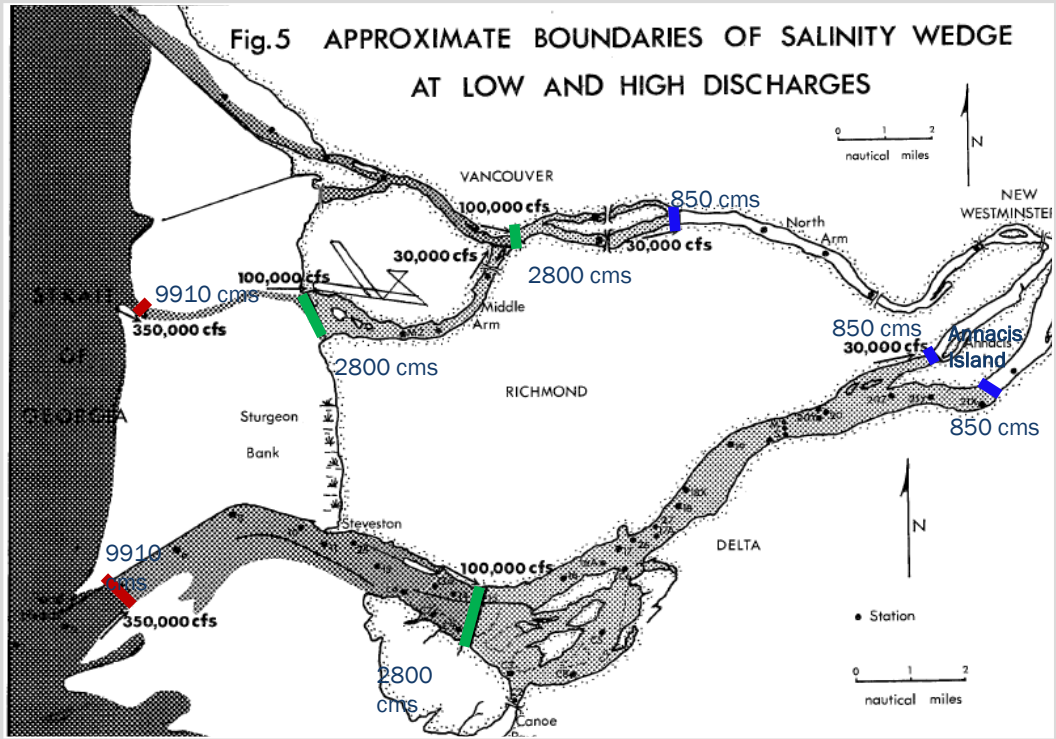
Overview: Why 3-D modeling?



Estuary: density stratified flow, salinity intrusion



Salt Wedge boundaries for variable flow



Source: Ages and Woollard 1976

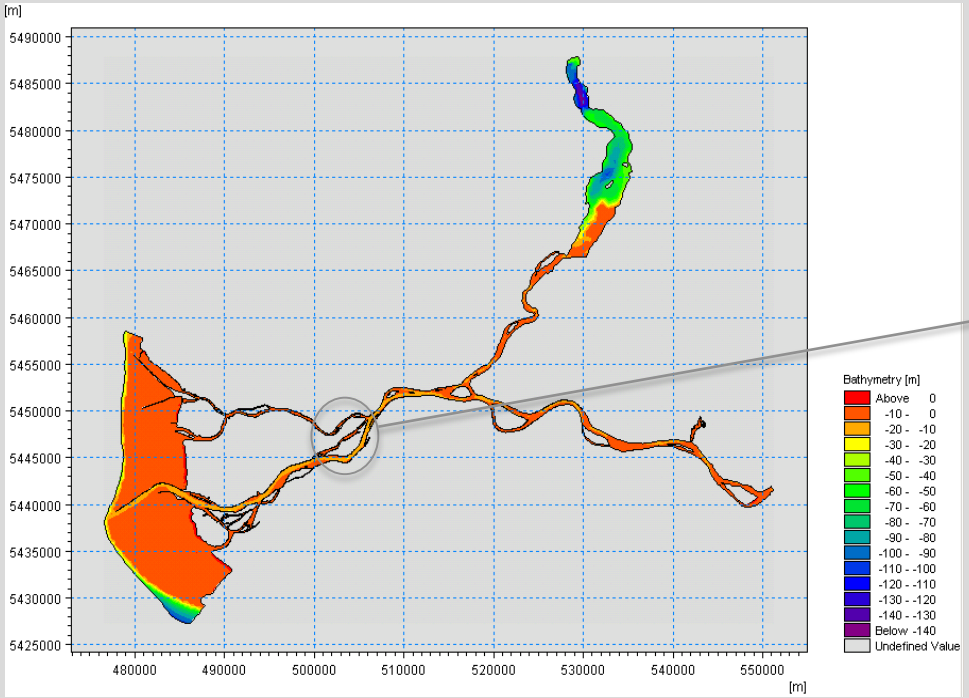
Salinity Wedge: Flow stratification reduces channel conveyance

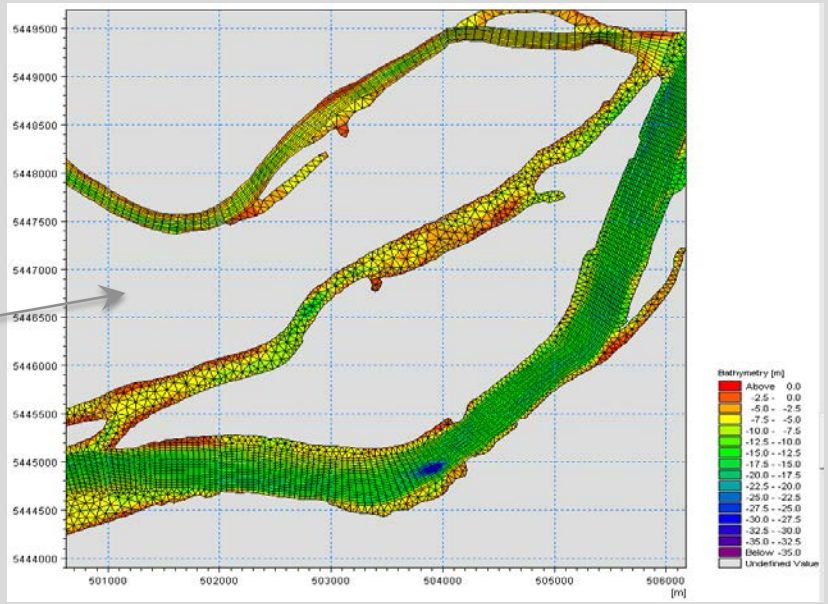
Overview: Physical Setting

Fraser River : Receiving GVRD's WWTP discharges

Fraser Model : Model extent From Mission to Sand Head

Model Development: Software, Mesh





Fraser Model : MIKE 3 FM software

Fraser Model mesh:

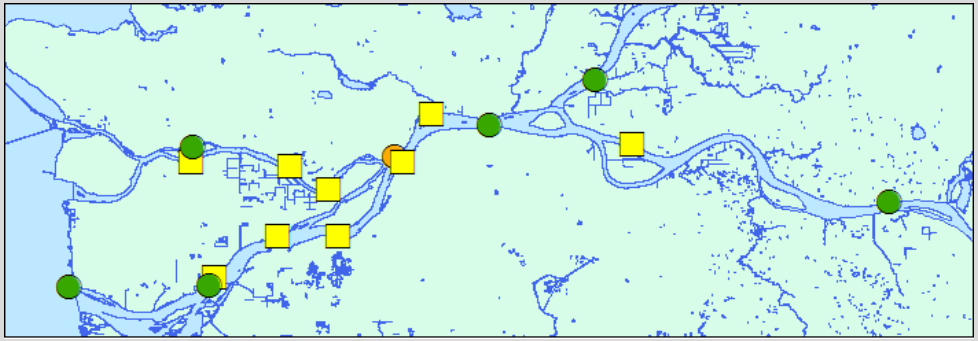
- 30,000 element mesh.
- A combination of triangular and quadrilateral elements
- 30 equidistant vertical layers for depth < 20m and 15 additional layer for depth > 20m.

Model Calibration And Validation: Data availability

Legend

- 6 WSC Hydrometric Stations
- DFO Tide Gauge
- 9 Municipal Gauges

Water Level Data

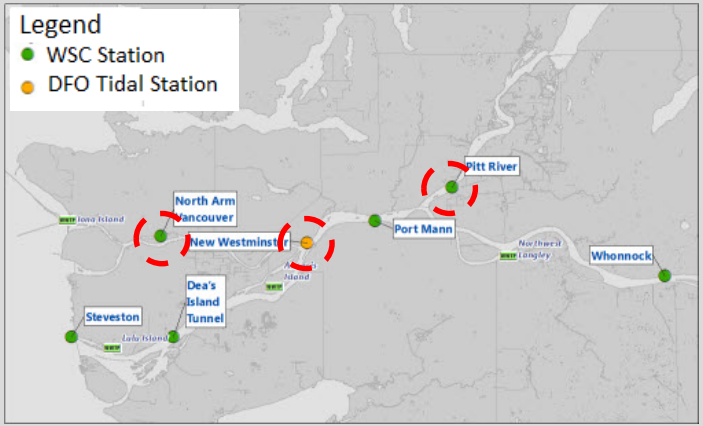


Salinity and Current Data

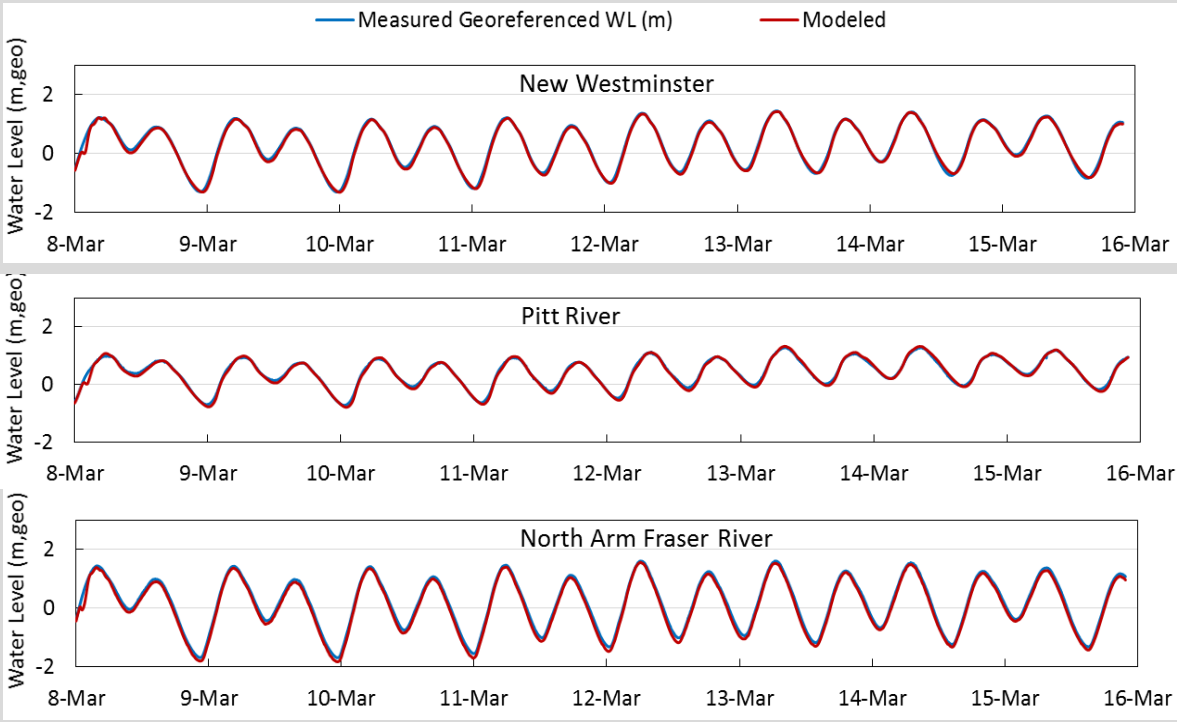
Discharge Data

Mission's estimated Q for H > 3m

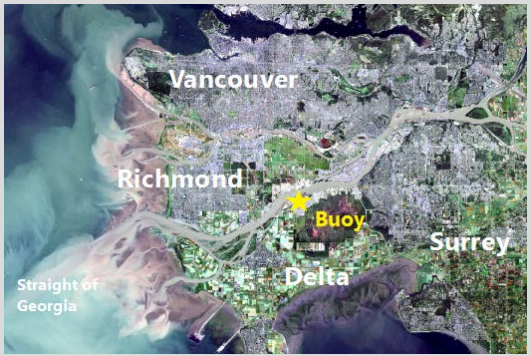
Model Validation: Water Level (March 2013)



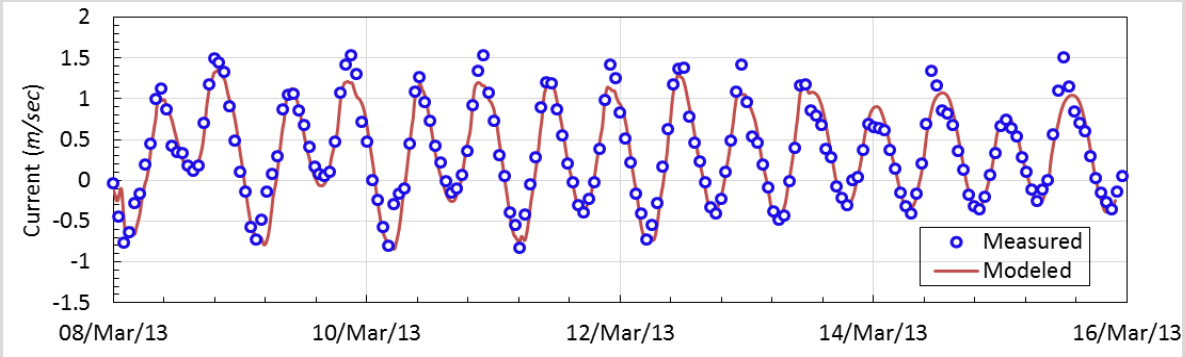
Gauge Name	Gauge Type	Standard Deviation or Root Mean Square Error in WL (m)
Steveston	WSC (08MH028)	0.05
Dea's Island Tunnel	WSC (08MH053)	0.06
Port Mann	WSC (08MH054)	0.10
Pitt River near Port Coquitlam	WSC (08MH035)	0.05
Whonnock	WSC (08MH044)	0.04
North Arm Vancouver	WSC (08MH032)	0.11
New Westminster	DFO	0.07



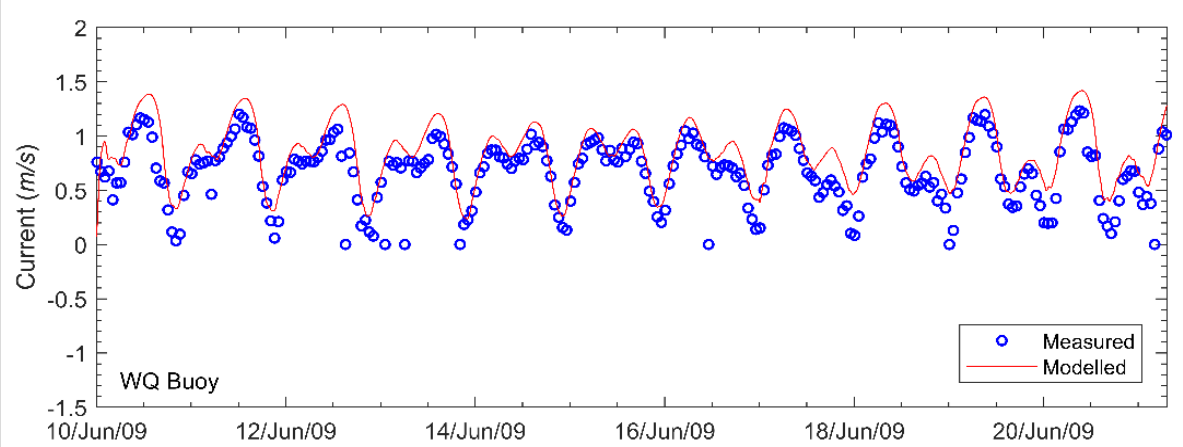
Model Validation: Current



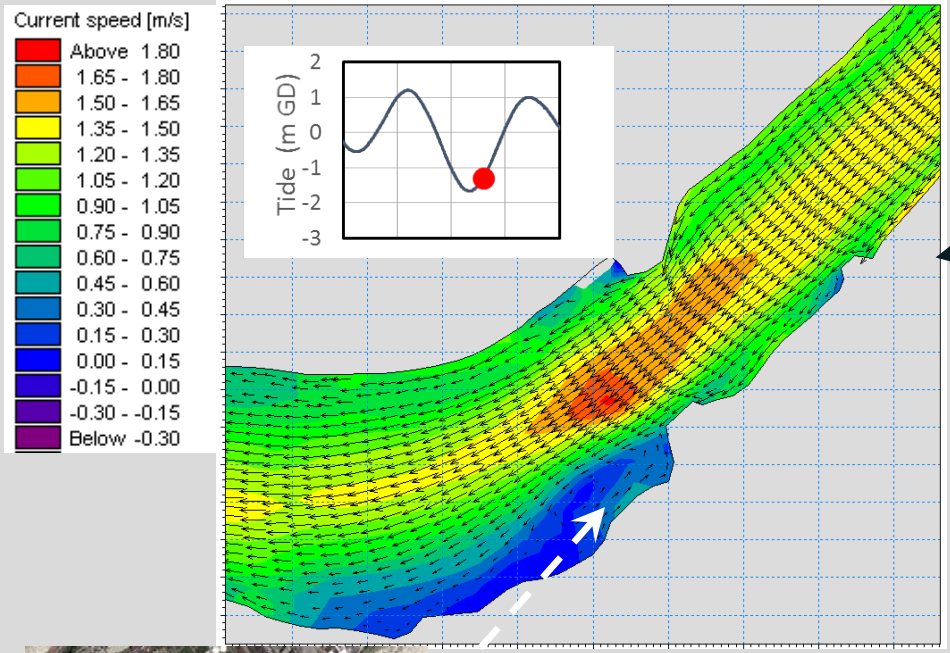
Model Validation: March 2013-Low Flow

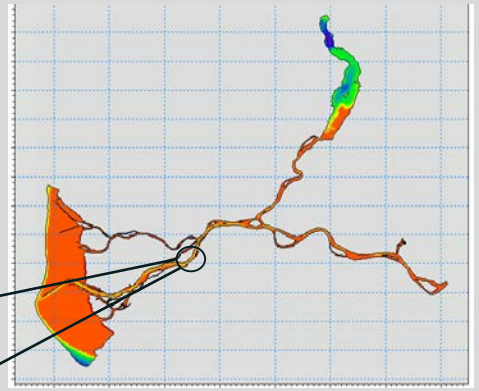


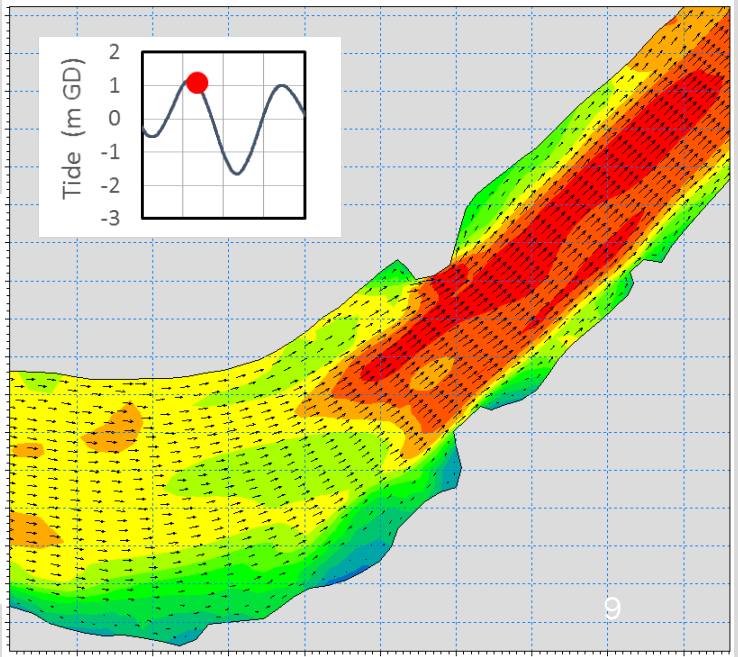
Model Validation: June 2009-Freshet

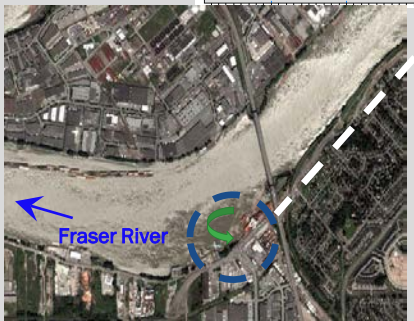


Low Flow Model Validation: Current



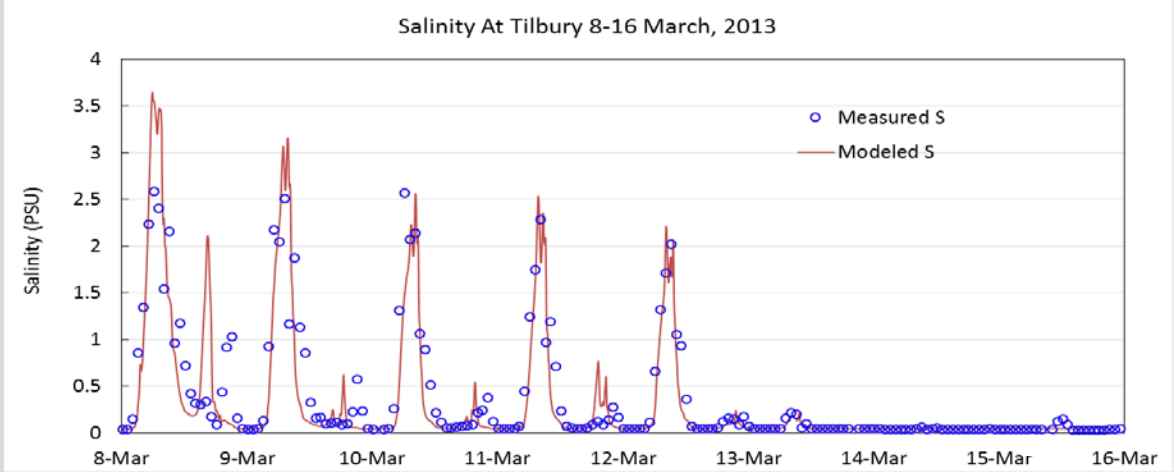




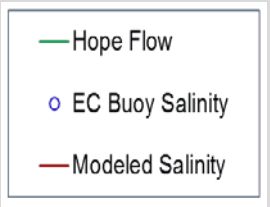


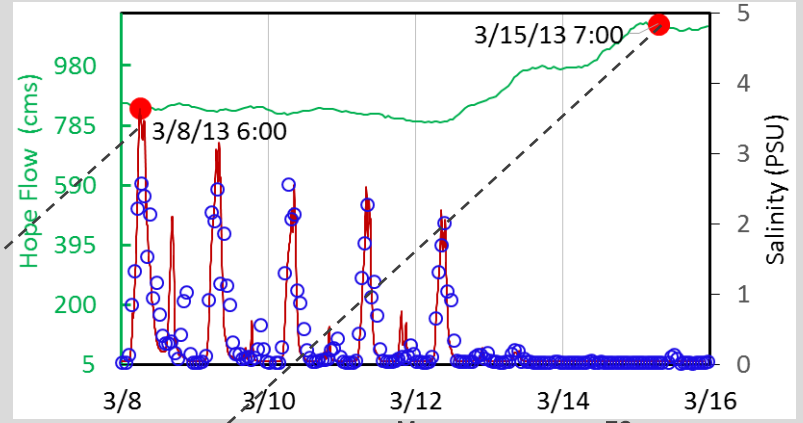
Black and Veatch (2013) ADCP measurement

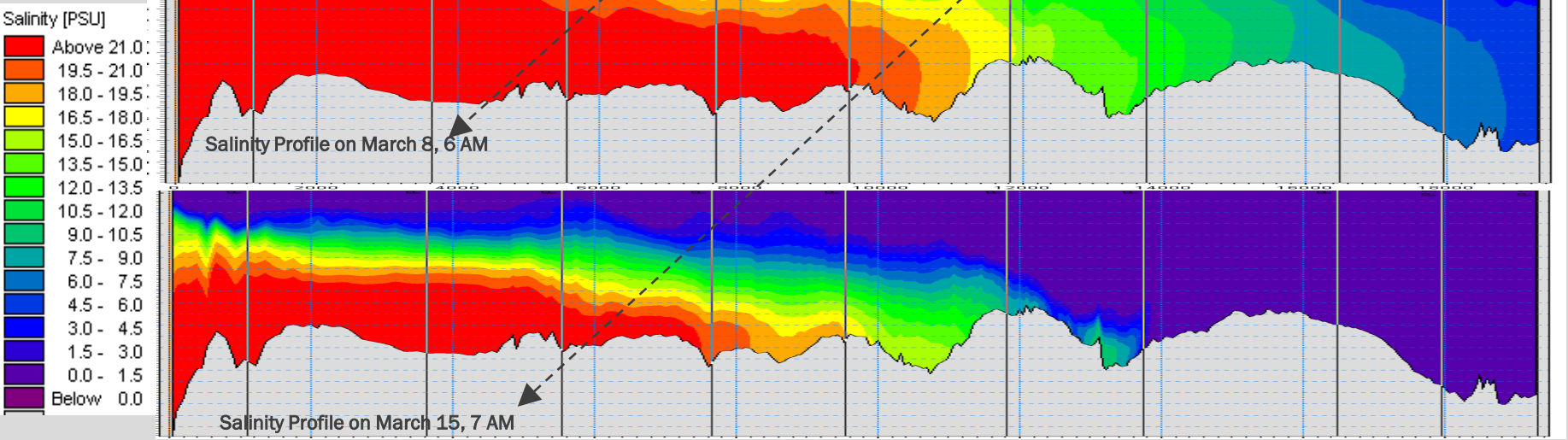
Model Validation: Salinity (March 2013)

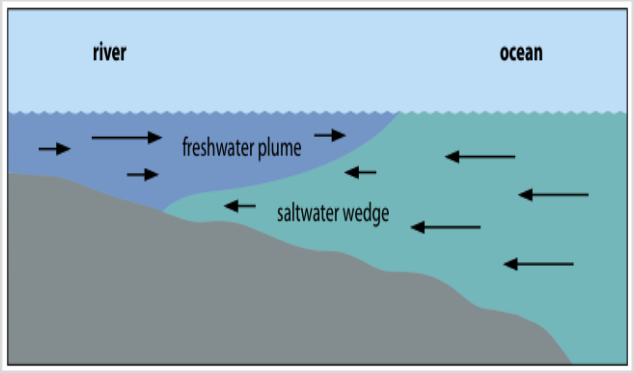


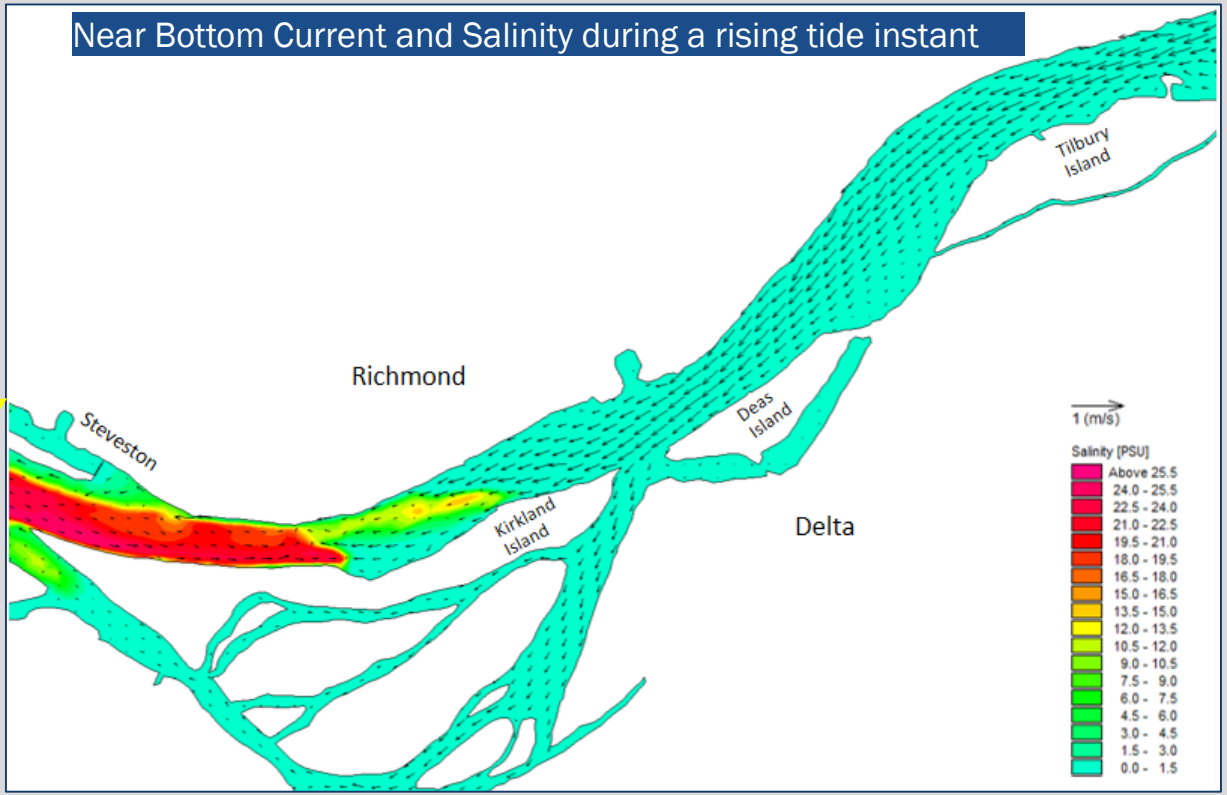

VANCOUVER
New Westminster
Fraser River Flow
Surrey
Richmond
Massey Tunnel
EC bouy
Steveston
Sand Heads
Delta


Hope Flow
EC Buoy Salinity
Modeled Salinity


3/15/13 7:00
3/8/13 6:00
Hope Flow (cms)
980
785
590
395
200
5
Salinity (PSU)
5
4
3
2
1
0
3/8
3/10
3/12
3/14
3/16

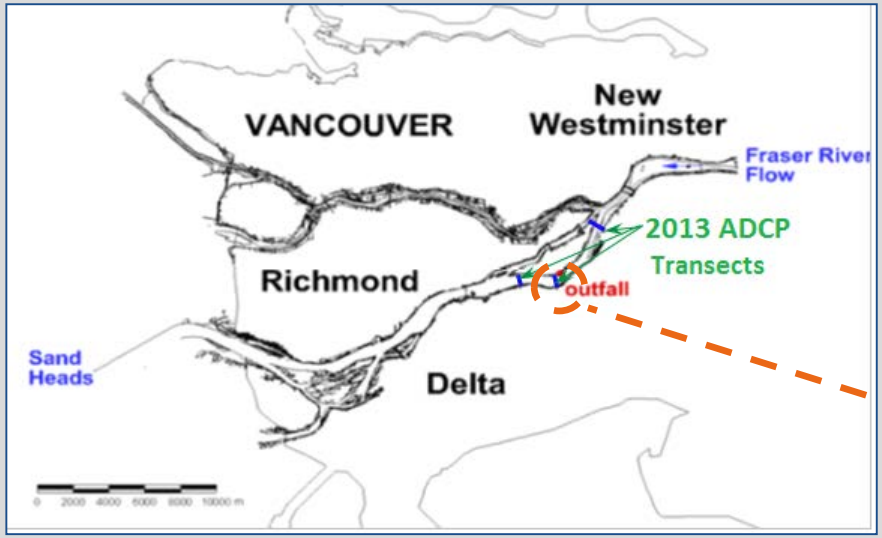

Steveston
Massey Tunnel
EC Buoy
Salinity [PSU]
Above 21.0
19.5 - 21.0
18.0 - 19.5
16.5 - 18.0
15.0 - 16.5
13.5 - 15.0
12.0 - 13.5
10.5 - 12.0
9.0 - 10.5
7.5 - 9.0
6.0 - 7.5
4.5 - 6.0
3.0 - 4.5
1.5 - 3.0
0.0 - 1.5
Below 0.0
Salinity Profile on March 8, 6 AM
Salinity Profile on March 15, 7 AM

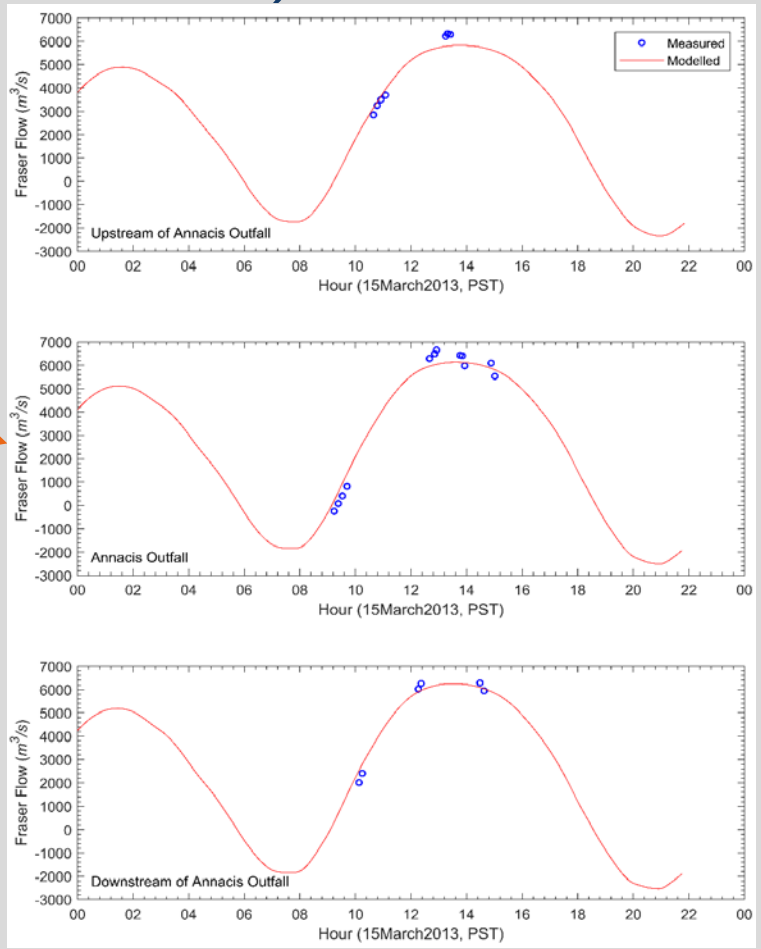




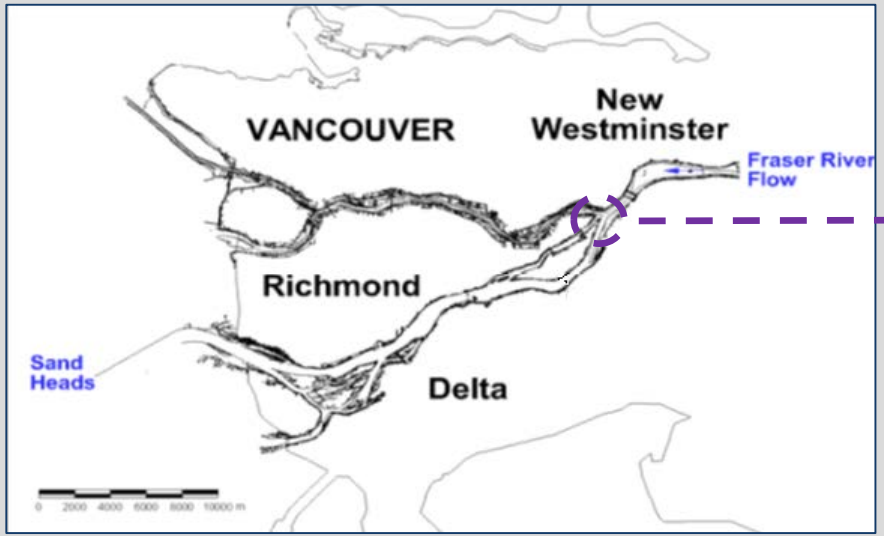
Bi-directional Current due to Salt Wedge

Model Validation: Discharge (March 2013)





Model Validation: Discharge/Flow Split

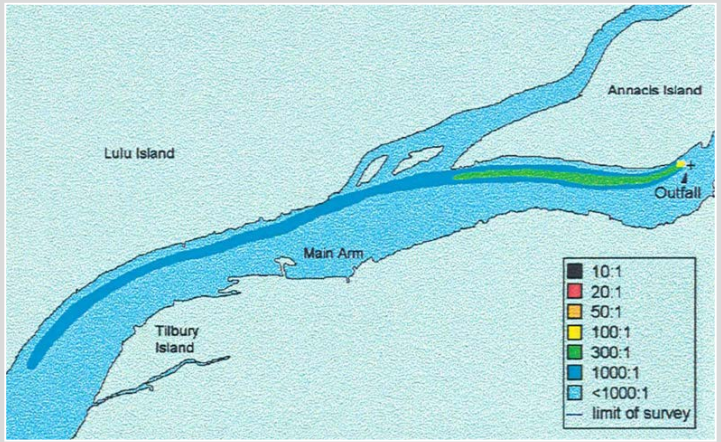


Flow split to North arm:

- 12 to 13.5%.
- Within the range (10-15%) reported for Fraser River North Arm (Thomson 1981 and nhc 2006)

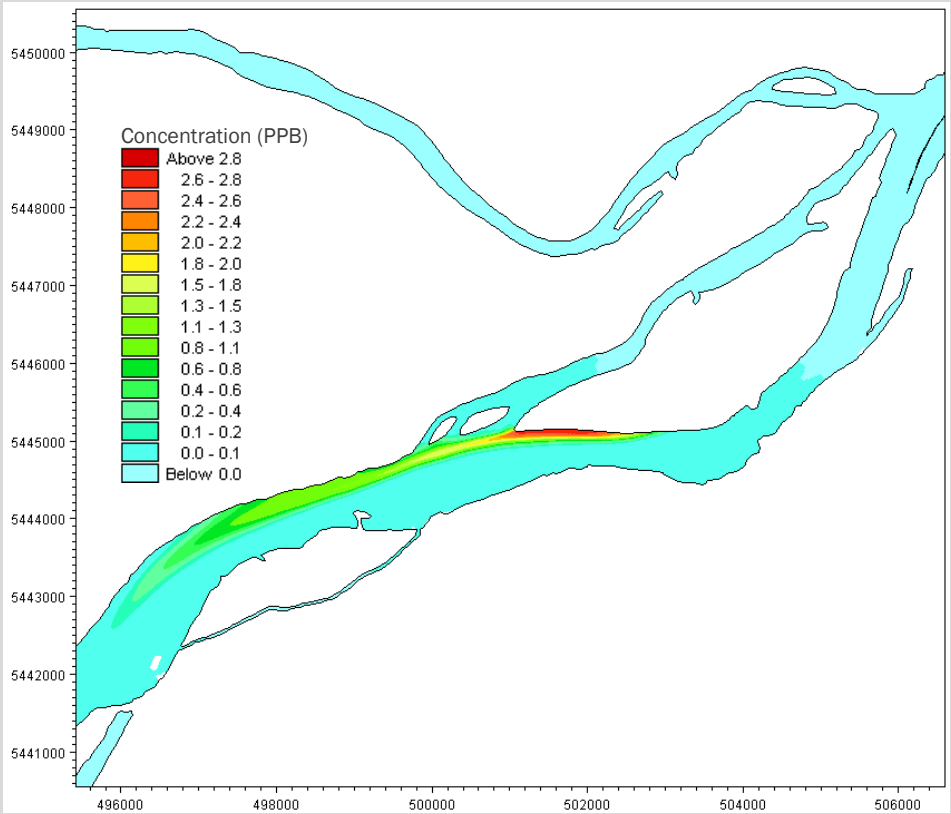
Application

Transport and diffusion module evaluation using Rhodamine Dye dispersion in Fraser River



Sea consult Dye study (1994)

Rhodamine Concentration 2hrs after discharge from AIWWTP



MIKE3 Fraser model prediction

Summary

- A numerical 3-D model is developed for Fraser River
- The model is calibrated and validated against measured data
- Future improvement: refined and updated bathymetry data, ADCP measurement of current and discharge, refined salinity and temperature boundary values by Salish Sea Model output (Under development).

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