Junction Creek Subwatershed Study and Stormwater Master Plan

Alternative Solutions Identification and Assessment

Public Meeting No. 3

December 13 and 14, 2017

1. Introduction and Meeting Goals

- The goals of this 3rd Public Meeting are to:
  - Present highlights from the Background Characterization Report specific to the system:
    - Natural heritage
    - Water quality
    - Hydrogeology
    - Geomorphologic assessment
  - Discuss Junction Creek hydrology (flows) and hydraulics (water levels)
  - Provide preliminary alternative management strategies being considered in the Study Area for critical locations at risk of flooding and erosion, and general water quality issues
  - Present an overview of the evaluation process
  - Provide an opportunity for the public to offer feedback on the Study and to discuss with staff

What is a watershed?

An area of land that collects water from rain and snow and drains through surface waterways (wetlands, streams, rivers, and lakes) or seeps beneath the surface to groundwater. The area of land is defined by the shape and height (elevation) of the ground surface.

2. Subwatershed Study and Stormwater Master Plan Purpose and Objectives

	Subwatershed Study and Stormwater Master Plan
Purpose:	• Develop a long-term plan that will provide policy and management actions to protect, maintain and enhance the surface water, groundwater and natural resources of Junction Creek and its tributaries
Objectives:	**Water Quality** • Improve surface water and groundwater quality • Minimize pollutant loadings to surface water and groundwater • Improved aesthetics of Junction Creek and its tributaries **Water Quantity** • Preserve and re-establish the natural hydrologic processes to protect, restore, and replenish surface water and groundwater resources • Reduce the impacts of erosion on aquatic and terrestrial habitats and property • Minimize the threats to life and property from flooding **Natural Environment** • Protect, enhance and restore natural features and functions of wetlands, riparian and ecological corridors • Improve warmwater and coldwater fisheries as appropriate

3. Municipal Class Environmental Assessment Process

- Municipal projects that are similar in nature, routinely carried out and have predictable effects that can be effectively managed are examined according to the Municipal Engineers Association process, outlined in "Municipal Class Environmental Assessment," (October 2007, 2011 and 2015)
- Distinguishing features of Master Plans are:
    - Broad in scope, but require more detailed investigations at the project-specific level
    - Focused on the analysis of a system for the purpose of outlining a framework for the provision of future infrastructure
    - Focused on providing recommendations for specific projects that are part of a larger management system
- The Stormwater Management Master Plan will follow the Class EA process for Master Plans and is intended to satisfy Phases 1 and 2 of the process

***The Class EA defines a Master Plan as*:**
"A Long Range Plan which integrates infrastructure requirements for existing and future land use with environmental planning principles. These Plans examine the whole infrastructure system or group of related projects, in order to outline a framework for planning subsequent projects and/or developments."

4. Study Process and Schedule

Subwatershed Study Stage 1

- Existing conditions review
- Identify problem/opportunity

PIC No.1

Subwatershed Study Stage 2

- Identify environmental opportunities and constraints
- Confirm problem/opportunity
- Establish objectives and targets

PIC No.2

Subwatershed Study Stage 3

- Develop alternative subwatershed management strategies
- Evaluate alternative subwatershed management strategies

PIC No.3

We are here!

Subwatershed Study Stage 4

- Identify preferred subwatershed management strategy
- Develop implementation, monitoring, adaptive management and reporting plans

PIC No.4

Subwatershed Study Stage 5

- Finalize Subwatershed Plan and Master Plan
- Implement

PIC No.5

Class EA Phase 1

Class EA Phase 2

Ongoing Public and Community Outreach with Public Meetings

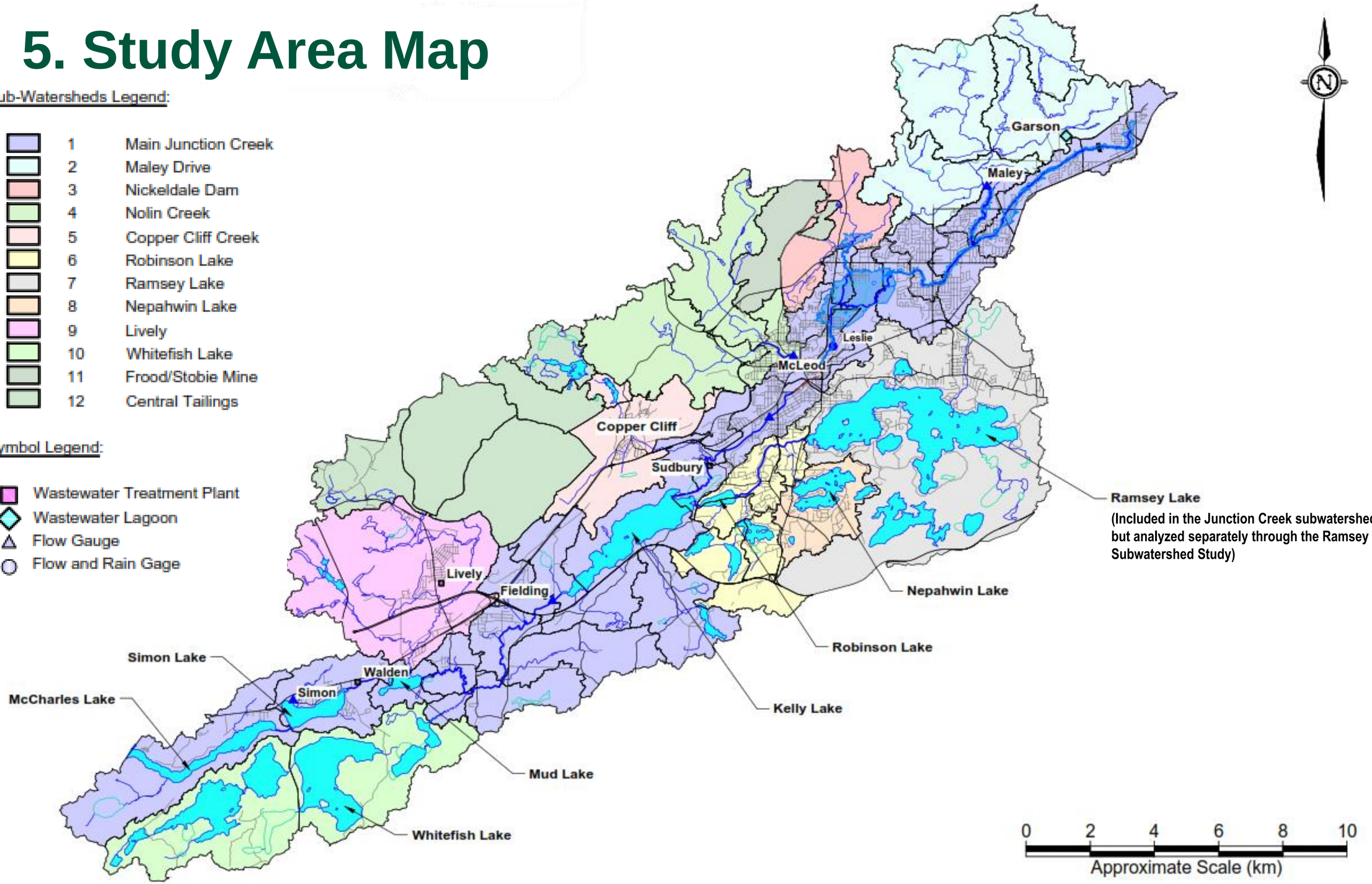
5. Study Area Map

Sub-Watersheds Legend:

1	Main Junction Creek
2	Maley Drive
3	Nickeldale Dam
4	Nolin Creek
5	Copper Cliff Creek
6	Robinson Lake
7	Ramsey Lake
8	Nepahwin Lake
9	Lively
10	Whitefish Lake
11	Frood/Stobie Mine
12	Central Tailings

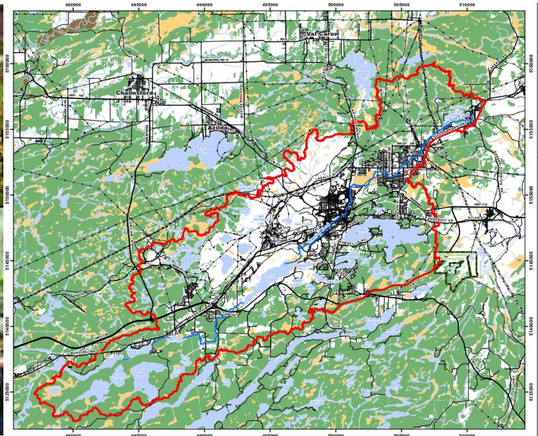
Symbol Legend:

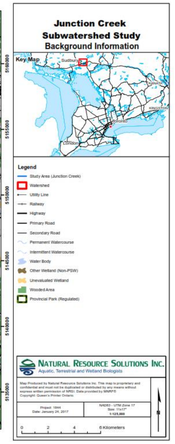
- Wastewater Treatment Plant
- Wastewater Lagoon
- Flow Gauge
- Flow and Rain Gage



6. Natural Heritage Characterization

- Purpose: Make recommendations to protect sensitive features and fauna within the subwatershed
- Objectives:
  - Review background information and data collected
  - Perform Species at Risk screening of the subwatershed
  - Identify significant terrestrial and aquatic features and sensitive areas
  - Perform Environmental Impact Studies were necessary
- Background Characterization Highlights:
  - The upper section of the subwatershed has been identified as the most likely area to support a brook trout population, with potential to improve summer thermal conditions
  - Water quality conditions are generally improving as evidenced through improvements in fish and bug communities





Photos on this page were retrieved from articles from The Sudbury Star.

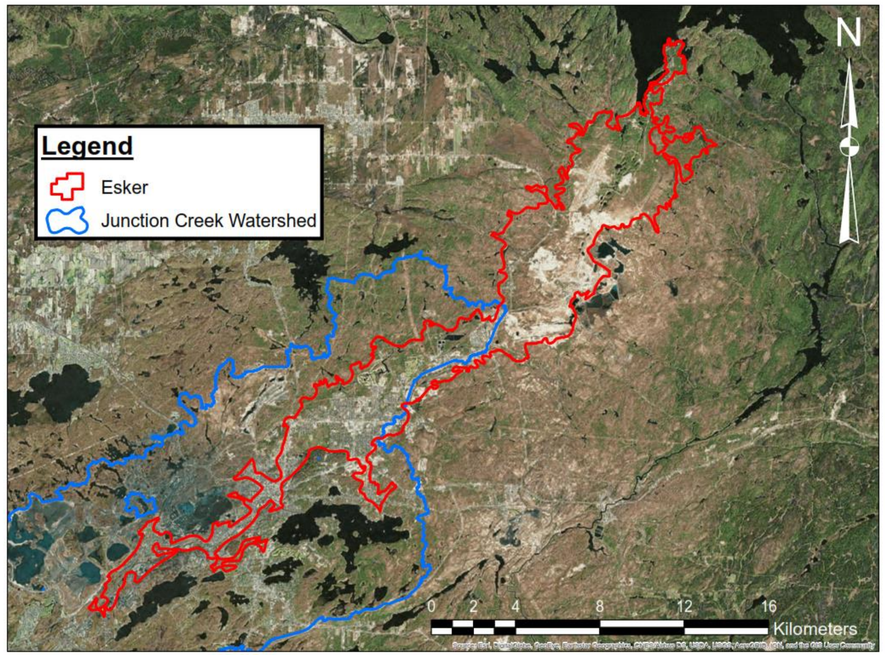
7. Hydrogeology (Groundwater) and Water Quality Characterization

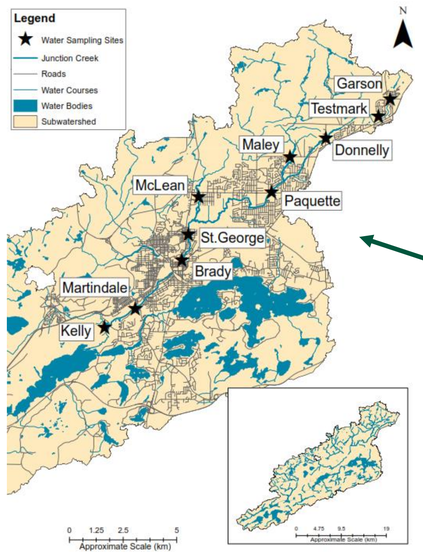
Hydrogeology:

- Purpose: Provide direction for related mitigation measures
- Objectives:
  - Characterize the subwatershed hydrogeology
  - Assess potential changes to groundwater recharge
  - Assess potential reduction to groundwater levels, hydraulic gradients and groundwater discharge
- Background Characterization Highlights:
  - Characteristics of the Wanapitei Esker present a high recharge potential, but also expose the groundwater to a greater risk of contamination from surface or near surface activities

Surface Water Quality:

- Purpose: Identify approaches to address and improve water quality in receiving waterbodies
- Objectives:
  - Establish an understanding of the existing water quality conditions using historical data
  - Assess potential impacts of development on future water quality
  - Provide recommendations and mitigation strategies for the continuing management of waterbodies within the subwatershed
- Background Characterization Highlights:
  - Water quality has improved drastically since the 1970's and chemical water quality parameters have remained consistent throughout the 21st century
  - Copper, iron and nickel are still routinely above the Provincial Water Quality Objectives



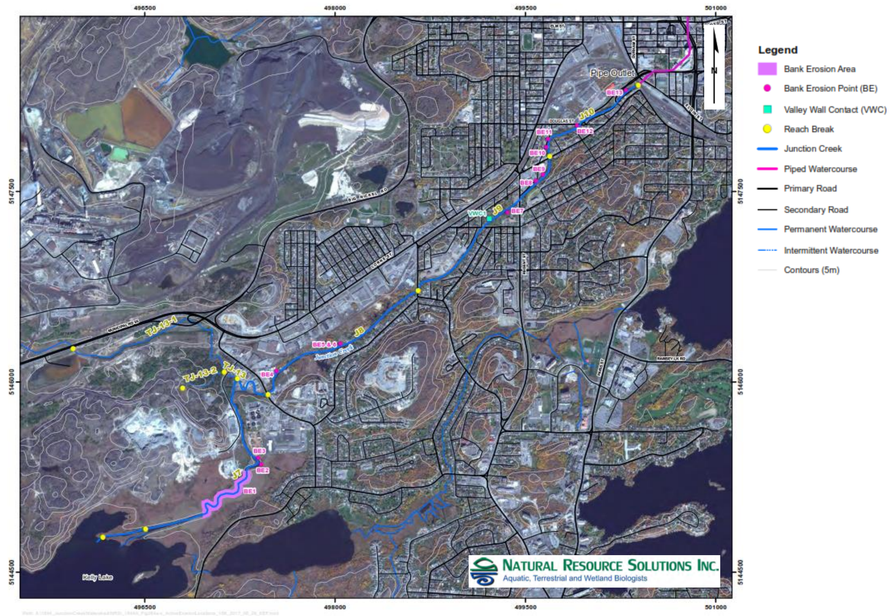


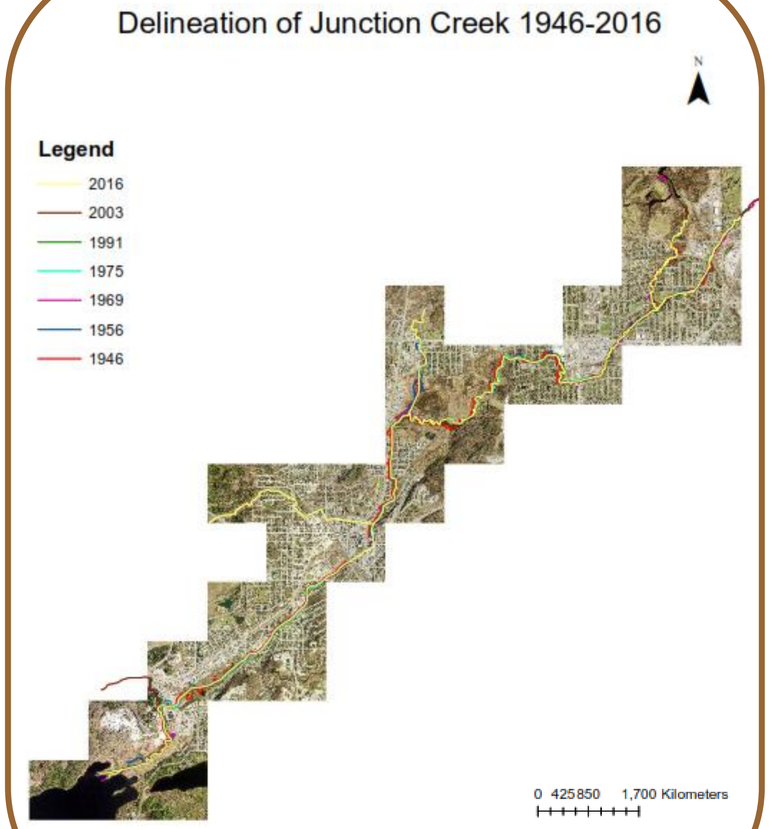
Location of Vale monthly water sampling sites

8. Geomorphologic Assessment

- Purpose: Identify site-specific opportunities for restoration and stormwater management and describe conceptual restoration approaches at the subwatershed scale
- Objectives:
  - Perform rapid geomorphic assessment and record observations of erosion and unstable banks
  - Characterize watercourses within the study area
  - Conduct detailed site assessments at areas identified as being sensitive to erosion
- Background Characterization Highlights:
  - Active erosion sites or evidence of erosion were found in every reach studied
  - Tree cover along the creek is low throughout much of the upper reaches, though the Frood and Maley branches have abundant tree cover

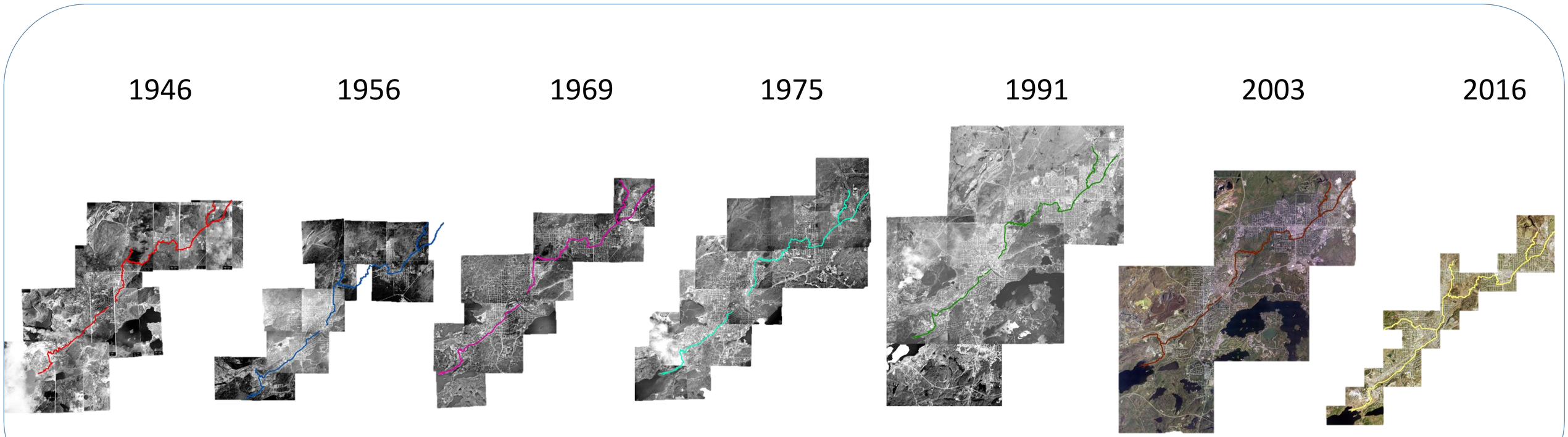
What is geomorphology?
The study of the physical features of the earth and their relation to its geological processes





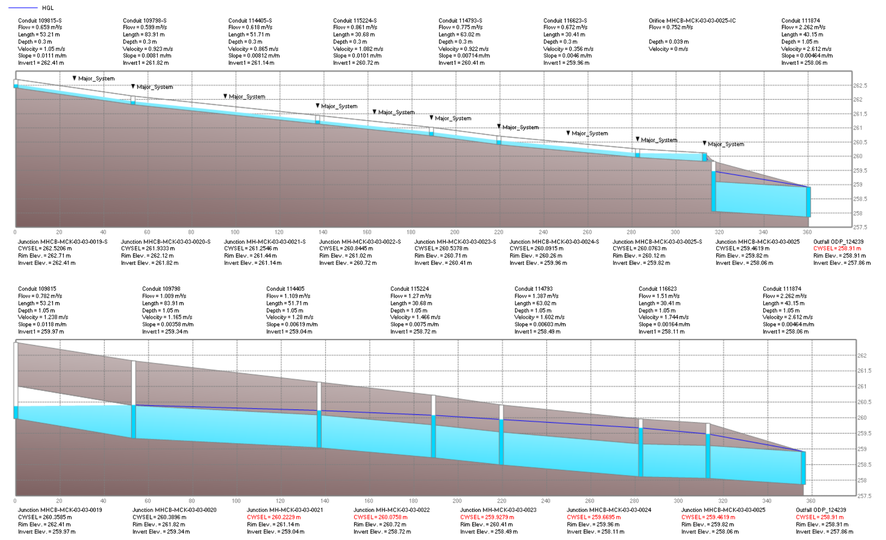
9. Creek Centerline Delineation Through the Years

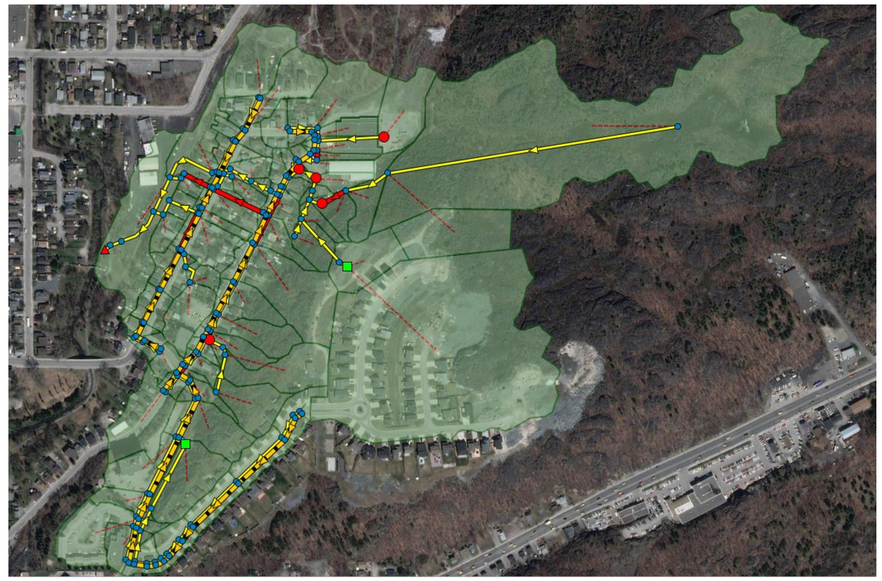
- Straightening of streams that naturally meander can cause instability of banks and sediments
- This often necessitates erosion control measures and restoration of banks to preserve water quality and stream function



10. Urban Infrastructure Assessment (Storm Sewers and Roadways)

- Purpose: Evaluate the performance of the sewer pipes and road network drainage systems
- Objectives:
  - Prepare models of various rain and snowfall storm events to gauge system performance
  - Consider climate change impacts by projecting increases in storm intensity
  - Analyze model response to various storm events to identify the most critical areas and optimal improvements for flood mitigation
- Background Characterization Highlights:
  - 7 design storm scenarios considered
  - Focus on “trunk” storm sewer systems, larger than 900mm diameter
  - Construction of the overflow channel from Mountain Street to the rail corridor has greatly reduced flooding potential along Leslie and Mountain Streets
  - Sediment deposition in the Ponderosa area has caused substantial blockage of sewer outlet pipes, resulting in regular flooding



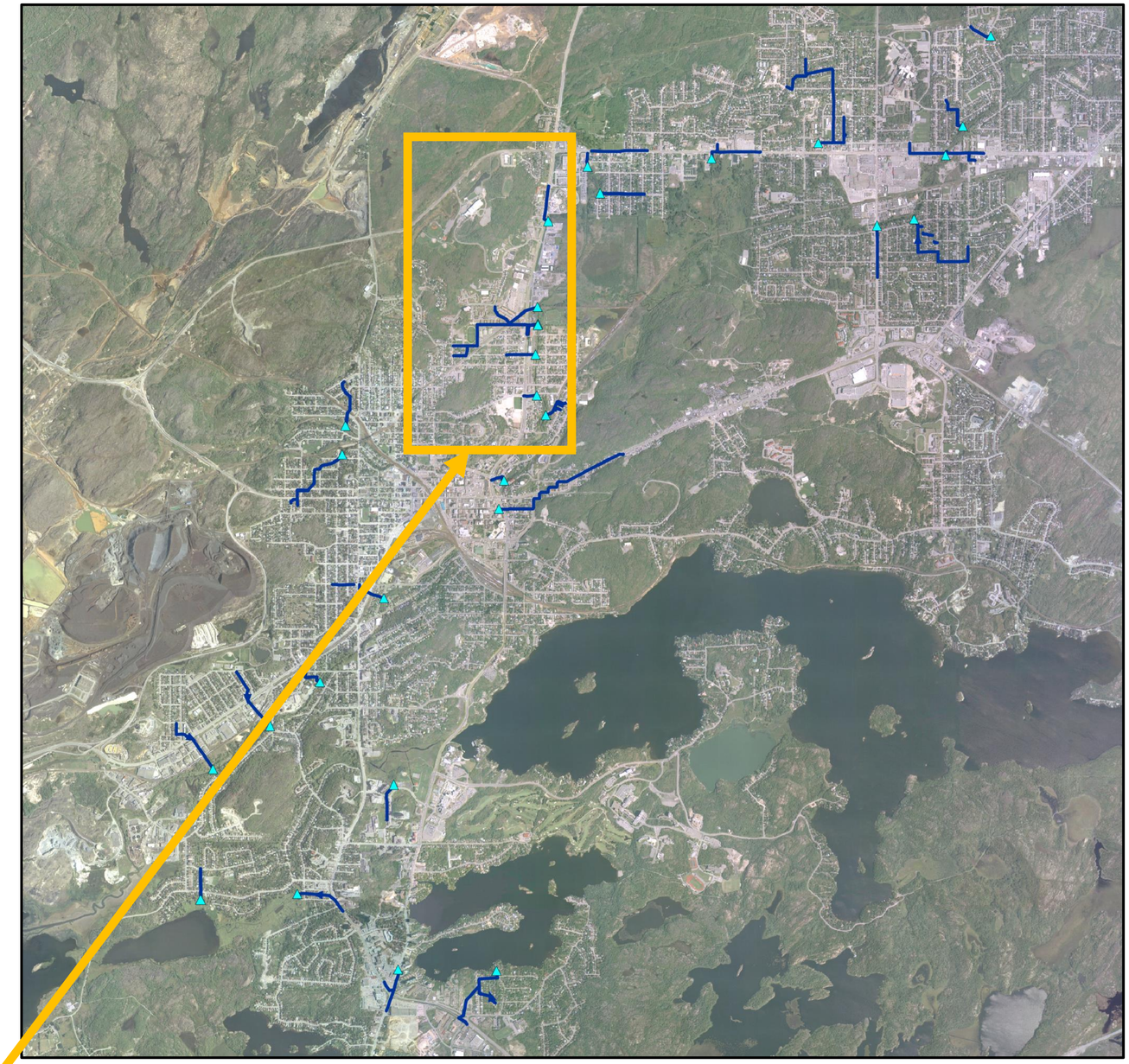


11. Storm Sewer Systems

In order to assess the most critical areas of flooding within the Study Area, storm trunk sewer systems in the following areas have been modelled:

- Garson
- New Sudbury
- Flour Mill
- Gatchell
- Donovan
- South End
- Downtown
- Lively

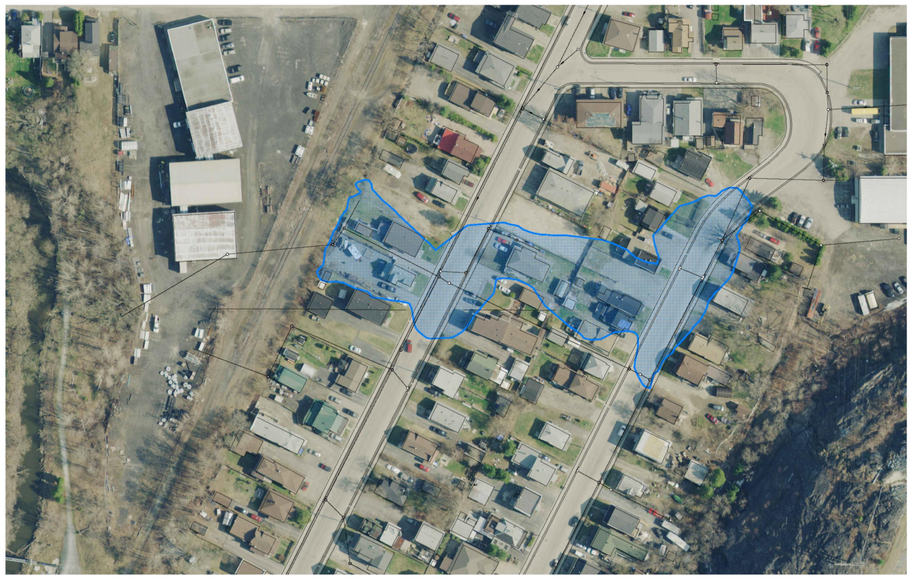
- Over 30 storm sewer systems and more than 20km of pipe analysed
- More than 1250 hectares of drainage area modelled
- The most significant areas of urban flooding were indicated in the Flour Mill, and Leslie and Mountain Street areas
- Limited trunk sewer infrastructure in the Lively area may restrict future development potential

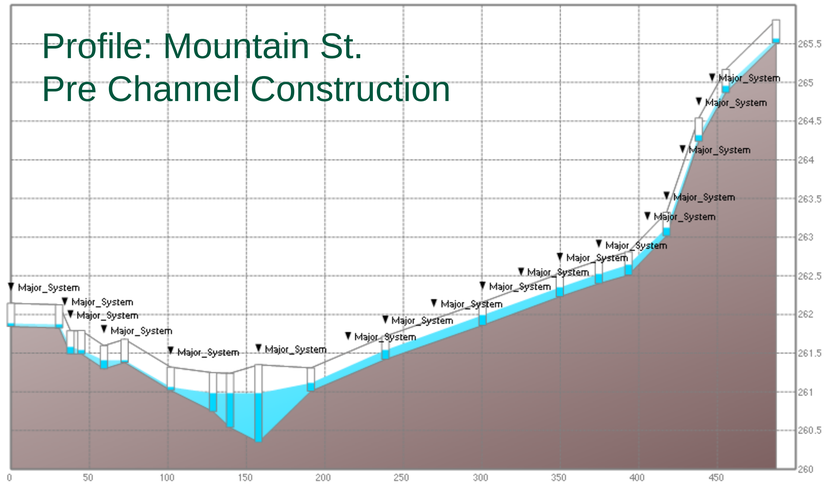


Critical Flooding Area

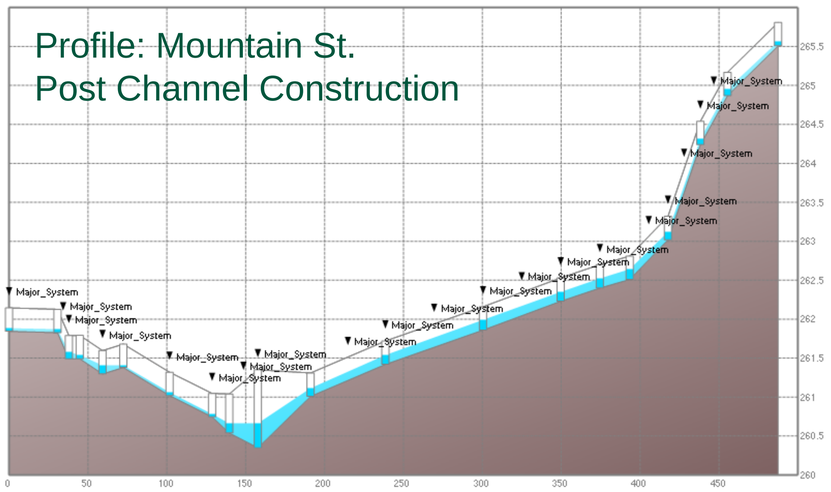
12. Critical Area: Mountain & Leslie Street

2009 Flood Event – Pre Channel Construction



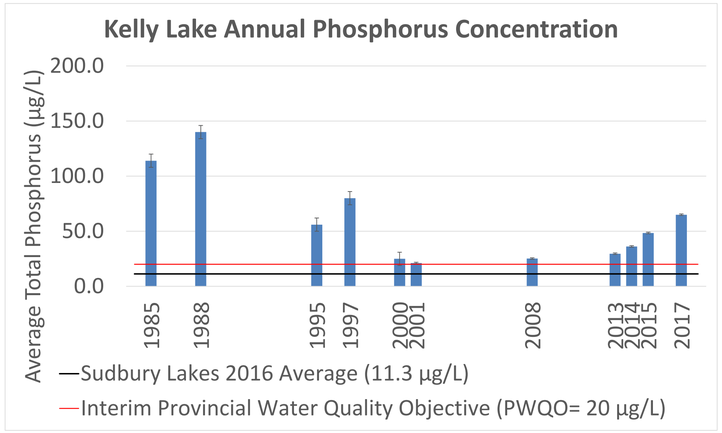


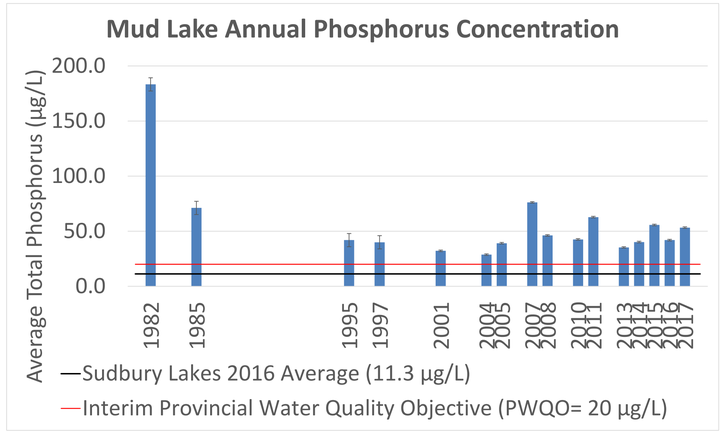
2009 Flood Event – Post Channel Construction

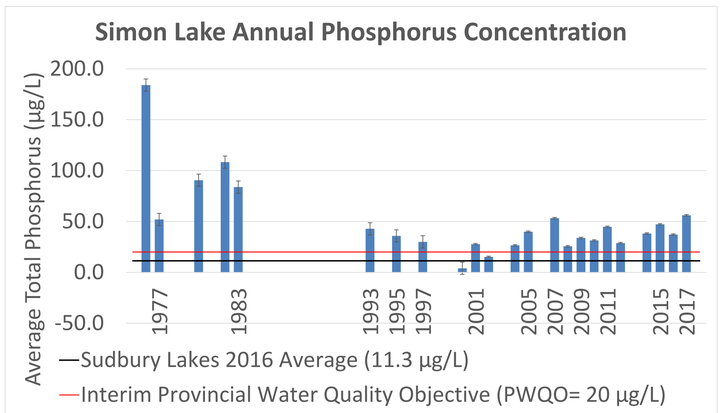


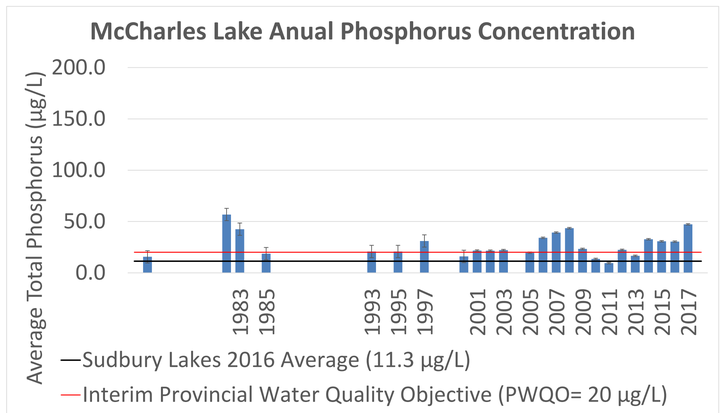
- Construction of the overflow channel (see photo below) has greatly alleviated the risk of catastrophic flooding
- More than 40 hectares of sewershed modelled
- Some existing storm sewers are insufficient to handle even minor storms
- Stormwater management strategies for the upstream existing and development areas are being considered

12. Surface Water Quality in the Lower Junction Creek Subwatershed









Surface Water Quality Report Card

- The Conservation Ontario Watershed Report Card for surface water quality indicator guidelines were used to calculate grades for E. coli and phosphorus concentrations
- Biological indicators are normally included in the overall surface water grade, but data was not available for all locations
- The grades listed in the table below are based on spring and summer data from 2013-2015, provided by the Vermillion River Stewardship
- Based on data from 2013-2015, E. coli is not an issue in the lower Junction Creek subwatershed
- High phosphorus concentrations continue to lead to large algae blooms throughout the summer months within Kelly Lake and the lakes below it

Annual Phosphorus Concentrations

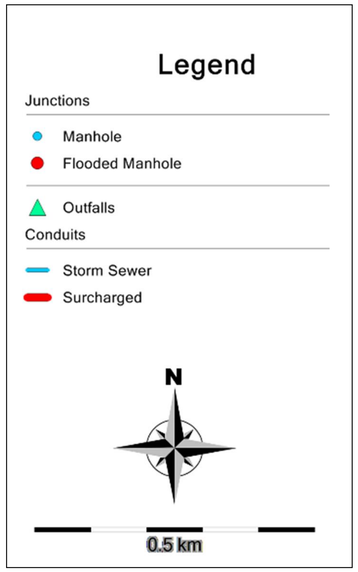
- Phosphorus data above was collected annually in the Spring from 1976-2017 as part of The City of Greater Sudbury's Lake Water Quality Program
- Phosphorus seems to have decreased since the start of the program but is still generally above the Interim Provincial Water Quality Objective of 20 µg/L and the 2016 Sudbury lakes average of 11 µg/L

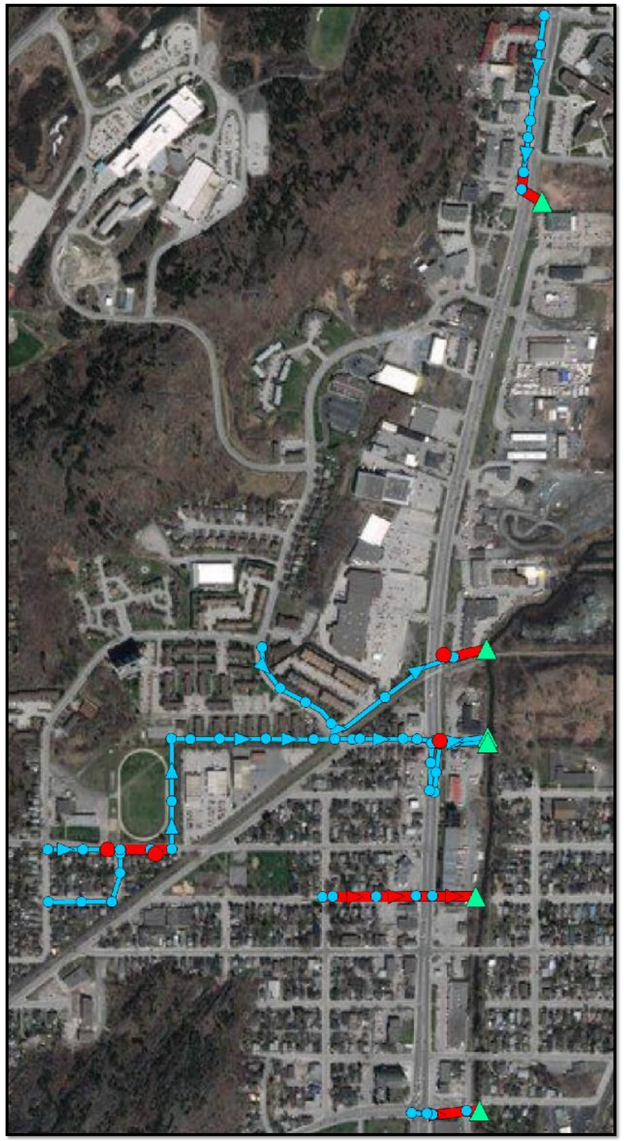
Location	E. Coli Grade	Phosphorus Grade	Overall Surface Water Grade
Lily Creek	A	C	B
Junction Creek (Fielding Road)	A	C	B
Mud Lake	A	C	B
Simon Lake	A	C	B
McCharles Lake (East)	A	C	B
McCharles Lake (Middle)	A	C	B
McCharles Lake (West)	A	A	A

13. Critical Area: Flour Mill

2 Year Chicago Design Storm

100 Year Chicago Design Storm





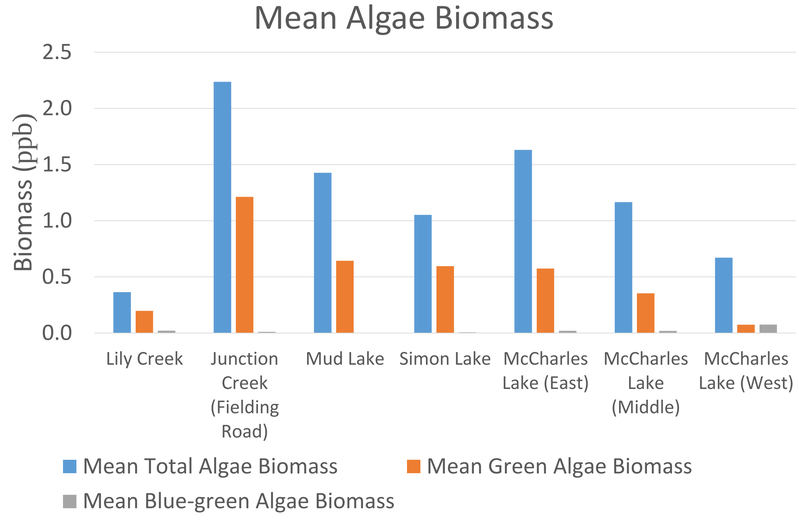
- More than 220 hectares of sewershed modelled
- Stream instability and sediment transport from urbanization and industry has caused partial blockage of many culverts in the area
- The flat Ponderosa and wetland areas nearby are susceptible to flooding from beaver activity

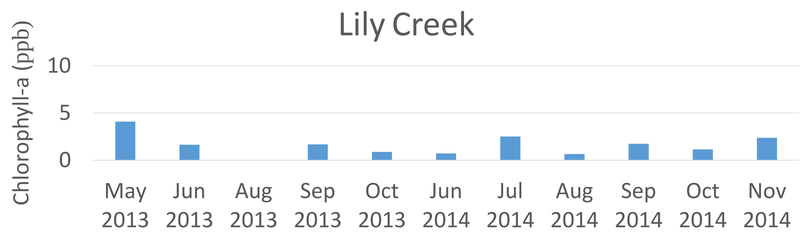
Overland flow network sag point

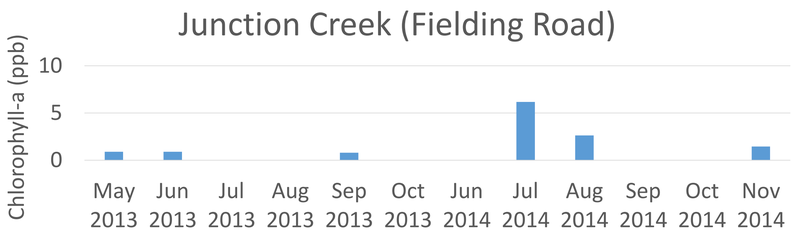
13. Algae in the Lower Junction Creek Subwatershed

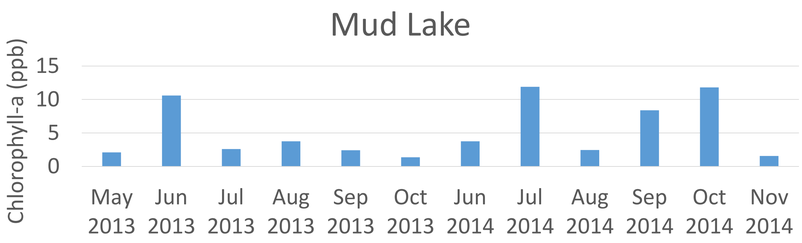
What is Eutrophic?
When a lake has abundant nutrients, like phosphorus, that support a dense growth of algae and other organisms, which lower oxygen levels when they decay.

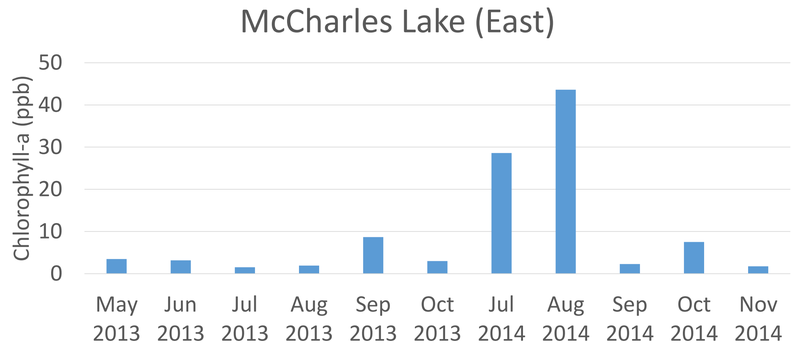
- Chlorophyll-a:
- Related to the trophic state of a lake, generally a large concentration of chlorophyll-a means that a lake is eutrophic
- Algae Biomass:
- Large algae blooms mostly consist of green and blue-green algae
- Blue-green algae can be toxic, but is not an issue in the lower Junction Creek subwatershed, as seen to the right











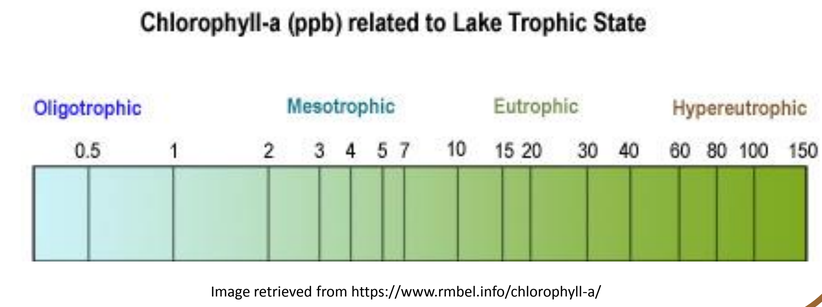
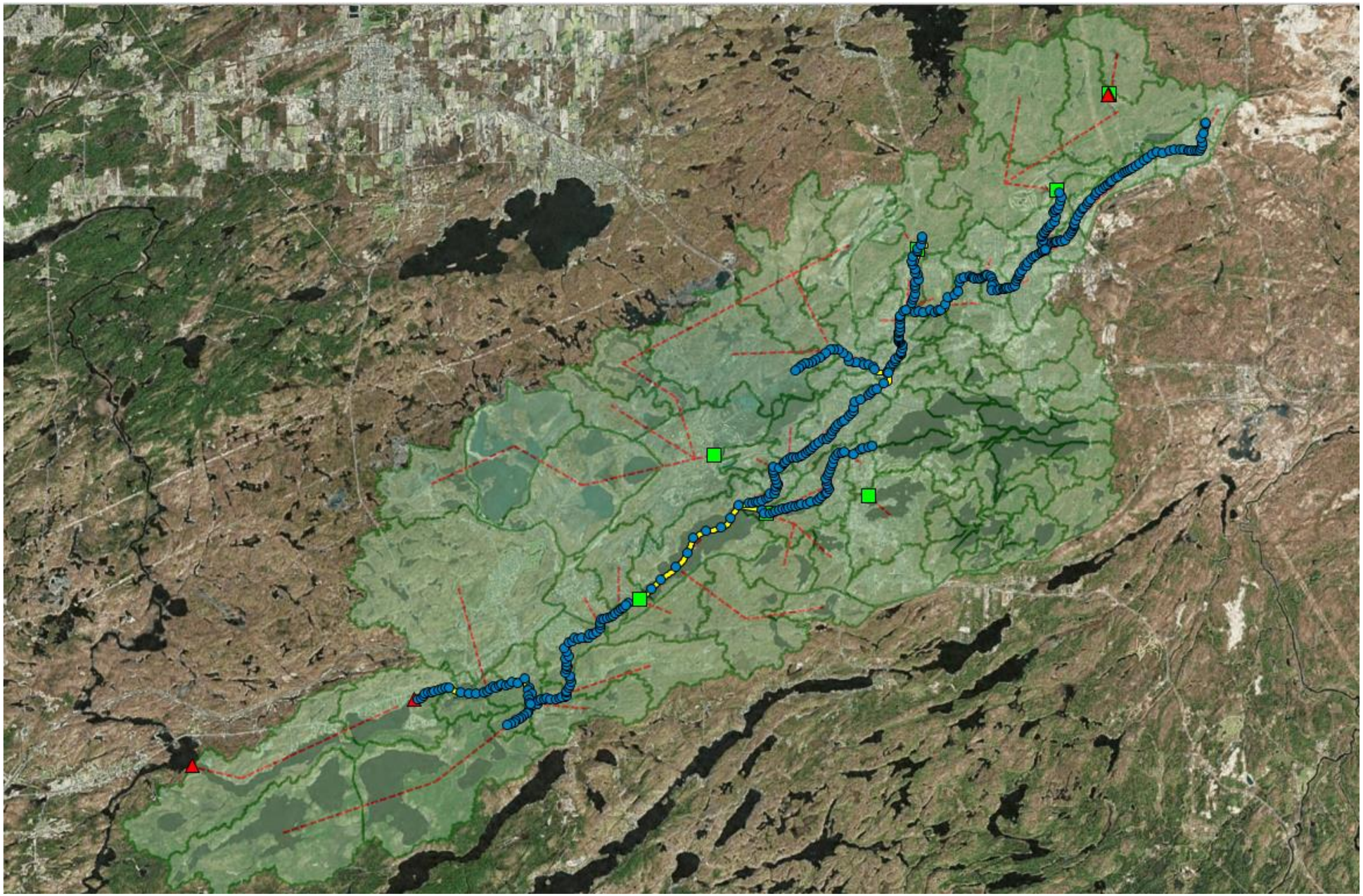


Image retrieved from https://www.rmbel.info/chlorophyll-a/

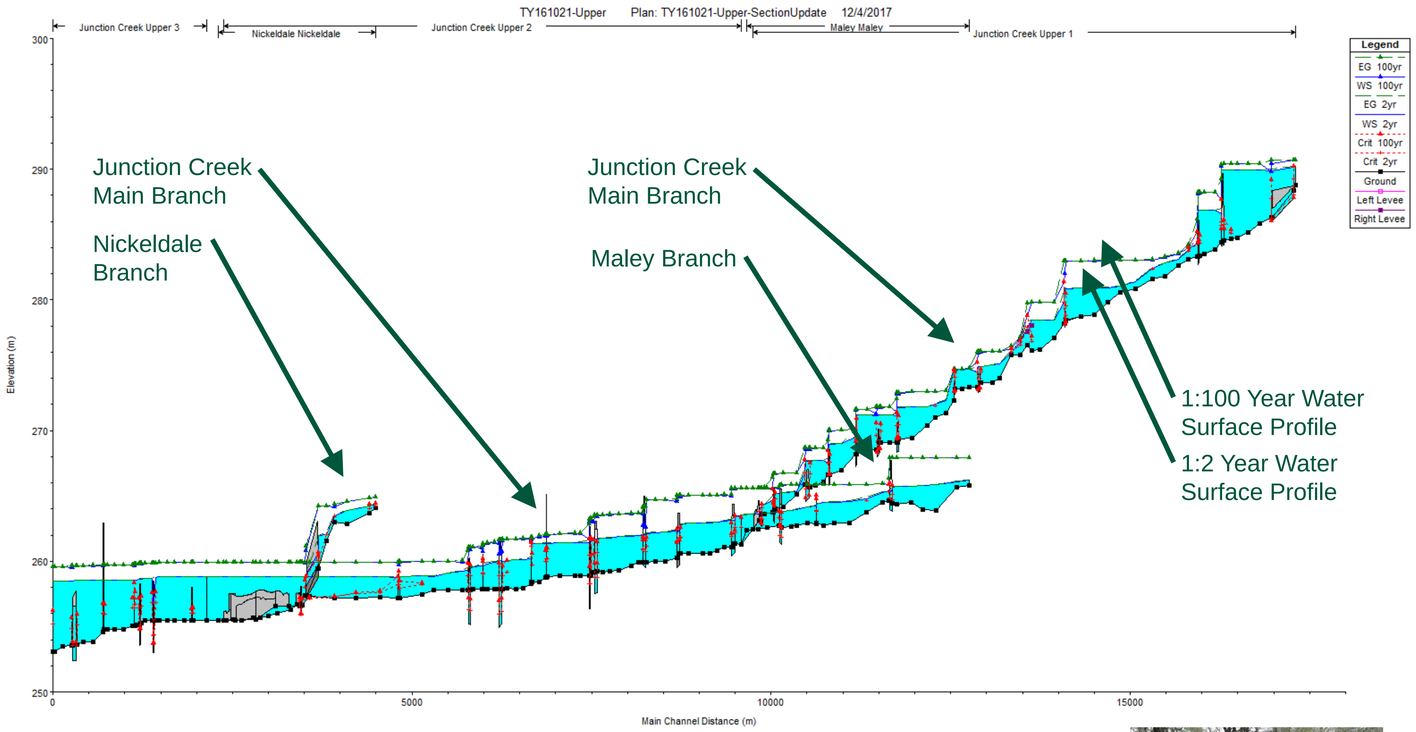
14. Hydrologic Model



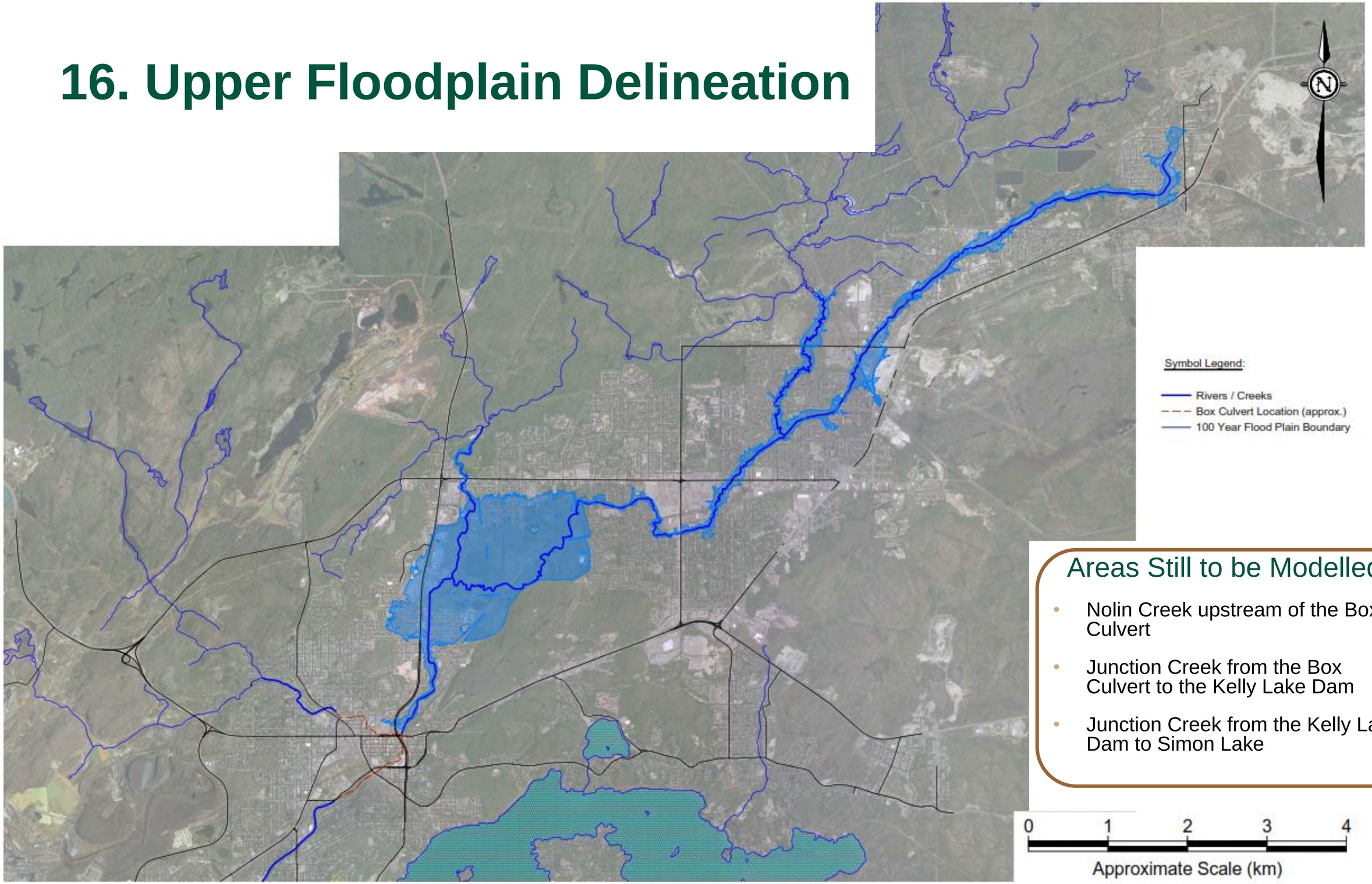
15. Riverine Floodplain Assessment

What is a floodplain?
The area adjacent to a river channel that experiences flooding during storm events

- Purpose: Make recommendations to mitigate or reduce flood risk for critical stream reaches and crossings
- Objectives:
  - Determine flood impacts to municipal infrastructure and private properties associated with different rain and snowfall storm events
  - Determine flood control storage recommendations for each study reach
  - Consider climate change impacts by projecting increases in storm intensity
  - Include the effects of the hydraulic crossing structures on hydraulic performance
  - Evaluate the effectiveness of various flood control and mitigation alternatives
- Background Characterization Highlights:
  - More than 55 structures and crossings have been modelled
  - The Maley and Nickeldale Dams provide control of flood waters entering downtown Sudbury
  - The generally flat topography, beaver activity, stream instability, and debris compound to make areas of the subwatershed susceptible to flooding
  - Frequent elevated road and railway crossings through the upper reaches of the creek create substantial areas of local flooding



16. Upper Floodplain Delineation

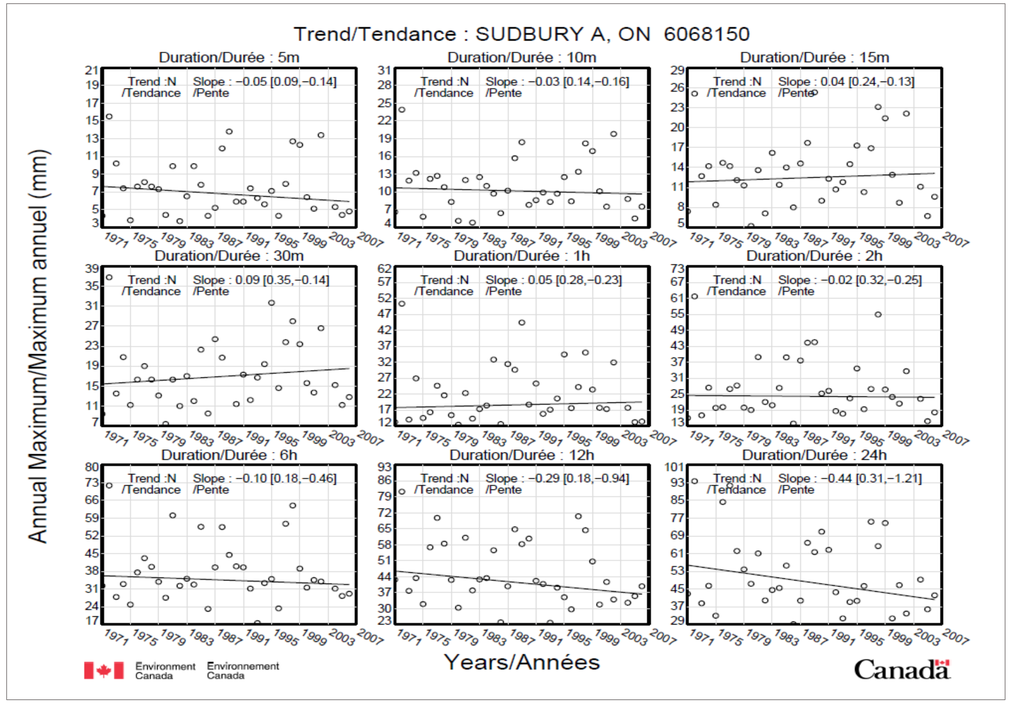


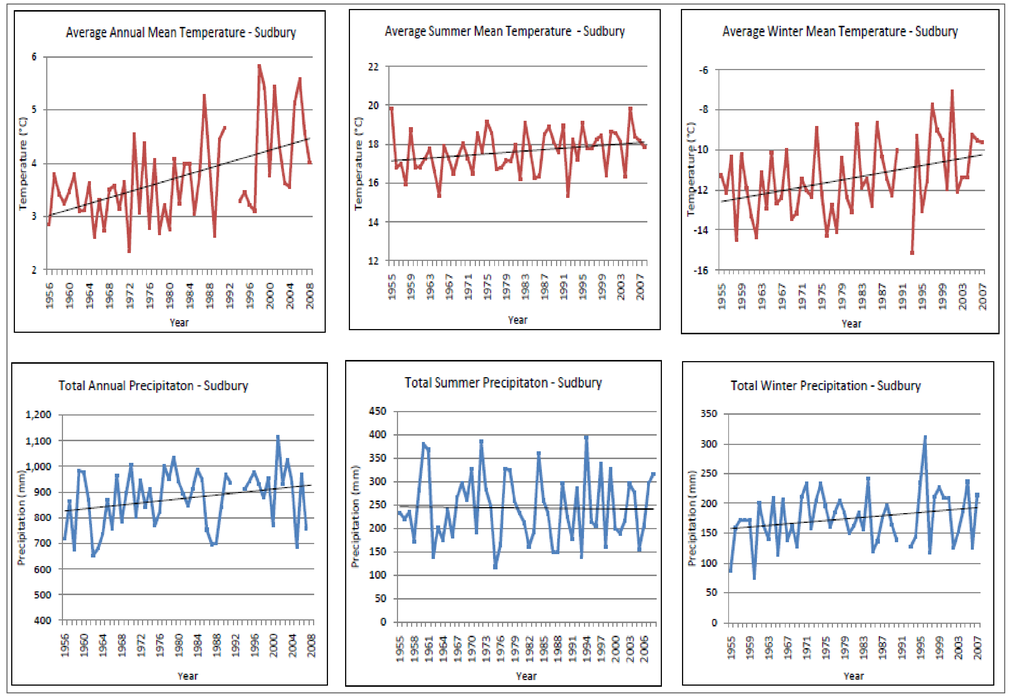
Areas Still to be Modelled:

- Nolin Creek upstream of the Box Culvert
- Junction Creek from the Box Culvert to the Kelly Lake Dam
- Junction Creek from the Kelly Lake Dam to Simon Lake

17. Climate Change Impacts

- Purpose: Make recommendations for climate change adaptation planning
- Objectives:
  - Determine the potential for climate change to influence precipitation and temperature in the future
  - Ensure the potential for climate change influences are recognized in the assessments via stress testing, where relevant
  - Inform flood mitigation and storm drainage approaches with adaptation planning
  - Ensure recommended infrastructure approaches address resilience
- Background Characterization Highlights:
  - Indication of near-term downward trend in longer duration rainfall intensity
  - Future temperatures trending upward, particularly in winter
  - Future precipitation, as rain, trending upward in winter





18. Evaluating Alternative Management Strategies

Alternative management strategy:

- A measure or combination of measures that when implemented will protect property and people from flooding and erosion, and enhance and/or restore environmental resources

Two evaluation approaches are proposed depending on the land use:

Environmental Assessment Approach

- Used for Existing Lands that are already developed or will remain undeveloped
- Follows a step-wise process that includes:
  - Develop a long list of alternatives
  - Establish a set of evaluation criteria
  - Conduct an evaluation of the alternatives
  - Identify a preferred alternative

Planning Approach

- Used for Proposed Development Lands that are proposed for future development
- Follows a process that includes:
  - Review of appropriate regulations and acts
  - Define appropriate policy, regulations and acts
  - Develop a framework for ensuring Proposed Development is consistent with policy, regulations and acts

19. Alternatives – Existing Lands

Objective: to protect the public from flood and erosion risks, and enhance or restore existing environmental conditions

- Alternatives may be implemented by the City, Conservation Sudbury, local stewardship groups, businesses or homeowners
- Alternatives have been broadly classified as:
  - Source
  - Conveyance
  - End-of-pipe
  - Restoration measures

Traditional Source Control Measures

These measures are typically used within high-density forms of development such as commercial or industrial land uses. Rooftops, parking lots, or oversized storm sewers can be used to temporarily store rainfall from large storm events, while oil-grit separator devices can improve water quality.

Restoration & Beaver Habitat Management

Development and destruction of natural habitats can cause beavers to migrate to urban areas, creating dams to restore their natural wetland fishing habitat. Restoration of natural wetland areas and stream reaches, along with targeted beaver management in critical areas, can help alleviate urban flooding.

Image retrieved from www.beaverdeceivers.com

20. Alternatives – Existing Lands

Source Control Measures (Low Impact Development Best Management Practices)

Homeowners and businesses can implement aesthetically pleasing measures that assist in cleaning and reducing the rate of runoff from their property.

Conveyance Control Measures

There are several local streets in the Junction Creek watershed serviced by sewer systems which have become clogged with sediment. Existing outfalls must be daylighted and maintained, and Low Impact Development techniques (LIDs) can help reduce both flooding and sediment loading.

End-of-pipe Measures

Potential opportunities to implement measures such as Oil-Grit separators or stormwater ponds to treat water prior to discharge natural environment.

Restoration Measures

Development along Junction Creek is extensive. In some locations the creek channel has bee altered, which has impacted the aquatic habitat. Restoration can improve conditions more suitable to aquatic habitat.

Photos on this page were retrieved from site visits, the Credit Valley Conservation's Grey to Green Low Impact Development Retrofit Guides, and articles from The Sudbury Star.

21. Alternatives – Proposed Development

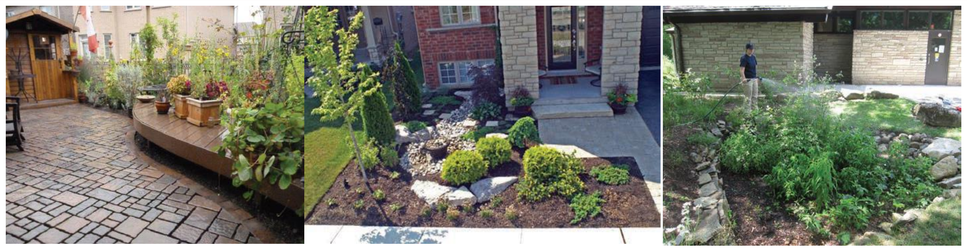
Objective: to maintain or enhance the natural environment as development proceeds

- Potential impacts include:
  - Increased surface water runoff volumes
  - Increased flood frequency
  - Decreased water quality
  - Lower groundwater recharge to aquifers
  - Potential decreased baseflow to surface watercourses
  - Negative impacts to downstream fisheries
- Existing standards from the following organizations need to be considered:
  - City of Greater Sudbury
  - Conservation Sudbury
  - Ministry of Environment and Climate Change
  - Ministry of Natural Resources and Forestry
  - Fisheries and Oceans Canada
- Similar to Existing Lands Alternatives, Proposed Development Alternatives have been broadly classified as:
  - Source
  - Conveyance
  - End-of-pipe
  - Restoration measures

22. Alternatives – Proposed Development Stormwater Management (SWM)

Low Impact Development (LID) Source Control Measures

Addressing SWM using property level / source controls to encourage the infiltration of water into the ground and reduce stormwater runoff. They can include green roofs, permeable pavement, soak away pits, bio-retention, downspout disconnection, etc.



Conveyance Control Measures

Stormwater transport systems generally located within the road right-of-way to encourage infiltration of water into the ground, improve water quality and reduce runoff. They can include traditional curb and gutter systems, bio-swales, grassed channels and subsurface perforated pipe systems.

End-of-pipe Measures

Addressing SWM using conventional stormwater facilities at the end of the flow conveyance system (i.e., end of pipe). These facilities are used to control erosion and water quantity and quality.

Restoration Measures

Replanting of floodplain and creek banks to improve waterway functions and water quality, slowing runoff, moderating stream temperatures, reducing erosion and improving aquatic and terrestrial habitat conditions.

Photos on this page were retrieved from the Credit Valley Conservation's Grey to Green Low Impact Development Retrofit Guides .

23. Next Steps

- Complete numerical modelling of urban stormwater system (sewer & road network) and riverine floodplain analysis
- Further develop and evaluate alternative solutions
- Identify preferred solutions
- Finalize Subwatershed Study and Stormwater Master Plan

24. How Can You Get Involved?

- **Join our Project Mailing List for timely, relevant updates by adding your name to the sign-in sheet**

- **Review information shared at this Stage 3 public meeting**

- **Attend upcoming public meetings:**
  - Stage 4: Recommended Preferred Solution
  - Stage 5: Subwatershed Study Completion

- **Provide input on your observations regarding:**
  - priorities and interests
  - opportunities to enhance the health of the ecosystem
  - constraints that may be sensitive to disruption

WAYS TO PROVIDE YOUR INPUT

- City's website: greatersudbury.ca/watershedstudy2016
- Comment form:
  - Paper copy
  - Online
- Speak with one of the Study Team members:
  - **Paul Javor**, MASc, P.Eng.
    City of Greater Sudbury
    Phone: 705-674-4455 ext. 3691
    Fax: 705-560-6109
    Email: Paul.Javor@greatersudbury.ca
  - **Brian Grant**, P.Eng.
    Amec Foster Wheeler
    Phone: 705-682-2632
    Fax: 705-682-2260
    E-mail: brian.grant@amecfw.com