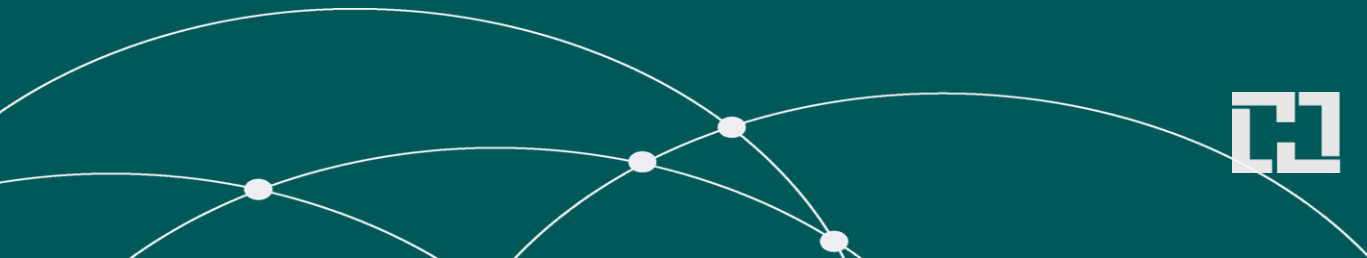




# Regional Background Groundwater Concentration of Selenium in Kamloops

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Date: November 23, 2016





# Outline

- Purpose
- Objectives and Focus of the Study
- Background
- Methodology
- Results and Significance



# Purpose

Help support future groundwater **management** strategies and Regulations.

Increase understanding of the **environmental** chemistry of B.C. aquifers, specifically with regard to their background concentrations of metals that may be of significance to human health and geographic distribution.





# Objectives

- 1:** Determines if regional background concentrations for selenium in groundwater can be inferred by using groundwater quality data from provincial contaminated site investigations
- 2:** Quantify naturally-occurring concentrations of dissolved selenium in Kamloops
- 3:** To characterize and illustrate the spatial distribution of dissolved selenium concentrations in groundwater



# Focus of the Study

**1:** Focus on Data Quality

**2:** Review of the geochemical properties of selenium relevant to its introduction into and mobility in groundwater towards interpreting these data

**3:** Define the naturally-occurring regional groundwater concentration

**4:** Discuss the potential significance for the management of contaminated sites

# Background - Kamloops

City is within  
the **Thompson  
Plateau**



**Kamloops Lake**  
and North and  
south branches  
of **Thompson  
River**

Alluvium (river) fan and lake  
deposits along the valley of the  
Thompson River at the lower  
elevations

Rock outcrops and morainal  
deposits are more commonly  
found in the highlands



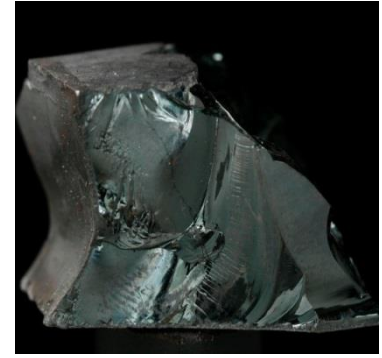
# Background - Selenium



**Selenium** occurs naturally in volcanic and sedimentary rocks - which are found in south-central B.C.



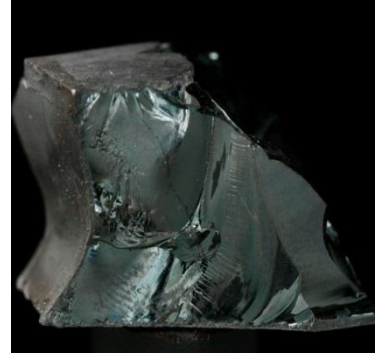
Common in **coal**, shale, and uranium deposits



Enters groundwater through **weathering**  
It can be patchy or localized, not necessarily throughout entire lithology

The AW and DW CSR standards for selenium :10 µg/L

# Background - Selenium



## Transport Mechanisms:

- Selenium is soluble and mobile in water under aerobic (high oxygen concentrations) and alkaline (high pH) conditions.
- Mobilized and concentrated by weathering and evaporation in the process of soil formation and alluvial fan deposition in arid and semiarid climates



# Background - Selenium



## Anthropogenic Sources of Selenium to the Environment:

- In pigments used in plastics, paints, enamels, inks, and rubber
- By-product of copper refining
- Pharmaceuticals
- Pesticide formulations
- Burning coal



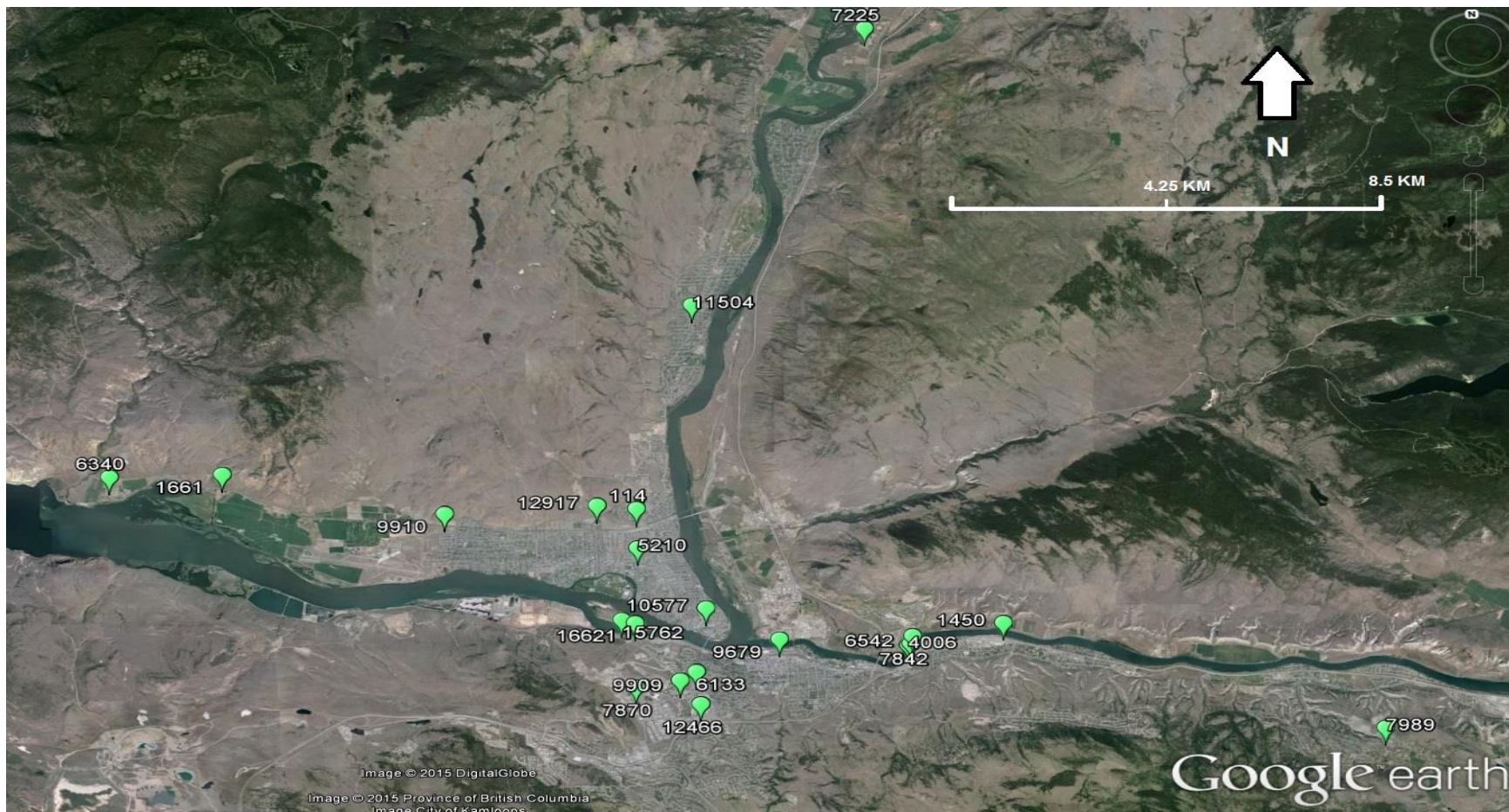
# Methodology

## Data Compilation

- A total of 265 groundwater samples were collected and analyzed for dissolved selenium from a total of 141 groundwater monitoring wells

## Data Collected

- Depth to groundwater
- Dissolved Metals
- pH, Hardness
- Borehole Logs
- Stratigraphy
- Site Locations
- Basic Hydrogeology
- Anthropogenic sources (APECs, AECs)



# Study Site Locations





# Methodology

## **Spatial Illustrations**

Data were illustrated:

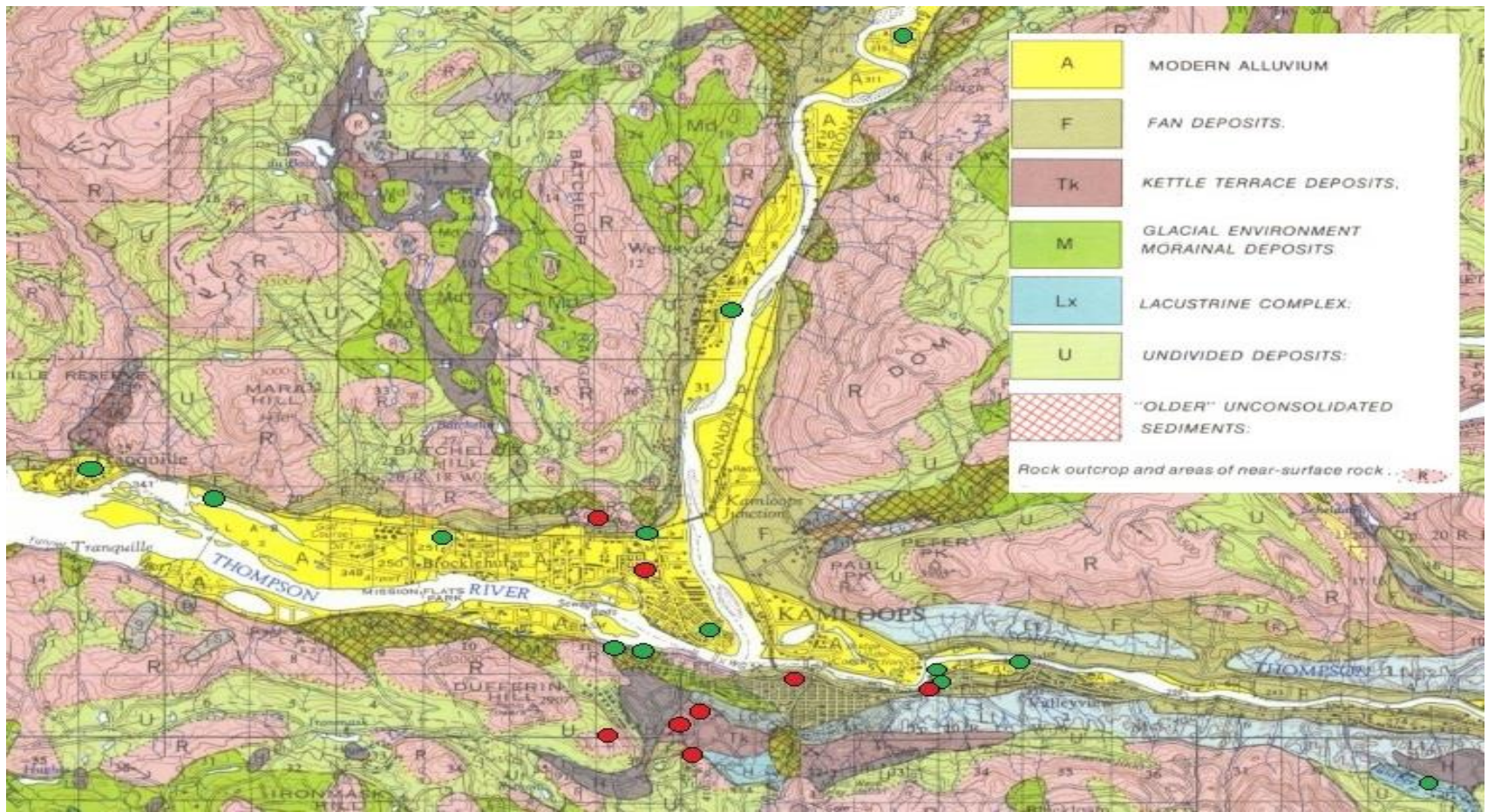
- Bedrock Geology
- Surficial Geology
- Aquifer Map

## **Statistical Analysis**

- Some statistical analysis and comparison with other groundwater characteristics
- The 95th percentile for selenium was calculated for each site.
- The overall 95th percentile for the entire dataset was calculated.

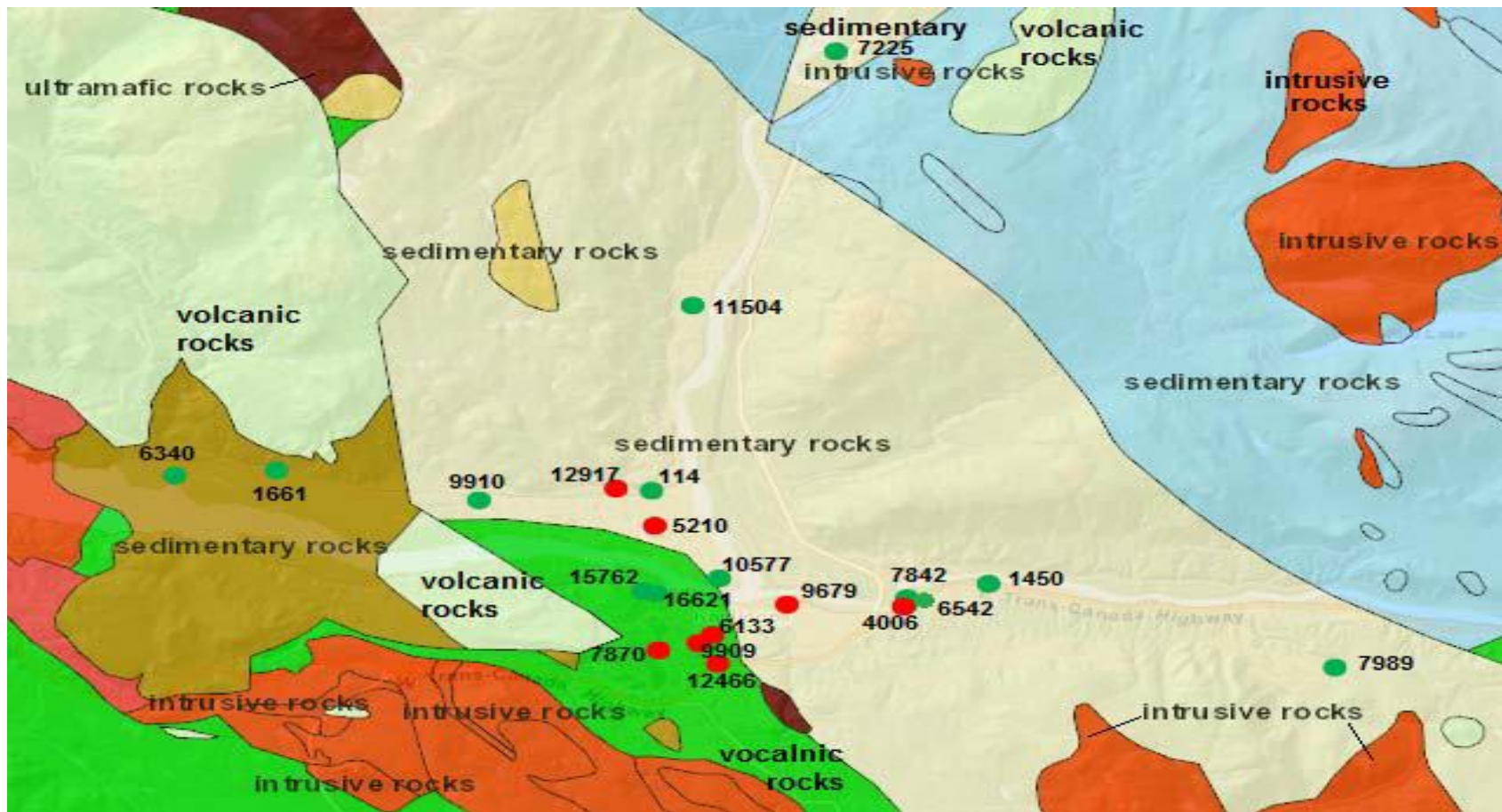
## **Data Evaluation**

Major cation concentrations (i.e., sodium, potassium, magnesium, and calcium) in all of the wells were plotted with selenium concentrations.



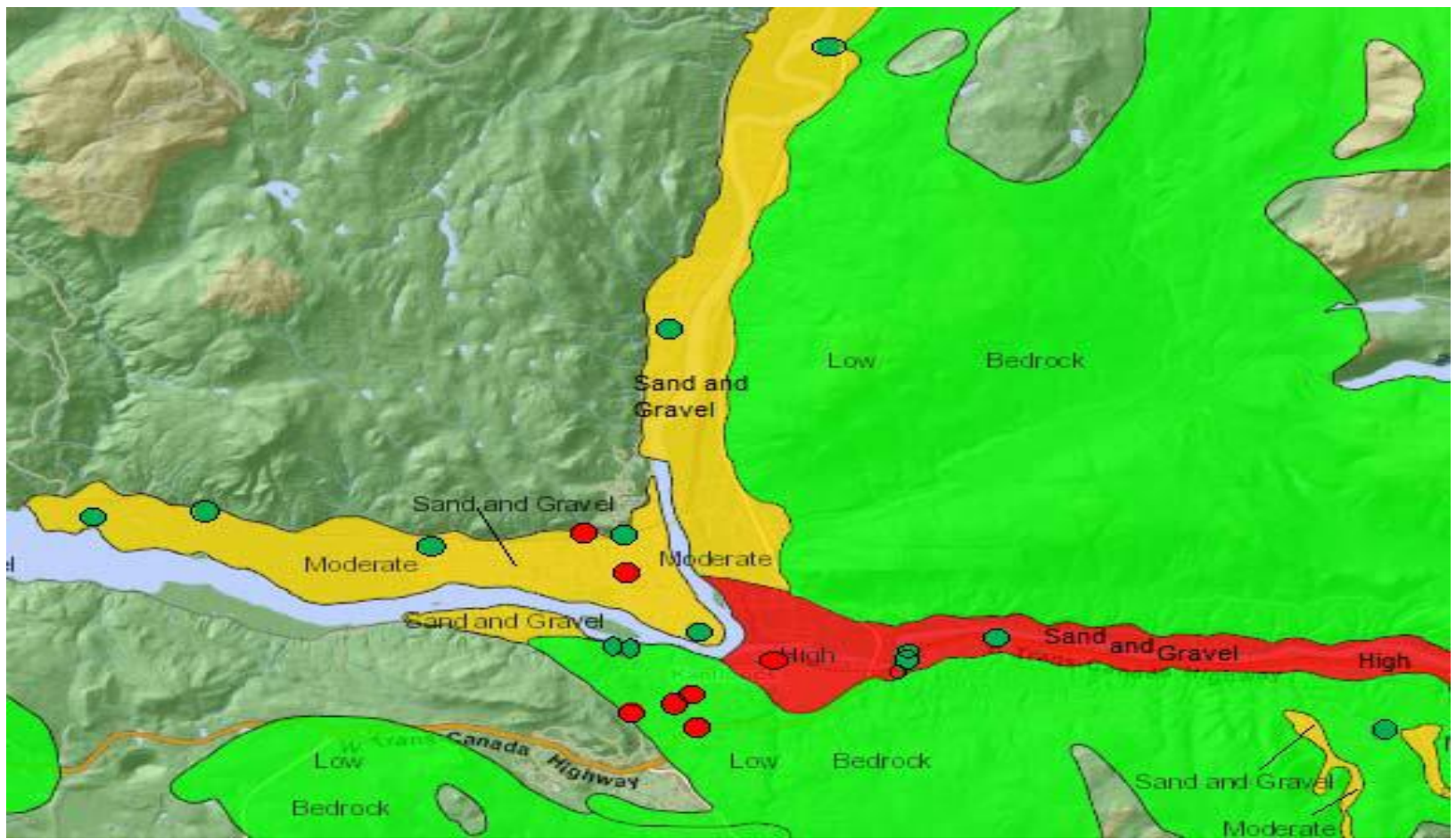
# Regional Surficial Geology





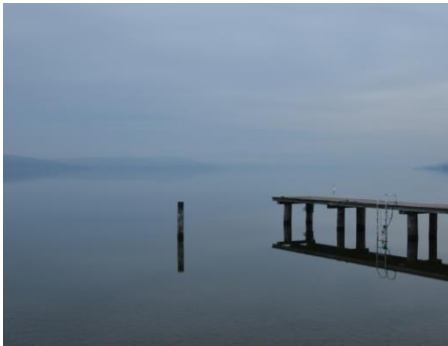
# Regional Bedrock Geology





# Aquifer Productivity and Material

# Results



- The selenium dataset was not attributable to or observed to be significantly influenced by anthropogenic sources
- The soils generally consisted of alluvium and fan deposits consisting of mainly silt and sand
- The data indicated that samples collected at greater depths tend to have higher concentrations of selenium.

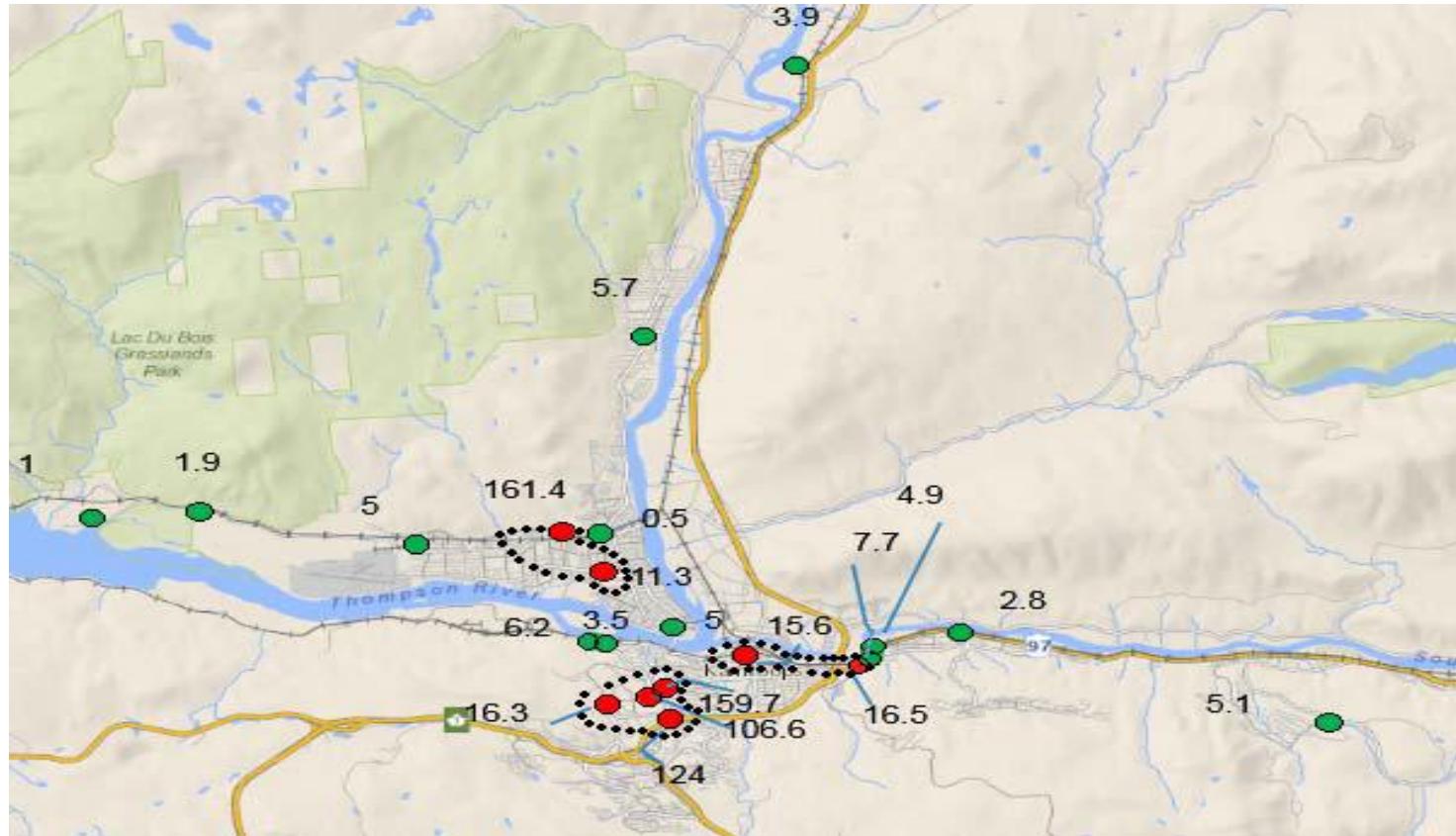
# Results



- The overall 95th percentile selenium concentration in groundwater was determined to be **160  $\mu\text{g/L}$** .
- The higher selenium concentrations may be due to the leaching of subsurface soils in the saturated zones underlying alluvial fan deposits and sedimentary and volcanic rocks.



# Estimated extents of naturally-occurring elevated selenium concentrations in groundwater



# Significance



- The results may potentially provide an additional line of evidence to support determinations of background groundwater concentrations and/or provide regional background groundwater quality estimates for dissolved selenium for the Kamloops area.



# Limitations

- Data were obtained from public records, and they were not originally collected to support background groundwater characteristics.
- Not all wells were sampled more than once to address temporal or seasonal variability or necessarily screened within the same aquifers.
- Data were also collected over an extended duration of time, collected by various consultants, and analyzed by several different labs using different analysis methods. As such, results may be biased high or low.





# Thank you. Questions?

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