
*Real-Time Water Quality Monitoring
in the Fraser River Estuary*
- *Development of a real-time water quality buoy* -

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Pacific and Yukon Water Quality Monitoring Office (Vancouver)

Real-Time Water Quality Monitoring Workshop
St. John's, Newfoundland
2007-06-04



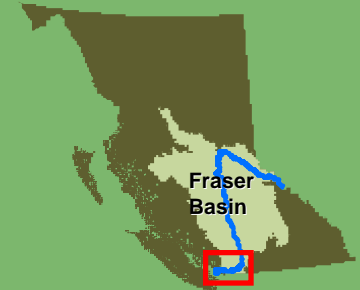
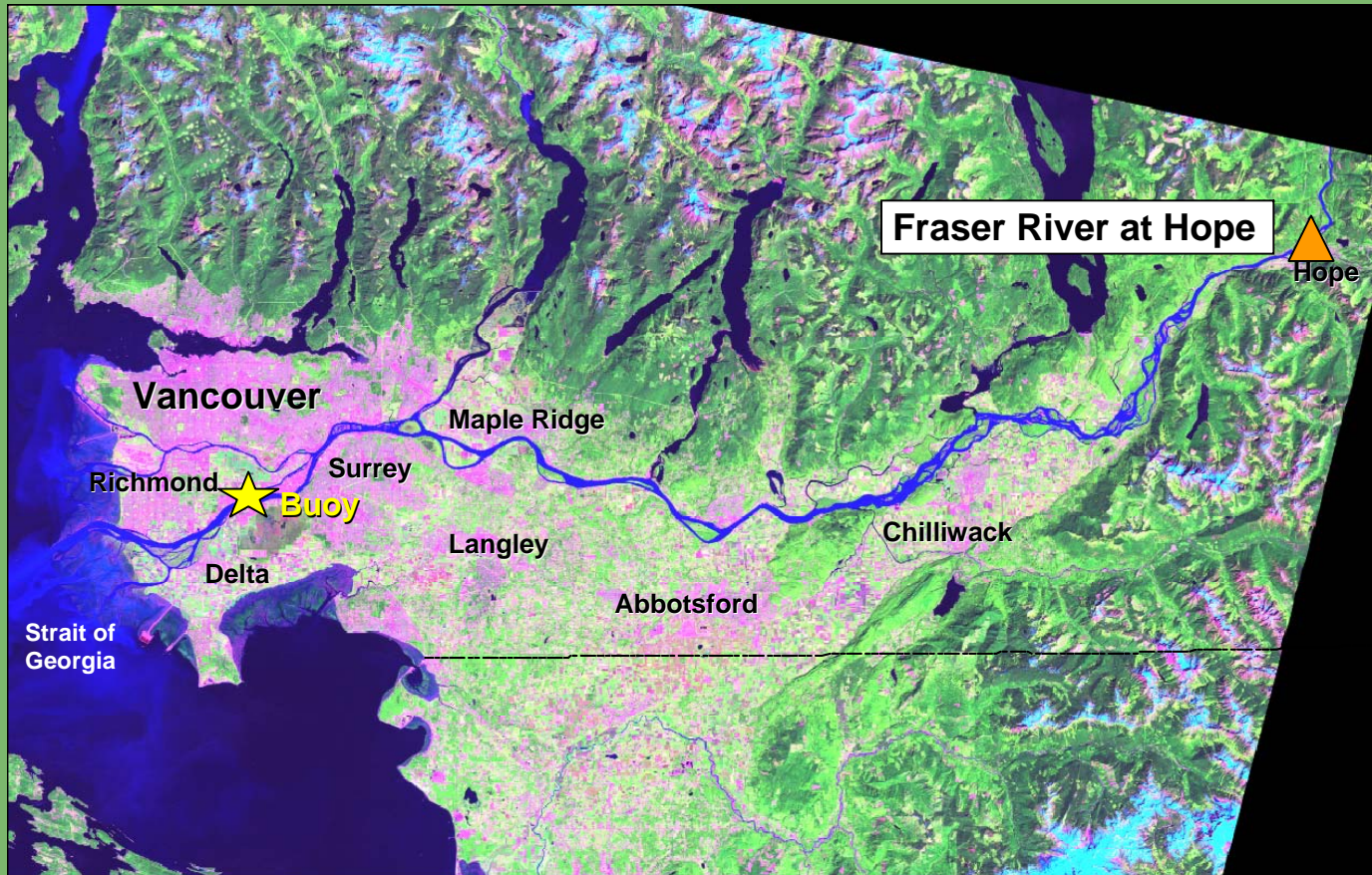
Environment Canada
www.ec.gc.ca

Canada

Overview

- Overview and Background
 - *Fraser River Estuary Sampling (History and Issues)*
- Buoy Equipment and System Configuration
- Technical Challenges
- Real-Time Data & Information
- A National Real Time Water Quality Website
- Next Steps

Lower Fraser Valley



Fraser River Estuary Sampling - History

2003-2006: Georgia Basin Action Plan (GBAP)

- *Study to develop an effective sampling method for assessing the quality of Fraser River water (fresh water) in the Estuary.*
- *Possible to establish a long-term monitoring site in the Estuary.*

2006: Canadian Environmental Sustainability Indicators program and BC Ministry of Environment

- *Funding available to develop a real-time water quality monitoring buoy*

2007: Environment Canada and BC Ministry of Environment

- *Buoy deployed as part of the existing federal-provincial water quality monitoring network of 39 stations in British Columbia*



Station Location



Main Arm of the Fraser River

- 85% of flow from Fraser River
- Minimal variability with depth



The Buoy...

- designed in collaboration with *AXYS Technologies Inc.* (Sydney, BC) to provide **continuous, year-round, real-time data** on water quality in the Fraser River estuary



Continuous

Water quality parameters

(DO, pH, conductivity, turbidity, temp...)

Meteorological information

(wind speed & direction, RH, air temp and pressure...)

River webcam images

Bi-weekly

Trace Metals

Nutrients

Major Ions

Coliforms

Event-driven

Organic Contaminants

Pesticides

Nonylphenols

Polychlorinated biphenyls (PCBs)

Polycyclic aromatic hydrocarbons (PAHs)

Polybrominated diphenyl ether (PBDEs)

Pharmaceuticals & Personal Care Products

Buoy Platform



Buoy Hull (*provided by MSC*)

3M Gilman foam float
(4.5 PCF Ionomer Foam)



Aluminium
superstructure and
steel substructure.

Dimensions:
5 m above water
3 m in diameter



Mooring

- 3 ton serrated anchor
- all chain mooring



Buoy Platform: Power Supply and Navigational Aids

Power Supply – 12VDC

Six 55 watt solar panels
(Solara AG SM220S/M55)

Eight 100 Ah batteries (12V)
(Sunlyte GNB 12-5000X)

Underwater generator
(Ampair UW)

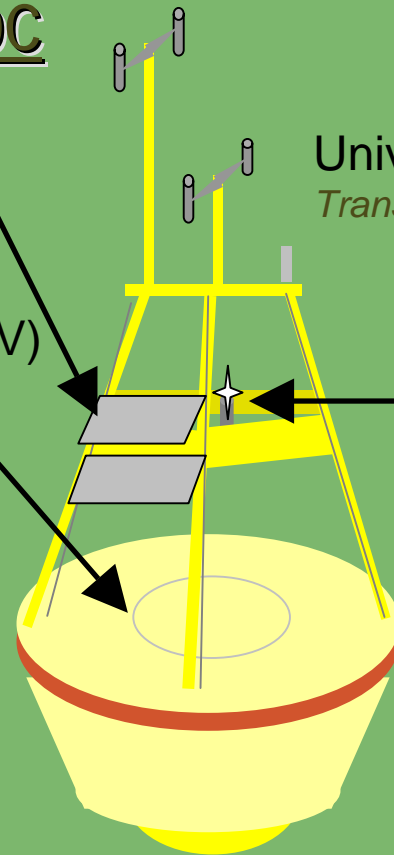


Safety & Navigational Aids

Universal Automatic Identification System
Transmits position, identification, meteorological data

Navigational Light - Amber Flashing
(Tideland MLED 120E marine lantern)

Radar reflector
Reflective strips



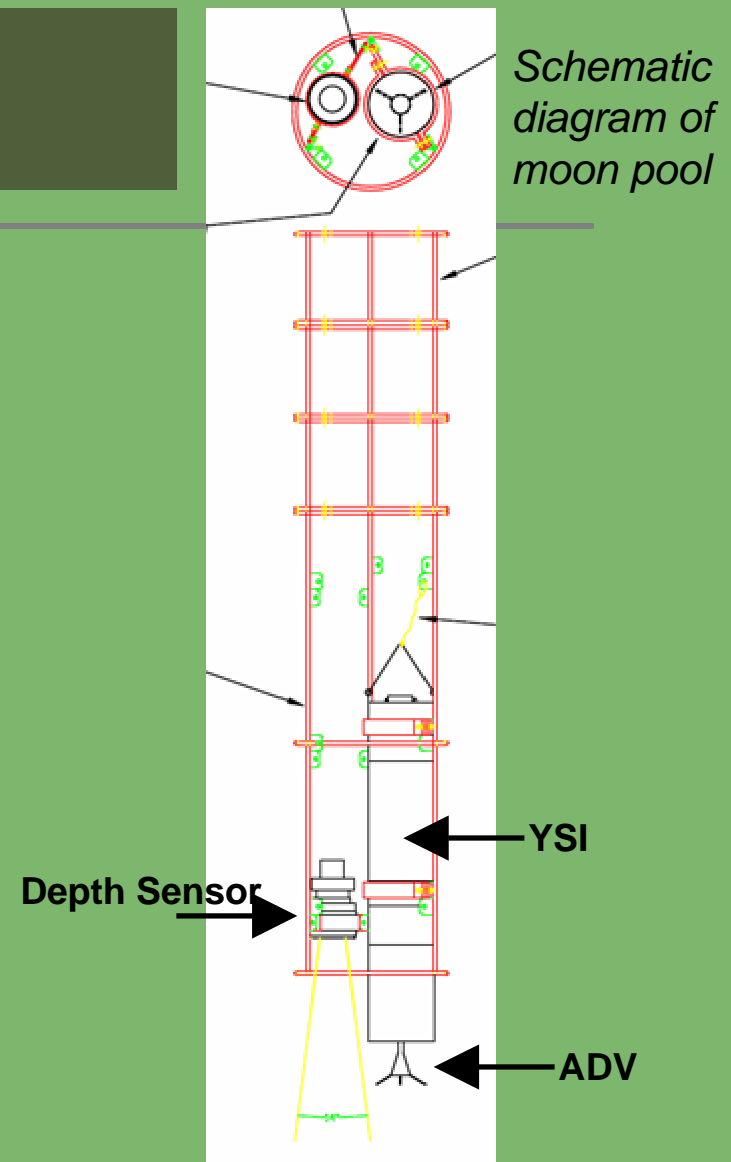
Buoy Instrumentation – Water Quality

YSI ADV6600

*dissolved oxygen, pH, conductivity, water temperature, turbidity, **water velocity***



- ADV - Acoustic Doppler Velocimeter
- sampling depth: 1 m below hull
- sampling interval: configurable



Buoy Instrumentation – Water Quality

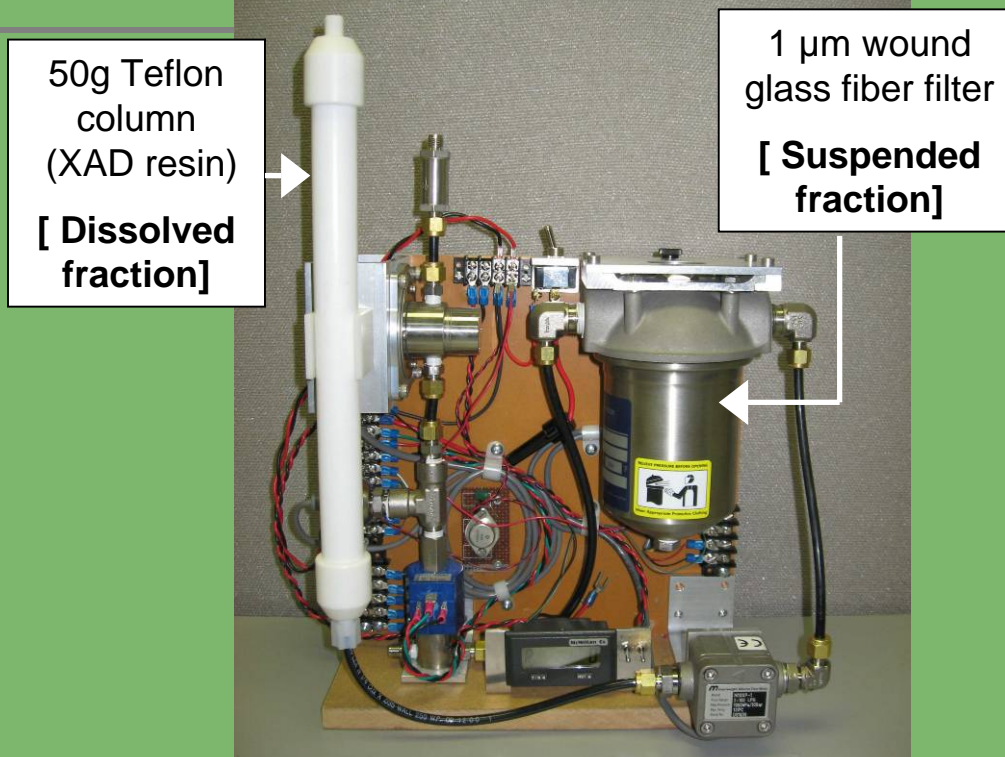
YSI ADV6600

dissolved oxygen, pH, conductivity, water temperature, turbidity, water velocity

Infiltrax 300L

*Organic contaminants
(Pesticides, PCBs, PAHs, PBDEs ...)*

- Anticipated volume: 10-15 L/day
- Time integrated sample



1) Valid Date/Time

2) Conductivity < threshold
(2 minute average from YSI)

Begin
sample →

Purge
cycle →

Sample
for set **TIME** →

**Volume sampled &
flow rate recorded**



Buoy Instrumentation – Water Quality

YSI ADV6600

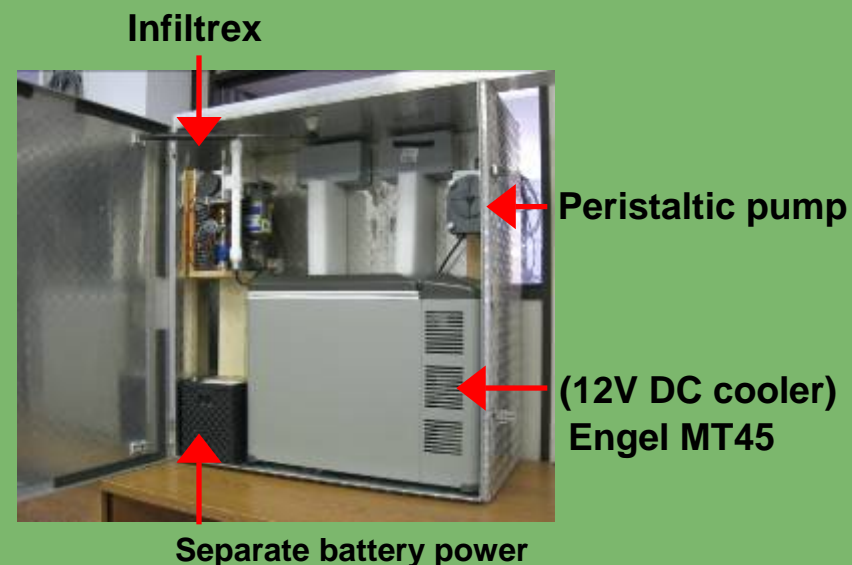
dissolved oxygen, pH, conductivity, water temperature, turbidity, water velocity

Infiltrex 300L

*Organic contaminants
(Pesticides, PCBs, PAHs, PBDEs ...)*

Whole Water Sampler

*Bi-weekly grab samples
(trace metals, nutrients, major ions, coliforms)*



1) Valid Date/Time

2) Conductivity < threshold
(2 minute average from YSI)

Begin
sample

Pump activated
for set **TIME**

- Refrigeration unit turned on

- 'Awaiting Service Message' Sent



Buoy Instrumentation – Other

	Instrumentation	Parameters
Meteorological	Anemometer (RM Young 05103)	Current wind speed/direction* Peak wind speed/direction*
	Digital Barometer (Vaisala PTB210)	Air pressure*
	Hygroclip (Rotronics MP101)	Air temperature* Relative Humidity and Dew point
Other	Camera (NetCam XL 3MP with EH3515 Pelco Enclosure)	10 images/hour (configurable)
	Compass (KVH 100)	Heading* Status
	Depth Sensor (Airmar D800)	Water depth*
	GPS	Position (lat/long)*
	Water level sensor	Detects flooding in instrument well

***Instantaneous & Average values**

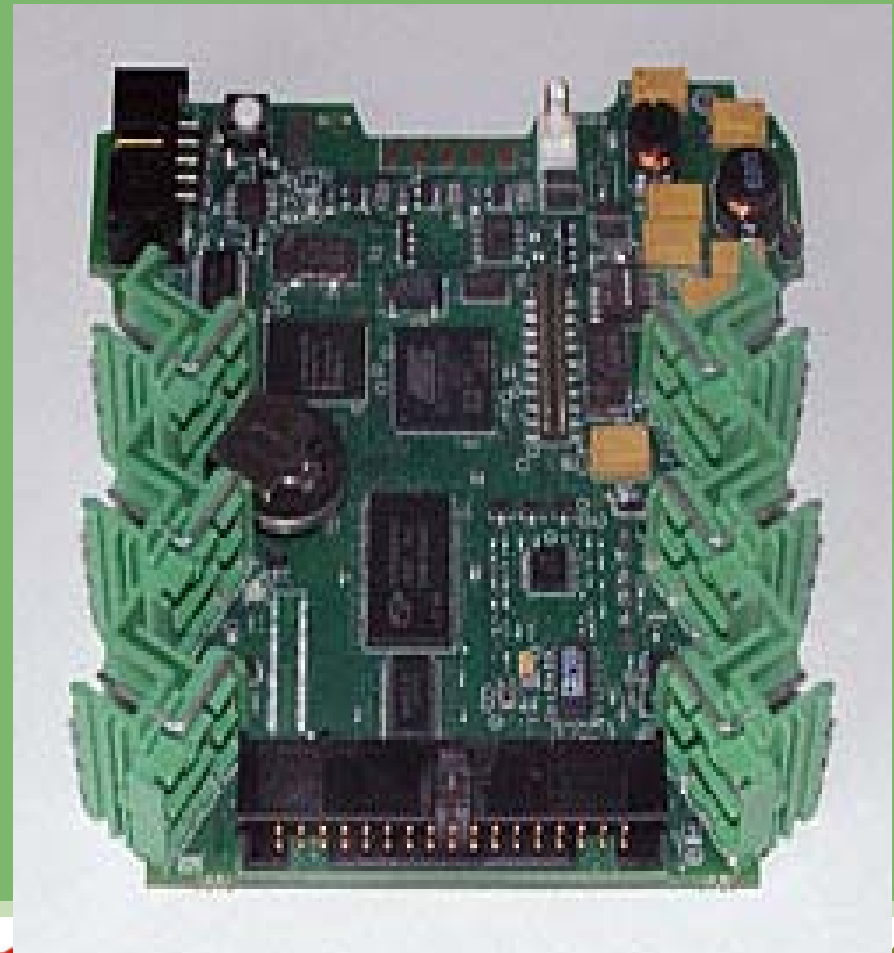


Technical Challenges

- Buoy
 - *Telecommunications / Telemetry*
 - *Telus CDMA digital cellular package*
 - *INMARSAT D+ satellite backup*
 - *AXYS Technologies solutions*
 - *AXYS Watchman 500 DCP datalogger*
- Data
 - *Integrate downloaded data into national automated real-time water quality network*

Buoy Systems – Data Acquisition & Processing System

- Data acquisition and processing system
 - *Watchman500 datalogger*
 - *Two-way communication and configurable I/O*
 - *ARM7TDMI Processor @ 16/32MHz*
 - *4MB flash program memory, 1MB RAM, 8kB EEPROM*
 - *16 x 16 bit single ended or 8 differential analog inputs*
 - *4 full duplex 115.2kbps serial ports*
 - *1 full duplex 460.8kbps serial ports*
 - *Operational from -40 degrees C to 85 degrees C*

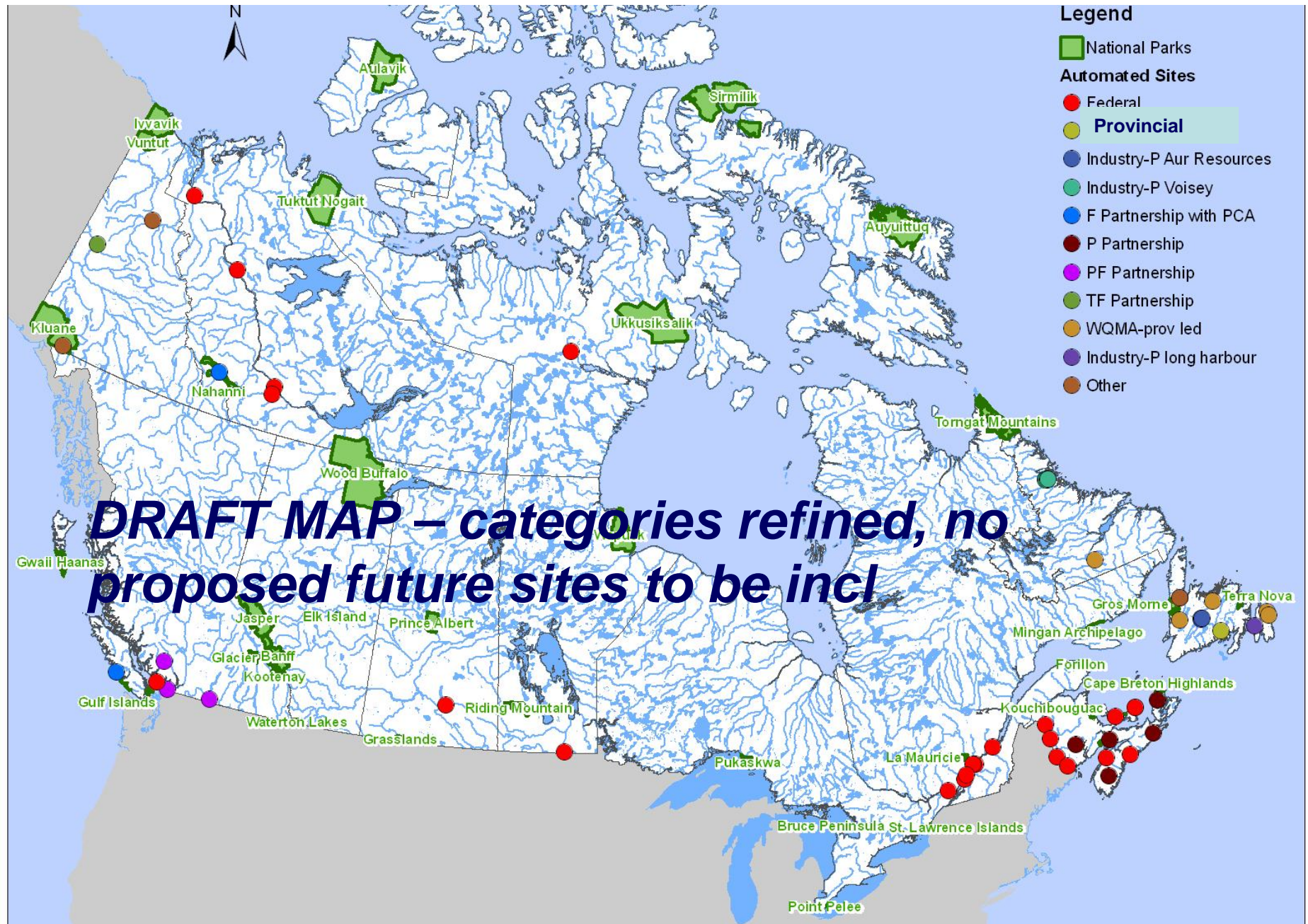


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Buoy System – Telemetry

- Data acquisition and processing system
 - *Watchman 500 Network Solution Data Management System provides two-way communication between buoy and server*
 - *Main network telemetry provided by Telus CMDA EVDO modem*
 - *InmarsatD+ provides 2-way backup telemetry (stackable 8-byte message)*
 - *Inputs/Outputs*
 - *Station Configuration, Data Message Configuration, Data Collection/Storage, Multiple Data Broadcast Pipelines*
 - *Data stored in Microsoft SQL Server 200 database*
 - *Camera imagery captured via FTP*





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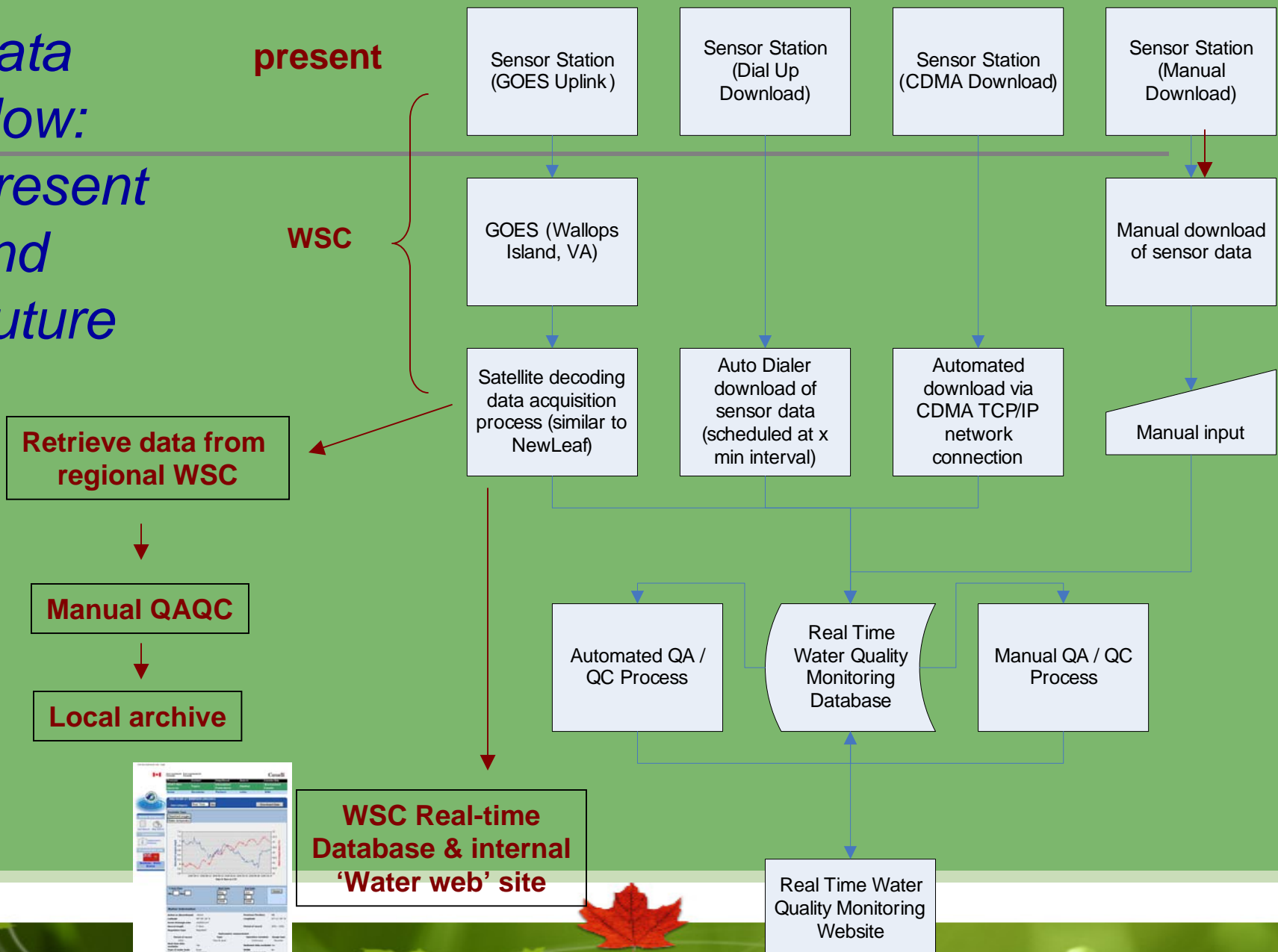
May 2007
National Water Quality Monitoring Office

National Real-Time Data and Information

- Environment Canada 2007/2008 will be creating a national real-time automated water quality database
- Database will collect sensor data from various real-time stations across Canada
- Canada-wide network will include stations that transmit telemetry through GOES, CDMA modem and dial-up
- Dissemination of data into national real-time automated water quality monitoring database
- QA/QC initially done by flagging and visual inspection
- Automated QA/QC using software and applications tools to be developed for the near future



*Data Flow:
Present
and
Future*

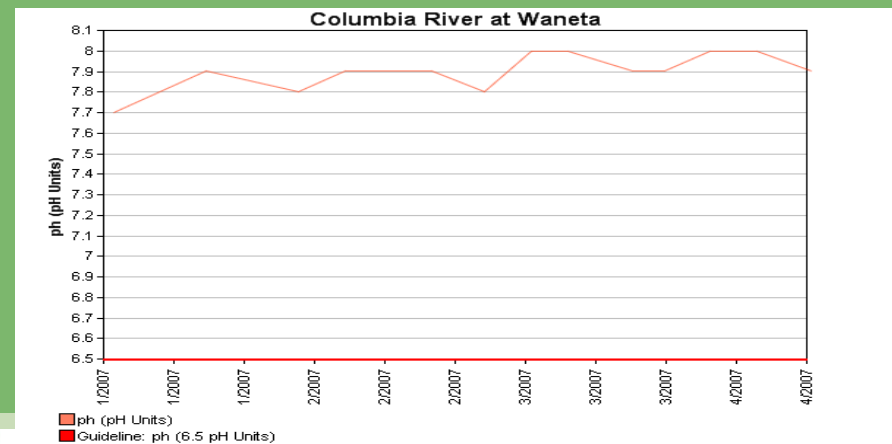
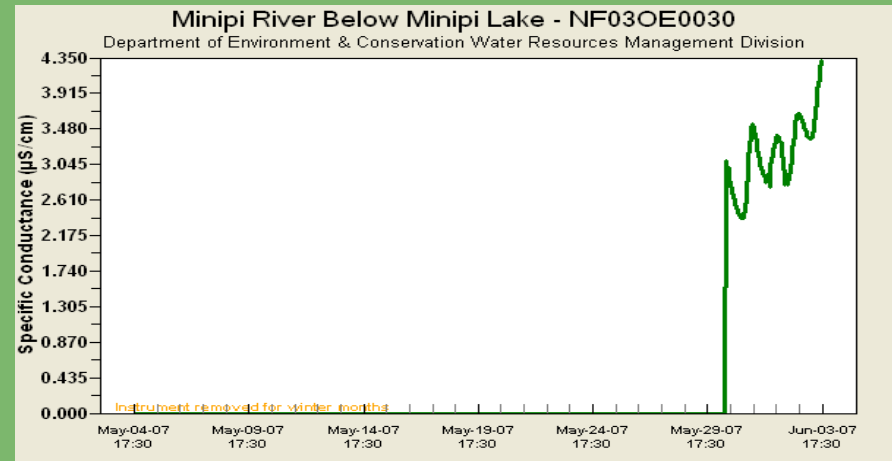


WSC Real-time Database & internal 'Water web' site

Real Time Water Quality Monitoring Website

A National Real-Time Water Quality Website

- Environment Canada will deliver real-time automated water quality information to the web with a national focus
- Functions:
 - Station profile and metadata (FGDC, SensorML)
 - Real-time graphing of sensor variables
 - Guidelines (CCME, provincial)
 - Multi-station comparison
 - Time-series data download (Via HTML, CSV, XML Web Services)
 - Variable-based alerting



ChartDirector (unregistered) from www.advsofteng.com

Near real-time on 'Water web'

- Current display of water quality information for selected sites on *internal* Water Survey of Canada 'Water Web' site

Real-Time Hydrometric Data - Graph

Environment Canada / Environnement Canada

Canada Site

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RED RIVER AT EMERSON (050C001)

Data Category:

Parameter Type:

Y-Axis View: Min Max

Start Date:

End Date:

Station Information:

Active or discontinued	Active	Province/Territory	MB
Latitude	49° 00' 18" N	Longitude	97° 12' 54" W
Gross drainage area	102000 km ²	Period of record	2002 - 2006
Record length	5 Years		
Regulation type	Regulated		

Hydrometric measurement			
Period of record	Type	Operation schedule	Gauge type
2002 -	Flow & Level	Continuous	Recorder
Real-time data available	Yes	Sediment data available	Yes
Type of water body	River	RHBN	No
EC regional office	WINNIPEG	Data Contributed By	

http://scitech.pyr.ec.gc.ca/waterweb/fullgraph.asp (1 of 2)6/7/2006 2:20:02 PM



Timeline - Milestones

- *Summer 2007* - Database development and deployment
- *Summer 2007* - Telemetry and data acquisition development
- *Fall 2007* - Application Framework development
- *Fall 2007* - QA / QC tools
- *Fall 2007* - Application programming
- *Winter 2007/08* - Web page development
- *Winter 2008* - Testing
- *Spring 2008* - National Real-Time Automated Water Quality website launch



Next Steps

- Application development
- Expansion of network
- QA / QC

Acknowledgements

- Tony Ethier and AXYS Technologies
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- BC Ministry of Environment



Questions? Comments?

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