Municipal Groundwater Monitoring in Waterloo Region

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WATER
Ours to Protect

Region of Waterloo

Presentation Overview

- Waterloo Region
- Groundwater monitoring programs
  - Overview and examples
- Clean Water Act
- Next Steps/Lessons Learned

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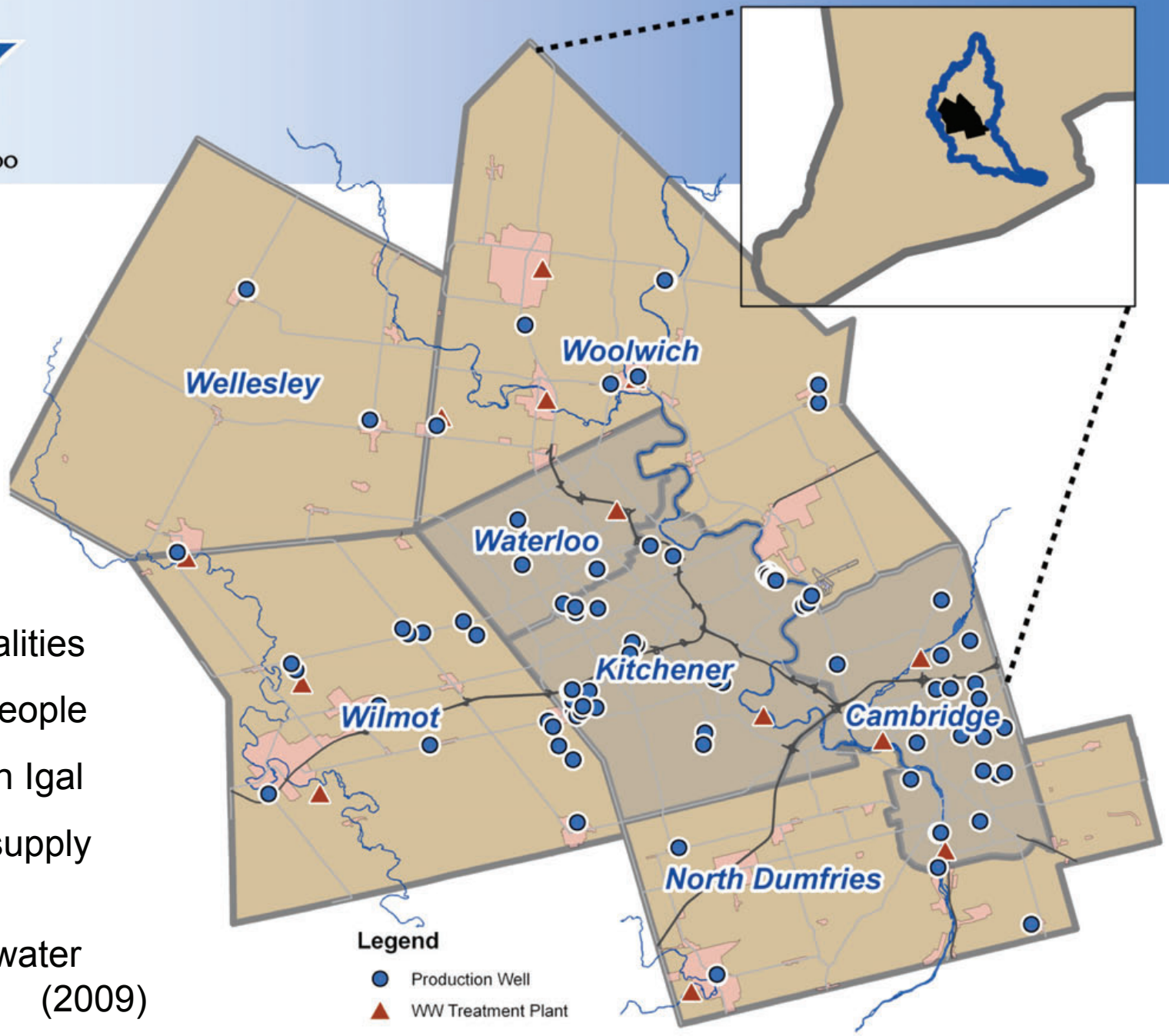


7 Municipalities

525,000 people

12.5 Billion Igal

17 water supply systems

13 waste water systems (2009)

Water Sources

- Surface Water
  - Intake at Grand River (Kitchener)
  - Treatment at Mannheim WTP
  - 20%

Water Sources

Groundwater Wells

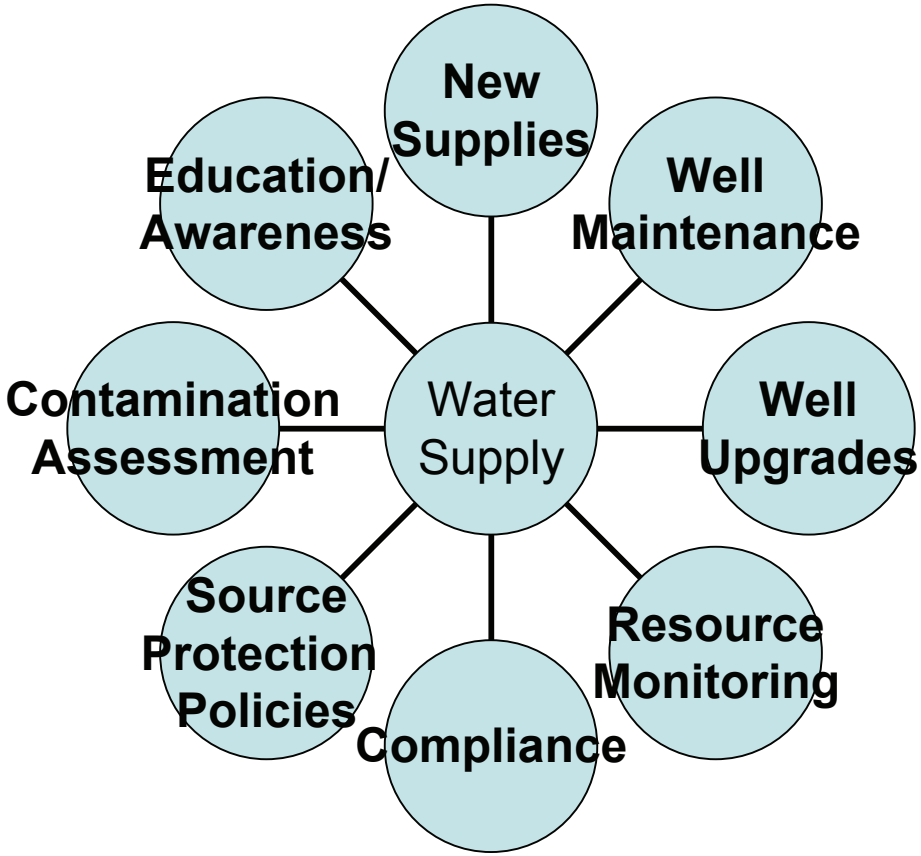
- 120 wells
- GUDI Wells (under influence of surface water)
- Aquifer Storage & Recovery Wells
- Waterloo Moraine, Fractured Rock, and River Collector wells
- 80%

Rural & Urban

Elmira

Cambridge

Hydrogeology & Source Water Group



Monitoring Programs

- 120 Production Wells
- 50 Monitoring Well nests (quality)
- 170 Monitoring Well nests (levels)
- RoW Laboratory
- On-line analyzers

- Monitoring Scope:
  - Regulatory &
  - "Beyond-Regulatory"

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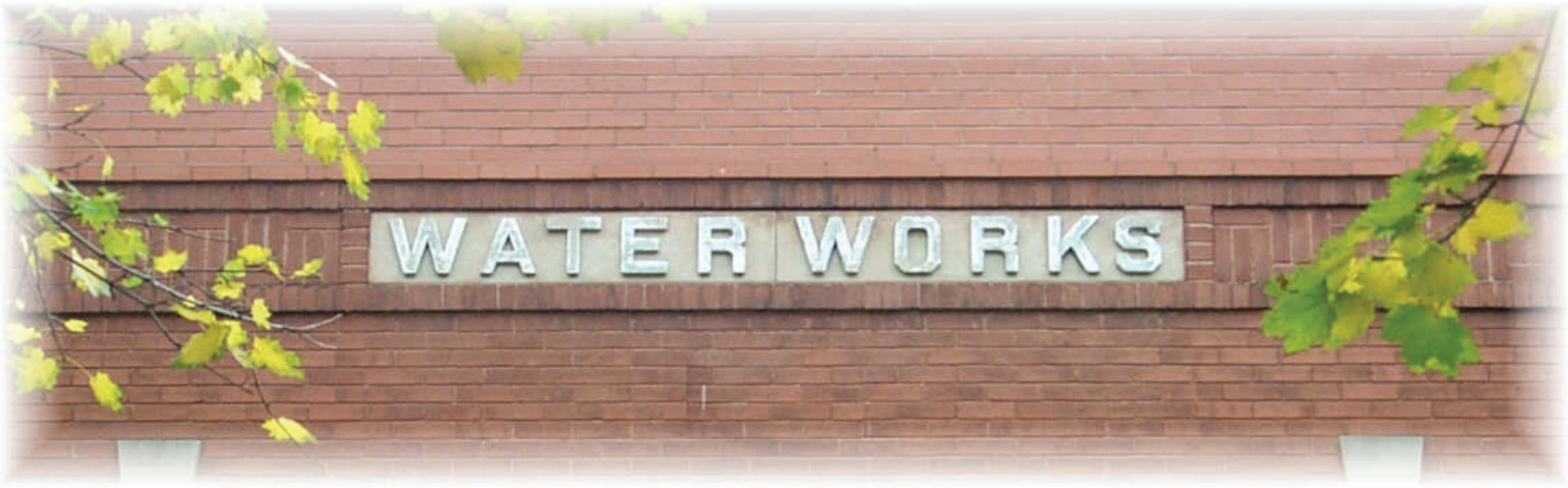
Monitoring Program Objectives

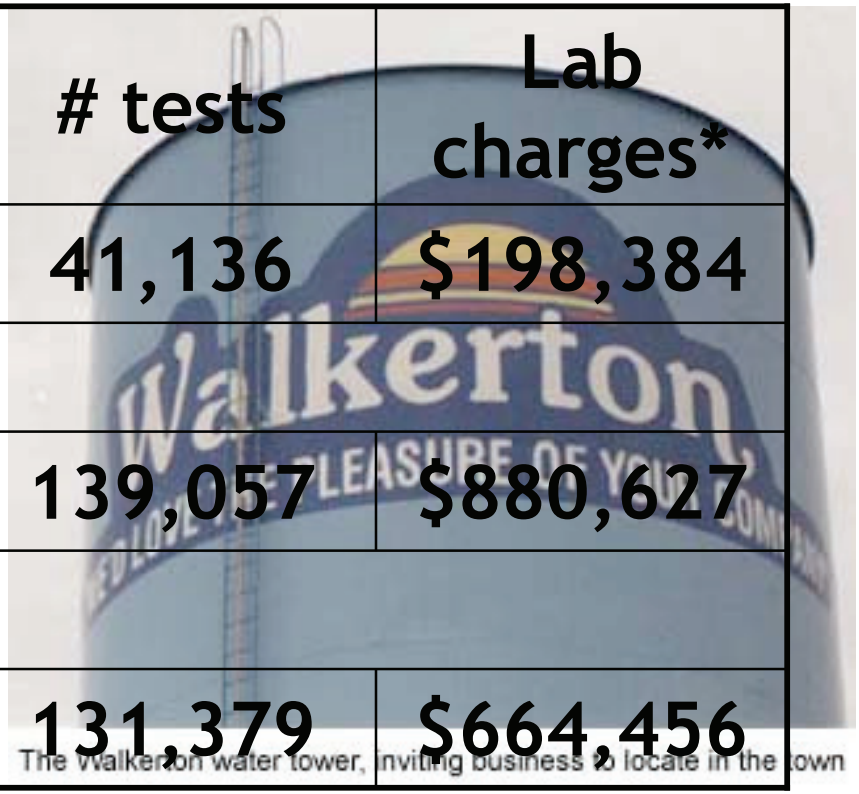
- ✓ Compliance with Legislation
- ✓ Proactive monitoring - early warning of supply or contamination issues
- ✓ Sustainable management of groundwater resources
- ✓ Understanding the hydrogeological systems



✓ Compliance with Legislation

Water samples and laboratory testing

	# samples	# tests	Lab charges*
1999	11,173	41,136	$198,384
2001	28,369	139,057	$880,627
2009	18,311	131,379	$664,456



The Walkerton water tower, inviting business to locate in the town

* Not including Water Protection extra samples

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✓ Proactive Monitoring Greenbrook Wellfield

- 5 overburden wells (Waterloo moraine)
- Park/residential area
- GUDI wellfield
- 2.5 million gal/day (125 L/s) production
- Fe, Mn treatment

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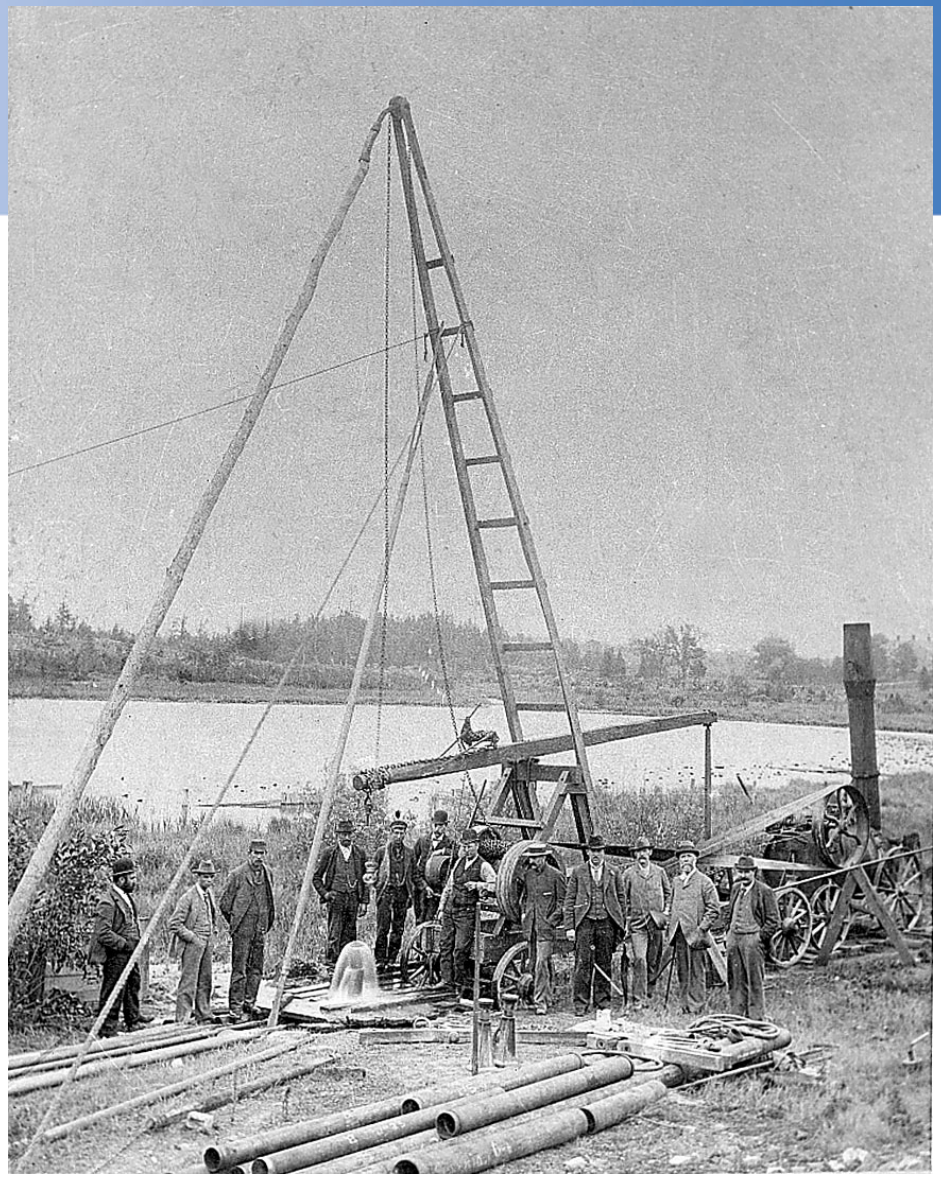
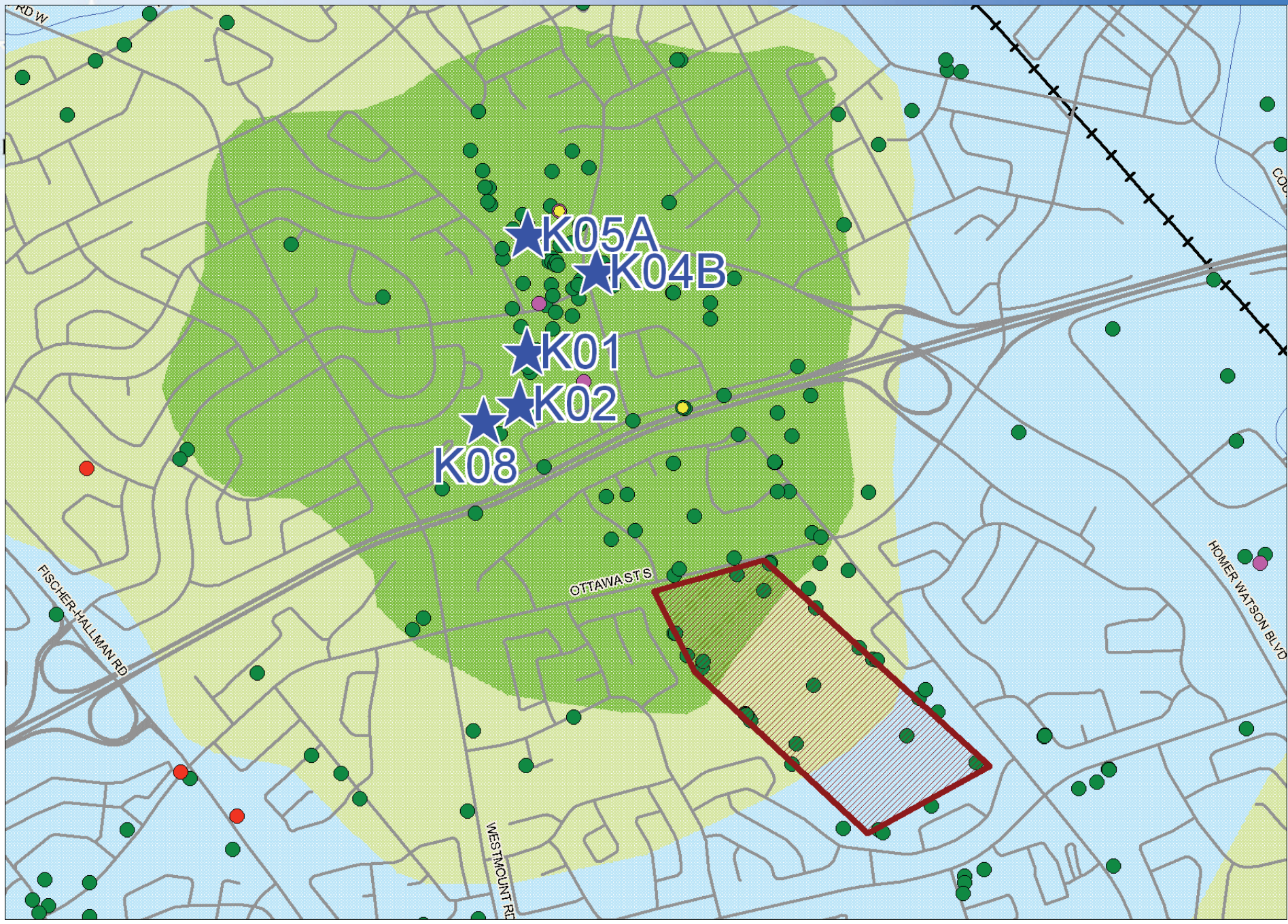
- Studied since the 1970s by University of Waterloo
- Operated since~1900
- Water quality database to 1970s
- Water level database to 1950s




K05A
K04B
K01
K02
K08
OTTAWA ST S
FISCHER-HALLMAN RD
WESTMOUNT RD
HOMER WATSON BLVD

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Beyond Compliance testing

- Testing each source (raw wells, monitoring wells)
- More frequent testing (eg seasonal trends, early warning monitoring)
- Non-regulated chemicals
  - TCA, MTBE, NDMA, 1,4-dioxane, ….

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In The News

Source of chemical that closed Kitchener wells remains a mystery

By Bob Burtt
Record staff

KITCHENER

Waterloo Region officials still don't know where an industrial chemical responsible for closing down five Kitchener wells came from, but they do know it is going to be an expensive problem to fix.

The Greenbrook wells were shut down last August after 1,4-dioxane, an industrial solvent, was found in Kitchener drinking water.

Thomas Schmidt, the region's commissioner of transportation and environmental service, said the chemical, was found at the old Ottawa Street dump, but in concentrations too low to be responsible for the high concentrations detected in Greenbrook wells.

Schmidt said the source may never be identified with any degree of cer-

The plume of dioxane-contaminated water extends from where it was first discovered near Stirling Avenue and Greenbrook Drive to south of Ottawa Street and into the old city dump.

"The observed dioxane at the Greenbrook municipal wells and at the observation wells south of the wellfield appears to have originated from the general area between Highway 7/8 and the northern part of the former Kitchener landfill," according to a regional report to be presented at the planning and works committee today.

Schmidt said a number of old industrial dumps and industrial sites are potential sources.

The region is now focusing on determining exactly how far the plume has spread and the best available technology to destroy or remove the chemical from drinking water supplies.

The five Kitchener wells are among

supplies of groundwater, with a capacity to produce 2.5 million gallons of water a day. That's five per cent of all of the water used in the tri-city area.

Schmidt said the region expects the wells to remain closed until the end of next year.

That means getting through two more summers, when demand for water is at its highest. Officials have already warned of possible water shortages this summer.

Schmidt said costs of installing a treatment system to remove or destroy dioxane haven't been firmed up yet.

"There's no question it is going to be expensive. It will cost more to run Greenbrook with dioxane than it was without it."

The region is considering two methods of treatment that have been proven effective with dioxane. The first involves a form of oxidation and the sec-

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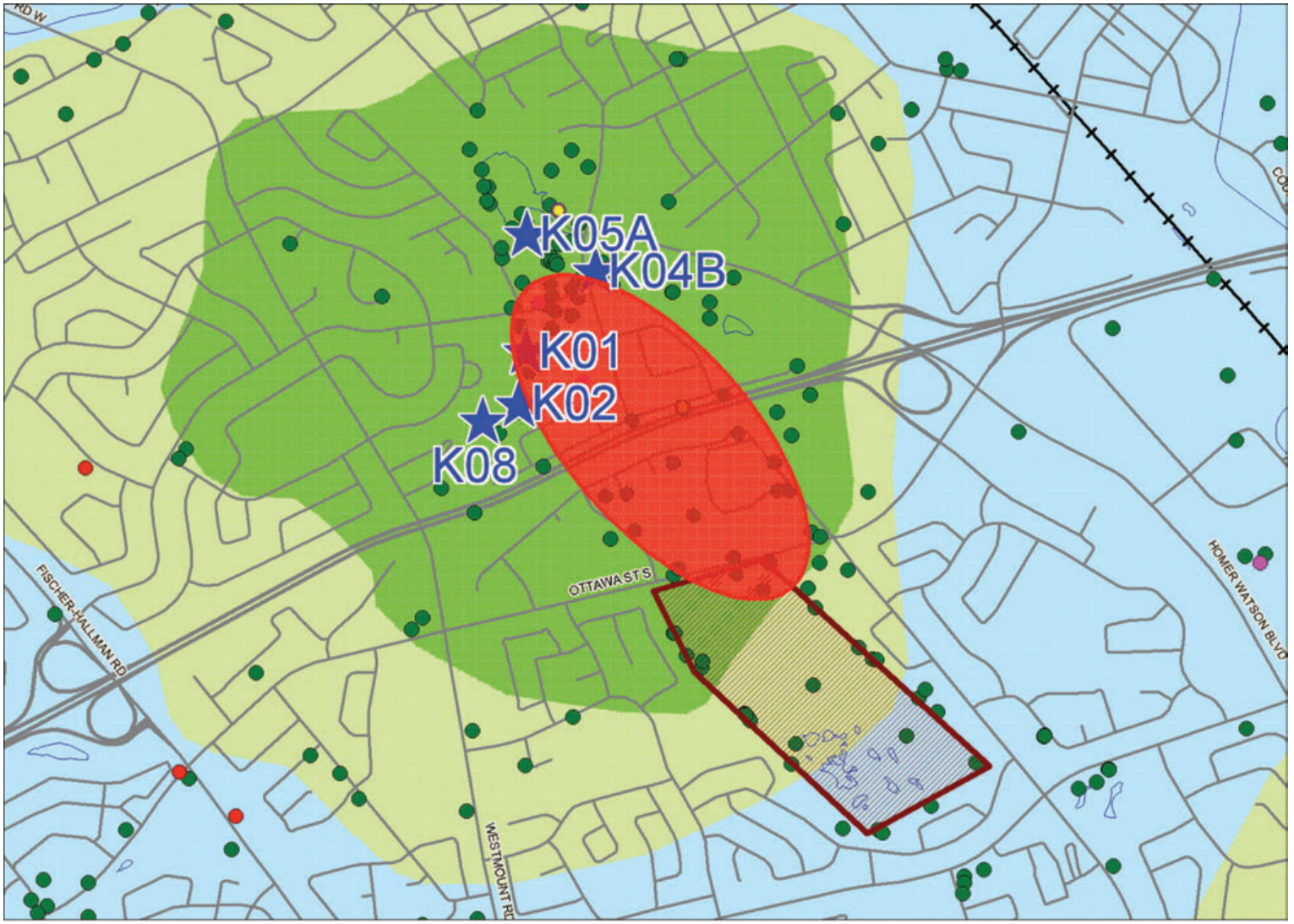
1,4-dioxane plume at Greenbrook



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UV - Hydrogen Peroxide

Aside: The challenges of well fields in developed areas

✓**Sustainable Management**

- ❖Well/Aquifer optimization
- ❖GUDI research
- ❖Well decommissioning

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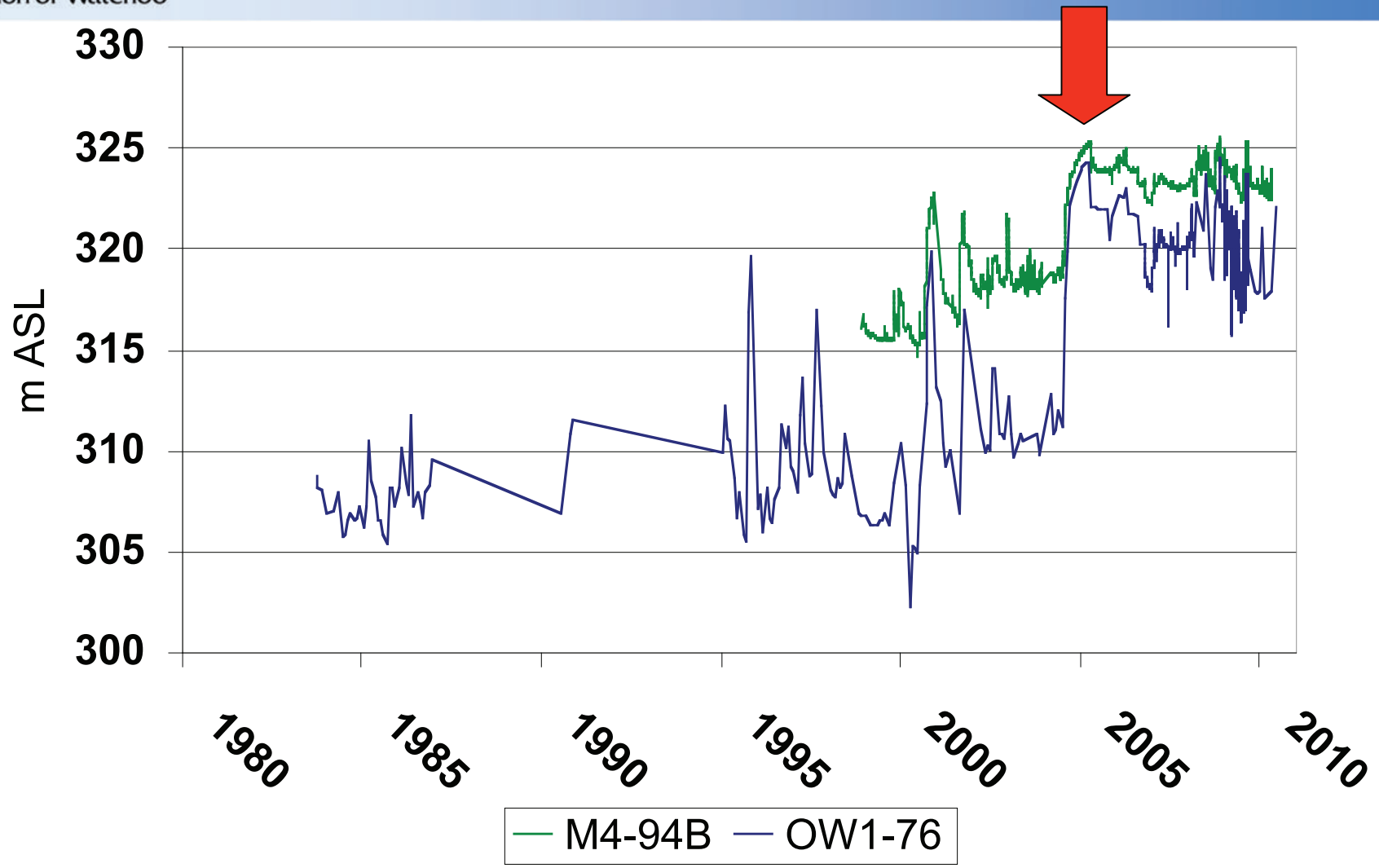
Greenbrook Water Level Monitoring

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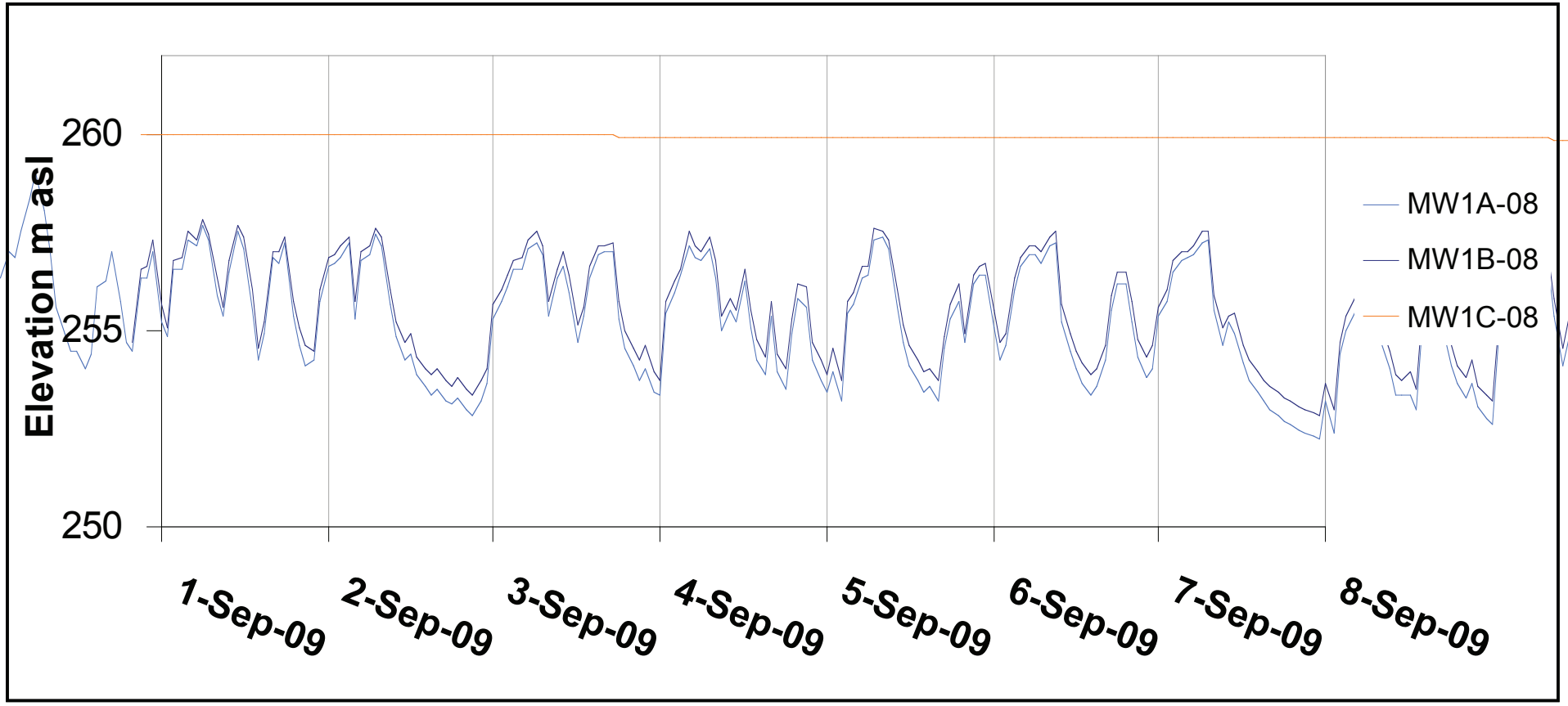
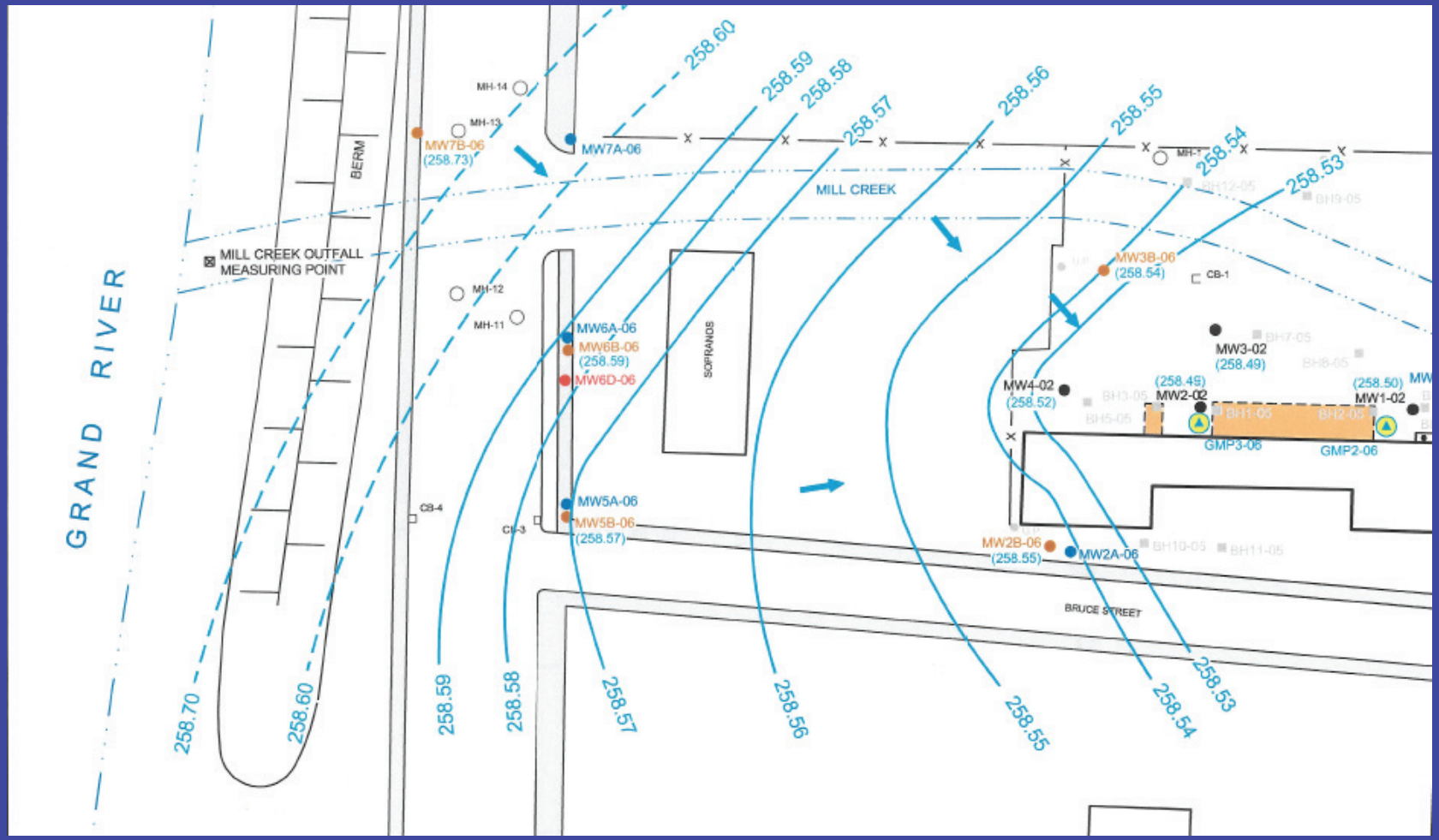
MIDDLETON
WATER PUMPING
STATION
50

✓Understanding Hydrogeological Systems - Middleton St. Wellfield

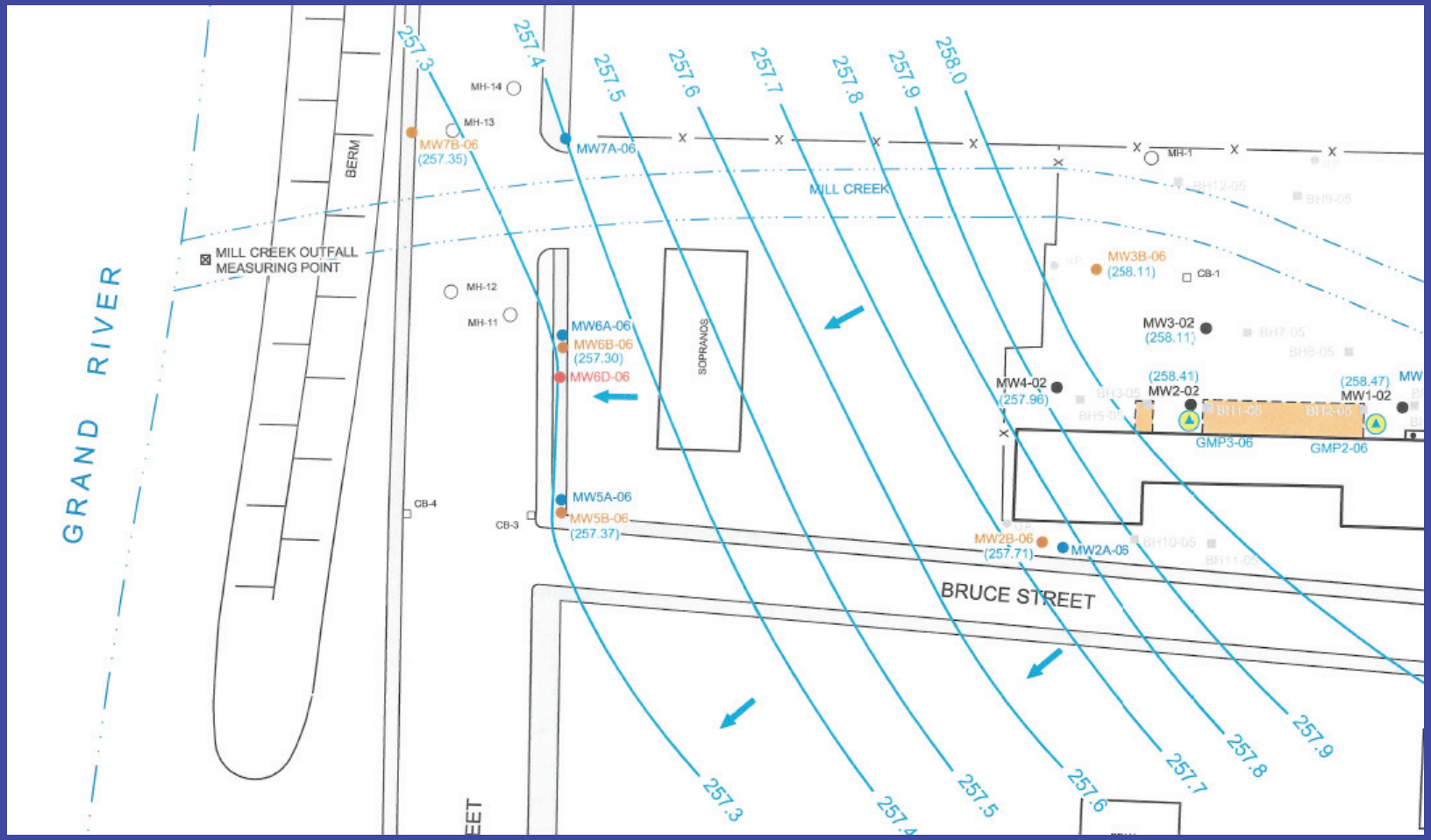
- 5 bedrock wells (Guelph/Gasport fms)
- Residential/Industrial area, Cambridge
- GUDI wellfield
- 5 mil gal/day (250 L/s), 40% of Cambridge water supply
- Under construction for TCE treatment
- Must ensure un-interrupted wellfield operation



- Importance of appropriate water level monitoring to understand hydrogeology
- Cost effective



SHALLOW BEDROCK GROUNDWATER CONTOURS - MAY 15, 2006 (6:00 AM)
HYDROGEOLOGIC INVESTIGATION
62 AINSLIE STREET SOUTH
Cambridge, Ontario



SHALLOW BEDROCK GROUNDWATER CONTOURS - MAY 15, 2006 (12:00 PM)
HYDROGEOLOGIC INVESTIGATION
62 AINSLIE STREET SOUTH
Cambridge, Ontario

TREET

GUDI monitoring at an operating wellfield

- Regulatory requirement to complete long-term GUDI monitoring
- Operational constraints- ensure continuous supply AND manage TCE levels in finished water
- Continuous turbidity meters
- SCADA
- Electronic water level measurements

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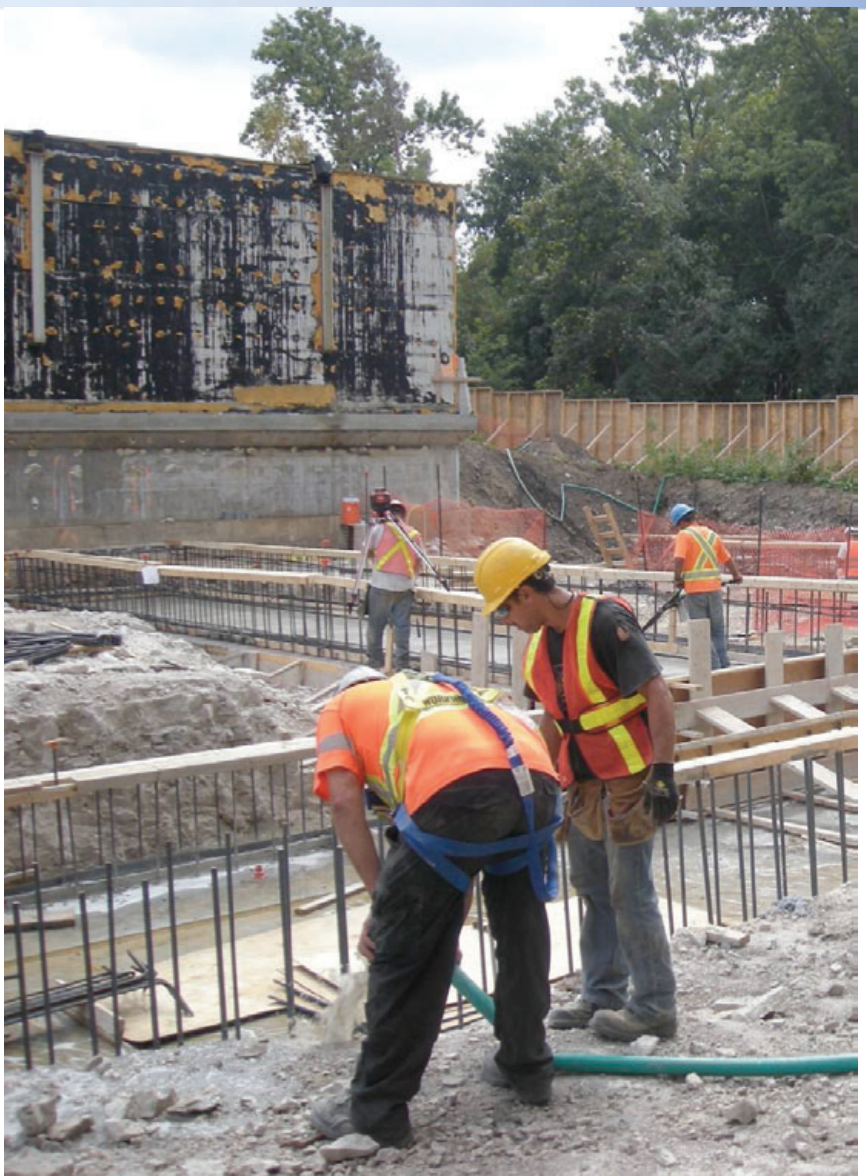

- Continuous water levels, online turbidity, now a key component of management during Middleton station construction
- Reliable, cost-effective, minimum interference with construction schedule

Ontario's Clean Water Act

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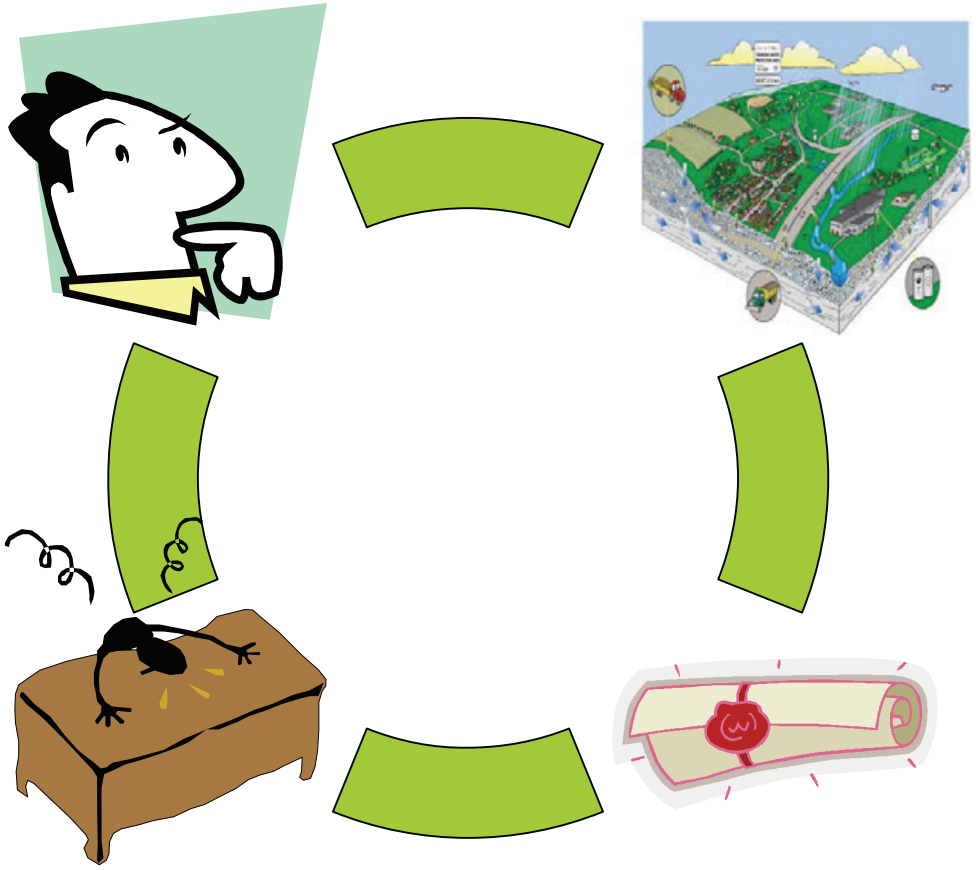
Four Steps:

- Stage 1: Establish Local Framework
  - SP Committee, TOR
- Stage 2: Watershed/Source Water Assessment *
  - Technical Rules and provincial guidance
- Stage 3: Protection Plan Development
- Stage 4: Protection Plan Implementation

* Now completing



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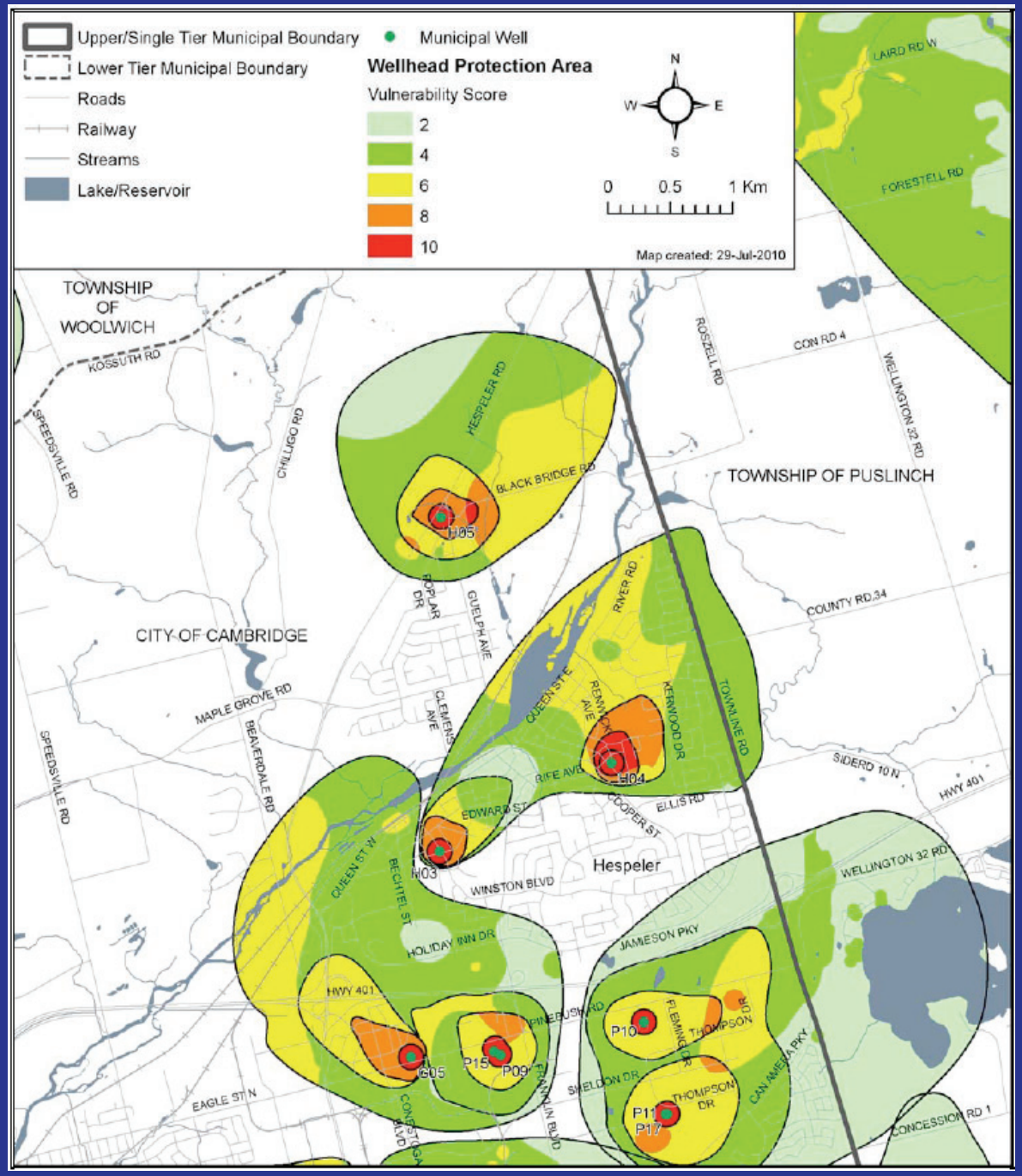
Grand River Source Protection Area



DRINKING WATER SOURCE PROTECTION
ACT FOR CLEAN WATER

LAKE ERIE SOURCE PROTECTION REGION

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CWA "Threats & Issues"

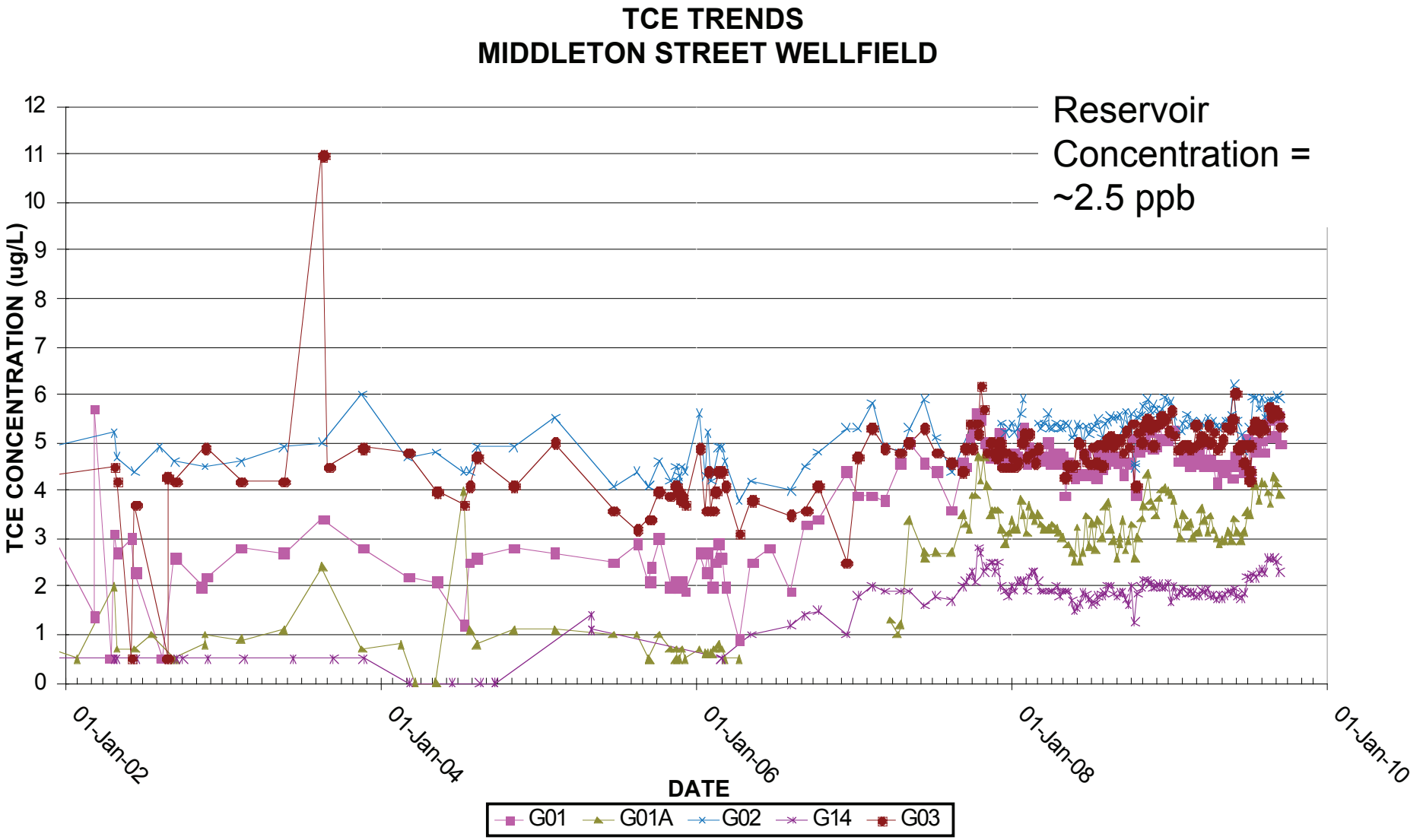
- Threat: potential source of groundwater contamination
- Condition: area that is already contaminated
- Issue: documented contamination within a water intake
  - According to Technical Rules- must use data to identify contamination and/or trends

Issues Assessment Results

- Issues at 13 wellfields
- Urban & rural
- *"Issue Contributing Areas"* defined
- Related *Threats* become *significant* within *ICAs*

- Nitrate
- Salt (chloride, sodium)
- Trichloroethylene
- ROW already monitoring and addressing these issues

Example: TCE


TCE TRENDS
MIDDLETON STREET WELLFIELD
Reservoir Concentration = ~2.5 ppb
TCE CONCENTRATION (ug/L)
0
1
2
3
4
5
6
7
8
9
10
11
12
01-Jan-02
01-Jan-04
01-Jan-06
01-Jan-08
01-Jan-10
DATE
G01
G01A
G02
G14
G03

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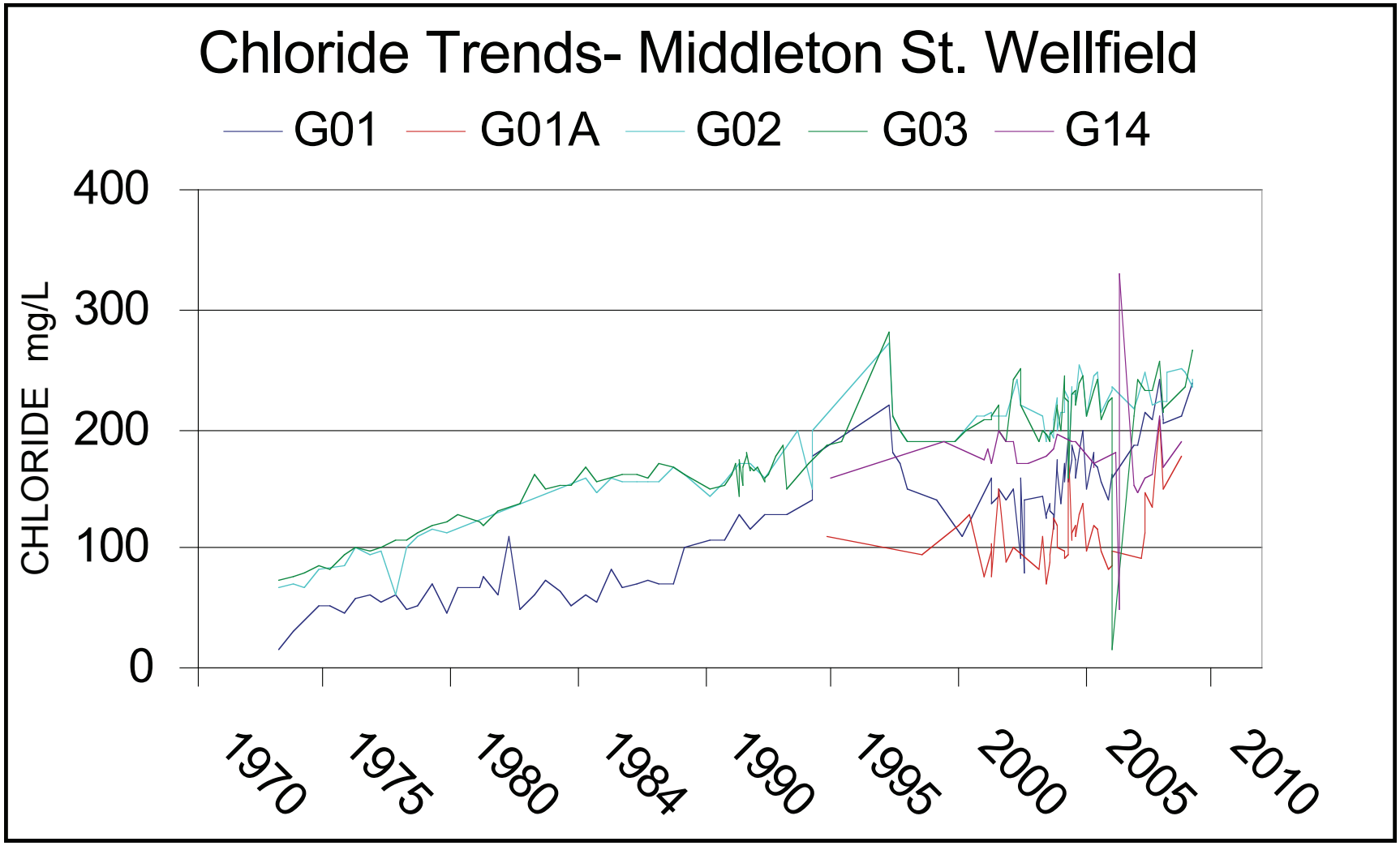
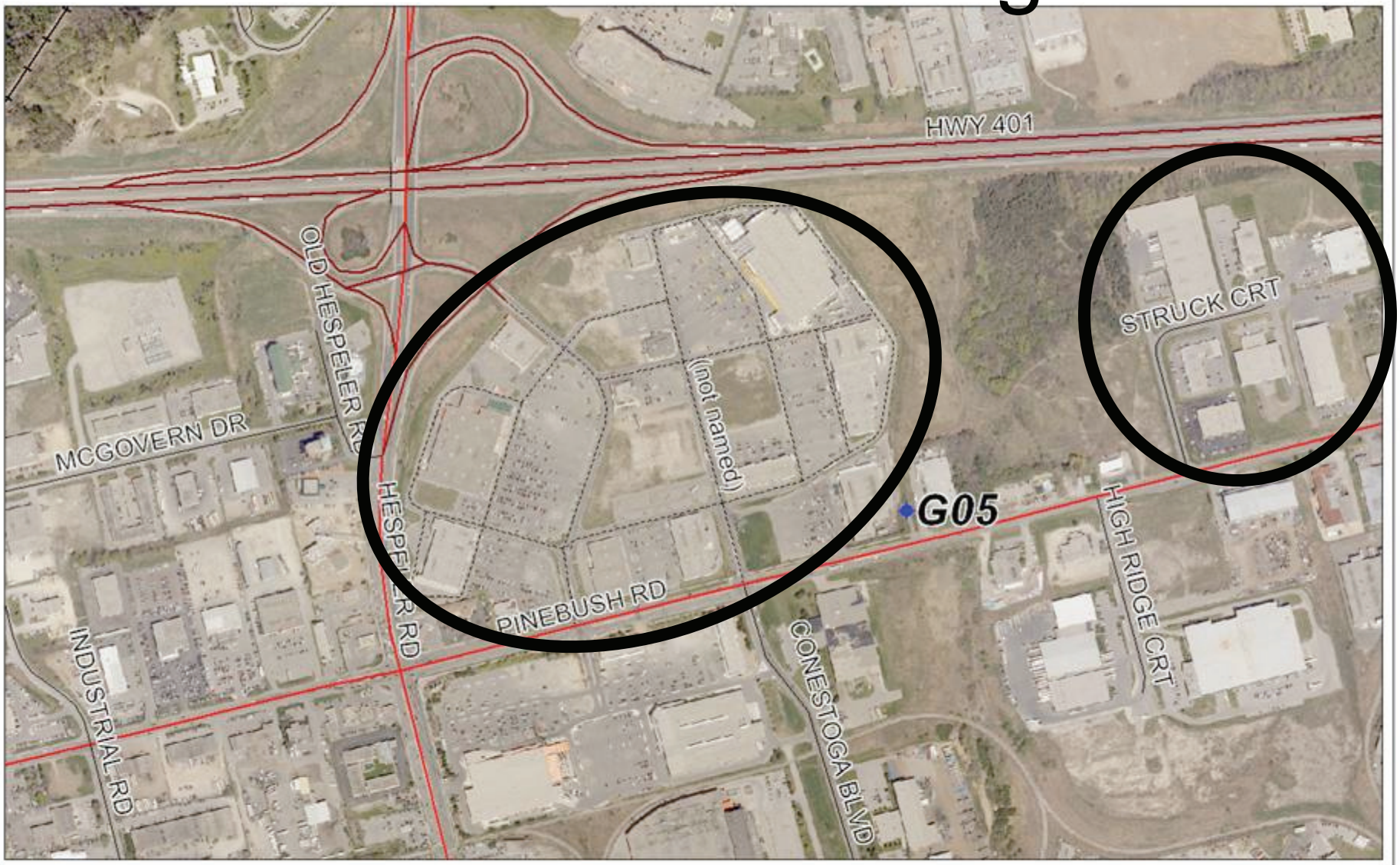
Example: Salt



Salt Sources – Parking Lots



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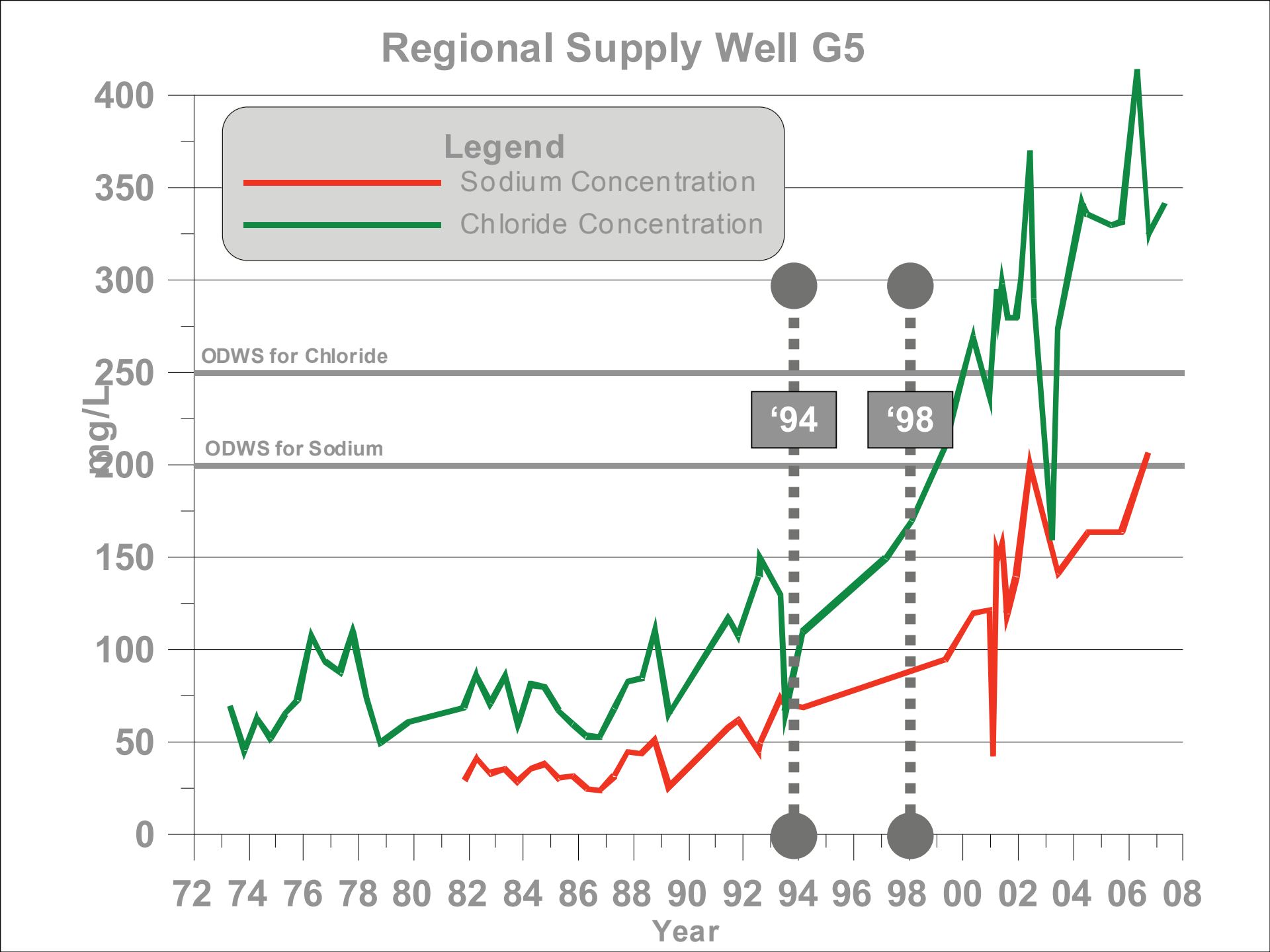
Hydrogeology and Source Water

*2007 Single Line Road Network shown
*RMOW Imagery May 2007

N
W
E
S


Regional Supply Well G5
Legend
Sodium Concentration
Chloride Concentration
ODWS for Chloride
ODWS for Sodium
'94
'98
mg/L
400
350
300
250
200
150
100
50
0
72 74 76 78 80 82 84 86 88 90 92 94 96 98 00 02 04 06 08
Year

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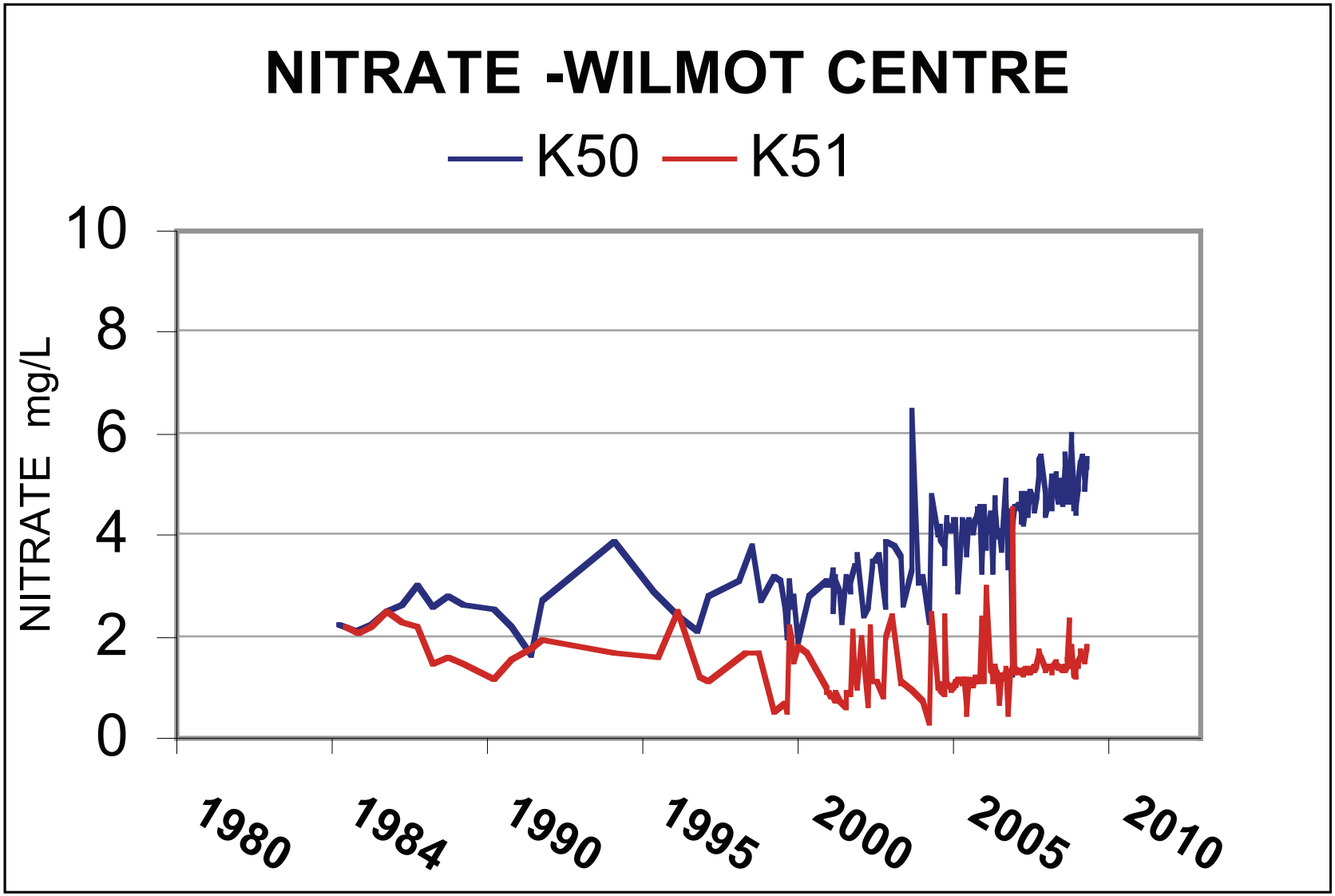
Example: Nitrate



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Next: Possible SPP Activities

Municipal road-salt management plans

Smart about Salt accreditation

Salt management for new development

Financial Incentives for improved farm management

Land purchase of most vulnerable areas

Update Official Plan

• Studies and restrictions

Business inspections

Risk management plans

Financial incentives to reduce spill risk

Challenges/Lessons Learned

- Large program- 38 wellfields
  - Have monitoring objectives and prioritize
  - Look for technology, efficiency, simplicity
  - Allocate manpower, resources
  - *I take suggestions!*

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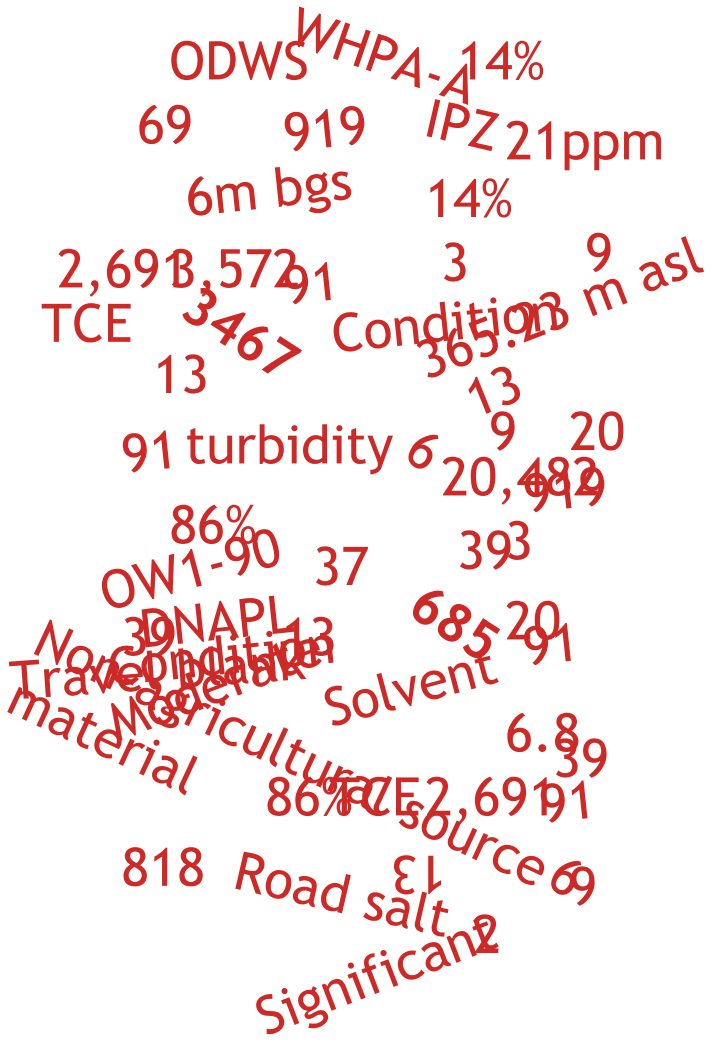
Challenges/Lessons Learned

Effective Monitoring

- Set monitoring program objectives
- Plan ahead - what data will you need in 1 year? 10 years?
- Tailor monitoring to your objectives and report accordingly
- Contingency plans to respond to monitoring data

Challenges/Lessons Learned

- Data
  - Set procedures for data review and management (SOPs)
  - ROW datasets too large for usual computer tools
  - Team with data experts, automate as much as possible
  - Integrate with the lab
  - Make QA/QC a priority
  - New technology, GIS databases
  - Avoid proprietary programs for data storage

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Challenges/Lessons Learned

- Large and aging monitoring network
  - Regulatory burden: work with MOE inspectors to prioritize, anticipate
  - Plan and carry out an inspection/maintenance program
  - Technology- finding and replacing/plugging aging wells
  - Limit new permanent installations (technology?)

Challenges/Lessons Learned

- Working in an increasingly regulated environment
  - Communicate with MOE, foster professional relationships
  - Get legal advice
  - Comply, but don't be afraid to challenge, MOE will listen
  - Be careful about communicating monitoring results, to avoid time-wasting "compliance" misunderstanding, eg. Preliminary results vs final
  - Look ahead, stay educated for new rules (eg Clean Water Act)

Questions?

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