



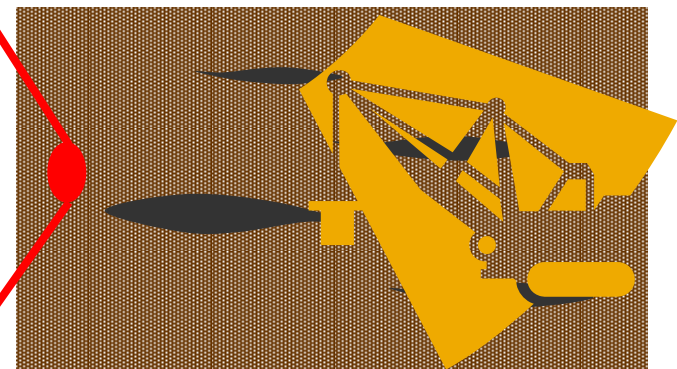
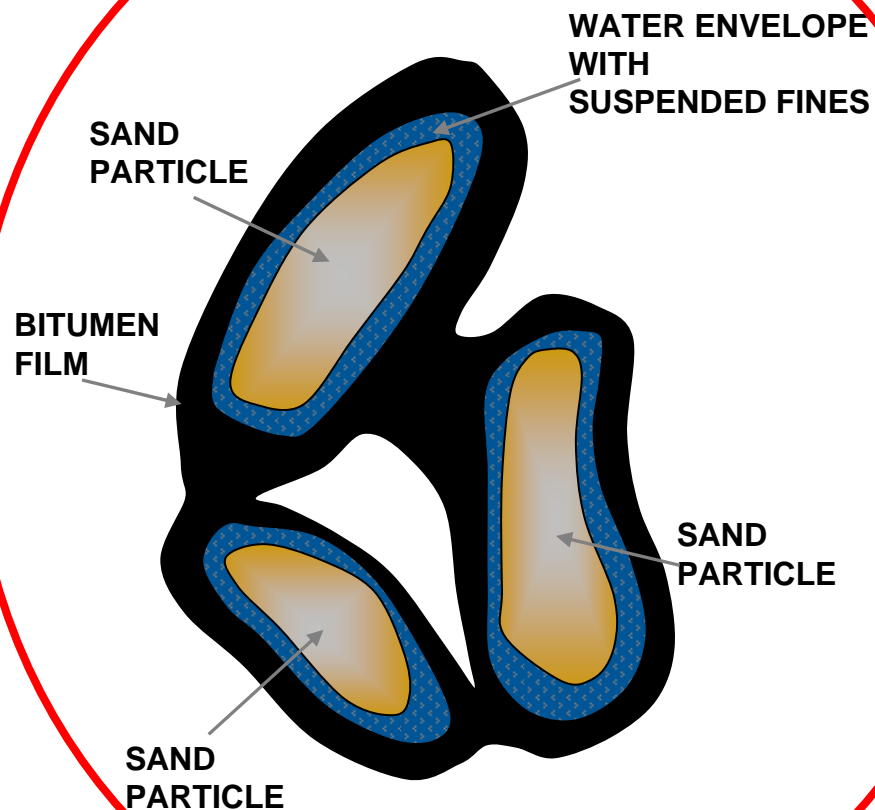
The Faces of Oil Sands Reclamation

Patrick Sean Wells, P.Eng.

Oct 21, 2010

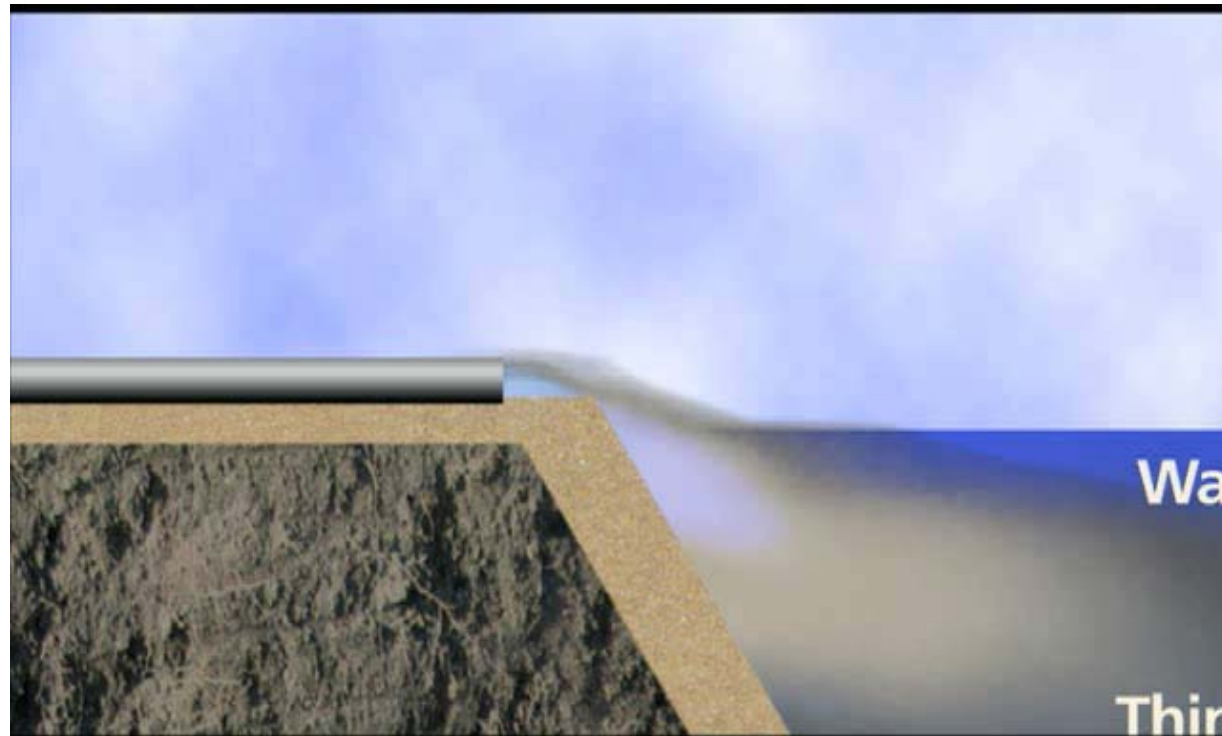


The Need - Conceptual Bitumen Ore



Ore Block with Shale Lenses

Oil Sands Tailings Behaviour



Tailings Ponds – The Need

- Increasing volumes of MFT
- Require long term storage
- Does not consolidate within reasonable timeframe
- Water contained within MFT not available for recycle

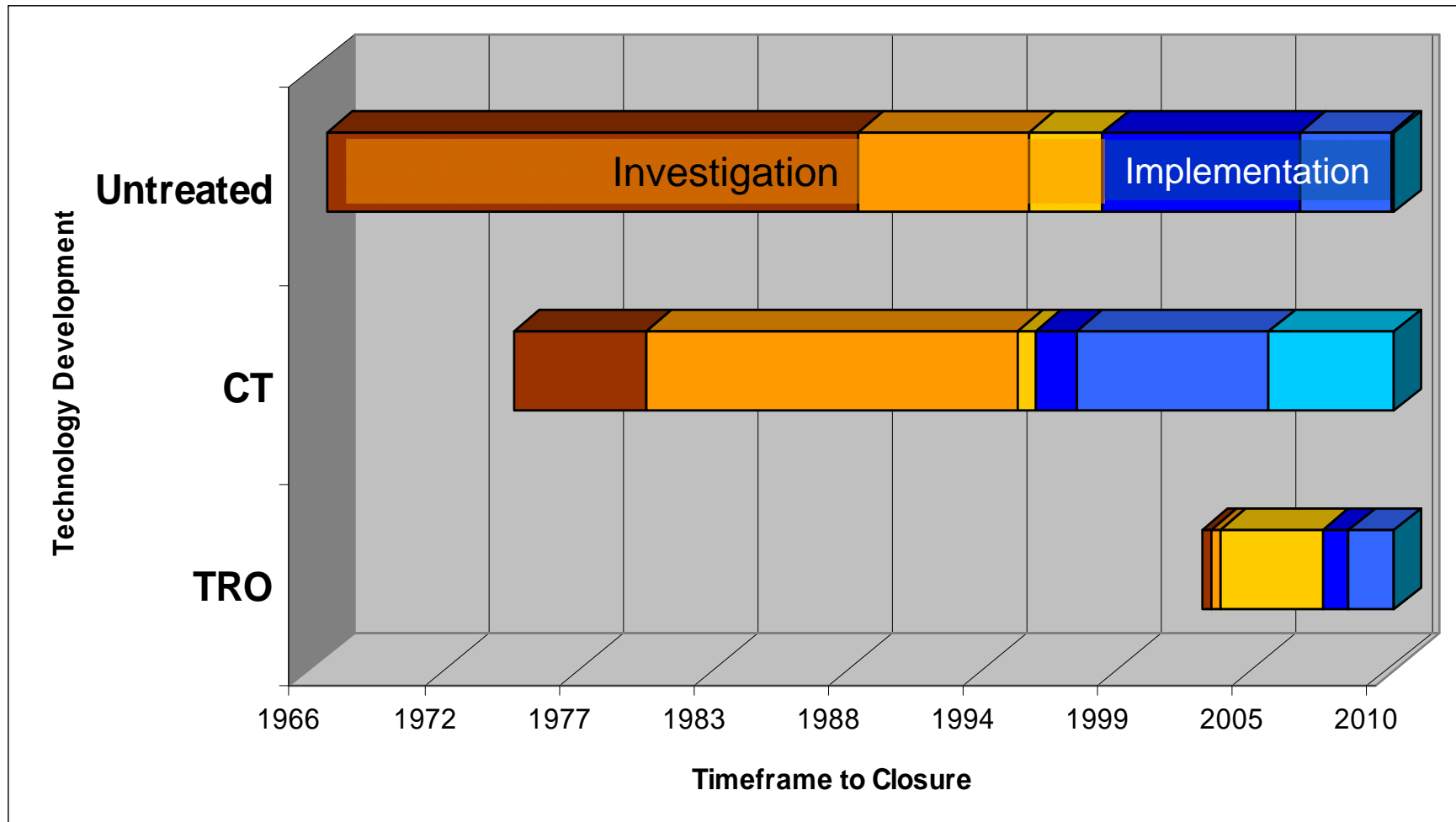
Phases of Technology Development

- Research Engineering recognises two Processes
- Investigative Process
 - Wide range of participants
 - Academic, 3rd part research, government, corporate, others
 - Large number of potential projects
 - Need
 - Often identified within the operation first, but not always
 - Inspiration
 - Researchers from any sphere
 - Trials
 - Wide ranging model
 - Can be conducted within an operation, through university research, 3rd party corporate trials, collaborative teams, etc.

Phases of Development

- Implementation Process
 - Development of selected, successful projects
 - Much smaller number of projects
 - Engagement
 - Convincing decision makers that it can be successful
 - Management teams, regulators, stakeholders
 - Scale-up (Getting it Done)
 - Commonly only achievable by Operators
 - Improving It
 - Communicate successes and failures
 - Get feedback for improvements and next steps

Accelerating Pace of Development



Oil Sands Tailings - Inspiration Phase

- Tailings operations in Pond 1 provided the first hints at the challenge of MFT
- Industry joined with Government and Universities
- Collaborative Research projects focused on defining the challenge and looking for potential solutions
- Culminated in the release of *“Advances in Oil Sands Tailings Research”* in 1995

Inspiration Phase

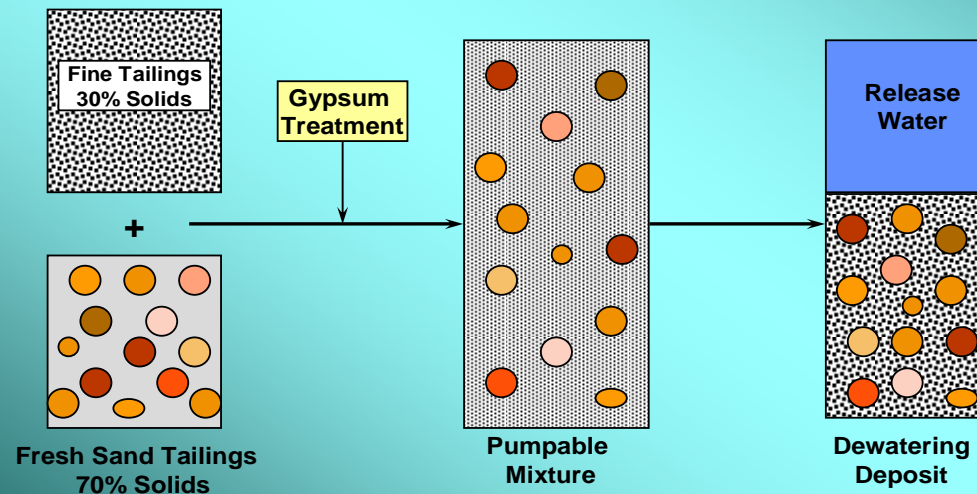
“Advances in Oil Sands Tailings Research”

- Management and Technical Committee members:
 - Alberta Dept of Energy
 - AOSTRA
 - Alberta Research Council
 - CANMET
 - Environment Canada
 - OLSO
 - Suncor
 - Syncrude
 - National Research Council
- Contributions from:
 - CANMET
 - Syncrude
 - NRC
 - Independent researchers
 - Consultants
 - Suncor
 - Alberta Department of Energy
 - University of Alberta
 - Alberta Research Council

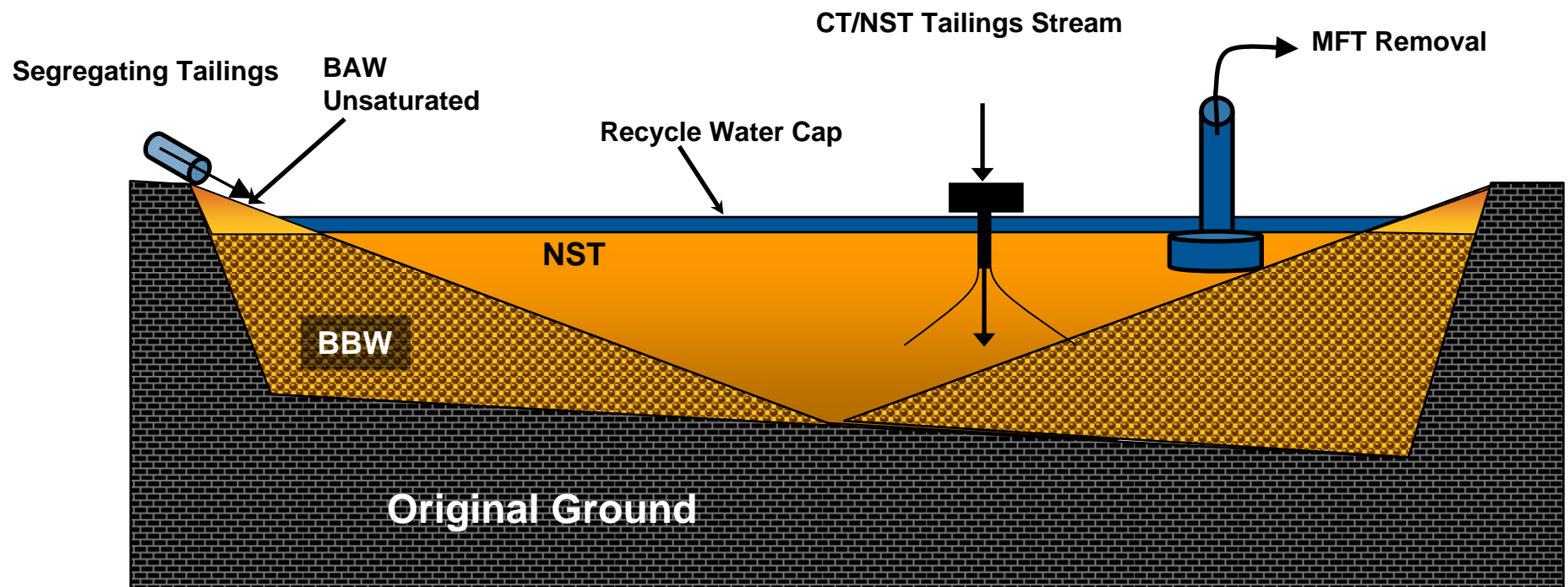
First Technology - Trials Phase

- Chosen Technology: Consolidated Tailings (CT)
- First large-scale treatment option adopted by major operators

CONSOLIDATED TAILINGS PROCESS



CT - Engagement Phase Pond Management Plan



CT - Engagement Phase

- Large body of research backing up the technology provided a good basis for corporate and regulatory approval
- Suncor began development of the process at commercial scale in 1995, followed rapidly by Syncrude
- CT approved for use by Suncor in 1996 by ERCB (EUB)
 - First large-scale treatment option adopted by major operators

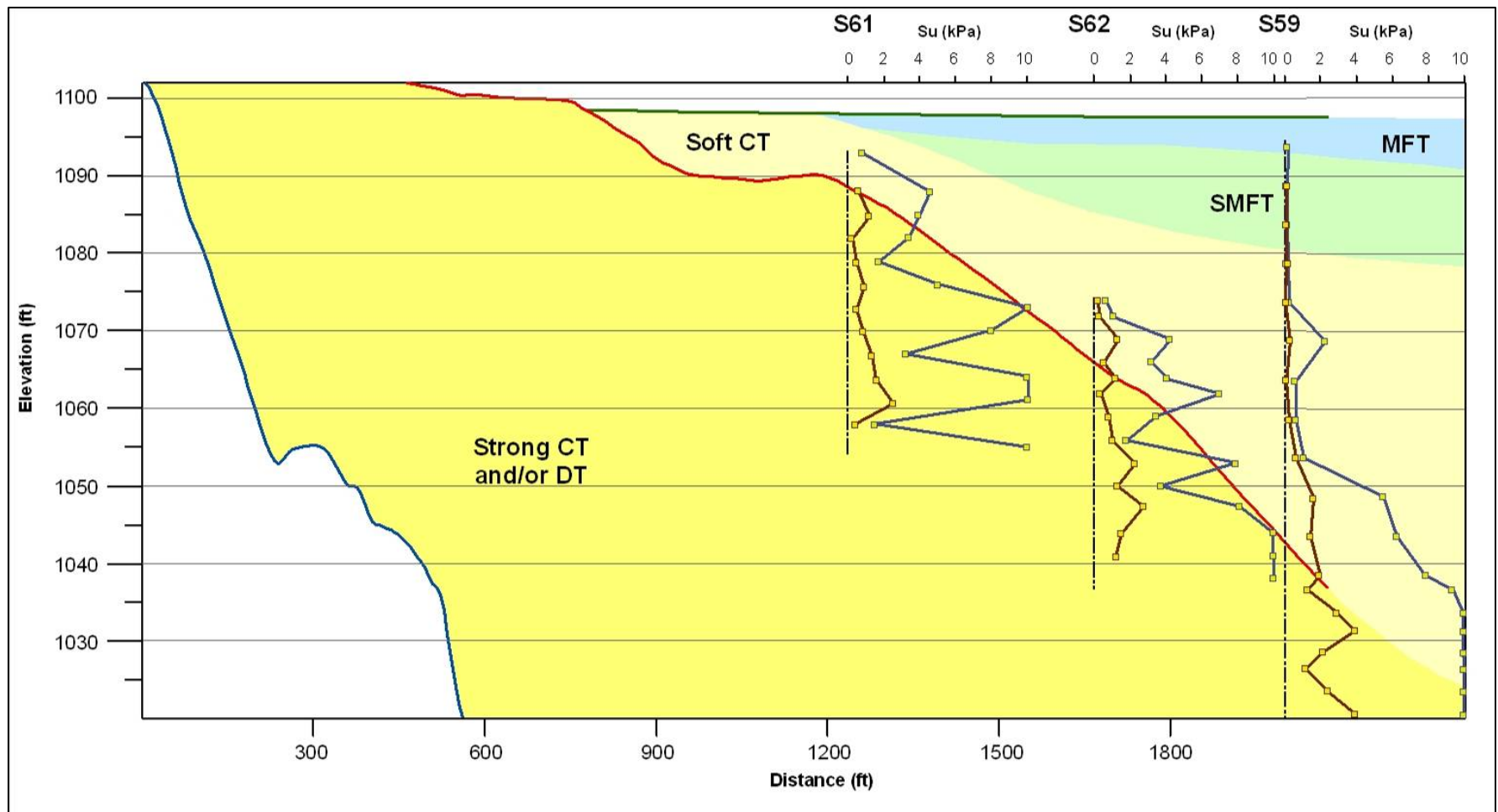
Scale Up Phase - Implementation



Improving It - Commercial Scale Advances

- Advanced process controls for tailings control
- MFT withdrawal systems
- CT Water Co-mingling Systems
 - Mixing high Ca release water with cyclone overflow clays
- Specialised deposition methods
 - Tremies
 - High density ponds
 - CT Spigots
- Advanced Pond Assessment & Modeling
 - Needed to determine the effectiveness of the deposit

After 15 years of Scale Up CT Works (but not Perfectly)



Inspiration for Soft Tailings Capping Australia



Inspiration Germany



Trial Phase – Coke Capping



August 2009 Airphoto



June 2009

Trial Phase – 2009



- Laid geosynthetics out onto frozen tailings
- Pushed 1-m lift onto geosynthetics

Engagement Phase

Management and Regulators Involved Early

- **July 2003**
 - Suncor begins testing MFT drying
 - Provides regular updates to Regulators on progress
- **February 2009**
 - Alberta government introduces regulations that set annual MFT reduction targets, require tailings ponds to be ready for surface reclamation within five years of the ponds being inactive
 - Suncor begins consulting with stakeholders on the company's new tailings management proposal
- **October 2009**
 - Suncor applies to the Energy Resources Conservation Board and Alberta Environment seeking approval to implement TRO at the Millennium and North Steepbank Extension mines
- **November 2009**
 - Suncor allocates approximately \$450 million for TRO as part of its 2010 capital spending plans
- **Mid-Year 2010**
 - Commencement of commercial TRO implementation (subject to pending regulatory approvals)

Scale Up Phase - 2010



Success – 100t on a Floating Cap



A New Need - Soft Tailings dewatering

- Installation of vertical strip (“wick”) drains will dewater underlying soft tailings
- Trials started in 2009 – so far very successful



Implementation Phase

Assessing and Improving It

- Now we understand the CT process and lifecycle
 - Dyke construction
 - Long infill period
 - Always needing a next pond
- Is there a better way?

The New Technology

- Tailings Reduction Operations
 - Next generation of Tailings Technologies
 - Developed at Suncor – starting in 2003
 - Combination of Technologies
 - Accelerated thin lift dewatering of MFT
 - Stacking of Sand into self-draining deposits

Trial Phase – MFT Drying Field Trials 2003-2007



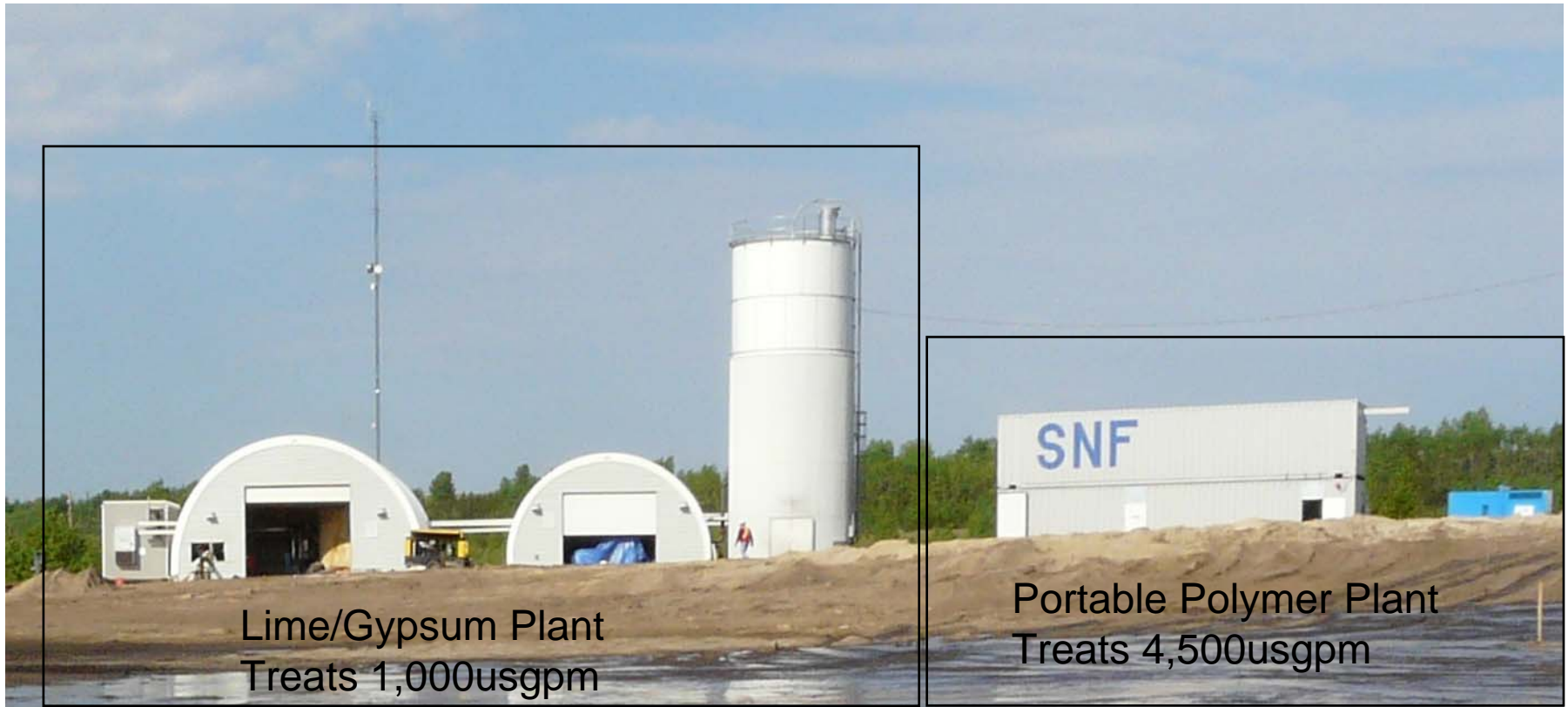
September 24, 2003
Preparing for first pour



Scale Up Inspiration - Ireland



Trial Phase – 2008 Lime/Gypsum vs. Polymer



Mature Fine Tailings Drying (MFTD)

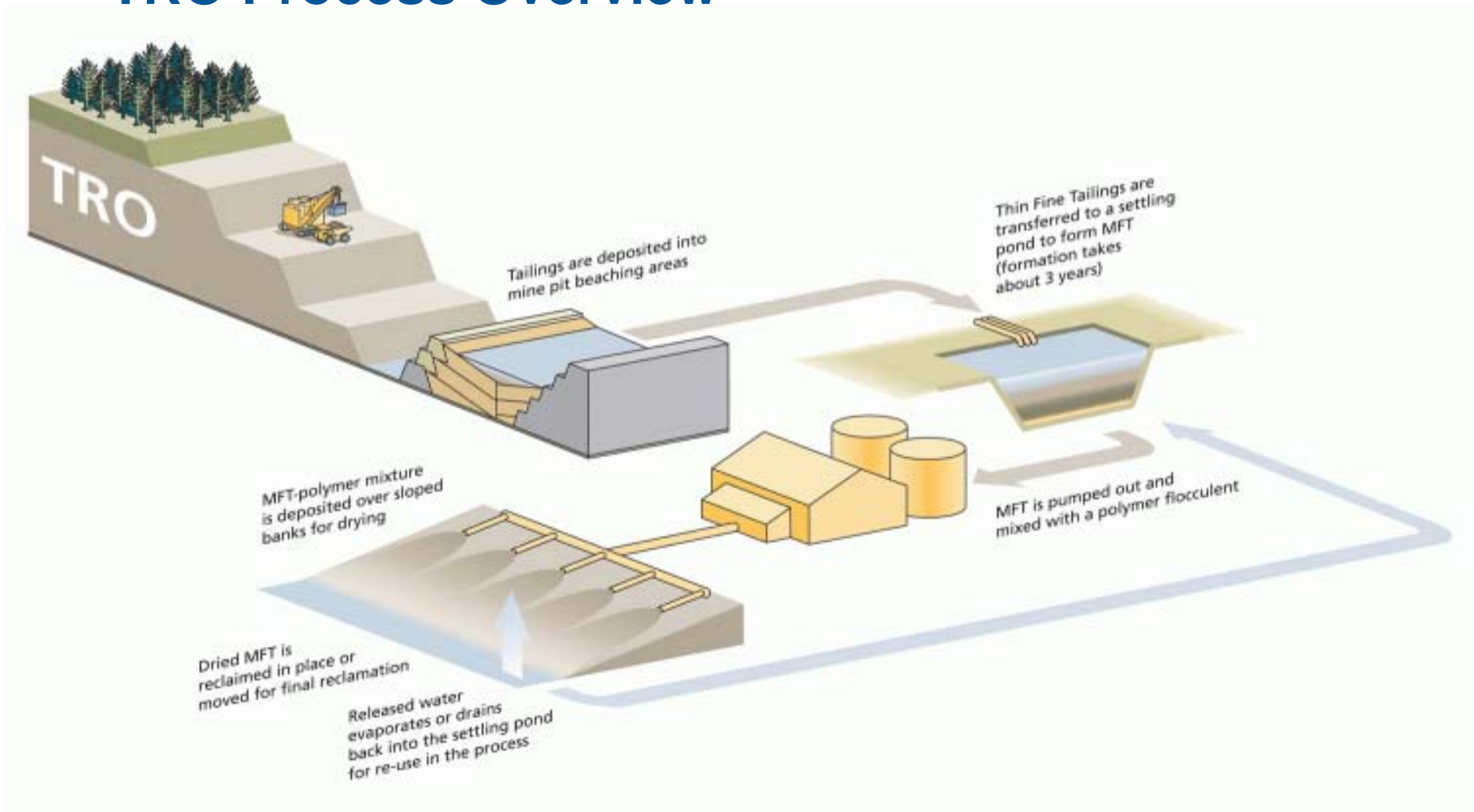


- Dry product is composed of up to 80% solids
- Strengths meeting/exceeding those required by ERCB Directive 074
- No odours associated with drying process



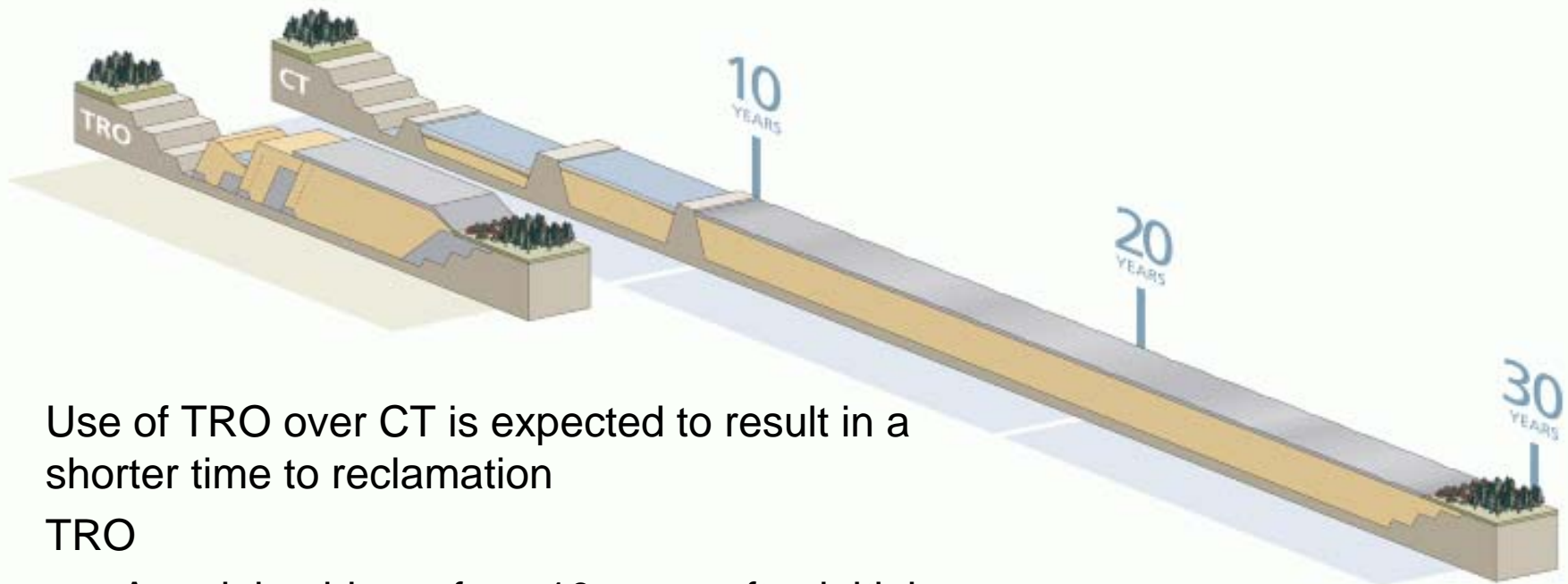
Engagement Phase – Building the Plan

TRO Process Overview



Engagement Phase

TRO Compared to CT: Time To Reclamation

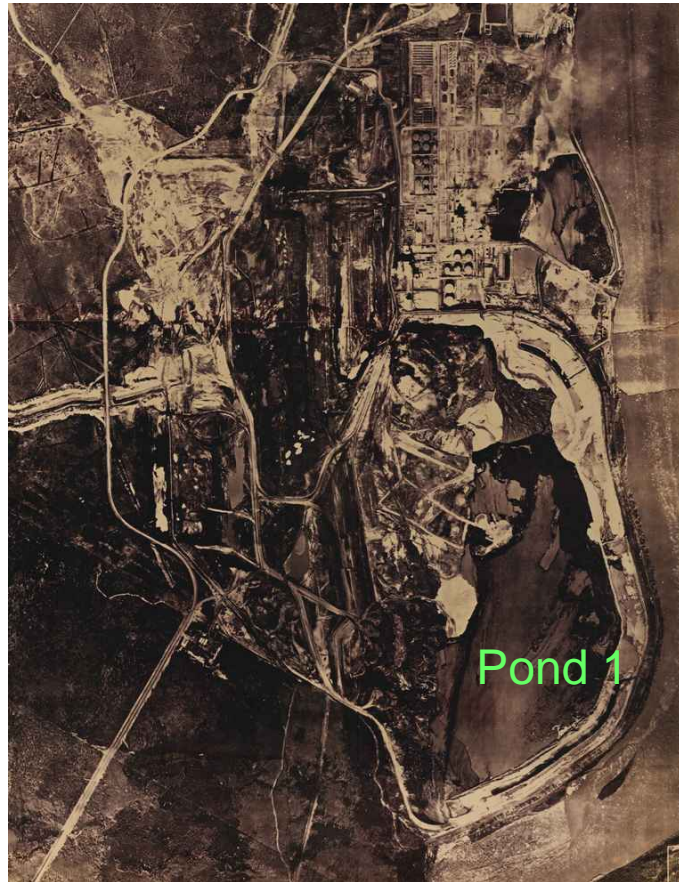


- Use of TRO over CT is expected to result in a shorter time to reclamation
- TRO
 - A reclaimable surface 10 years after initial disturbance
- CT
 - A reclaimable surface 30 years after initial disturbance

Engagement and Scale Up

- **October 2009**
 - Suncor applies to the Energy Resources Conservation Board and Alberta Environment seeking approval to implement TRO at the Millennium and North Steepbank Extension mines
- **November 2009**
 - Suncor allocates approximately \$450 million for TRO as part of its 2010 capital spending plans
- **2010**
 - Commencement of commercial TRO implementation
 - Regulatory approval received
- Only D74 industry submission that meets Directive 074

Back to Where it All Started Construction of Tar Island Dyke



1969

Tailings Pond Work – The Changing Faces



Reclamation Team in Germany



Reclamation Team in Australia



Engagement and Pride



Pride Builds Performance



Reclamation “Getting it Done” MFT Removal and Infill Operations



2006



2007



2008



2009



The Faces of Oil Sands Reclamation



The New Faces of Oil Sands Reclamation

