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Comparative Analysis of Environmental Impacts of CBM and Thermal *In-situ* Projects

presented by

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Rationale

1. It is considered appropriate to compare the existing baseline and impact assessment approach for *in-situ* oil sands projects in Alberta with environmental data collection and reporting for proposed coalbed methane (CBM) projects because of similarities in impacts and disturbance types.
2. A review and comparison is worthwhile for the future development and environmental management of these and similar resources.

Presentation Objectives

- Compare and contrast environmental impacts of Thermal *In-situ* oil sands production with coalbed methane (CBM) production.
- Discuss regulatory requirements for environmental impact assessment.

Thermal *In-situ* Definitions

- Steam Assisted Gravity Drainage (SAGD) - steam is injected into an upper well creating a high-temperature steam chamber. The increased heat loosens heavy oil or bitumen allowing it to flow downward in the reservoir to the second horizontal well where it is pumped to the surface.
- Cyclic Steam Stimulation (CSS) - high-pressure, high temperature steam is injected into the oil sand deposit which fractures the oil sand while the heat of the steam melts the bitumen. The process is repeated several times in a formation.
- Enhanced Oil Recovery (EOR) - other forms of enhanced oil recovery include Vapor Extraction (VAPEX), Steam Flooding, Expanding Solvent-SAGD (ES-SAGD), Tapered Steam Solvent-SAGD (TSS-SAGD) and *In-situ* Combustion.

Coalbed Methane Definitions

- Coalbed methane is natural gas that is trapped in coal seams.
- Coal seams have a large surface area that holds large quantities of gas.
- CBM production involves drilling “closely-spaced” wells and dewatering to reduce hydrostatic pressure, if necessary, capturing the gas released from the seams and then transporting the gas to market via pipelines.
- Coal Mine Methane (CMM) and CBM are the same gas, the difference being that CMM is released during the mining of coal.

Countries of Operation or Active Research

Thermal *In-situ*

- Canada
- China
- India
- Middle East
- United States
- Venezuela

Coalbed Methane

- Australia
- Canada
- China
- India
- New Zealand
- Russia
- United States

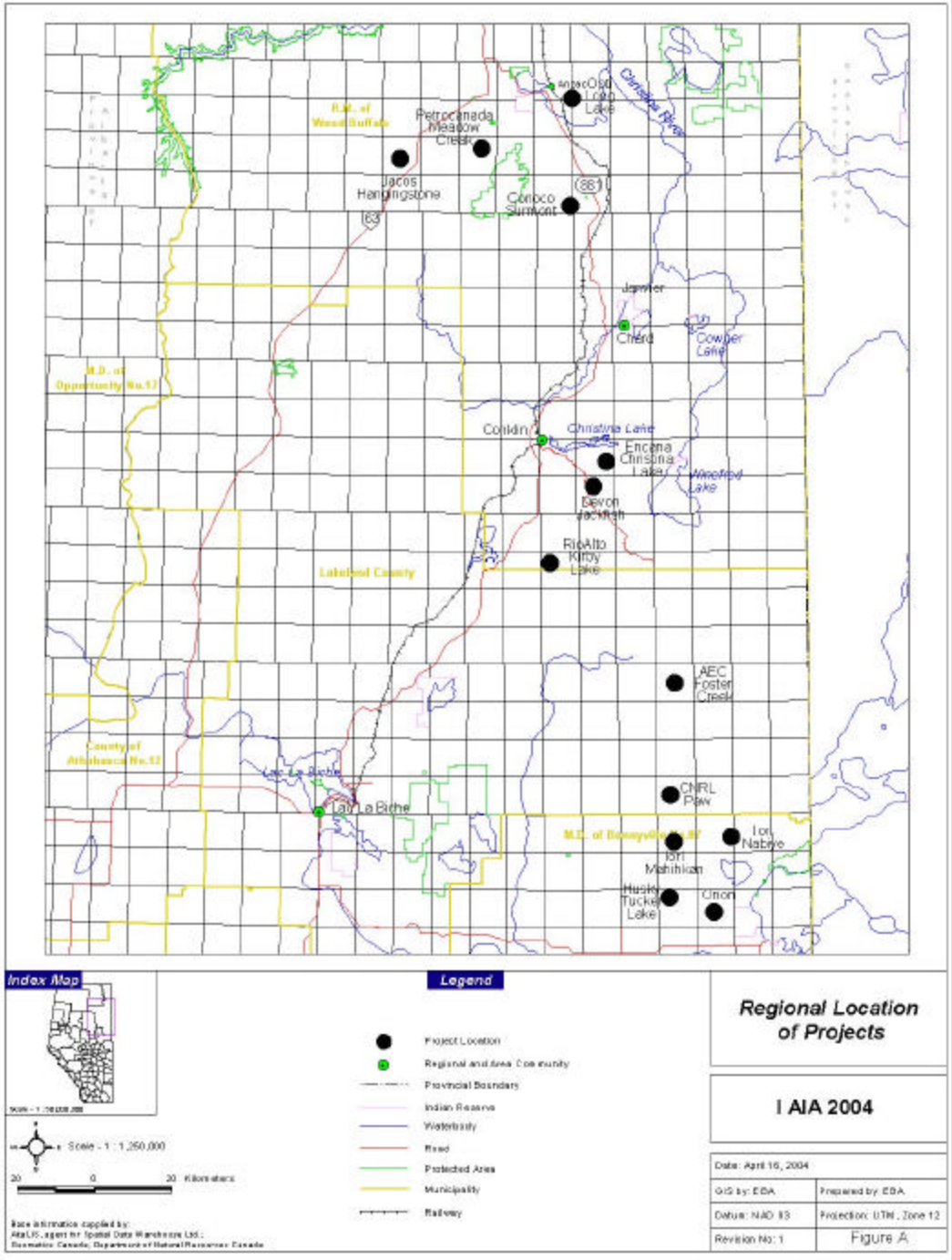
Current Activities

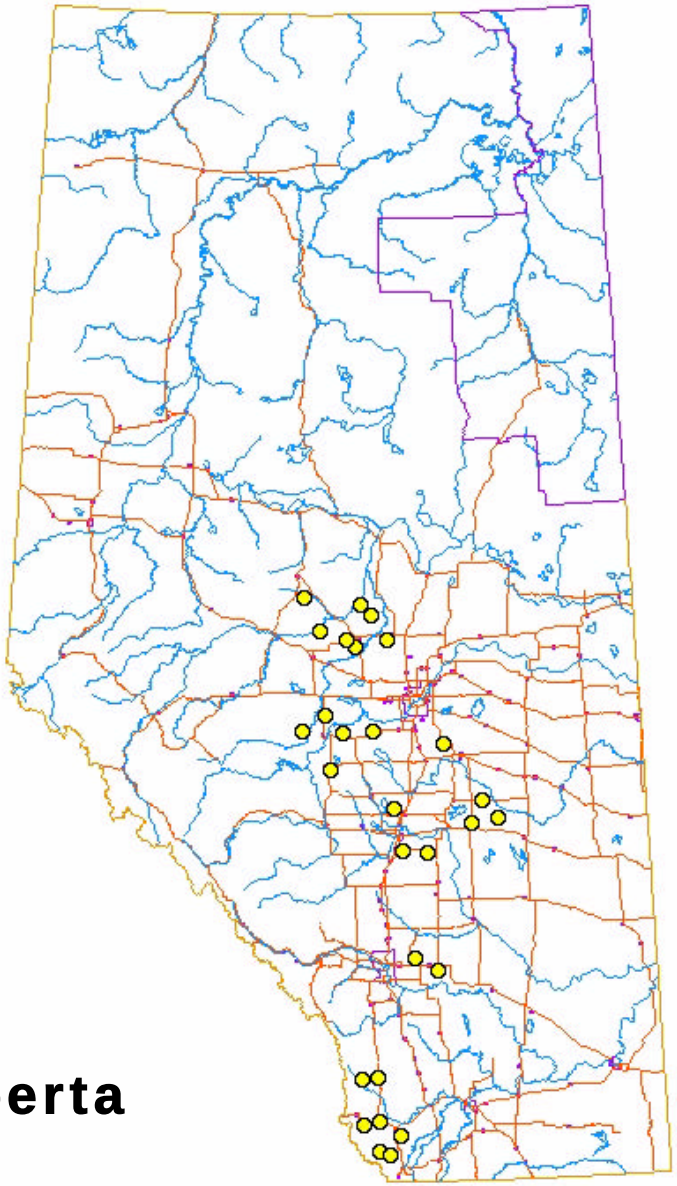
Thermal *In-situ*

- In 2003, there were 10 in-situ bitumen projects in Alberta.
- An additional 7 projects have been approved, are under review, or are in the EIS preparation stage.

Coalbed Methane

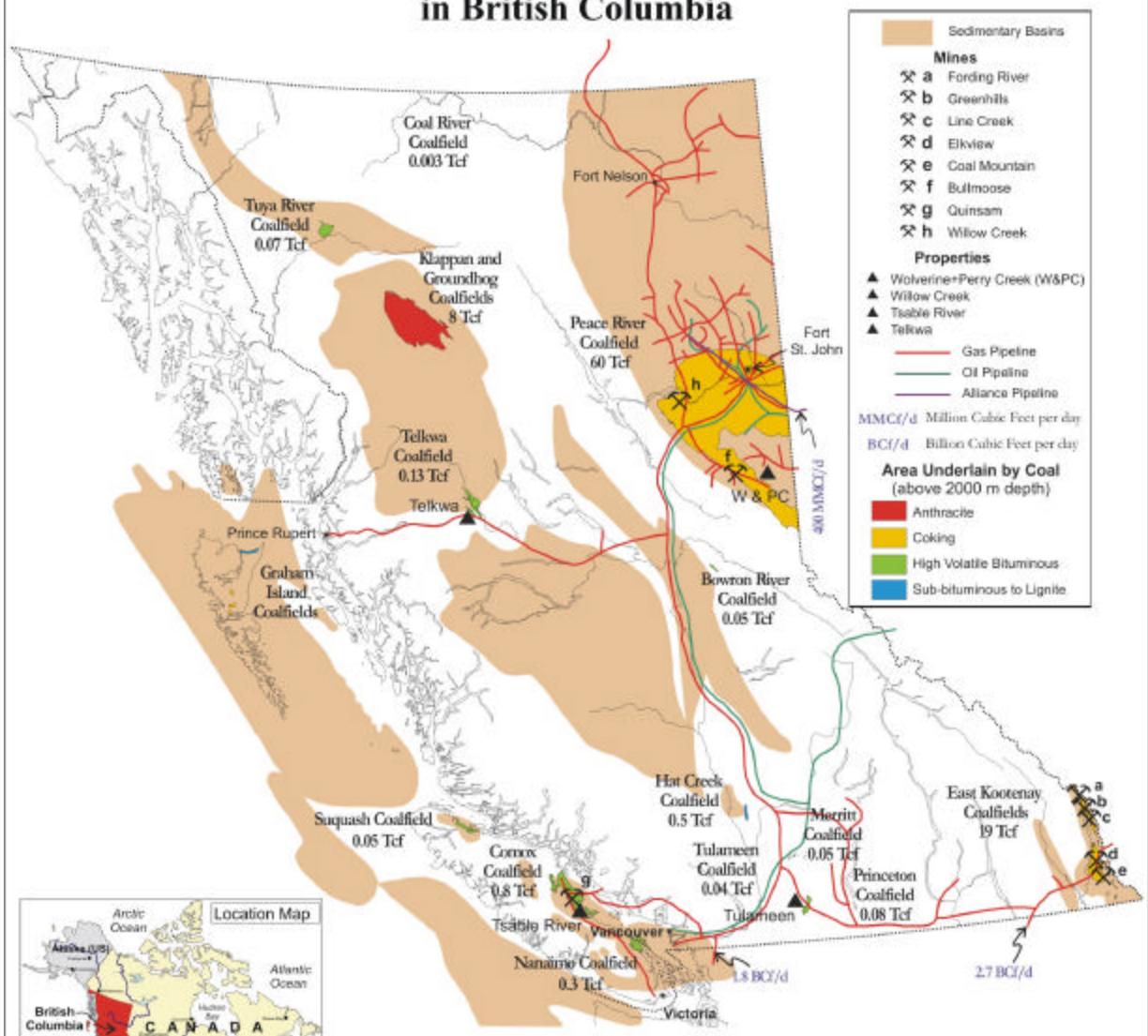
- Approximately 340 wells drilled in Alberta since 1977.
- Two companies in Alberta are operating commercially at this time.
- Approximately 23 wells have been drilled under the experimental scheme in British Columbia.


Index Map
Legend
Project Location
Regional and Area Community
Provincial Boundary
Indian Reserve
Waterbody
Road
Protected Area
Municipality
Railway
Scale - 1 : 1,250,000
20 0 20 Kilometers
Base information supplied by:
AltaLIS, agent for Spatial Data Warehouse Ltd.;
Regional Location of Projects
I AIA 2004
Date: April 16, 2004
GIS by: EBA
Prepared by: EBA
Datum: NAD 83
Projection: UTM, Zone 12
Revision No: 1
Figure A



CBM Wells in Alberta

Coalfields and Coalbed Gas Potential in British Columbia



Basin Outlines : Geological Survey of Canada, unpublished: P. Hannigan, P.J. Lee, K Osadetz et al., 1993-1998.

Infrastructure and Disturbances

Thermal *In-situ*

- Well pads
- Disposal wells
- Observation wells
- Plantsite
- Landfill
- Pipelines
- Utility corridors

Coalbed Methane

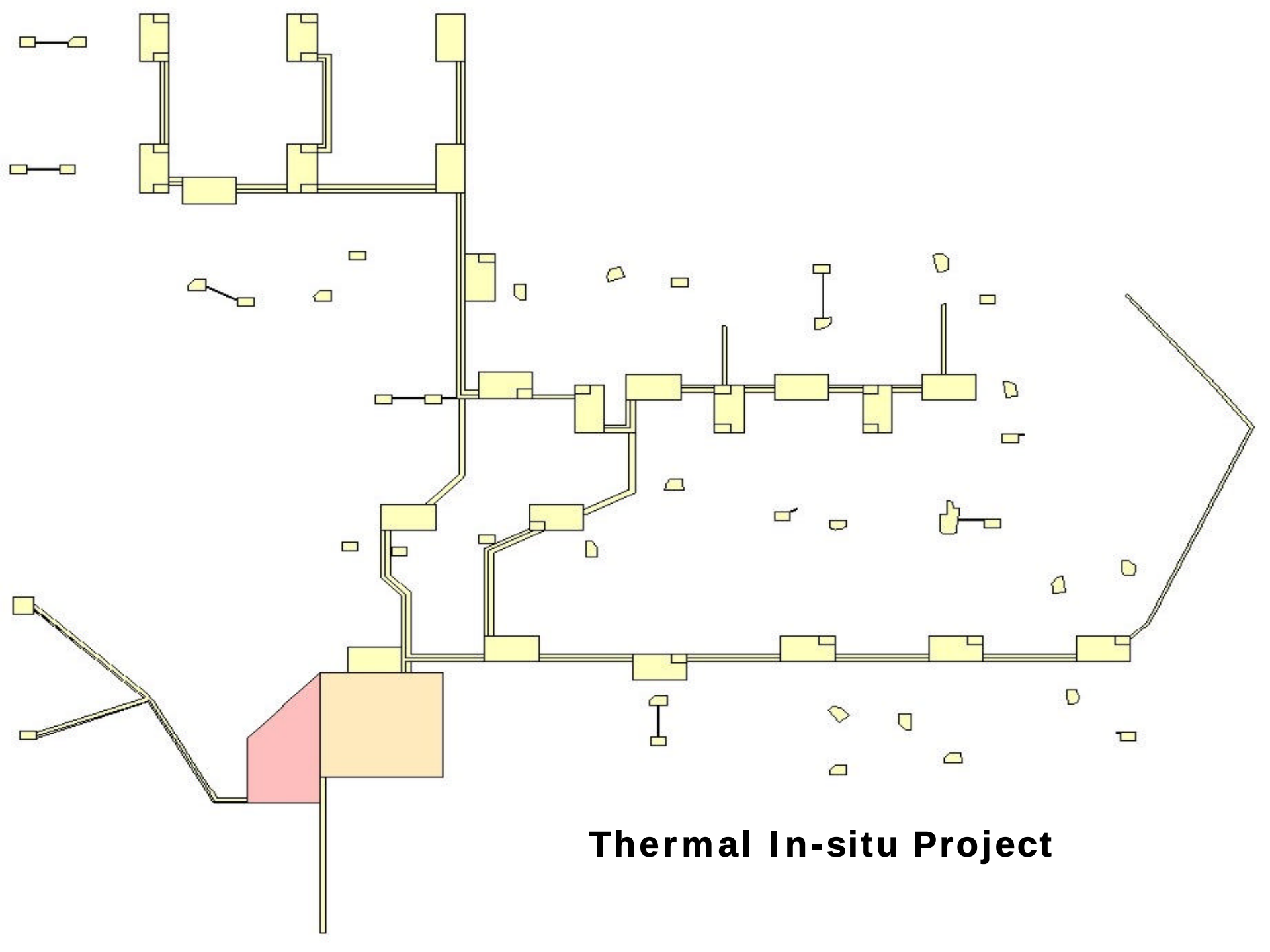
- Well pads
- Compressors
- Pipelines
- Impoundments (dugouts)
- Access roads

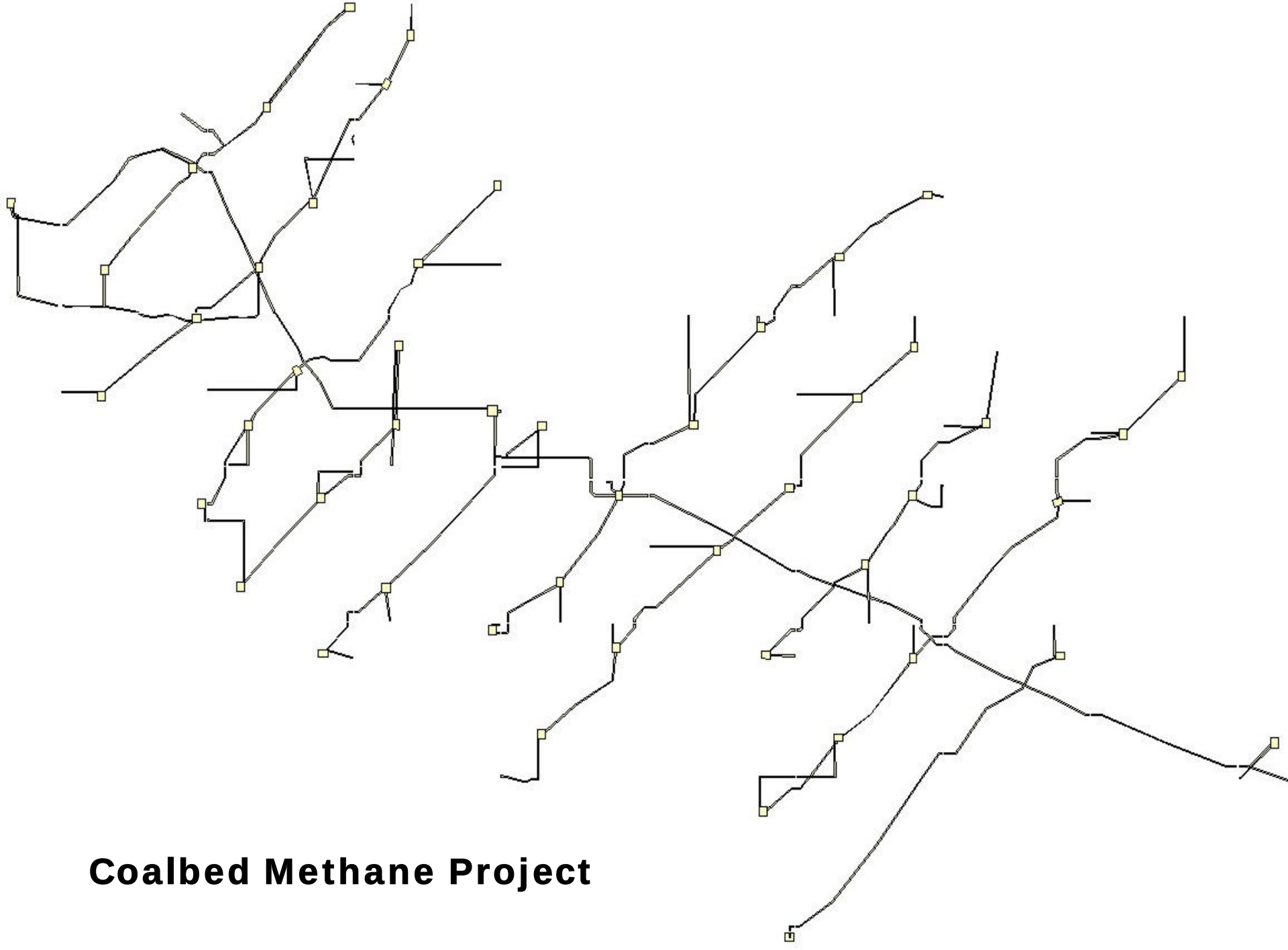
Thermal *In-situ* Lifecycle

1. 2-D and/or 3-D seismic programs.
2. Obtain subsurface rights.
3. Negotiate surface lease.
4. Exploration drilling (road access and wellsite drilling).
5. Pilot studies.
6. Economic assessment and evaluation.
7. Environmental impact assessment.
8. Completion and production.
9. Continuous production for 25+ years.
10. Decommissioning and reclamation.

CBM Development Lifecycle

1. Screening for CBM prospects.
2. Obtain subsurface rights and negotiate leases.
3. Exploration – access and wellsite construction, drill test wells, dewater and evaluate.
4. Conduct pilot project.
5. Drill multiple “closely spaced” wells.
6. Pump out coal seam/reservoir groundwater.
7. Fracture coal seam to improve cleats.
8. Completion and continuous CBM production for 10+ years.
9. Decommissioning and reclamation.


Thermal In-situ Project



Coalbed Methane Project

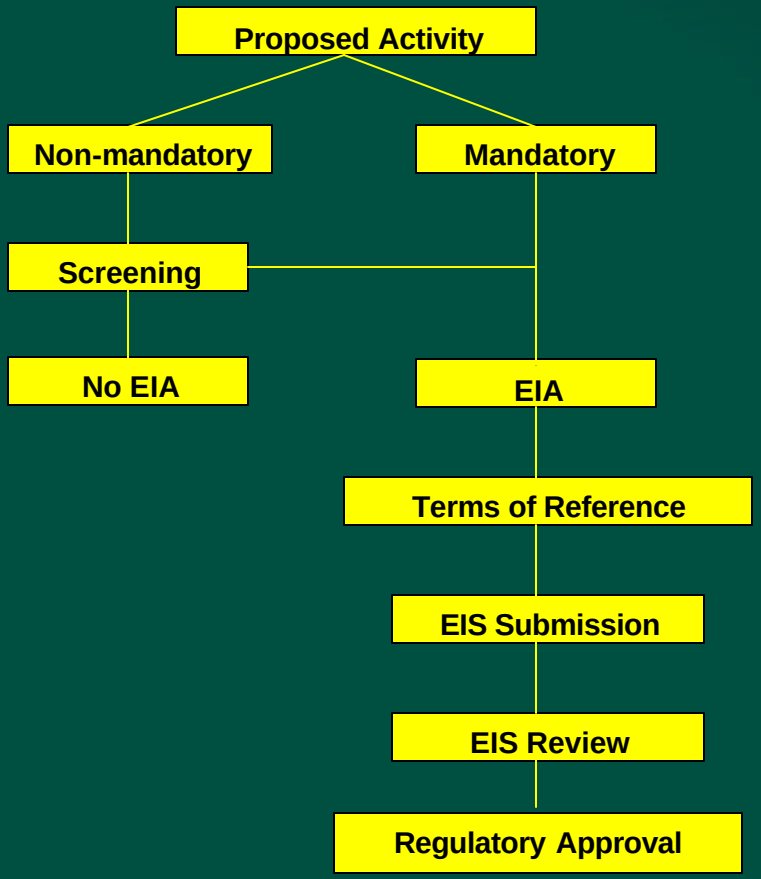
Environmental Impacts

- Surface disturbances affect vegetation, wildlife habitat and aesthetics.
- Surface water quantity and quality affected.
- Groundwater (alteration and contamination).
- Cumulative effects.
- Air quality effects.
- Noise.
- Land use.

Regulatory Requirements

- Alberta – thermal *in-situ* projects are reviewed under the Environmental Impact Assessment Alberta Environmental Protection and Enhancement Act.
- Alberta – CBM projects are reviewed through the Energy and Utilities Board (EUB) (differences between white zone and green zone).
- British Columbia – no thermal *in situ* projects. There is no formal requirement for a review of a project through the British Columbia Environmental Assessment Act. CBM projects are reviewed individually using guidelines provided by the Oil and Gas Commission. There are no requirements for environmental studies currently although fisheries and wildlife studies may be requested.

EIA REVIEW PROCESS



Environmental Impact Assessments (EIAs)

- Existing and proposed thermal *in-situ* projects in Alberta have been subjected to some form of EIA review.
- Current CBM projects in Alberta have not been subjected to a thorough EIA review although an environmental overview was prepared for one of the pilot projects.
- CBM pilot projects in British Columbia are currently not reviewed under the British Columbia Environmental Assessment Act although a brief environmental overview was prepared for one of the pilot projects.

Impact Statement Components

- Socioeconomics
- Cultural/Historical Resources
- Land use
- Climate and Air Quality
- Noise
- Surface water
- Groundwater
- Bedrock geology
- Surficial geology / terrain
- Vegetation
- Wildlife
- Biodiversity
- Cumulative effects

Summary

- Important similarities as well as differences exist between the environmental impacts of thermal *in-situ* oil sands and CBM projects.
- Impact scoping is essential.
- Good baseline data is required to adequately address project-specific and regional impacts.
- Good baseline data now exists for the thermal *in-situ* projects in Alberta but is limited for many regions where CBM projects are proposed, particularly in British Columbia.
- Important regional issues exist for both types of development.

Summary - Continued

- Regional planning and cumulative effects assessment is essential for good environmental/ecosystem management.
- Regional mapping based on constraints and/or vulnerability indices should be developed.
- Adaptive management should be applied broadly.
- Post-development monitoring is essential.
- Issues related to a phased approach with CBM make it difficult to justify the standard EIA process but cumulatively these projects can have significant impacts.
- The environmental assessment process for CBM projects would benefit from the development of threshold triggers.

Acknowledgements

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