

*Constructed Wetlands
for Treatment of
Condensate in Water*

1997-2001

Constructed Wetland Funding

- **Cost: \$550,000 over four years**

- ◆ *\$180k construction*

- ◆ *\$350k detailed monitoring and laboratory work*

- **Funders:**

Gulf (Conoco), Keyspan Energy,

Environment Canada (PERD), CAPP, Komex

Researchers

- **University of Calgary**
- **University of Alberta**
- **Alberta Agriculture**
- **Dr. Sherwood Reed**
- **Utah State University**
- **Komex**

Problem / Solution

- **Mechanical treatment can be expensive to operate over long term pump and treat projects**
- **Constructed wetlands may be a more economic treatment alternative**

Constructed Wetland Objectives

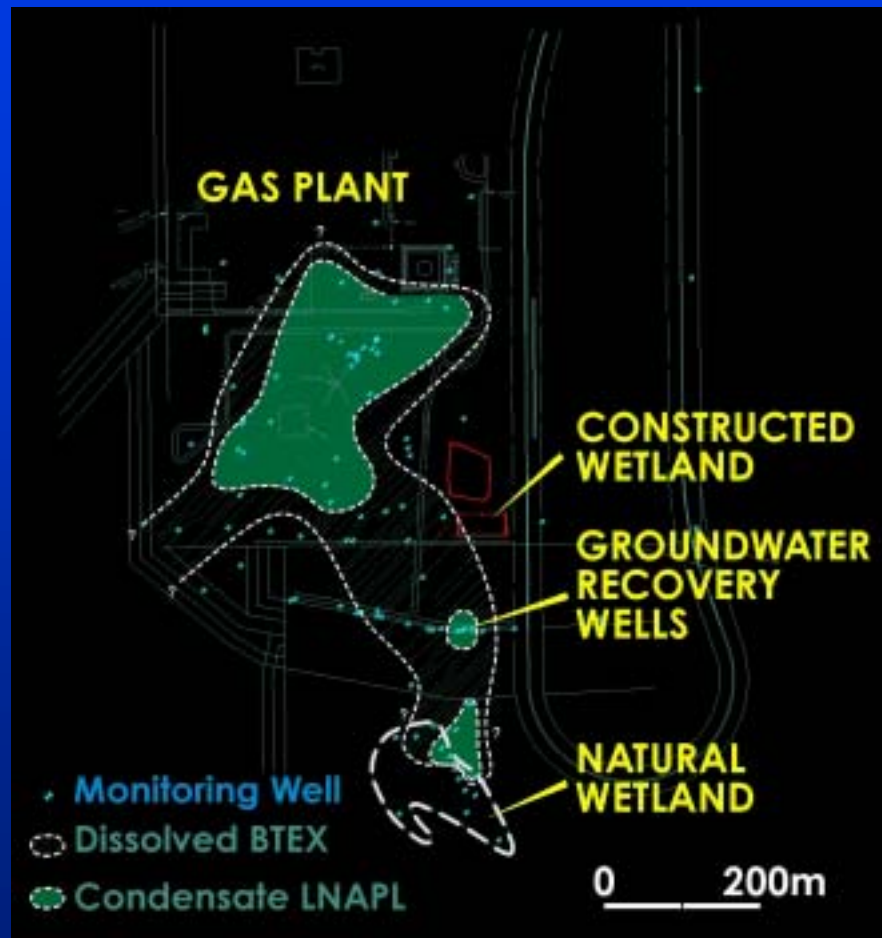
- **Assess treatment capacity of pilot scale wetland**
- **Evaluate winter operation effectiveness**
- **Evaluate role of plants in treatment**
- **Determine economics of wetlands**

Remediation Scenario:

Pump and Treat for Hydraulic Containment

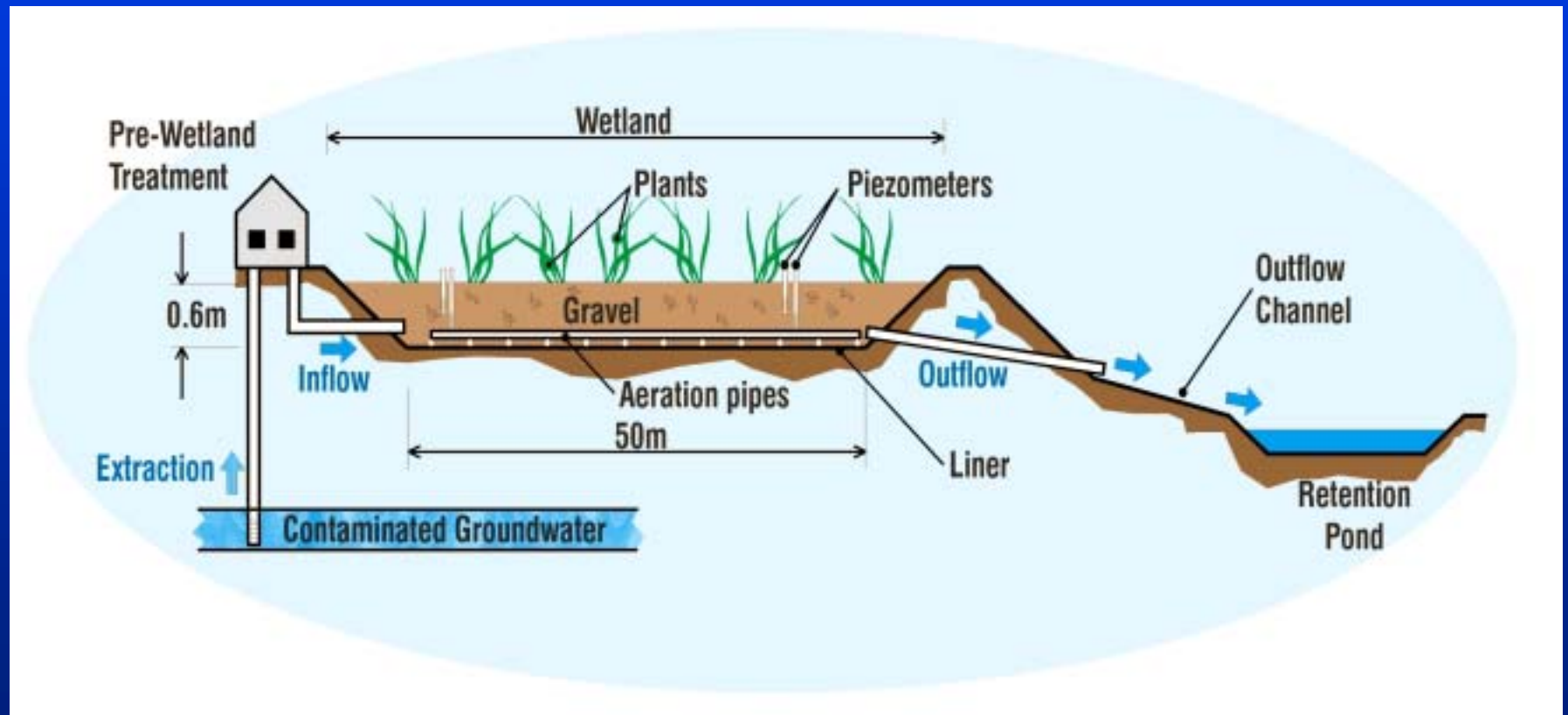


Gas Plant



Condensate Plume

Constructed Wetland Cross Section Schematic



Constructed Wetland Plant Growth



July 1997

- 2000 phragmites and cattails in a 50 m lined gravel bed
- Aerated, heated in winter

July 1999

**Wetland treats 50% of flow
Mech. Treatment in background₂**



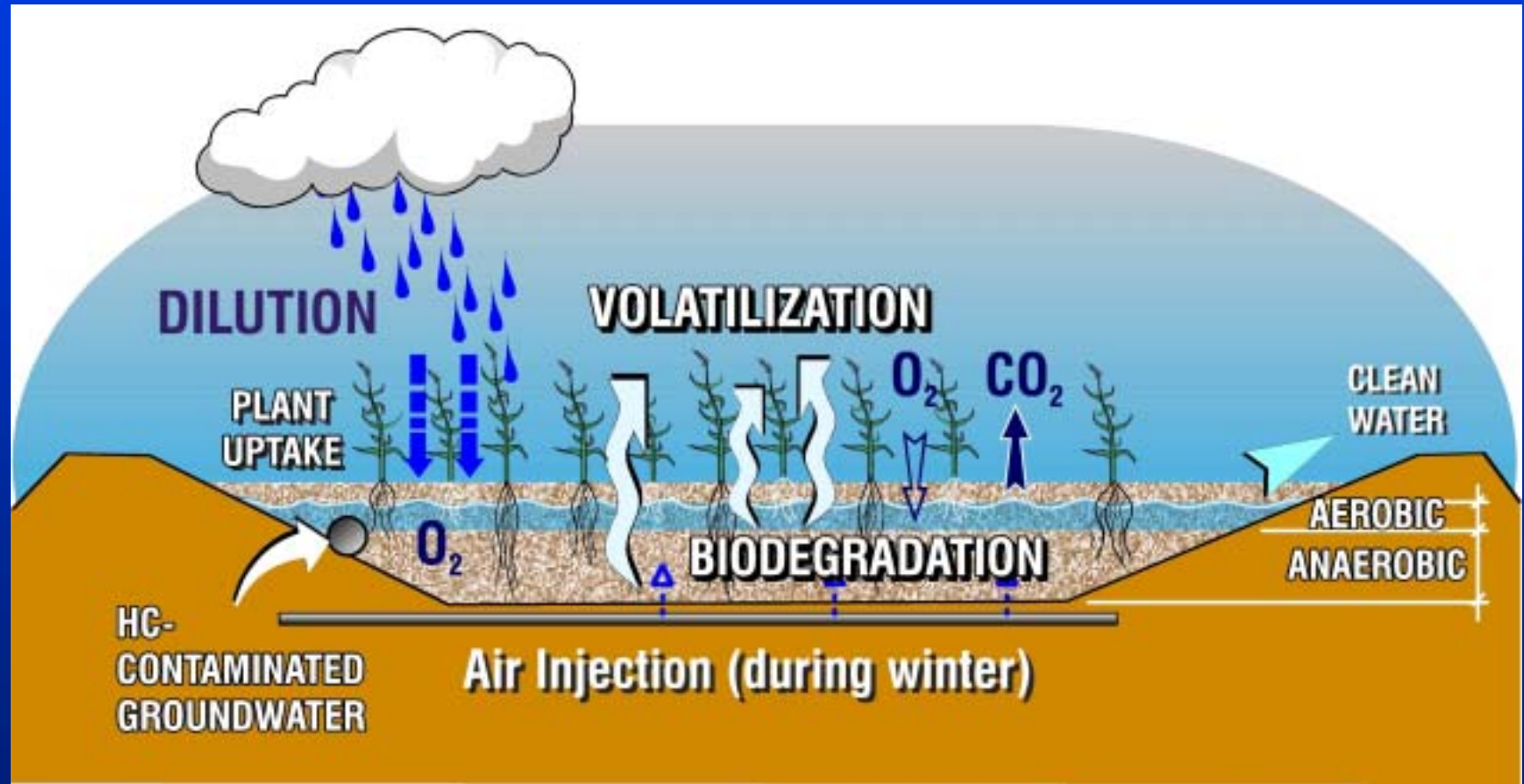
Winter Operation

- **Air temperature ranges from -30 to +20 °C,**
- **Heating or insulation required during winter to prevent freeze up**
- **At low temperatures, aeration is required to achieve full hydrocarbon removal**

Wetland Treatment Capacity

- **Average treatable flow rate 12 L/sec (3 gpm)**
- **Higher flow rates achievable when injecting air at the base of the wetland**

HYDROCARBON REMOVAL PROCESSES



Preferred Treatment:

Aerobic Biodegradation in Root Zone



Plant Roots

- Lab and field results show plants did not increase treatment
- Implication: Plants not a necessary treatment component. Therefore, less cost for planting and maintenance

Economics of Wetlands

- **Capital cost of wetlands similar to mechanical treatment**
- **Maintenance costs with wetlands appear to be lower**
- **Over a 15 year pump and treat project, significant savings can be realized**

Constructed Wetlands: Implications

- **Successful for year round condensate removal**
- **Aeration required during winter to prevent freezing, and improve treatment**
- **Plants are not required for treatment**
- **Economics are promising**
 - ◆ *similar capital costs, reduced maintenance costs*

2002 Operation

- **Research component now complete**
- **Enhance aeration process to improve treatment effectiveness**
- **Increase flow from pilot scale to full scale treatment**