# Future Land Use and Sustainable Remediation at the Sydney Tar Ponds and Coke Oven Sites: A Case Study and Lessons Learned on Adaptive Remedial Design

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# Cape Breton Island

# Sydney Steel Plant

**1899 – begin construction.**

**1901 – largest North American steel mill begins production.**

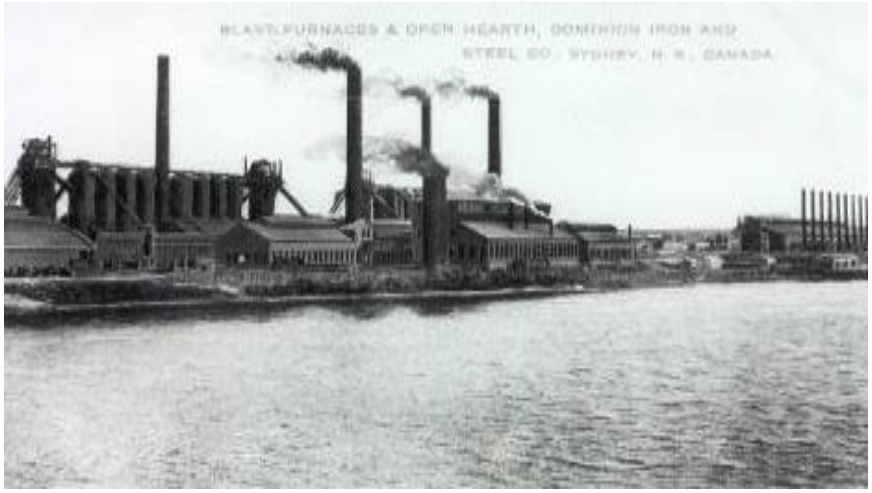
**1912 – steel mill is producing half of the steel made in Canada.**

# History of the Site

Employed ~ 6,000 workers at its peak.

Produced mainly rails; 1st global producer of shatter free rails.


# The Legacy Contaminated Site




- 100 years of coking operations
  - Tar Ponds: 81 acres
  - 700,000 tonnes of PAH contaminated sediments
  - 45,000 tonnes of PCB contaminated sediments
- Coke Ovens: 178 acres
  - 3,000 tonnes of PAH & VOC contaminated soil
  - 25,000 tonnes of coal tar in tar cell

# Previous Clean-up Attempts

Two failed clean-up attempts:

1. Sydney Tar Ponds Incinerator
2. Encapsulation

Mandate: to get unanimous consensus for method of clean-up

Framework:

- Roundtable
- Working groups
  - Health and Safety
  - Environmental
  - Engineering
- Public meetings (>1000 over 5 years)

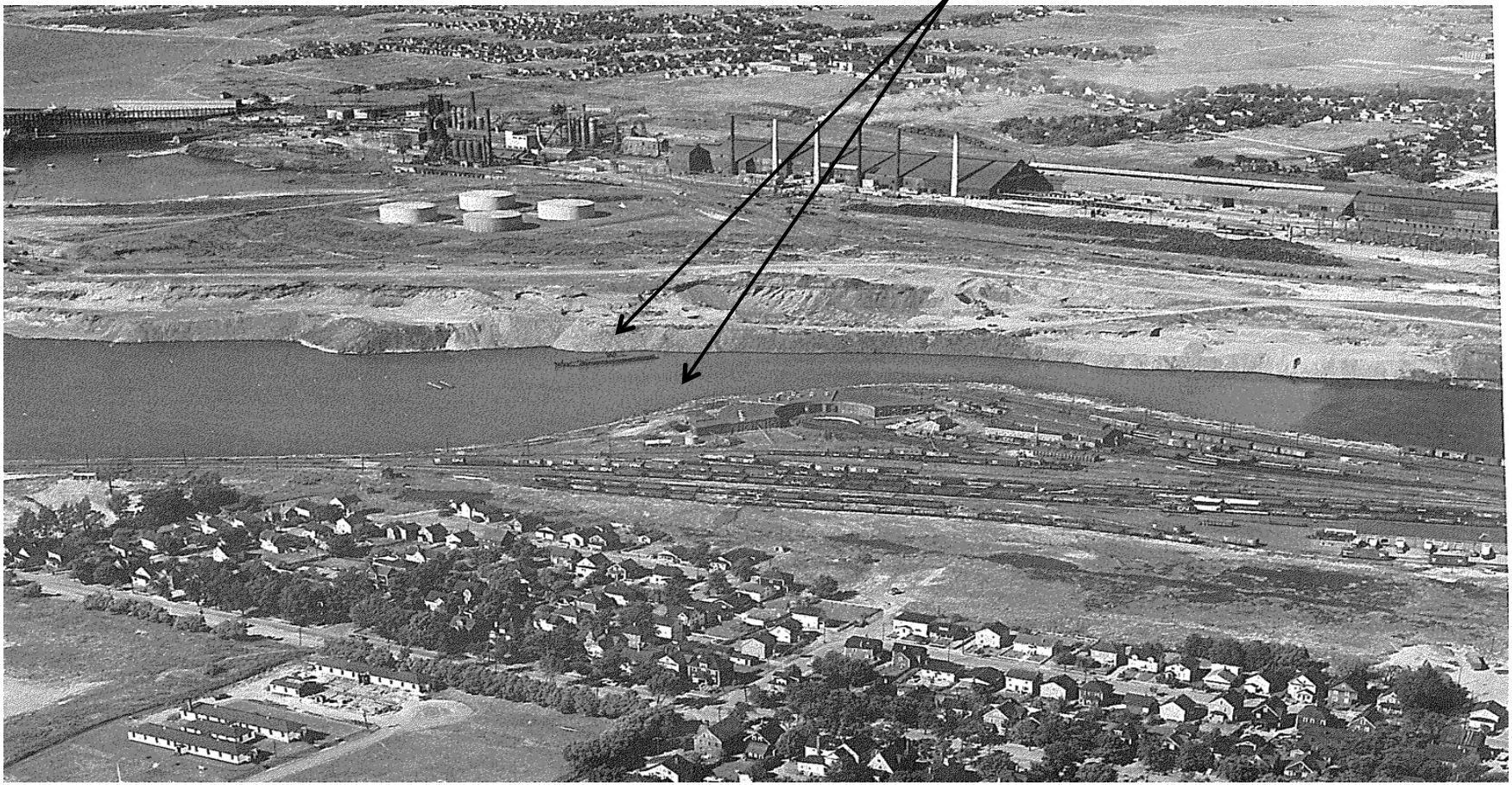
# Previous Clean-up Attempts

## Tar Ponds Incinerator

# Previous Clean-up Attempts

## Tar Ponds Encapsulation

Slag pile was to be pushed into Pond



# Joint Action Group (JAG)

The Joint Action Group (JAG) formed

- 1996 - Federal and provincial ministers meet to consider community-based process to find acceptable solutions.
- 1998 - Three levels of government and JAG sign an MOU.
- 1999 - Ottawa, Nova Scotia, and Cape Breton Regional Municipality sign $62-miilion cost sharing agreement to fund scientific studies, surface clean-up and JAG activities.

# Remedial Action Evaluation Reports (RAER)

## Purpose:

To identify potential solutions for the clean up of both the Coke Ovens site and the Tar Ponds site

## Report to discuss:

- Description of clean up technology
- Construction methodology
- Order of magnitude costing
- Conceptual schedule
- Economic benefits

Report not to make recommendations or select option

Selection of clean up technology to be made by JAG

# Preliminary Engineering Design

Carried out preliminary engineering on selected clean up technologies from JAG/RAER

## Tar Ponds

- Stabilization and solidification PAH impacted sediments
- Incineration PCB impacted sediments
- Final capping

## Coke Ovens

- Interception barrier
- Groundwater collection & treatment
- Surface water control
- Final Cap

(2006 by EarthTech (now AECOM) and CBCL Limited)

# Preliminary Remedial Works

The following remedial works were carried out by the Sydney Tar Ponds Agency in preparation for the major clean up remediation:

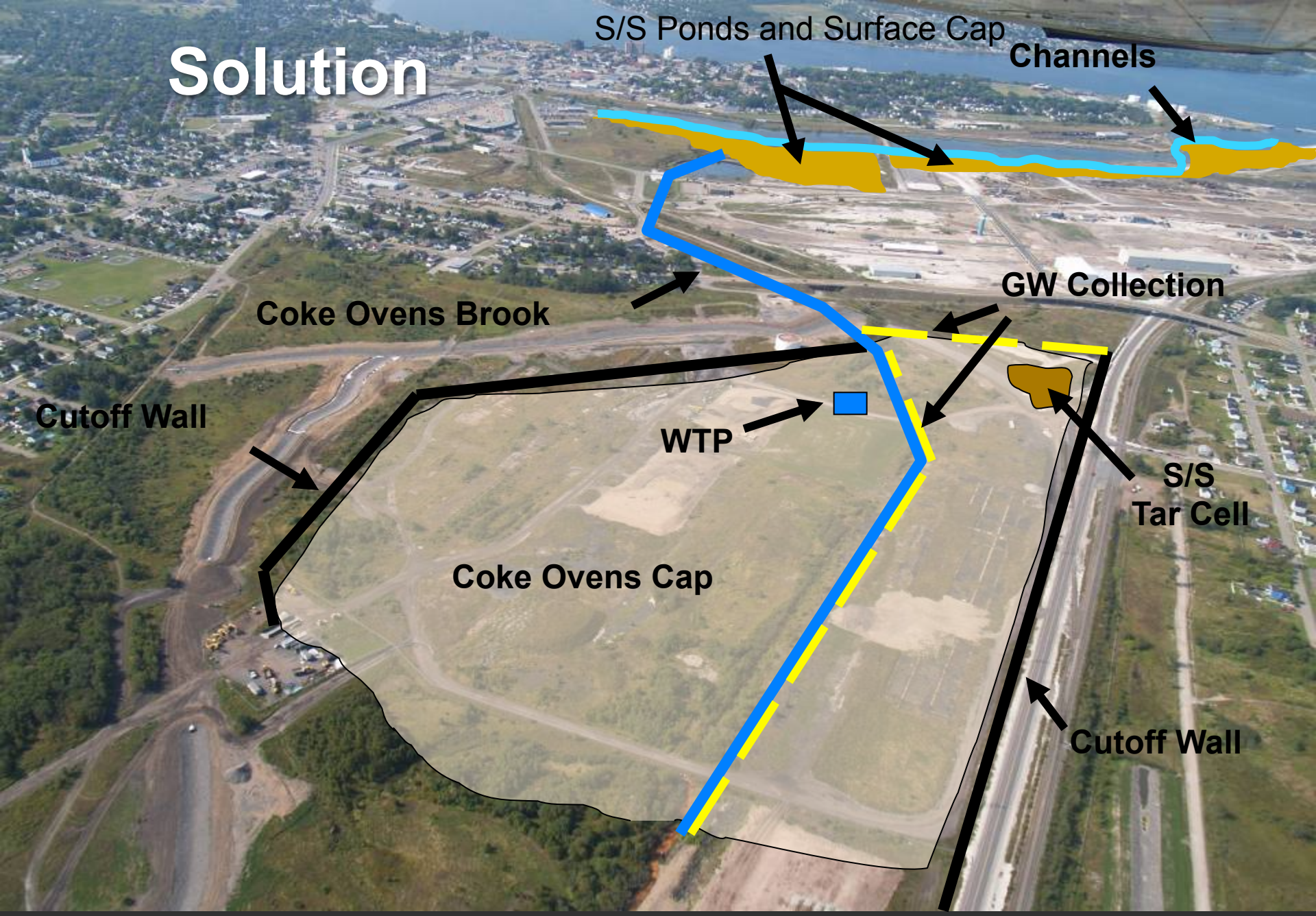
- Relocation Coke Oven Brook
- Relocation City Water Line
- Battery Point Barrier
- Cooling Pond*

*First Nations set aside

# Battery Point Barrier and Cooling Pond

# Coke Ovens

# Solution


S/S Ponds and Surface Cap
Channels
GW Collection
Coke Ovens Brook
Cutoff Wall
WTP
S/S
Tar Cell
Coke Ovens Cap
Cutoff Wall

# Project Schedule

- Detailed Design Started in October 2006
- Construction Commenced in 2008
- Construction Completion Scheduled for 2014 – complete in 2013

# Solidification / Stabilization

# General S/S Approach

- Control incoming flows from Coke Oven/Wash Brook by diverting them around the work area
- Control water coming from other sources using barriers
- Create a new channel within the isolated areas
- Complete in situ treatment of tar ponds sediments through solidification/stabilization
- Cap S/S treated Sediments

# Solidification and Stabilization Steps to Completion

- Characterization
- Design Criteria
  - Environmental
  - Future land use
  - GSR/LEB/fish enhancement
- Bench Scale Testing
- In-Situ Pilot Scale Testing
  - Mix Optimization
- Tender
- Full Scale Construction

# S/S Site Specific Acceptance Criteria

| Property | Test Method | Criteria |
|---|---|---|
| Strength (UCS) | ASTM D 1633 Method B | = or > 0.17MPa (25psi) |
| Hydraulic Conductivity | ASTM 5084 (Flex Wall) | < or = 1 x $10^{-6}$cm/sec |
| Leachate | Modified SPLP 1312 (as monolithic structural integrity procedure) | Site Specific Leachate Criteria based on MCP GW 3 (ceiling values apply) and pre/post leachate comparison |

# Implementation – Stabilization and Solidification of Sydney Tar Pond Contaminated Sediments

- Water Control
- Mechanical Mixing
- Data Collection / Verification

# Water Control: Pumping Stations – Multiple Stages

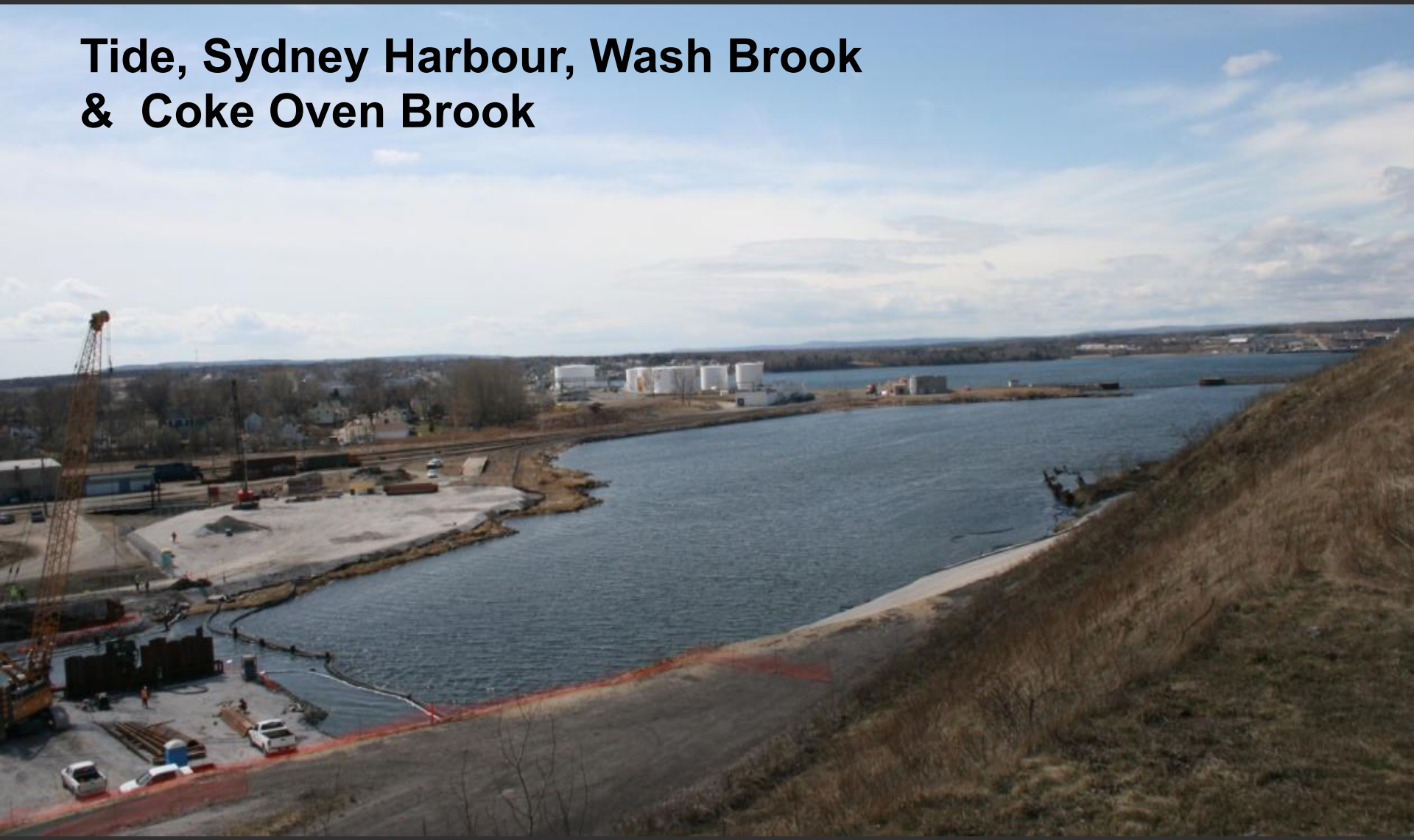

**Staged**

Minimum Flow
0 L/second

Median Flow
400 L/second

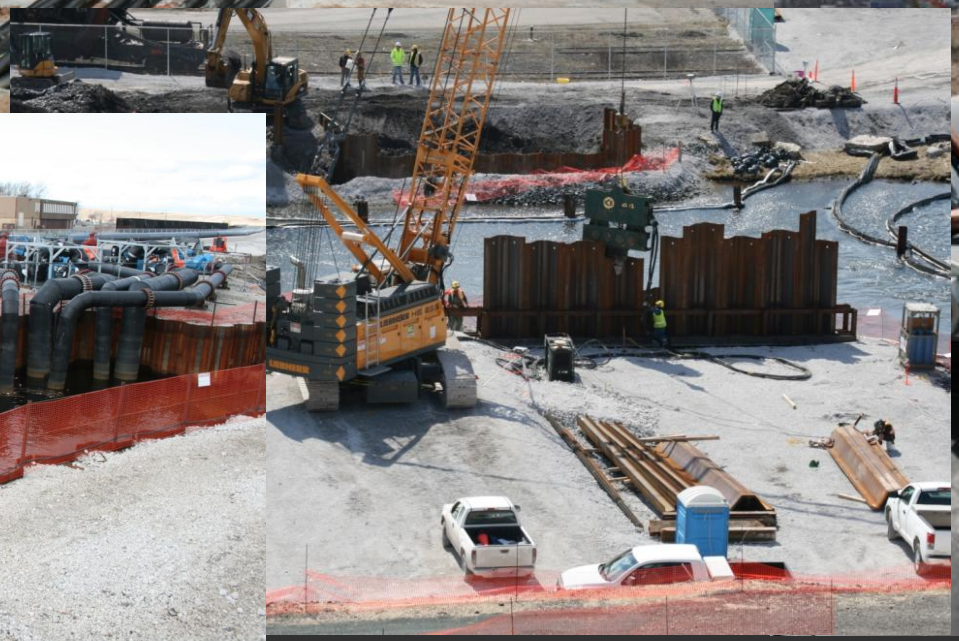
Peak Flow
14,000 L/second

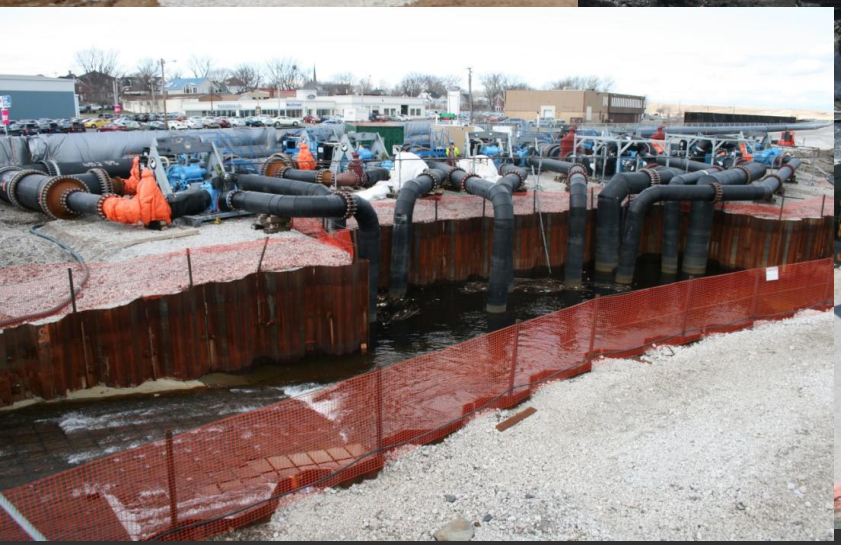
# Sources of Water



# Water Collection and Pumping

- Barriers: Sheet Pile walls, berms
- Collection: Sumps, Fish Protection
- Pumping ~ 500-800 m





# Stabilization and Solidification

- The dryer the contaminants, the less cement is used, thus lowering the overall costs.
- Too dry and it is too difficult to mix.

# Data Management

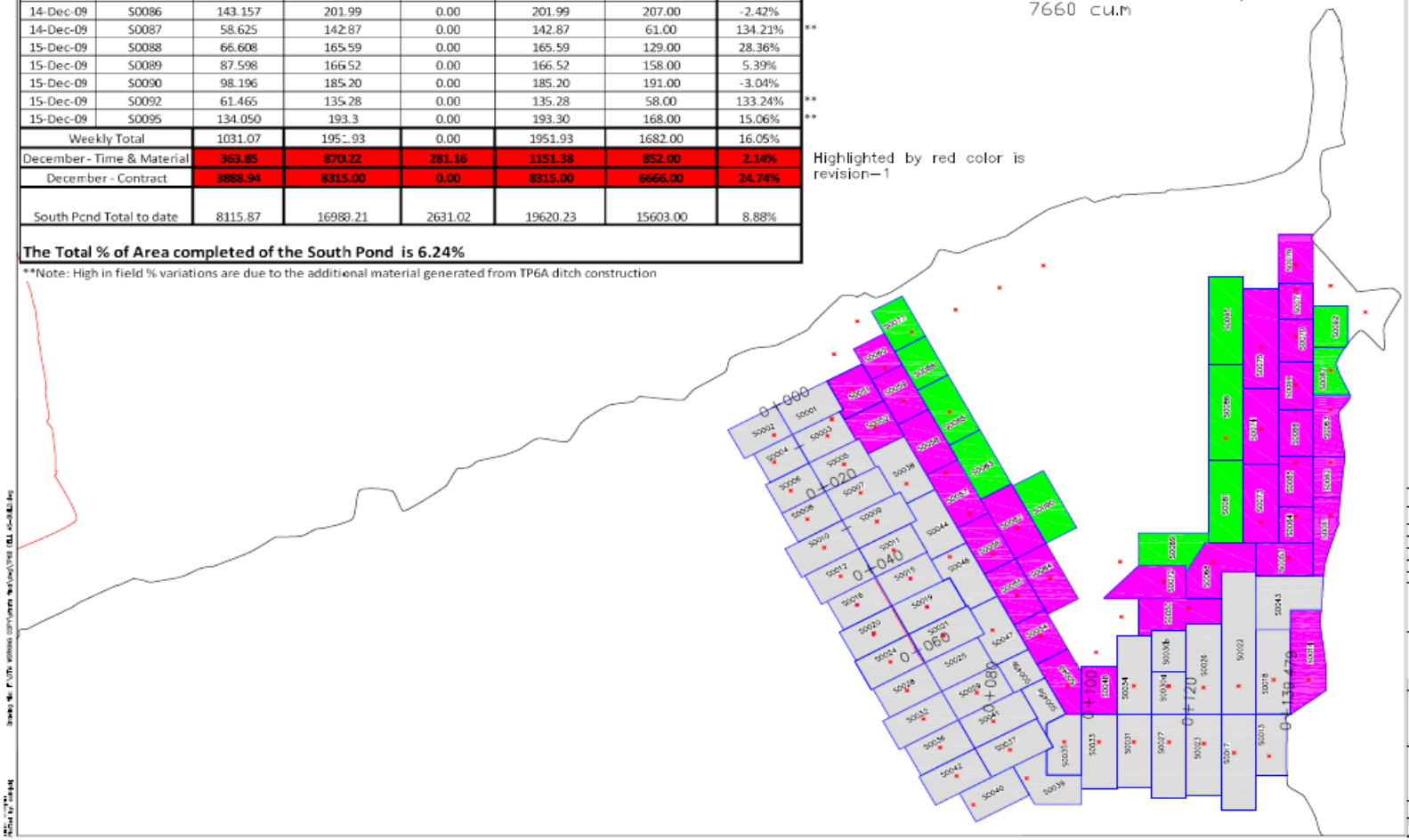
| Date Treated | Cell Number | Treated Area (sq.m) | Quantity of Sediments Treated (cu.m) | Quantity of Import Treated (cu.m) | Total Material Treated (cu.m) | Model Estimates (cu.m) (Sediments) | In field %Variation from Model | |
|---|---|---|---|---|---|---|---|---|
| 14-Dec-09 | S0077 | 68.719 | 171.04 | 0.00 | 171.04 | 137.00 | 24.85% | |
| 14-Dec-09 | S0081 | 125.678 | 202.47 | 0.00 | 202.47 | 205.00 | -1.23% | |
| 14-Dec-09 | S0083 | 92.729 | 193.71 | 0.00 | 193.71 | 184.00 | 5.28% | |
| 14-Dec-09 | S0085 | 94.248 | 193.96 | 0.00 | 193.96 | 184.00 | 5.41% | |
| 14-Dec-09 | S0086 | 143.157 | 201.99 | 0.00 | 201.99 | 207.00 | -2.42% | |
| 14-Dec-09 | S0087 | 58.625 | 142.87 | 0.00 | 142.87 | 61.00 | 134.21% | ** |
| 15-Dec-09 | S0088 | 66.608 | 165.59 | 0.00 | 165.59 | 129.00 | 28.36% | |
| 15-Dec-09 | S0089 | 87.598 | 166.52 | 0.00 | 166.52 | 158.00 | 5.39% | |
| 15-Dec-09 | S0090 | 98.196 | 185.20 | 0.00 | 185.20 | 191.00 | -3.04% | |
| 15-Dec-09 | S0092 | 61.465 | 135.28 | 0.00 | 135.28 | 58.00 | 133.24% | ** |
| 15-Dec-09 | S0095 | 134.050 | 193.3 | 0.00 | 193.30 | 168.00 | 15.06% | ** |
| Weekly Total | | 1031.07 | 195_.93 | 0.00 | 1951.93 | 1682.00 | 16.05% | |
| December - Time & Material | | 363.85 | 870.22 | 281.16 | 1151.38 | 852.00 | 2.14% | |
| December - Contract | | 3888.94 | 8315.00 | 0.00 | 8315.00 | 6666.00 | 24.74% | |
| South Pond Total to date | | 8115.87 | 16988.21 | 2631.02 | 19620.23 | 15603.00 | 8.88% | |

**The Total % of Area completed of the South Pond is 6.24%**

**Note: High in field % variations are due to the additional material generated from TP6A ditch construction

Estimated (DTM) Quantity Remaining inside of the Berm as of Dec 18, 2009
7660 cu.m

Highlighted by red color is revision-1




Sydney Tar Ponds Agency

NOTES:

LEGEND:
- 1.0m Contour (Limit of S/S Treatment)
- TREATED AREA NOV 02 to DEC 04
- TREATED AREA DEC 07 to 11
- TREATED AREA DEC 14 to 18
- LOCATION OF TEST/CENTER COORDINATE

Revision or Issue

| No. | Description | Date | By |
|---|---|---|---|
| 1 | Weather, contract and time a... | FEB/09/10 | EJ |
| | Material quantities are changed | | |

Remediation of the Tar Ponds and Coke Ovens Sites

TP6B AS-BUILT
CONSTRUCTION PROGRESS
REPORTED FOR AS OF DEC14-09 to DEC18-09

CBCL Limited Consulting Engineers

AECOM

# Odour Management

# Spring Construction

- Solidification & Stabilization
- Channel Construction
- Stockpiling
- Coke Ovens Brook Cleanup

# Air Aware & Hotline

**Deliverables**

Letter hand-delivered to neighbouring residents

Radio ads (82)

Newspaper ads (4 times over three weeks)

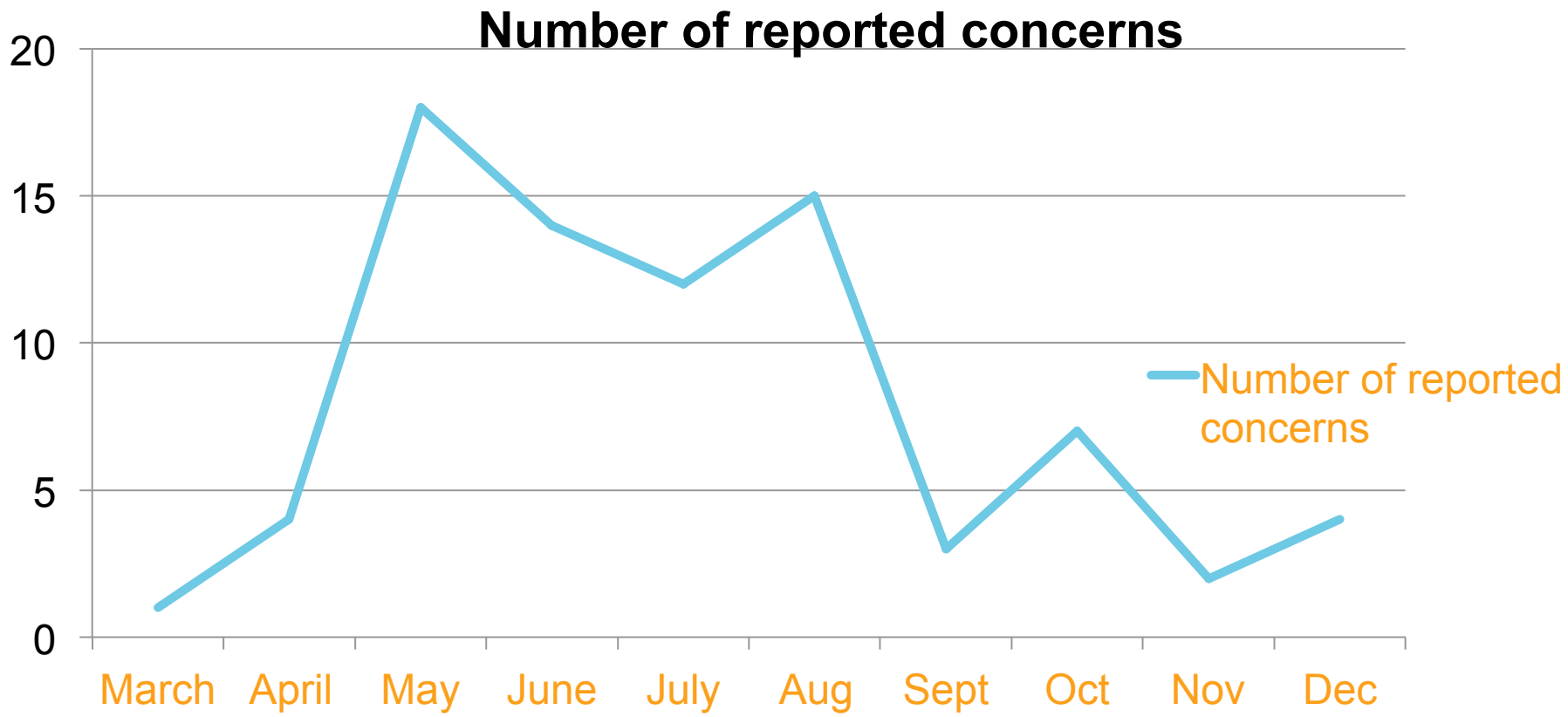
Letter to the Editor

Online Air Facts

One-on-one communication with residents

Satisfaction survey

# Odour Concerns




Concerns peaked in May

- Odour management plan: long-term foam starting end of June
- Hotline launched in August
- Coke Ovens channel construction in October

# Odour Generating Activities

- Solidification and Stabilization
- Treated Sediments
- Importation of Coke Ovens Contaminated Soils

# Odour Management Plan

- Development of an Odour Management Plan
  - Define Roles for Contractor, Design Engineer and Client
  - Define Protocols
  - Odour Complaint Hotline


Dedicated “Odour Champion”
•Respond to Work Activities
•Ensure Adequate Supply of Odour Suppressant Products

# Odour Management Plan

- Reduce Area of Exposed Materials
- Dedicated Crew
- Acquire and Apply Control Products
- When, Where and What to Apply

# Odour Management Plan

| Activity | Description | Action |
|---|---|---|
| **Depth Determination** | Advancing test pits | BioSolve |
| | Cell associated with test pit will be solidified and stabilized within 24 hours | High concentration BioSolve or short term foam |
| | Cell associated with test pit will NOT be solidified and stabilized within 24 hours | High concentration BioSolve or Long term foam or ConCover |
| **S/S** | Within the active treatment zone | BioSolve |
| | Cell will be disturbed within 24 hours | High concentration BioSolve or short term foam |
| | Cell will NOT be disturbed within 24 hours | Long term foam or ConCover |
| **Foreign Material Importation & Handling** | During importation and handling | BioSolve |
| | Material will be disturbed within 24 hours | High concentration BioSolve or short term foam |
| | Material will NOT be disturbed within 24 hours | Long term foam or ConCover |

# Odour Suppressing Foam

**Concover 180** (typical in landfill application)

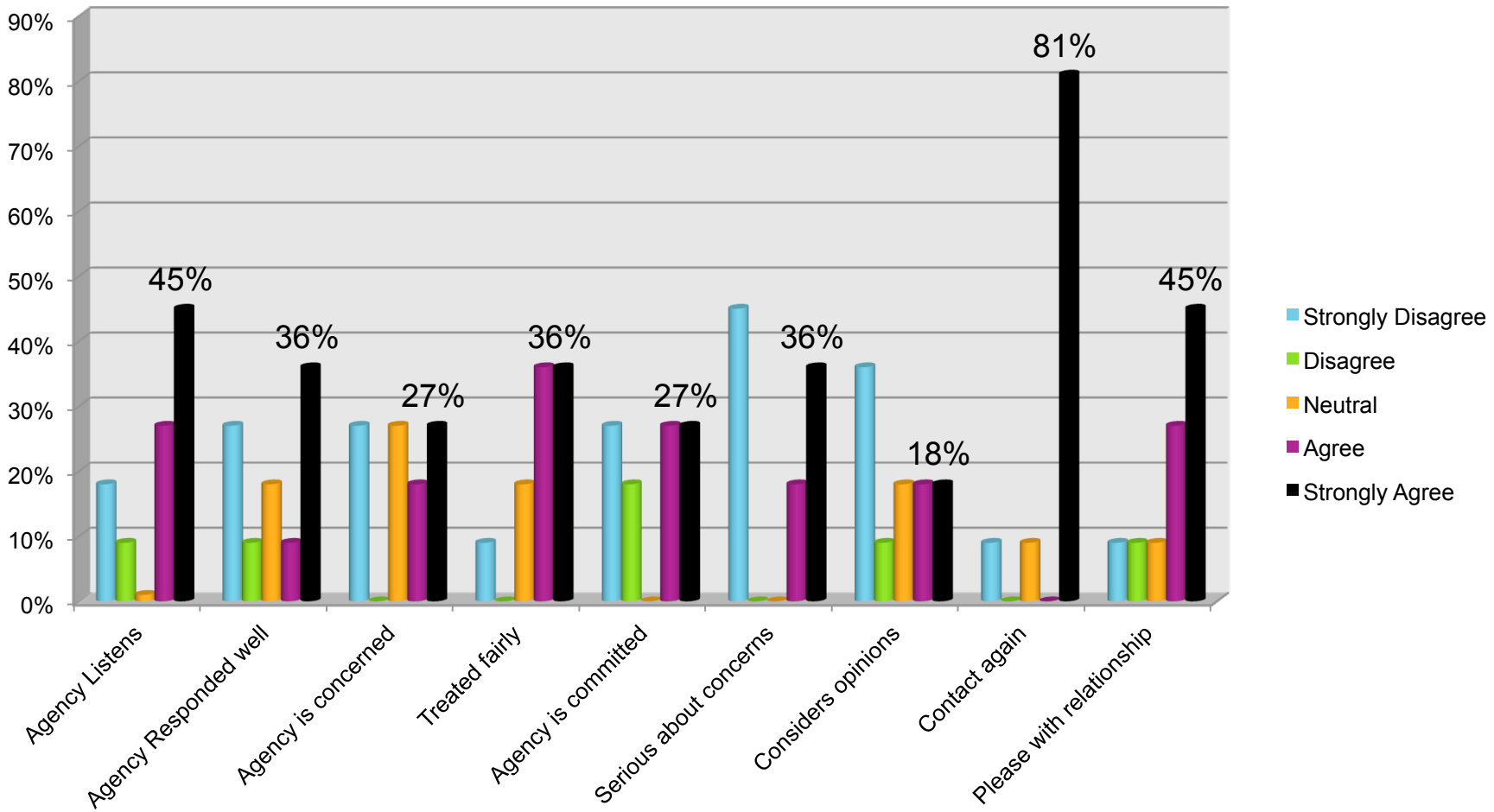
**Short term foam – Rusmar 645**

- Aqueous anionic surfactant mixture

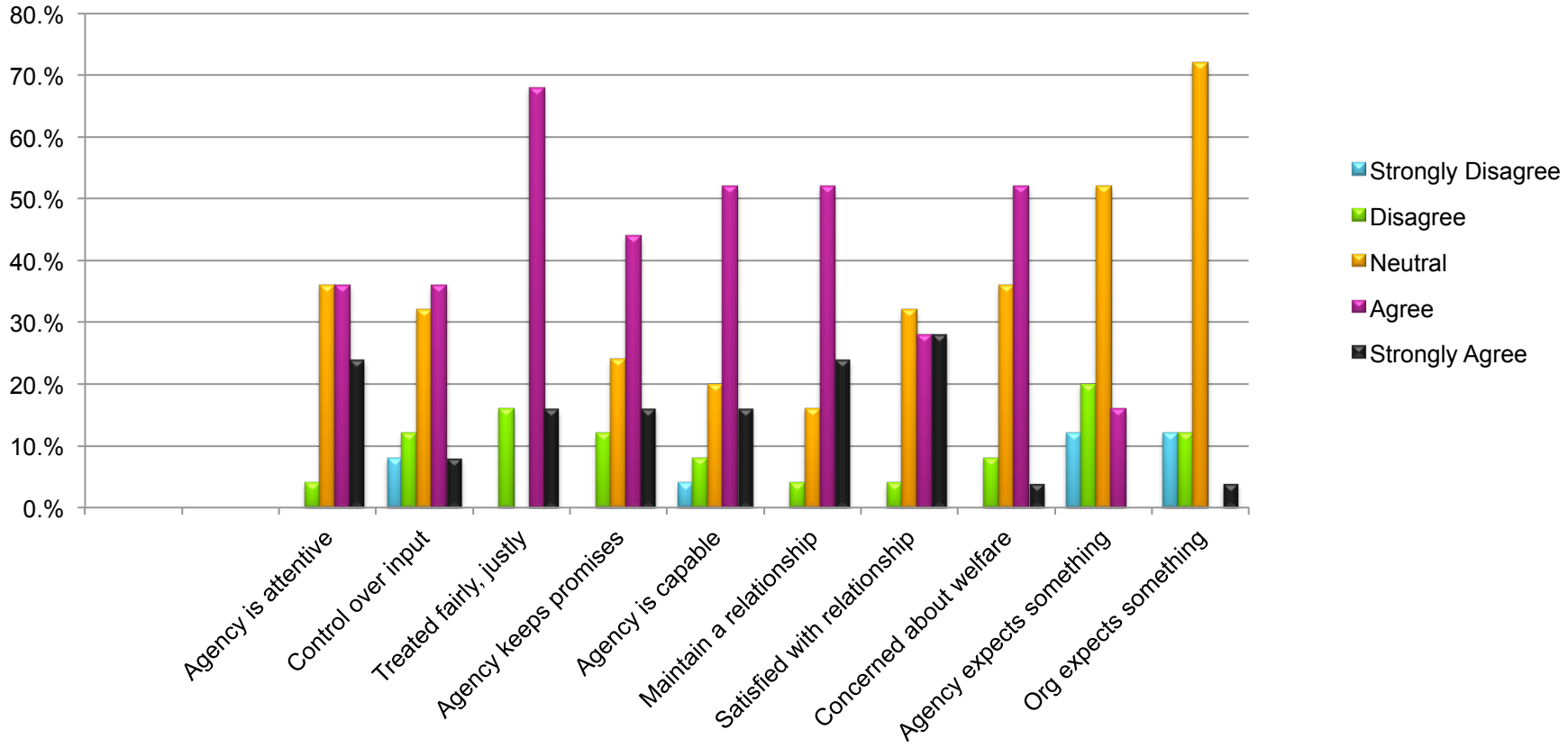
**Mid and Long term foam**
**Rusmar 900s**

- Impermeable latex-based Membrane
- Repels water
- Optional fragrance
- Application – Pneumatic Units

# Concern Response Survey (informal)



# CLC Survey Results (informal)



# Green and Sustainable Remediation

# Other Green and Sustainable Remediation (GSR) Aspects in Planning and Design

| Actions | Implementation | Benefits |
|---|---|---|
| Sequencing Plans | • Tar Pond contractors<br>• Shared site infrastructure | • Reduction of air emissions<br>• Reduces erosion<br>• Reduces waste/new material<br>• Reduces fuel use |
| Reuse options for Existing Structures | • Materials handling pad<br>• CO Brook | • Reduces demolition activities<br>• Reduces off-site disposal waste material<br>• Reduces fuel use |
| Abandon subsurface structures | • Coke Ovens Voids and underground infrastructure | |

# Green & Sustainable Remediation in Planning and Design - continued

| Actions | Implementation | Benefits |
|---|---|---|
| Salvage Options / Recycling Options | • TP2 Recycling | • Reduces off-site disposal of waste material<br>• Reduce SS volumes<br>• Recycle/reclaim scrap |
| Stockpile cover | • Project Materials Management Strategy | • Reduces dust<br>• Reduces erosion<br>• Odour Management |
| Routinely evaluate treatment process | • SS Process QA/QC Management | • Reduces air emissions<br>• Reduces water use and waste water discharge<br>• Reduces off-site disposal waste material<br>• Reduce material use |

# Future Land Use

Recreation

- Walking/cycling trails
- Green Space

Light Commercial

Sydney “Common” Area

# Future Land Use

## Highlights of the Plan:

A Commons Area including:
- Sports fields
- Outdoor concert venue
- Walking trails
- Wildlife stations
- Parking area
- Urban forest

A Greenway Trail Network with:
- Bridges
- Boardwalks
- Interpretive stations
- Outdoor exercise stations
- Rest areas

New Roads and Sidewalks for:
- Community connectors
- Business campus
- Land banking for future growth
- Commercial expansion along SPAR road

Photos from: Ekistics Planning & Design “Former Tar Ponds Site Future Use ” Sowing the Seeds of Change http://www.tarpondscleanup.ca/futureuse/


# Sydney Tar Ponds & Coke Oven Site

contour interval = 2m scale = 1:3000

August 2009

TICS PLANNING & DESIGN

BASE PLA


# Sydney Tar Ponds & Coke Oven Site

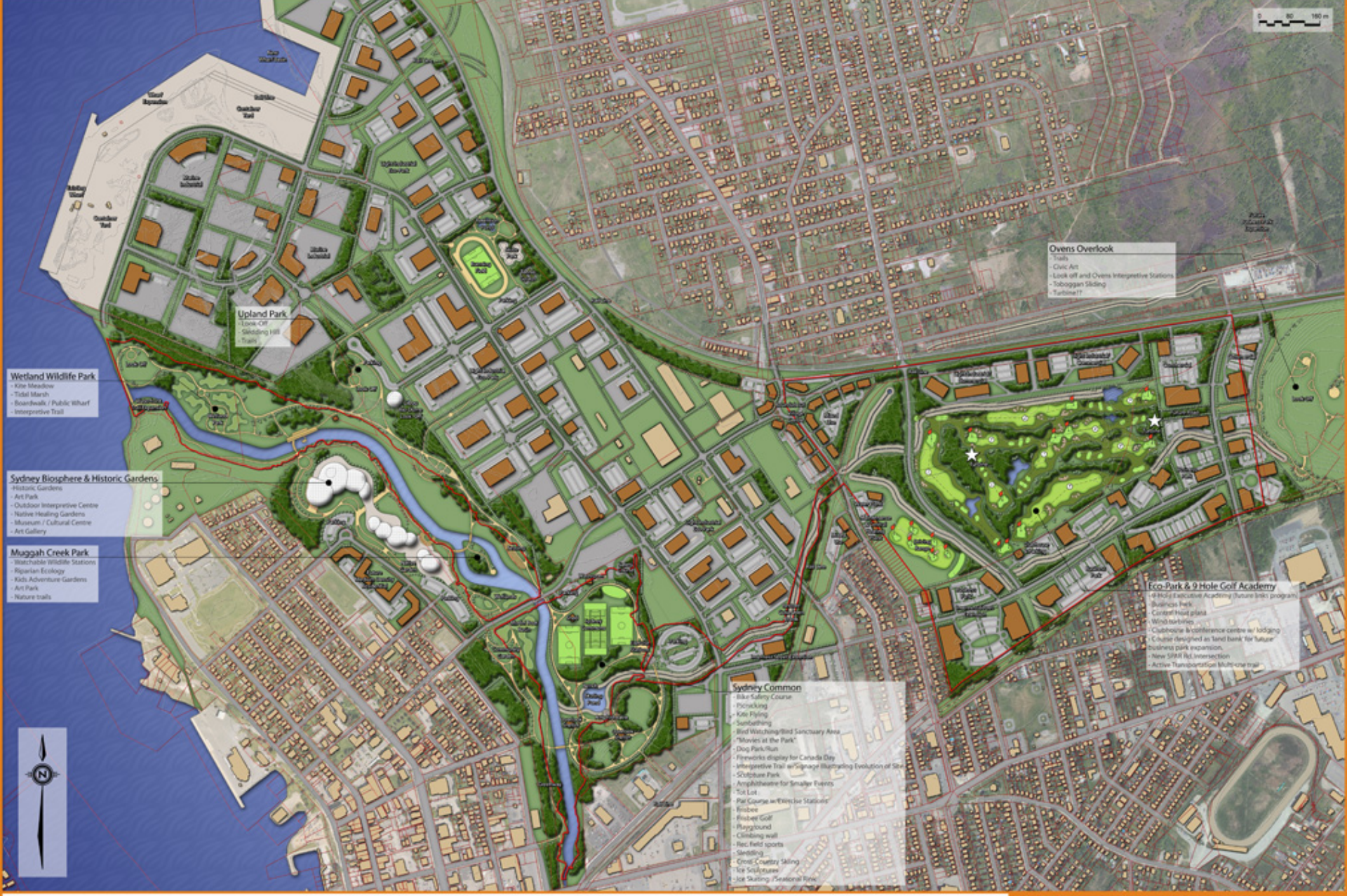
contour interval = 2m  scale = 1:3000

April 2010

EKISTICS PLANNING & DESIGN

**PHASE 1**

**4 YEAR PLAN**




# Sydney Tar Ponds & Coke Oven Site

contour interval = 2m  scale = 1:3000

April 2010

EKISTICS PLANNING & DESIGN

**PHASE 2**

**FUTURE VISION**

# Local Economic Benefits

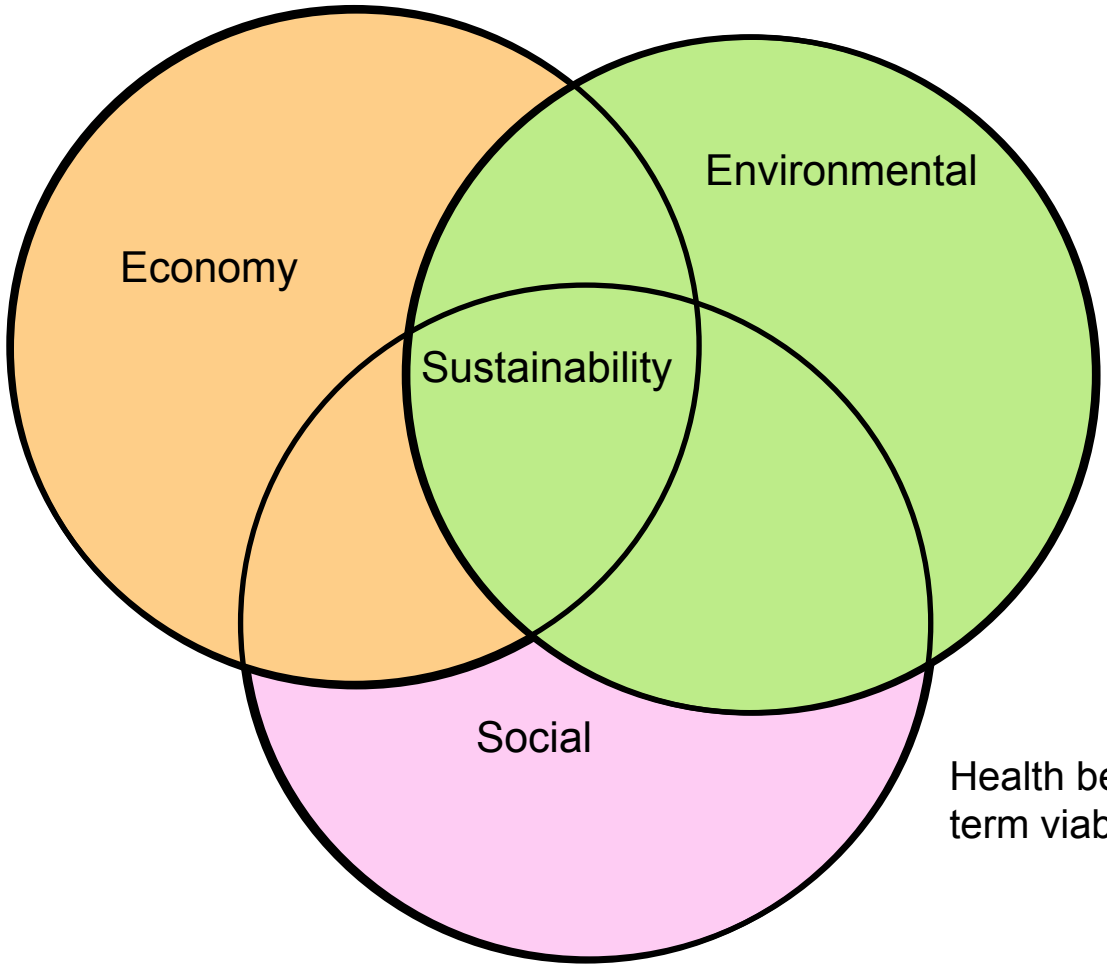
## Underlying objectives:

- To ensure that economic benefits accrued to the greatest extent possible to Cape Breton
- To realize the sustainability imperative, i.e., that real economic value, beyond the remediation itself, would endure

## Measures of success:

- Upwards of 50% of the monies have been spent in Cape Breton
- Through “set-aside” provisions, First Nations companies attained experience – now successfully competing on the open market – outstanding success
- Establishment of the Center for Sustainability in Energy and the Environment at Cape Breton University

# Sustainability Model – Tar Ponds Project

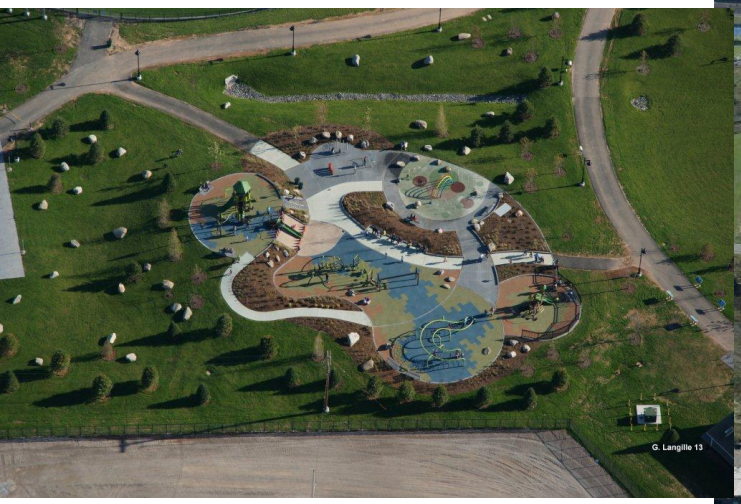



Local Economic Benefits and Long-term Economic Growth of the Region

Clean up of one of the most contaminated sites in Canada

Health benefits, long-term viability of Region

August 2008





September 2013

AECOM

# Prior to Remediation

# Progress to Fall 2013



# Questions?