A light blue, semi-transparent map of Canada is overlaid on the slide. The map shows the outlines of the provinces and territories, with some darker blue areas indicating water bodies or specific regions of interest. The map is centered on the continent of North America.

Update on CAPP Water Issues (Industry Perspective)

*Marc Dubord, CAPP
November 17, 2009*

- **Objective and Key Messages**
- **Public Concerns about Water**
- **Industry Use of Water**
- **Regulation of Water Use**
- **Water Issues and Perspectives**
- **Continual Improvement**
- **Summary**

- **Objective**

- Summarize water issues in the upstream oil and gas sector, and outline what we are doing to improve

- **Key Messages**

- Oil and gas sector is not a significant risk to Canada's water supply and uses relatively small volumes
- Existing regulations and industry practices strongly protect usable water
- Future trends in industry practices and regulation will lead to further collaborative reductions and efficiencies in water use

Why is the Public Concerned about Water?



- **Public concern is about fresh (non-saline), potable water supply and quality**
 - Climate change fears, regional drought conditions, reliance on water for agricultural use, perceived U.S. appetite for Canadian water
 - Population growth - more and different water users may diminish water quality
- **Concerns and misconceptions regarding oil and gas water use**
 - Sector usage, particularly in oil sands, leads to fear of shortages
 - Water injected into reservoirs is “lost forever”
 - Drilling activity (unconventional gas) could contaminate groundwater
- **Growing public expectations**
 - Water is more important than oil and gas
 - Governments need management strategies to address long-term water use
 - Pressure for industry to reduce or eliminate water use
 - Viewpoint that industry should pay for water

How Does Industry Use Water?



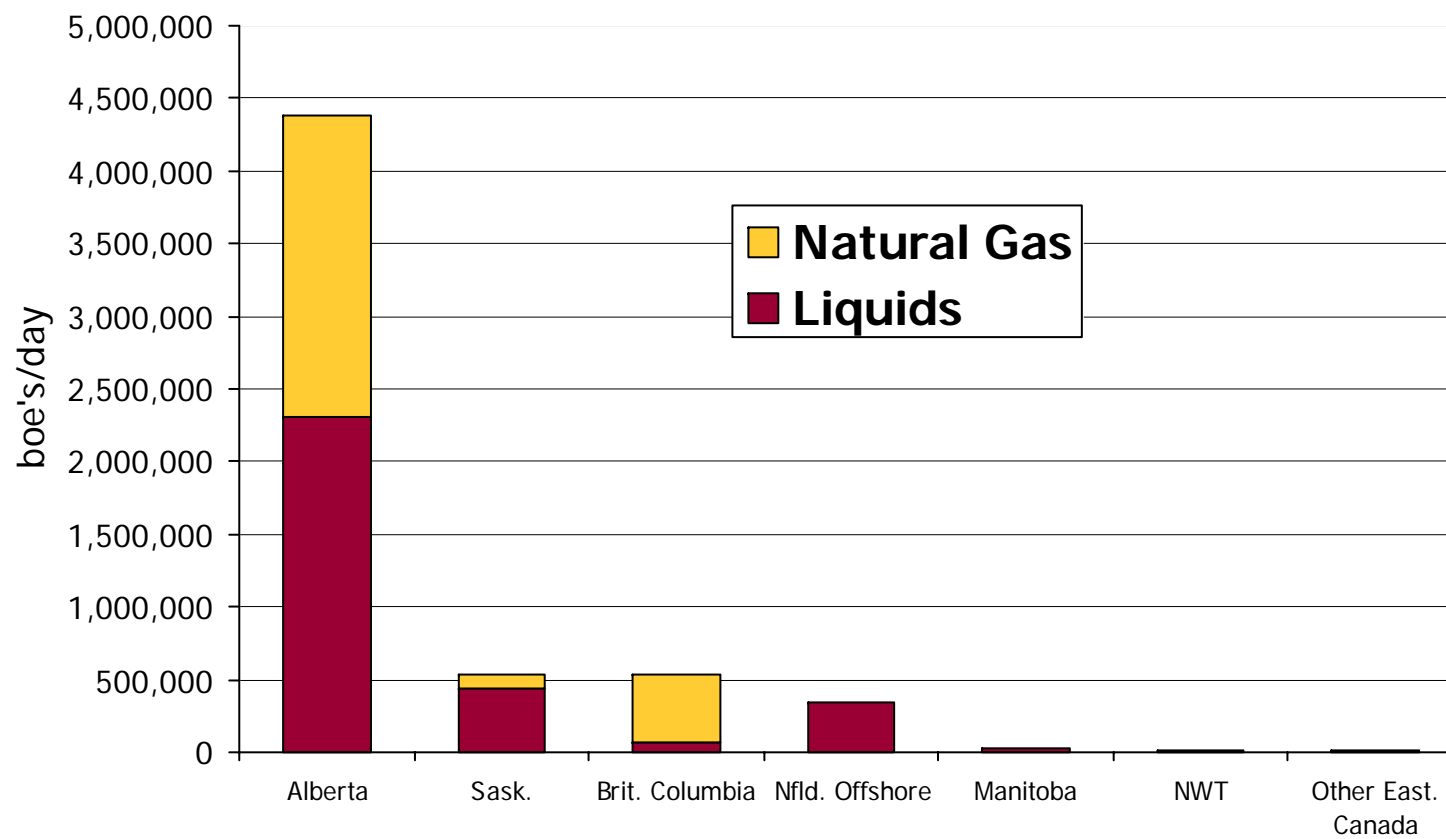
- **Conventional Oil**
 - Enhanced oil recovery (EOR) – Injection of water to push out oil
 - Drilling and completions
 - Minor pressure maintenance
- **Oil Sands**
 - Mining – Separation of bitumen from sand; steam for upgrading
 - In situ – Steam to heat bitumen underground, allowing it to flow to the surface
- **Natural Gas**
 - Shallow gas (including CBM), deep gas, tight gas, shale gas – Unconventional developments require advanced stimulation technologies
 - Drilling and completions
- **Other Uses**
 - Testing, camps and utility needs

Why Does Industry Use Water?



- **Owners (public, government) of the oil and gas resource require that industry optimize recovery through policy and demand**
 - Relatively abundant and low cost water has been preferred tool
 - Government policy has supported water-intensive technology
- **As oil sands production increases, water use will increase, until newer technologies predominate**
- **76% of Alberta's oil production (conventional, in situ and mining) was water-assisted in 2007**
- **Water-assisted production accounted for \$4 billion in royalties in 2008**

2008 Canadian Oil and Gas Production by Province



How is Industry's Water Use Regulated?



- **Highly regulated by numerous acts, regulations, directives, codes of practice, guidelines and policies**
- **Water Act**
 - Requires a license before diverting and using surface water or non-saline groundwater (saline groundwater is not licenced by AENV)
 - Before application is approved, Alberta Environment (AENV) reviews to ensure existing water users' rights are protected and to minimize impacts on aquatic environment
- **Water Conservation and Allocation Policy and Guideline for Oilfield Injection Purposes**
 - Risk-based approach
 - Requires investigation of alternatives to fresh water
 - In 2008, industry reduced its deemed licence allocation by 50%
 - Some companies voluntarily returned unused permanent licence allocations to the Province

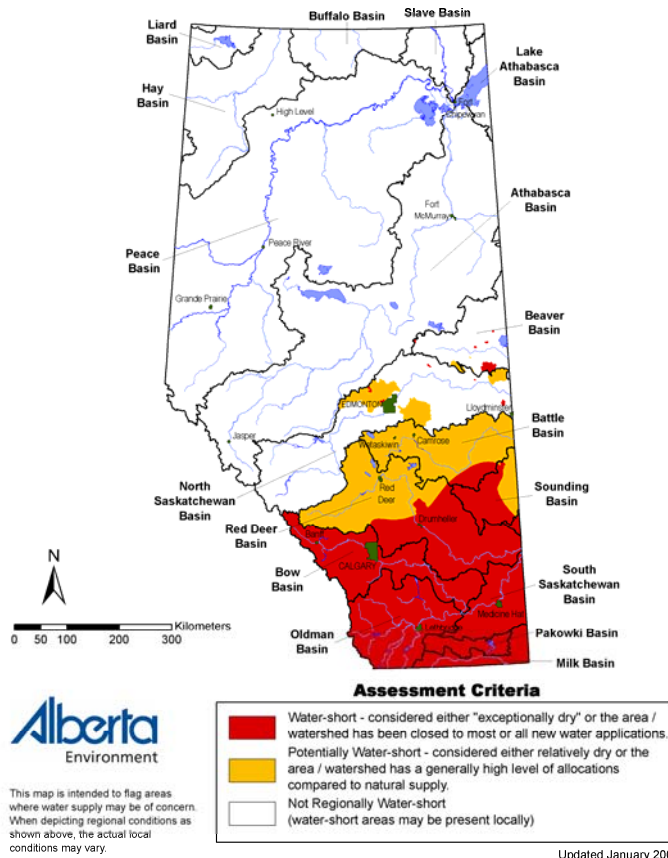
- **Groundwater Evaluation Guideline**
 - Information required when submitting application under Water Act
 - Industry conducts technical review of groundwater resources
- **Athabasca River Water Management Framework**
 - AENV/DFO implemented framework to protect the river and other water users
 - Sets strict withdrawal limits; industry license holders work together to coordinate water needs during seasonal low flow periods
- **Draft ERCB Directive: Requirements for Water Measurement, Reporting, and Use for Thermal In Situ Oil Sands Schemes**
 - Sets limits for fresh/brackish water use at facilities and calculates produced water recycled

- **Base of groundwater protection (BGWP) is the depth above which groundwater is deemed usable without treatment and thereby protected by regulation**
 - BGWP is 4,000 mg/L total dissolved solids (TDS) in Alberta
- **AENV Standard for Baseline Water Well Testing for CBM/Natural Gas in Coal Operations**
 - In conjunction with ERCB Directive 035: Baseline Water Well Testing Requirement for CBM Wells Completed Above the BGWP
 - Requires water well testing in vicinity of CBM developments
- **ERCB Directive 044**
 - Requirements for surveillance, sampling and analysis of water produced in oil and gas wells completed above the BGWP
- **Any many more!**

Northern Supply vs Southern Demand



Water-short Areas Assessment

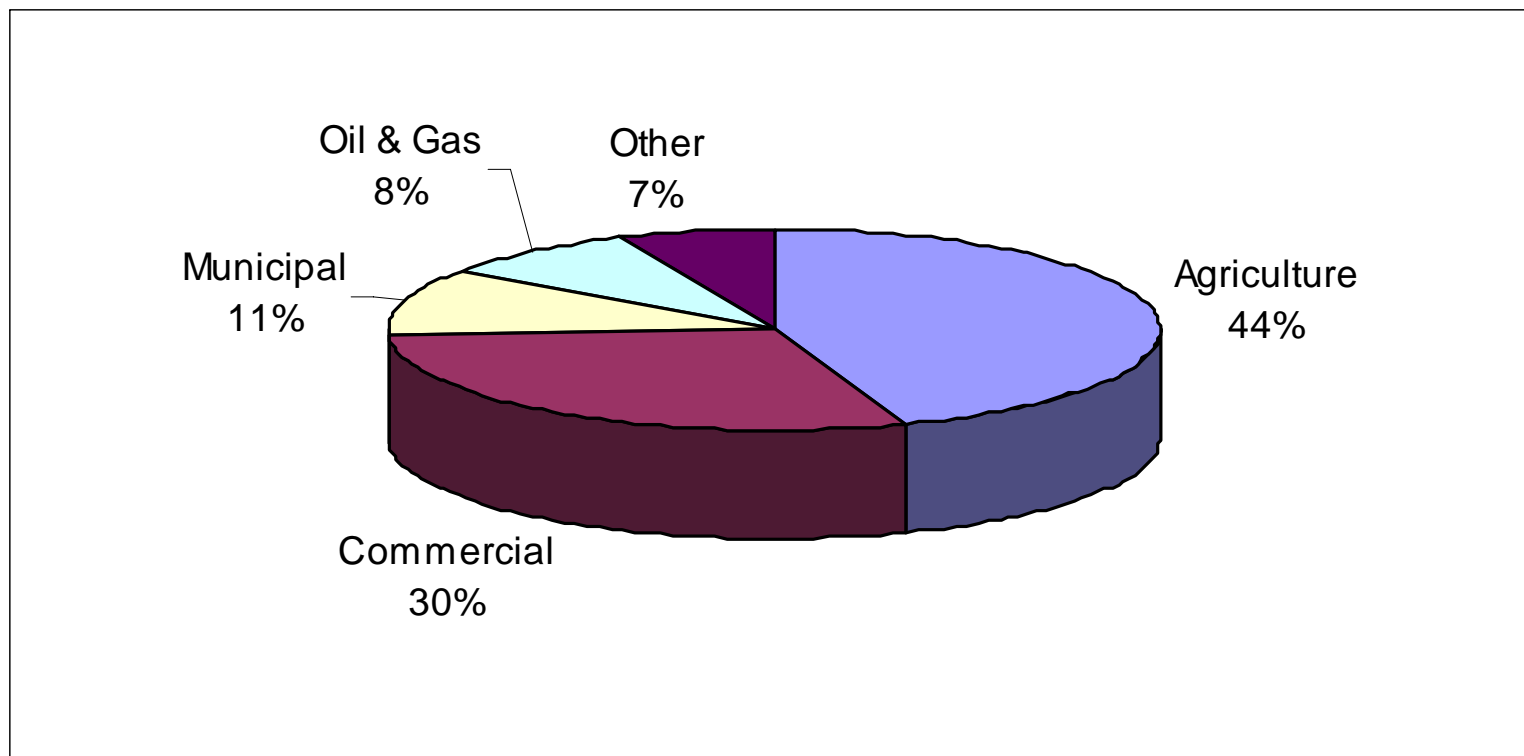


- 85% of Alberta's water supply is north of the North Saskatchewan River Basin
- 88% of Alberta's water demand is in the south
- All oil sands development occurs in the north, where there is abundant water supply and few other users
- In central and southern Alberta, water use for conventional projects is low, and declining

Oil and Gas Industry Water Allocation in Context with Other Sectors



- Oil and gas is allocated ~8% of Alberta's total (surface water and non-saline groundwater) water allocation

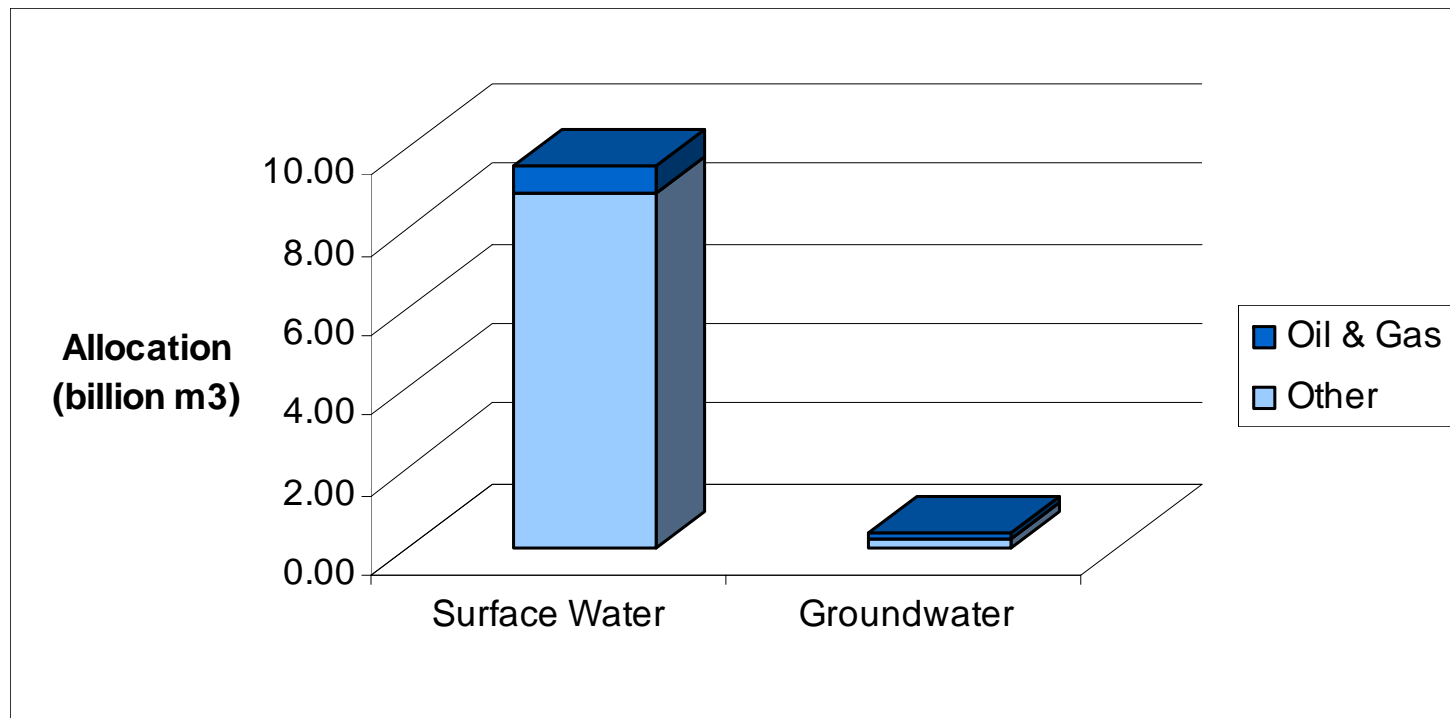


Source: AENV, 2009

Surface Water vs Groundwater Allocation



- Alberta's provincial water allocation is 97% surface water and 3% groundwater (2008)
- Oil & gas represents 7% of the total surface water allocation and 43% of the total groundwater allocation



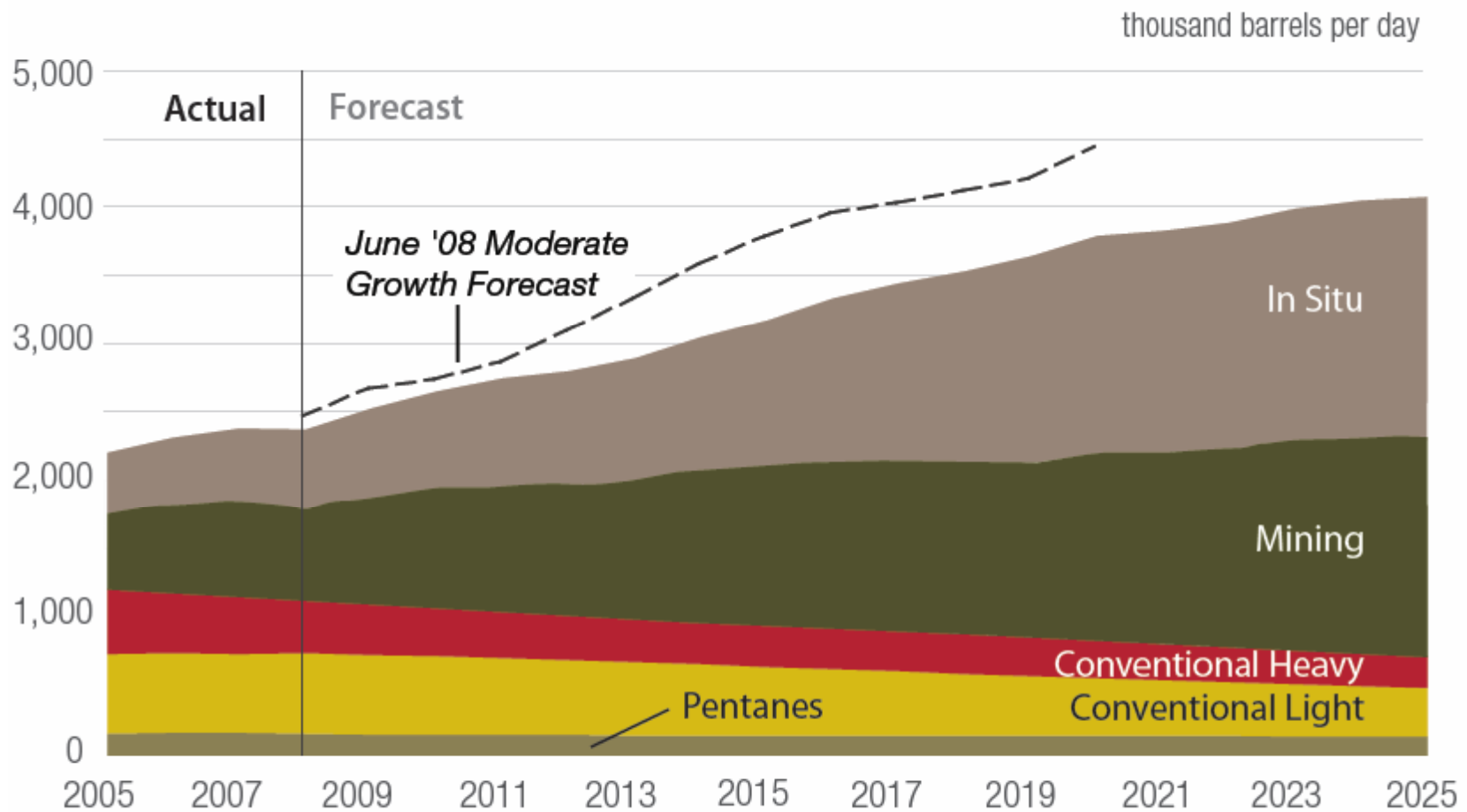
- **In 2007, 776 million m³ was allocated from surface water and non-saline groundwater sources to oil and gas sector**
- **Actual use was 159.5 million m³, or ~1/5 of allocation**
 - 144 million m³ from surface water (90%)
 - 15.5 million m³ from non-saline groundwater (10%)
- **24.3 million m³ was also diverted from saline groundwater sources (unlicensed)**
 - 13% of total water use was saline
 - Saline groundwater has >4000 mg/L total dissolved solids (TDS)
 - Not suitable for drinking, irrigation or agriculture

Source: Geowa, 2008

Growth Case - Western Canadian Oil Production



- Canadian oil production is growing, mainly due to oil sands

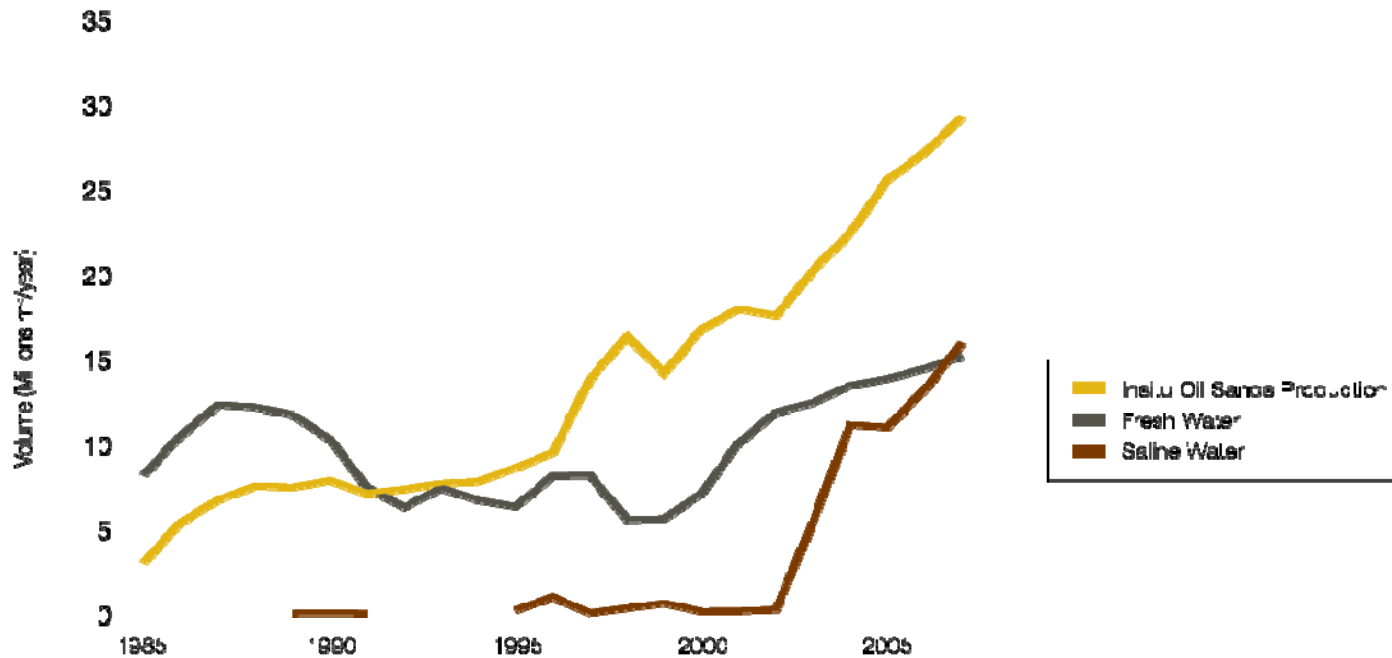


- **<20% of oil sands resource is shallow enough to be mined at surface**
- **Main source of water for mining is the Athabasca River**
 - Athabasca River basin is one of the least used river basins in the province (3.6% allocated for all uses in 2008)
- **Mining projects recycle ~80% of water**
- **Current oil sands water use from the Athabasca River**
 - < 1% of total average flow. Source: AENV, 2008
 - 5% of record low weekly winter flow rates. Source: AENV & DFO, 2007
- **Maximum projected use**
 - ~ 2% of average annual flow
 - 10% of record low weekly winter flow rates
- **Concerns about low winter flow periods are managed by government caps on water withdrawals during low river flow periods**

Oil Sands In Situ Water Use in Perspective



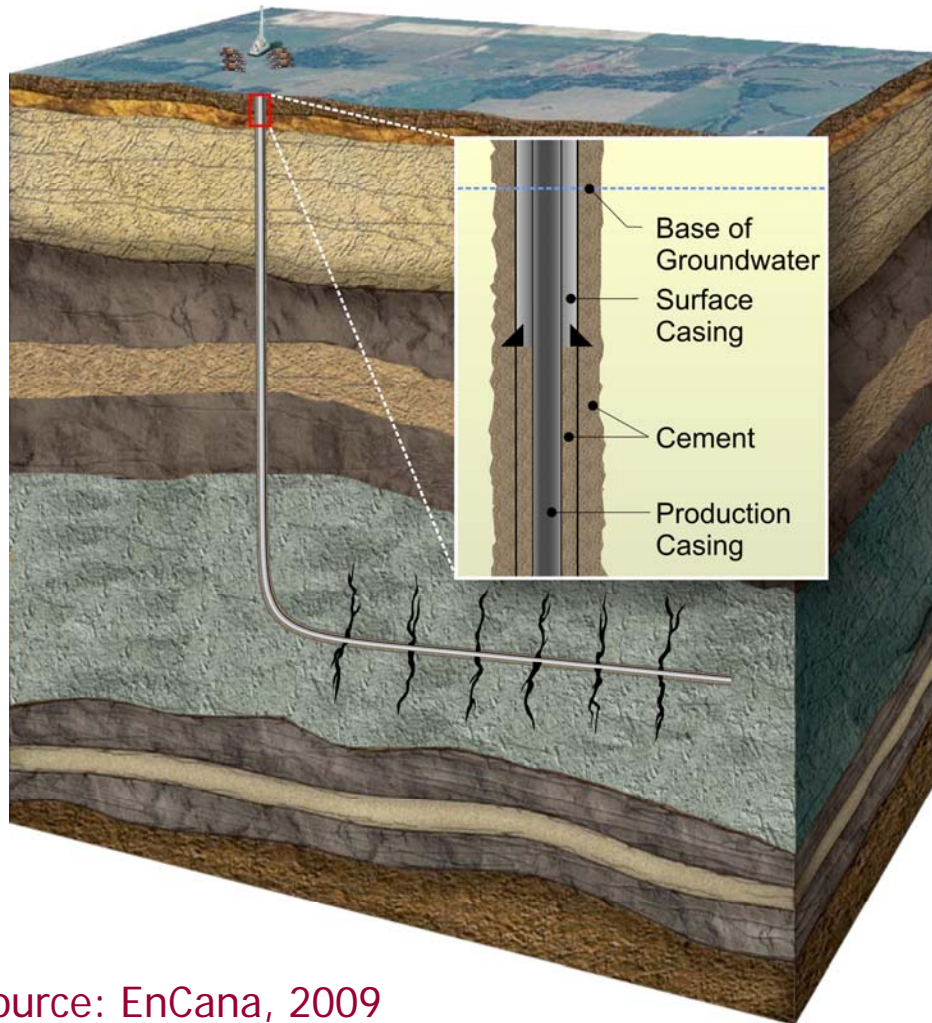
- >80% of oil sands resource is in situ - recovered through wells
- In situ projects use mainly saline groundwater, and recycle 90-100% of produced water
- Groundwater Management Frameworks in development (APEA vs. Groundwater Management Plan ?, grandfathering ?)



Source: GECWA, 2008 and CAPP, 2008

- **Water quality concerns due to improper produced water disposal techniques from CBM wells in U.S.**
 - Not transferable to Alberta; different geology and stricter regulations
 - Most of Alberta's shallow coal zones have not produced water (Horseshoe Canyon)
 - Some deeper coal zones have produced saline water (Mannville), and some test wells have produced small amounts of water of varying quality (Ardley)
 - Produced water is managed using deep well disposal as for conventional projects
- **Government-led CBM stakeholder engagement process increased public awareness and implemented water policy**
 - Emphasized existing Water Act protections for groundwater
 - Industry tests water wells in the vicinity of CBM development
 - Regional aquifer studies prior to CBM development
 - Regulated monitoring of produced water above the BGWP
- **No correlation found between water well concerns and CBM development to date**

Shale Gas Water Issues



- **Low permeability of shale reservoirs -> specialized completions techniques to enable production**
- **Fracturing**
 - Used to stimulate the formation to improve/enable resource recovery
 - Fluid is pumped down hole under sufficient pressure to create fractures in the formation

Source: EnCana, 2009

- **Two-fold: water quantity and water quality**
- **Fracture-intensive → water-intensive**
 - Each frac requires ~2,000-3,000 m³ water
 - Each well has ~10 fracs = 20,000-30,000 m³ water
- **Get ~25% of water back; saline and requires deep well disposal**
- **Produced water management not an issue; shales are dry**
- **Horn River BC is the only shale gas development currently occurring in Canada**
 - Uses surface water; looking at alternatives
- **Concern about frac'ing water containing drilling fluids contaminating groundwater**
 - Not specific to shale gas
 - Groundwater is protected during fracturing operations

- **Sector has made significant progress in reducing fresh water use through alternatives and technological innovation**
- **Supports research and development of commercially viable alternatives**
 - Saline groundwater, produced water, wastewater
 - Reuse and recycling
 - CO₂ and polymer floods
 - Toe-to-heel air injection (THAI)
 - Vapor Extraction (VAPEX) – i.e., solvent injection
- **Motivated to minimize fresh water use**
 - Licences typically require recycling
 - Policy requires evaluation of alternatives and landowner concerns
 - Water handling/infrastructure is costly; industry does pay to use water!

- **Alternatives to fresh water use often require more footprint, land disturbance, contamination potential, wildlife impact, waste generation, energy use and may strand resources**
 - E.g., treating saline or produced water requires energy, resulting in increased greenhouse gas emissions and creation of a waste stream (i.e., salt) that must be disposed of
 - Stakeholders not always aware of this complexity
 - Absolute reductions in water use could prioritize fresh water use reduction above all other environmental considerations
- **Fresh water use may be appropriate in areas that are not water-short**

- **CAPP Stewardship Redesign (for implementation in 2010)**
- **CAPP Water Use Best Management Practices (for release in 2009)**
- **Alberta Water Council**
- **Alberta Water Research Institute**
- **Alberta Upstream Petroleum Research Fund**
- **National Round Table on the Environment and the Economy (NRTEE) – Water Sustainability and the Future of Canada’s Natural Resource Sectors**

- **Oil and gas sector is a comparatively small but important water user**
- **Water use is vital to the oil and gas sector today, and the industry is important to the economy of Canada**
- **Sector water use shows continual improvement**
- **Sound regulatory/policy basis exists to manage industry water use**
- **Substantial improvements in water efficiency depend on technological innovation for commercially viable alternatives to water use**
- **CAPP supports sustainable development in Alberta that balances social, economic and environmental values for the Province**



CAPP

CANADIAN ASSOCIATION
OF PETROLEUM PRODUCERS

www.capp.ca

