### USE OF NATIVE SPECIES IN THE RESTORATION OF A TRAIN DERAILMENT SITE

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## Outline

- Emergency Response and Initial Remediation
- Site Description
- Baseline Data Collection
- Restoration Plan
- Restoration Activities
- Post-Restoration Data Collection
- Closure
- Acknowledgements



## **Emergency Response and Initial Remediation**

- Train derailment resulted in 21 railcars leaving the tracks
- 5 cars containing styrene monomer and 3 cars containing ethylene glycol were damaged, resulting in the leakage of liquid product into a wetland area





# Emergency Response and Initial Remediation

 Initial remediation was completed to contain styrene within the wetland, and prevent it from reaching a nearby lake



- Pumping of styrene and impacted groundwater collected in sumps
- Removal of residual product from damaged railcars
- Excavation of 30,000 tonnes of impacted soil and wetland sediment



### **Research Opportunities**

- Project presented opportunity to conduct research into a methodology for restoring wetlands at remote sites using native species
- Research investigated two areas of uncertainty:
  - 1. <u>Would it be possible to establish a wetland using native</u> <u>species that will regenerate into a natural state within</u> <u>approximately 5 years?</u> and
  - 2. Will native species enhance natural attenuation of residual styrene?



## **Site Description**

- Derailment occurred adjacent to a portion of a larger wetland
- Examination of the unaffected area of the wetland suggested that the damaged wetland formerly contained large mats of emergent vegetation dissected by narrow water channels
- A thick deposit of peat was present in the wetland





### Site Description Site Layout





# **Baseline Data Collection**

- Assessment of ecological communities
  - Vegetation
  - Fish habitat
- The distribution of remaining chemicals of concern in various environmental media
  - Soil / sediment
  - Surface water
  - Groundwater
- Completion of assimilative capacity study to predict fate of residual styrene. Processes investigated included:
  - Hydraulic dilution
  - Volatilization
  - Metabolic breakdown



### **Restoration Plan**

The objectives of the wetland restoration plan were to:

- 1. Provide a variety of healthy self-sustaining habitats for fish and wildlife
- 2. Minimize the potential for the introduction of invasive species, and
- 3. Be aesthetically pleasing when viewed from the road



### **Restoration Plan**







Activities completed in 2003 included:

- 1. Grading of shoreline to facilitate planting and growth of new vegetation
- 2. Creation of habitat islands using rock fill imported during remediation activities, imported sand, and trees felled during remediation
- 3. Creation of fish habitat using trees felled during remediation, and
- 4. Collection of plant material for propagation at Royal Botanical Gardens' wetland nursery





Construction of Habitat Island





- Plant material was collected by RBG staff
- Plant materials collected included seeds, soil and root plugs, rhizomes, and cuttings





- Plant material returned to site in 2004 planting season
- RBG crews planted wetland according to restoration plan developed by Stantec





### **Post Restoration Data Collection**

- A systematic approach was used to evaluate the performance of the experimental wetland:
  - Collection of data on vegetation and flora
    - Plot sampling (9 plots)
    - Transect sampling (2 transects)
  - Collection of data on wildlife using the wetland
    - Fish
    - Other wildlife (e.g., birds, mammals, reptiles, amphibians)



#### **Post Restoration Data Collection** Vegetation Monitoring Transects and Plots





### **Post Restoration Data Collection** Vegetation Monitoring Transects and Plots

2004

2005





Plot 3



Plot 4



#### **Post Restoration Data Collection** Vegetation

Vegetation monitoring indicated the following:

- Native species composed the majority of the flora;
- The majority of native species are in the low to moderate sensitivity classes, being representative of general habitats and not of highly specific, natural or undisturbed situations;
- The majority of non-native species are non-invasive; and
- The Site is dominated by obligate and facultative wetland species.



#### **Post Restoration Data Collection** Fish Surveys





#### **Post Restoration Data Collection** Wildlife

Fish

- Seven fish species were collected during 2005 survey;
- Compared with the unaffected wetland, fish density and diversity were much higher

Terrestrial

• Numerous bird and mammal species observed using the wetland



### Closure

Data collection and evaluation to date suggests that:

- The experimental wetland restoration program is progressing favorably
- It is feasible to construct wetlands using typical vegetation found in Canadian Shield landscapes, and
- The landscape disturbed by the train derailment and initial remediation activities had taken on a significantly natural appearance by the end of 2005



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