SANDY POINT SEWAGE TREATMENT PLANT UPGRADE: **PIEVC CLIMATE CHANGE VULNERABILITY ASSESSMENT**

Municipality of the District of Shelburne, Nova Scotia

PIEVC Process at Pre-Design

Presentation Outline:

- Existing System Description
- New Plant Design Criteria
- Technology and Site Selection
- PIEVC Process Results
  - Project Definition
  - Data Gathering & Sufficiency
  - Risk Assessment
  - Engineering Analysis
  - Conclusions & Recommendations

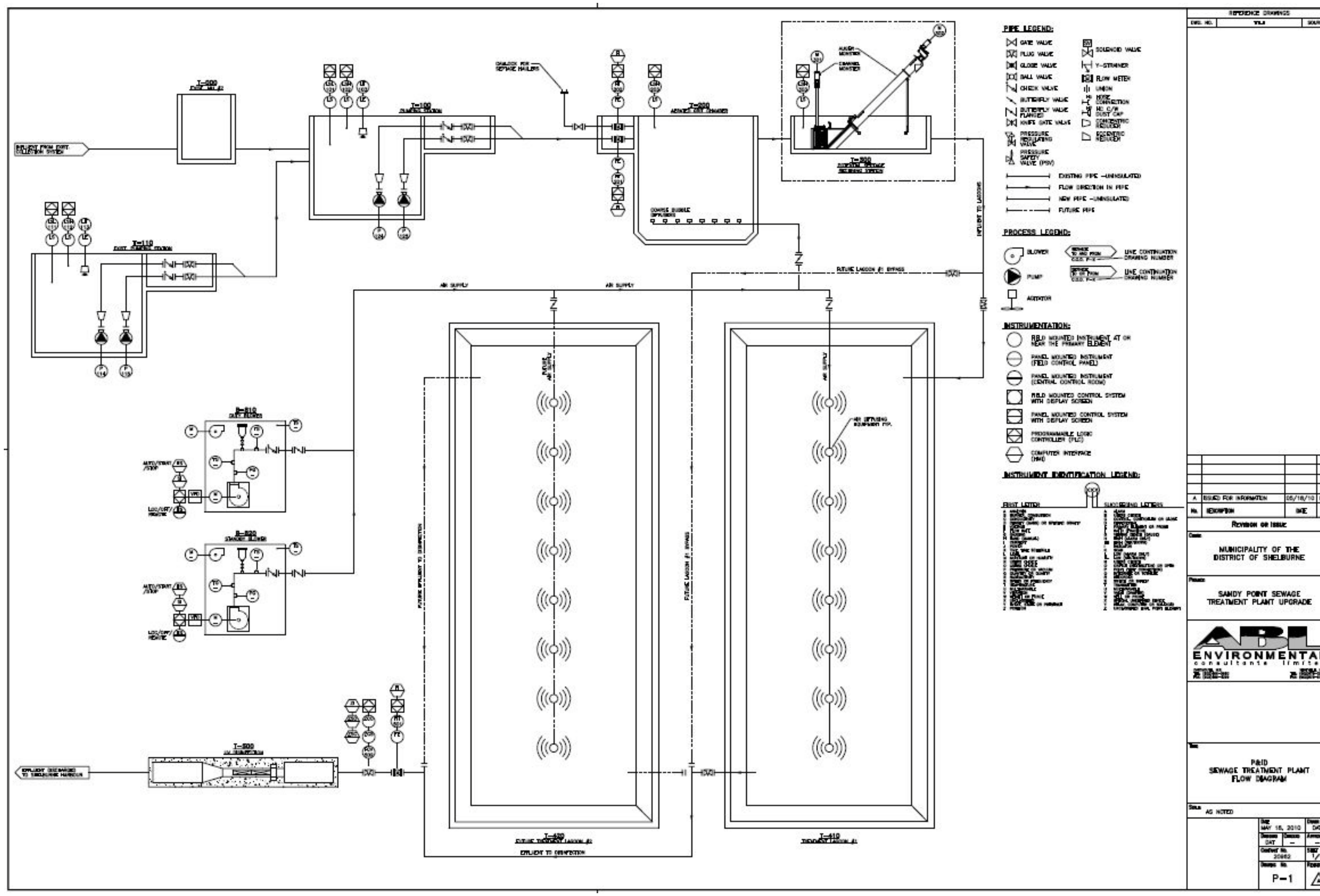
Existing Extended Aeration STP

- 30,000 USgpd capacity constructed in 1969
- Overloaded and out of compliance with NSE discharge limits
- Wet weather flows affecting plant performance

New Plant Design Criteria

- Expansion of Industrial Park (add'l 29 acres)
  - 5,000 USgpd
- Average Daily Flow – 100,000 USgpd
- Maximum Daily Flow – 350,000 USgpd
- Secondary Level of sewage treatment
- Modular growth/expansion
  - Future plan for servicing residences of Sandy Point Road (Industrial Park to Canadian Armed Forces Base)
- Option for receipt of septage

Flow Diagram



PIEVC Process Integrated with Design

Project Lifecycle

- Pre-Design
  - Specification
  - Site Selection
  - Technology Selection
  - **PIEVC**
- Detailed Design
- Tendering
- Construction
- Operation

- PIEVC Process
  - Project Definition
  - Data Gathering & Sufficiency
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Climate Data

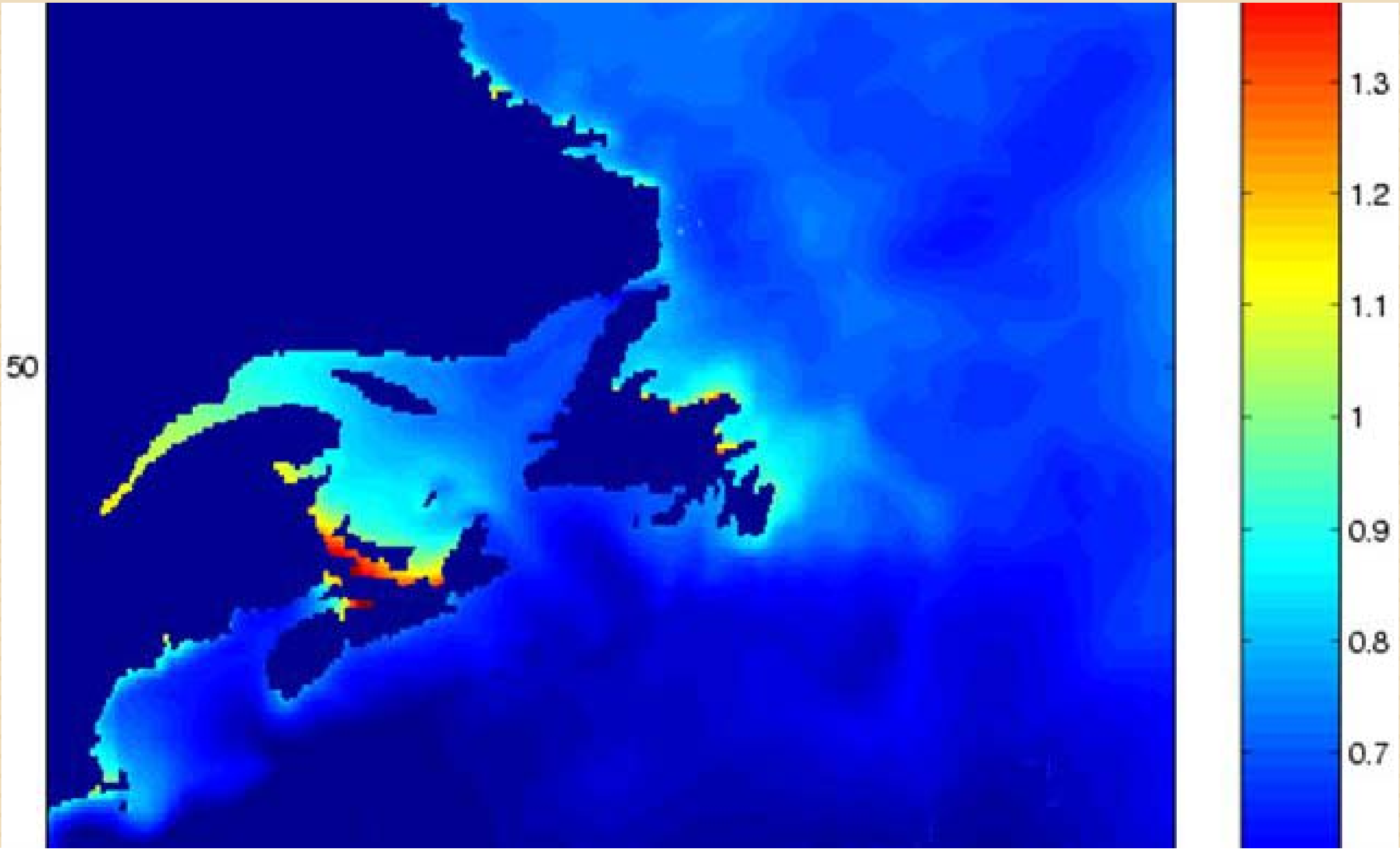
- Temperature and Precipitation

	Minimum Temperature			Maximum Temperature			Precipitation Amount		
Tri-decade	2020s	2050s	2080s	2020s	2050s	2080s	2020s	2050s	2080s
Units	Δ°C	Δ°C	Δ°C	Δ°C	Δ°C	Δ°C	%	%	%
Greenwood	1.8	2.7	4.1	1.5	2.6	4.1	7.5	7.0	4.5
Kentville	2.2	3.1	4.6	1.6	2.7	4.3	8.0	7.0	4.0
Shearwater	1.9	2.7	4.0	1.2	2.1	3.5	17.0	14.0	11.0
Yarmouth	0.8	1.3	2.0	1.0	1.6	2.3	7.0	6.0	3.0

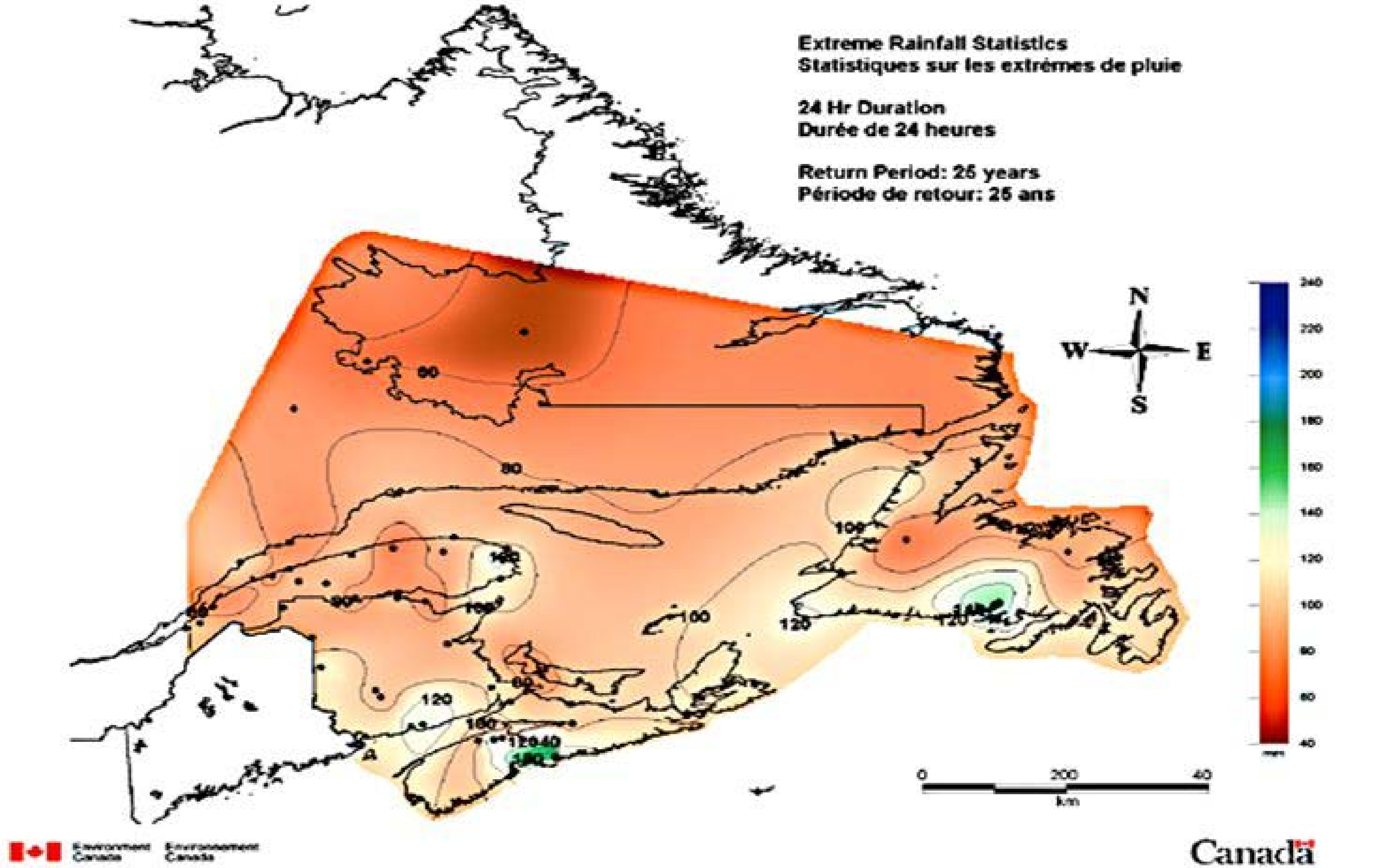
  - For current climate (1961 to 1990) the greatest three (3) day total rainfall is 87mm
  - For projected climate (2071 to 2100) the greatest three (3) day total rainfall is projected to increase to 116mm

Climate Data

- Storms, Storm Surges and Sea level Rise
  - Ultimately, high water levels result from a combination of the specific meteorological event, geographic location of event, sea level rise, storm surge, sinking land, and wave run-up
  - Sea Level Elevation
    - 40 – 132 average sea level rise globally
    - Crustal subsidence (sinking land)
- Frost and Freeze/Thaw cycling predicted to decrease



Storm Surge (40 year return) in Atlantic Canada



Extreme Rainfall Statistics – Atlantic Canada

Climate-Infrastructure Interactions

- Total of 45 infrastructure components identified
- Total of 24 Climate events identified
- Of 1080 possible interactions, 404 were identified as having potential consequences
- Performance response types considered:
  - Structural Design
  - Functionality
  - Watershed, Surface Water, and Groundwater Operations,
  - Maintenance, and Materials Performance
  - Emergency Response
  - Insurance Considerations
  - Policy Considerations
  - Social Effects

Risk Assessment

R = P x S

R: Risk

P: Probability

S: Severity

- Engineering team conducted pre-assessment of risk using matrix
- Modified workshop process to prioritize interactions discussed and to rank interactions as High/Medium/Low risk
  - 14/404 interactions were High Risk
  - 111/404 interactions were Medium Risk

Risk Assessment

- Participants identified opportunities for mitigation and adaptive capacity:
  - The majority of interactions related to power supply, communications and access to infrastructure components during extreme climate events
  - SCADA complete with UPS and backup power system requirements identified
  - Shut-off for existing pumping station when seawater ingress experienced
  - Planned increases in maintenance due to climate events
  - Installation of weather station at the plant site

Engineering Analysis

- Much of the data required for the Engineering Analysis did not exist or was difficult to obtain
- Professional judgment and experience was employed where data was not available
- For the thirty-five (35) components for which potential vulnerabilities were identified
  - 21 remedial engineering actions recommended
  - 4 management actions being recommended

Summary of Recommendations

- Reduce inflow and infiltration (I&I) into the collection system
- Install backup power supplies at the pumping stations
- Ensure the process building meets code for hurricane resistance
- Install a radio communications system at the pumping stations and process building
- Install high level pump shutoffs at the existing pumping station
- Install a bypass on the grit removal system
- Implement a policy to protect staff from hurricanes, storm surges and ice storms
- Discuss safe conditions for deliveries from septage hauling companies
- Adjust scheduling to accommodate required maintenance

Recommendations

- **Existing / New Pumping Stations**
  - *Remedial engineering or operation actions required:*
    - Provide permanent back-up power at the new pumping station
    - Provide temporary back-up (portable genset receptacle) power at the existing pumping station
    - Provide salinity sensor and/or high-high level float to disable pump stations in the event of saltwater intrusion or storm surge
    - Provide radio based SCADA / telemetry system to communication disruptions during extreme events (locate mast to avoid tree fall damage)

PIEVC at the Design Stage

- This project is small, and PIEVC was implemented at the pre-design stage:
  - The Protocol as presented was a useful complement to the pre-design process and assisted in site selection, technology selection and design of components.
  - It was difficult to assess the detailed system components at such an early stage in the design process.
  - The Protocol is currently 'one-size-fits-all' but if was flexible enough to adapt it to fit our purpose

Questions?