

Methods and Services for Tailings Dams BAUER Mining Solutions

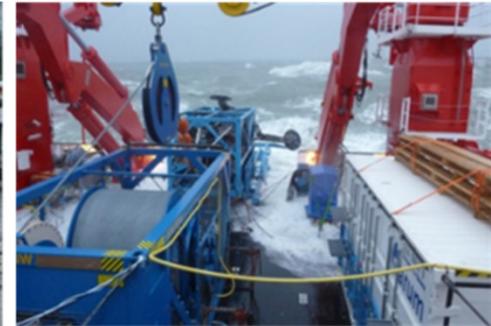
May, 2019

S.Schwank – BAUER Mining Solutions



Introduction

BAUER Mining Solutions



Customized Mining Solutions

• Equipment • Methods • Services



Introduction

BAUER Mining Solutions



■ Equipment

- Standard & customized
- Sale & rental

■ Services

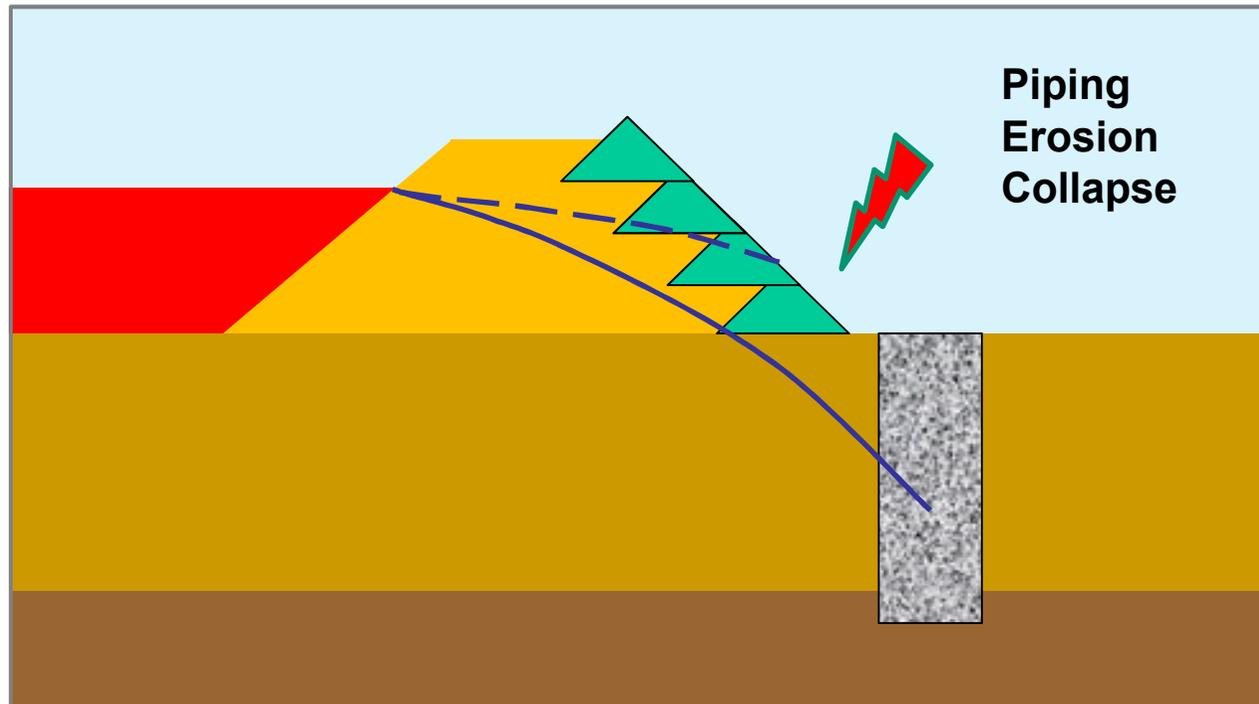
- Within the Bauer Group
- Together with local partners
- Providing operators & support

■ Methods

- Standard foundation methods
- Cross-over technology
- Customized mining methods

Tailings Dam Seepage Control & Stabilization

Drainage by Stone Columns



Drainage by stone columns

Tailings Dam Seepage Control & Stabilization

Drainage by Stone Columns

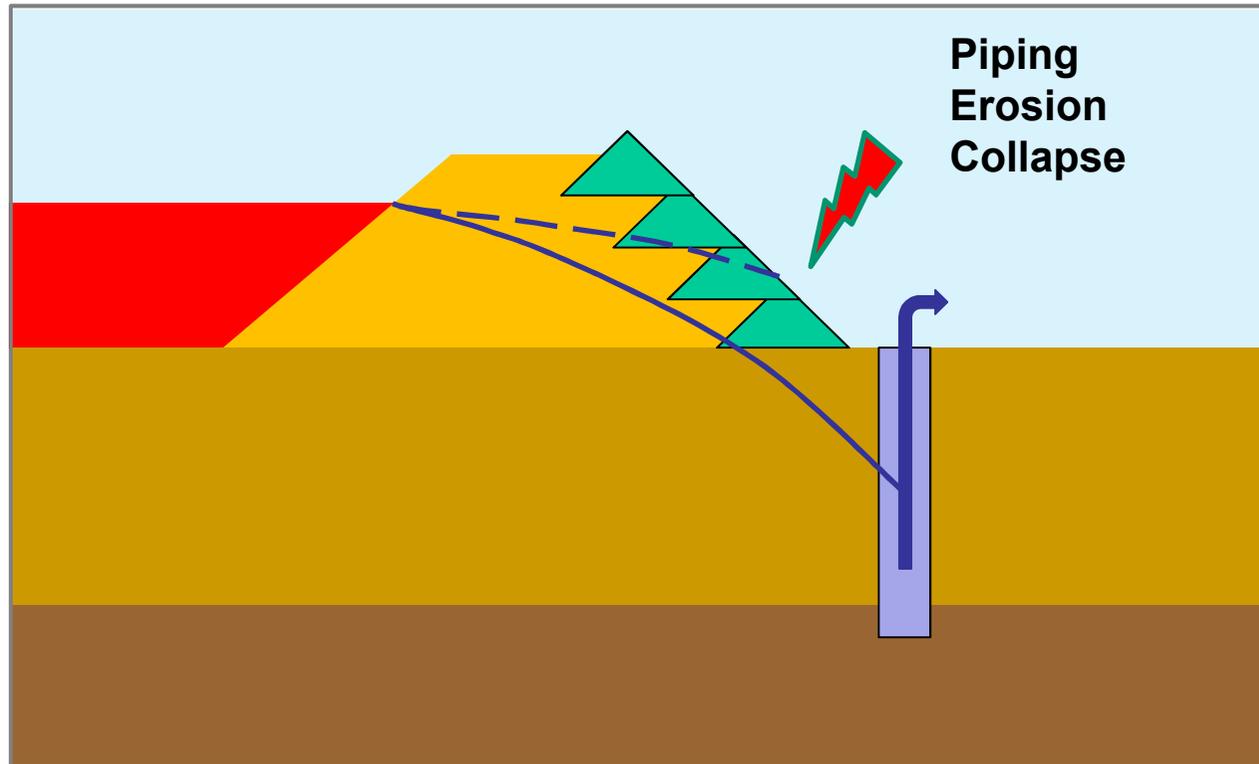


Feeding of gravel

Bottom feed vibrator

Tailings Dam Seepage Control & Stabilization

Drainage by Deep Wells



Drainage by deep wells

Tailings Dam Seepage Control & Stabilization

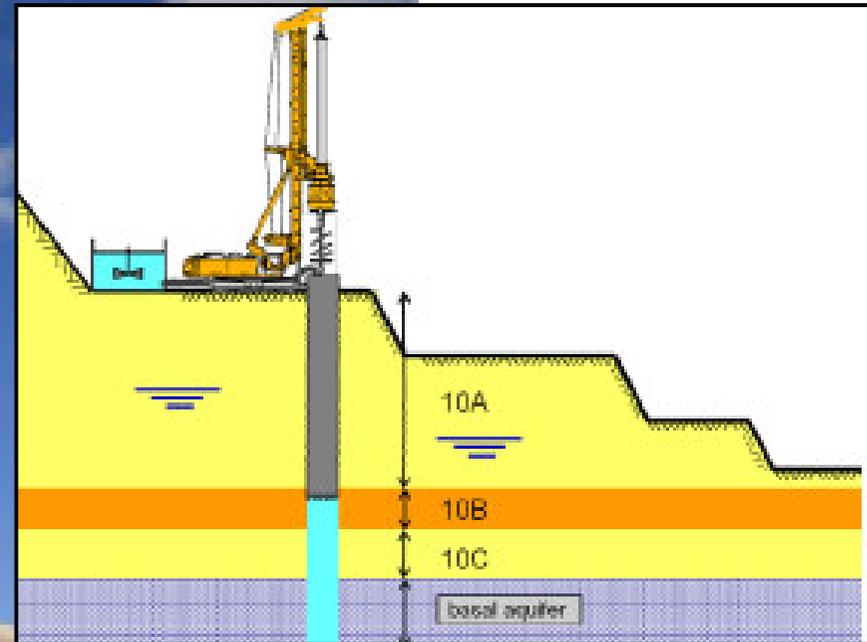
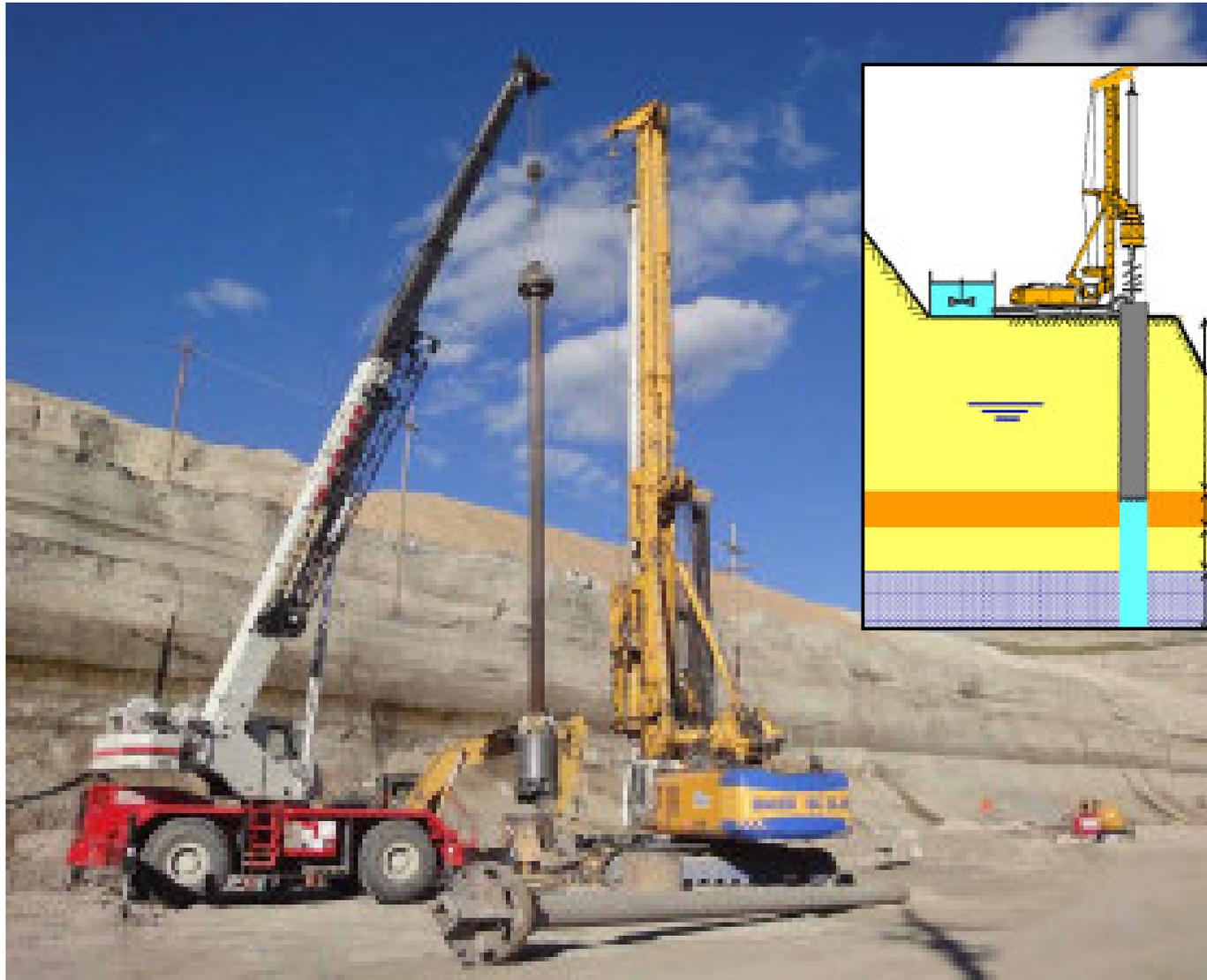
Drainage by Deep Wells



Newmont Gold
Ghana

Tailings Dam Seepage Control & Stabilization

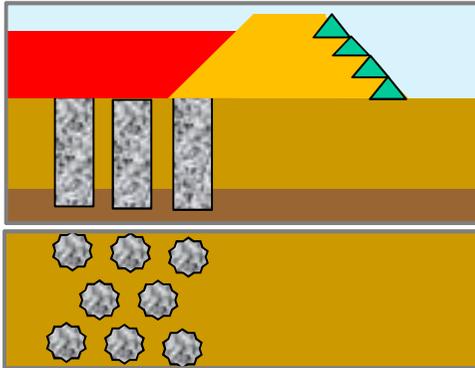
Drainage by Deep Wells



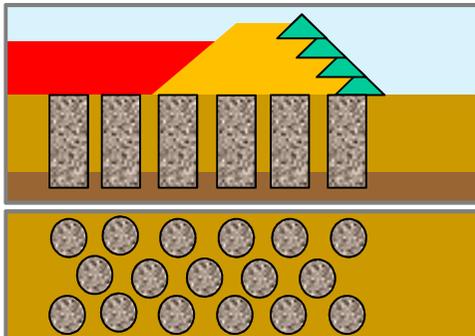
Highland Vally Copper
Teck Cominco, Canada

Tailings Dam Stabilization – Prevent Liquefaction

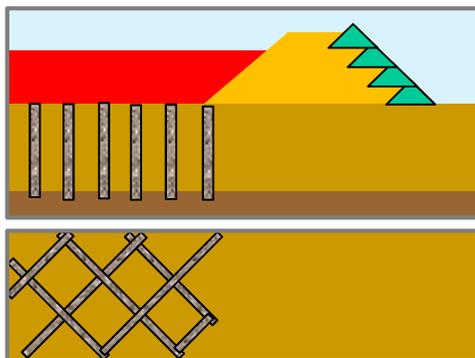
Methods to Prevent Liquefaction



Stabilization by Stone Columns



Stabilization by Jet Grout Columns

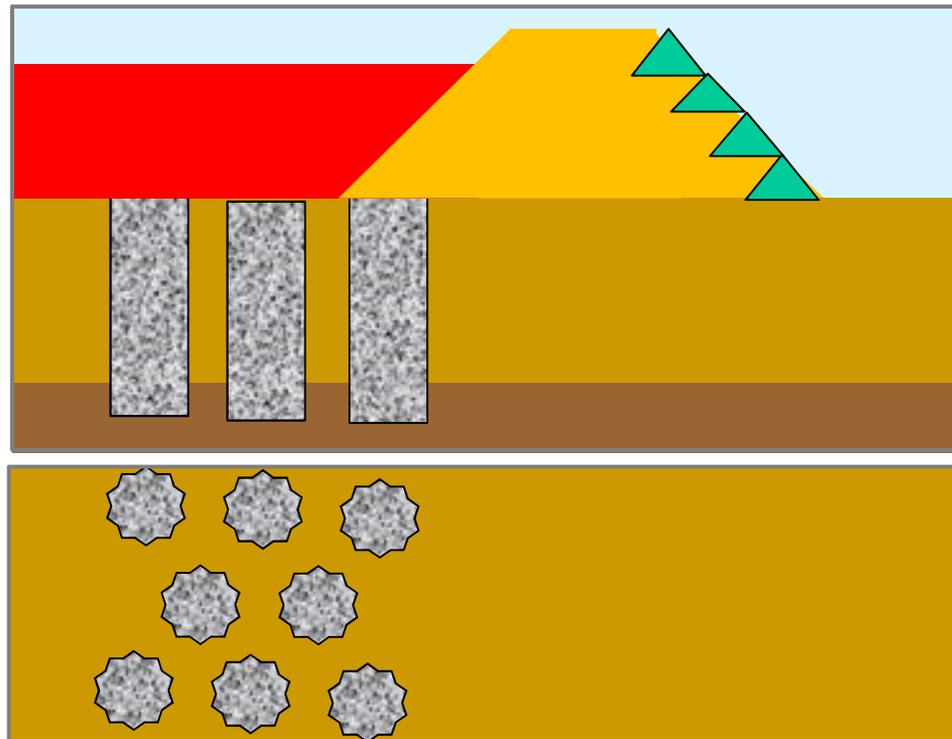


Stabilization by Cutter Soil Mixing Cells



Tailings Dam Stabilization – Prevent Liquefaction

Stabilization by Stone Columns



Stabilization by stone columns

Tailings Dam Stabilization – Prevent Liquefaction

Stabilization by Stone Columns



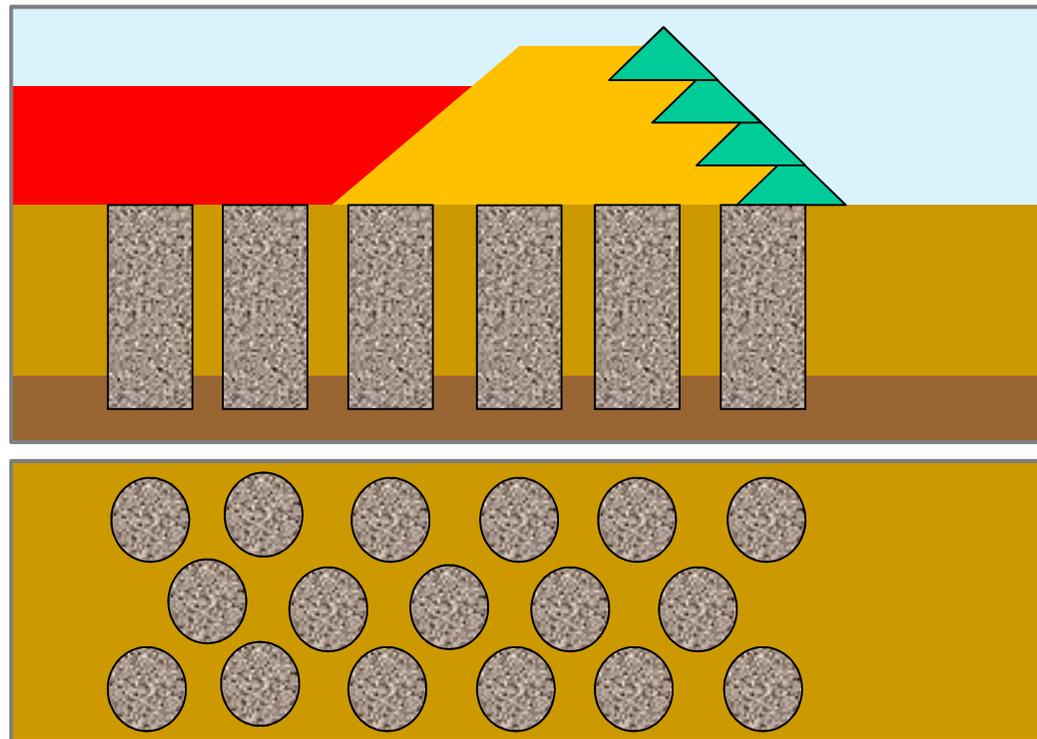
Stone Columns

- Increase of shear resistance
- Dewatering
- Separation in soil blocks
- Possible on existing tailing dams

DIAMIK Mine, Canada

Tailings Dam Stabilization – Prevent Liquefaction

Stabilization by Jet Grout Columns



Stabilization by jet grout columns

Tailings Dam Stabilization – Prevent Liquefaction

Stabilization by Jet Grout Columns



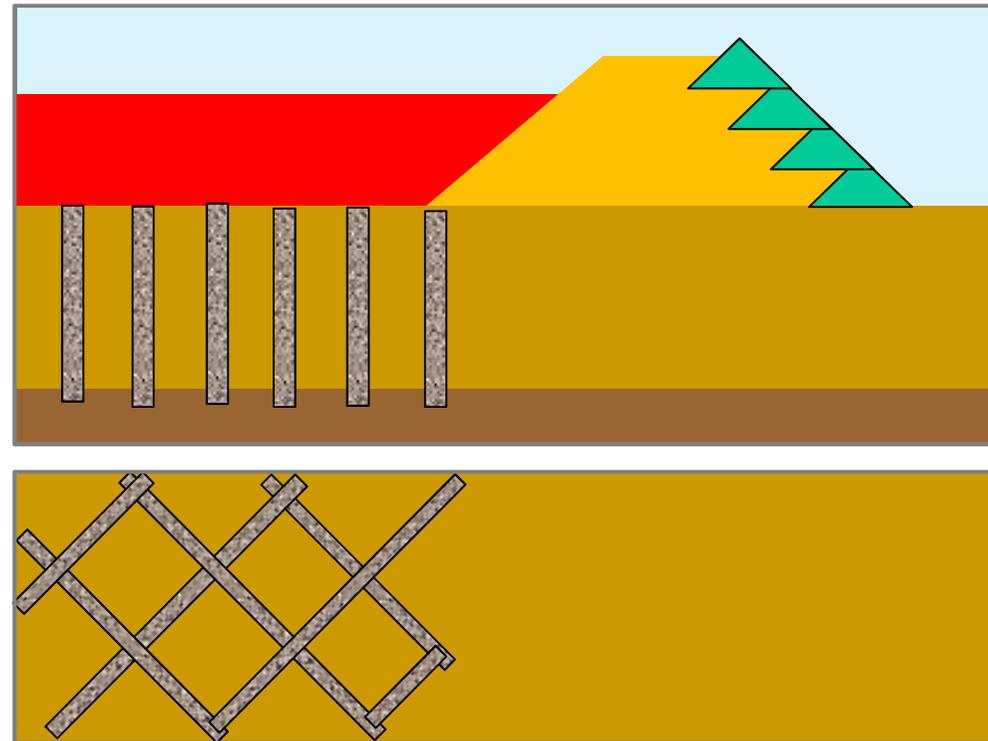
Jet Grout Columns

- Increase of shear resistance
- Separation in soil blocks
- Possible on existing tailing dams



Tailings Dam Stabilization – Prevent Liquefaction

Stabilization by Cutter Soil Mixing Cells



Stabilization by cutter soil mixing cells

Tailings Dam Stabilization – Prevent Liquefaction

Stabilization by Cutter Soil Mixing Cells



Soil Mixing Cells

- Increase of shear resistance
- Separation in soil blocks
- Possible on existing tailing dams

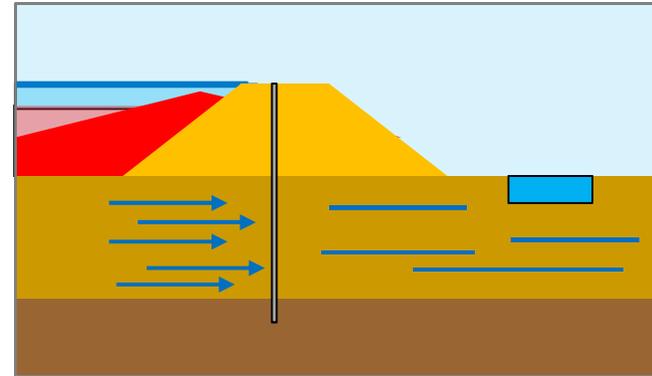
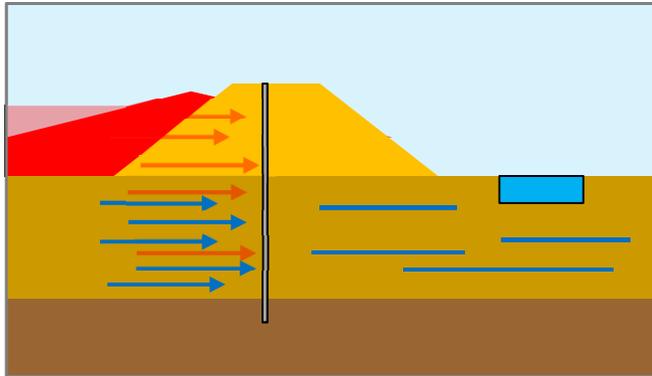


Tailings Dam Sealing with Cut-off Systems

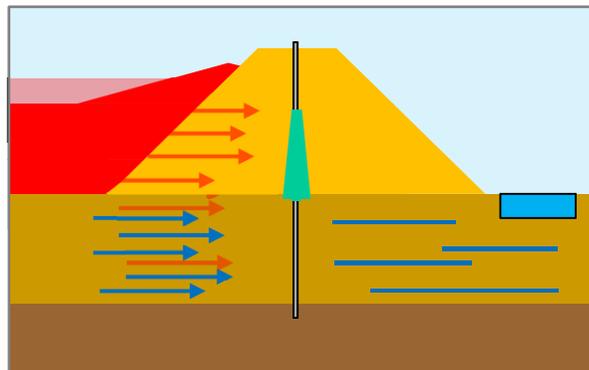
Exemplary Applications



- Sealing of tailings dams
 - Prevention of dam failure by seepage control
 - Prevention of acid mine drainage
 - Maintain permanent water to avoid oxidations of tailing



- Raising of dam crest for additional tailing pond capacity

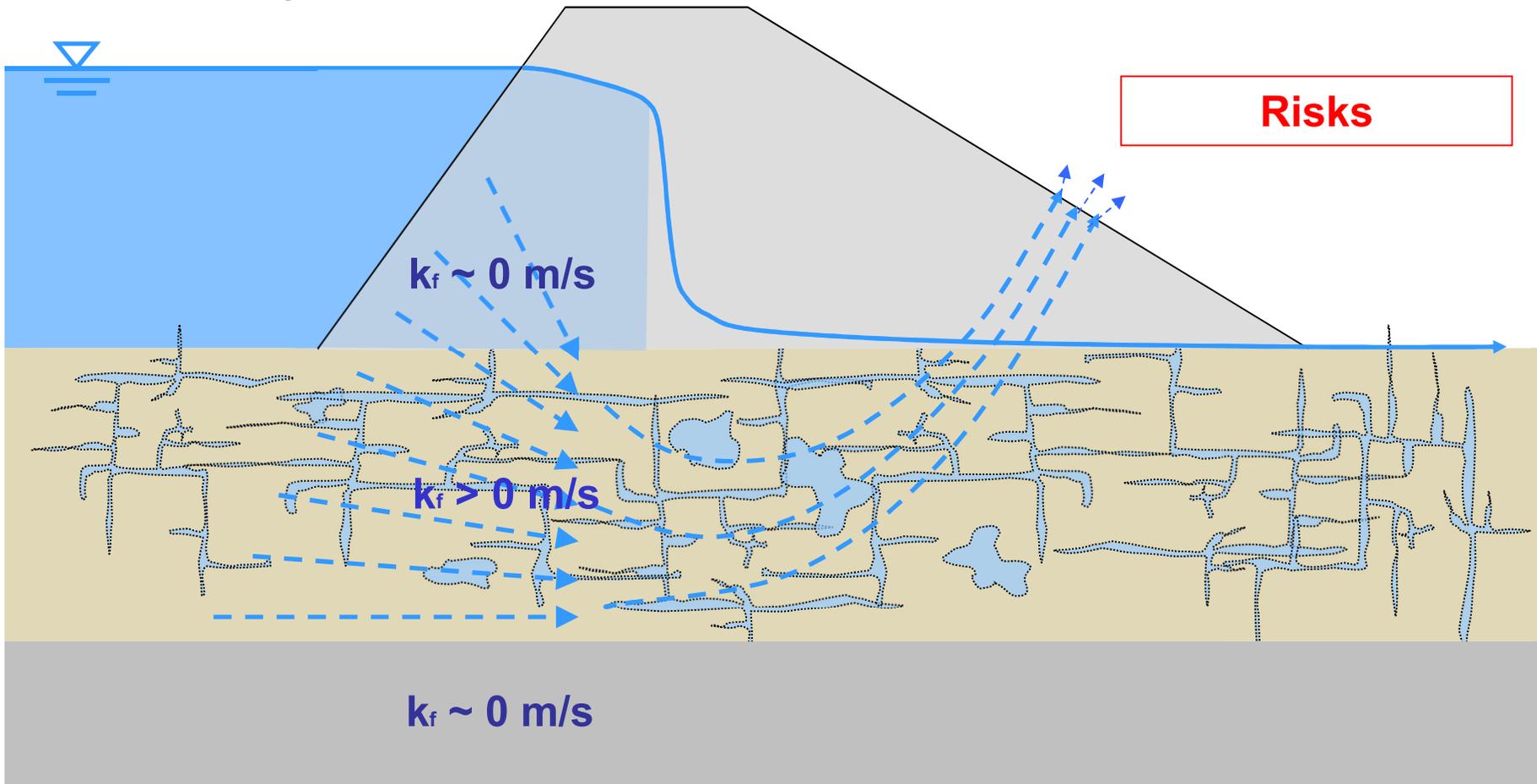


Tailings Dam Sealing with Cut-off Systems

Exemplary Applications



Seepage control under dams
Need for seepage control measures

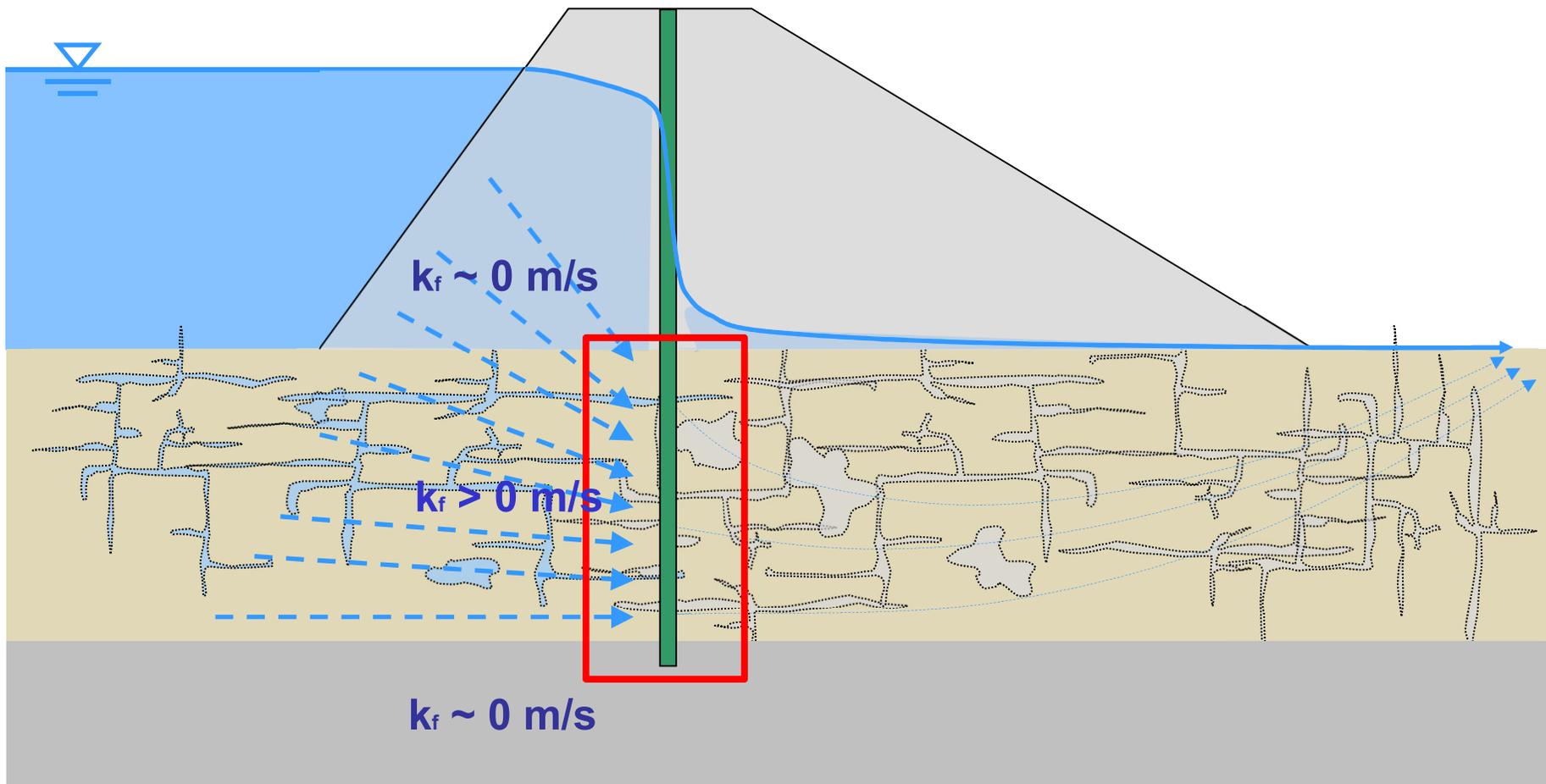


Tailings Dam Sealing with Cut-off Systems

Exemplary Applications



Seepage cut-off in the foundation of the dam



Tailings Dam Sealing with Cut-off Systems

Sheet Pile Wall



Sheet Piles

- Very fast installation by vibrator
- Up to 30 m depth
- Seating into impermeable layer

**Waoikaia Gold
New Zealand**

Tailings Dam Sealing with Cut-off Systems

Soil-Bentonite Mix with Excavator



Soil-Bentonite Mix

- Excavation by backhoe or grab
- Backfilling with bentonite slurry mixed with excavated soil
- For low hydraulic gradient projects
- Up to 60 m depth
- Excavation through all types of soils
- Seating into impermeable layer

Albian Sands, Fort McMurray, Canada

Tailings Dam Sealing with Cut-off Systems

Soil-Bentonite Mix with Hydraulic Grab



Albian Sands, Fort McMurray, Canada

Tailings Dam Sealing with Cut-off Systems

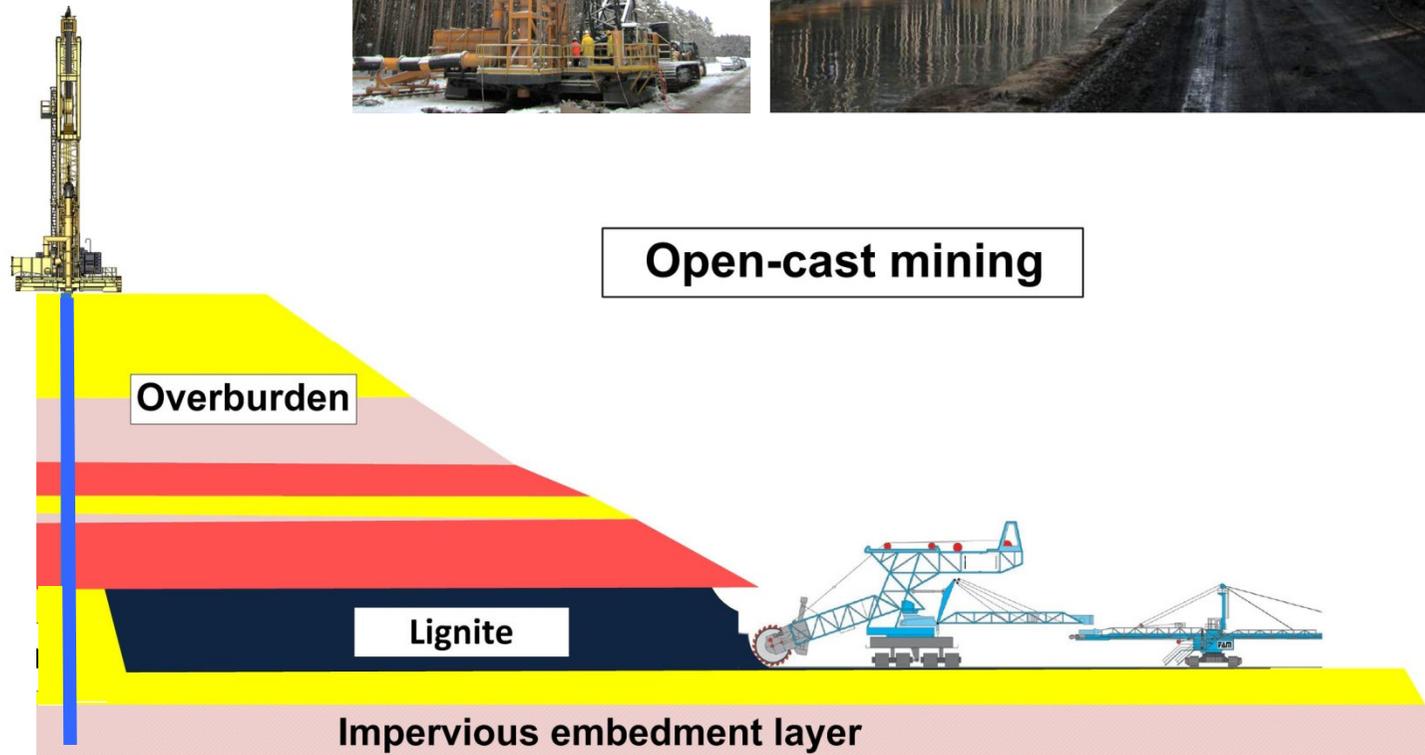
Soil-Bentonite Mix with Customized Cutter



Trench cutter PBC 40
with special HDS 130



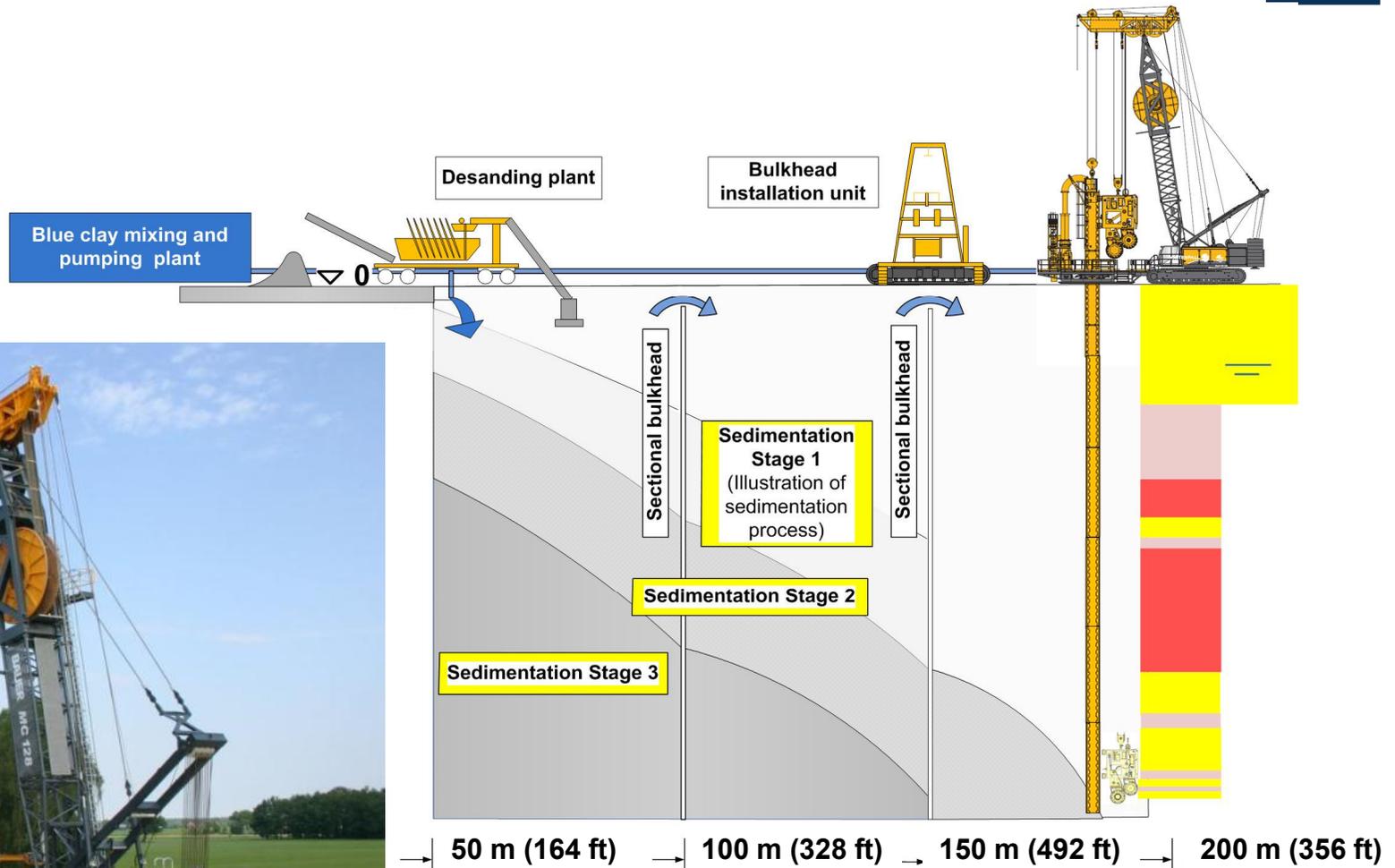
Lake Belt



Cut-off wall depth
max. 120 m (394 ft)

Tailings Dam Sealing with Cut-off Systems

Soil-Bentonite Mix with Customized Cutter



Rheinbraun Coal Mine, Germany

Tailings Dam Sealing with Cut-off Systems

Cement-Bentonite Mix with Hydraulic Grab



Namdeb, Pocket Beaches, Namibia

Cement-Bentonite Mix

- Excavation by backhoe or grab
Permanently feeding cement bentonite slurry
- Up to 60 m depth
- Excavation through all types of soils
- Seating into impermeable layer



Tailings Dam Sealing with Cut-off Systems

Cutter Soil Mixing



Cutter Soil Mixing

- Special CSM cutter
- Up to 80 m depth
- No excavation of soil !
- Downward homogenizing soil and bentonite slurry
- Seating into impermeable layer
- Upward introduction of cement slurry

Tailings Dam Sealing with Cut-off Systems

Cutter Soil Mixing

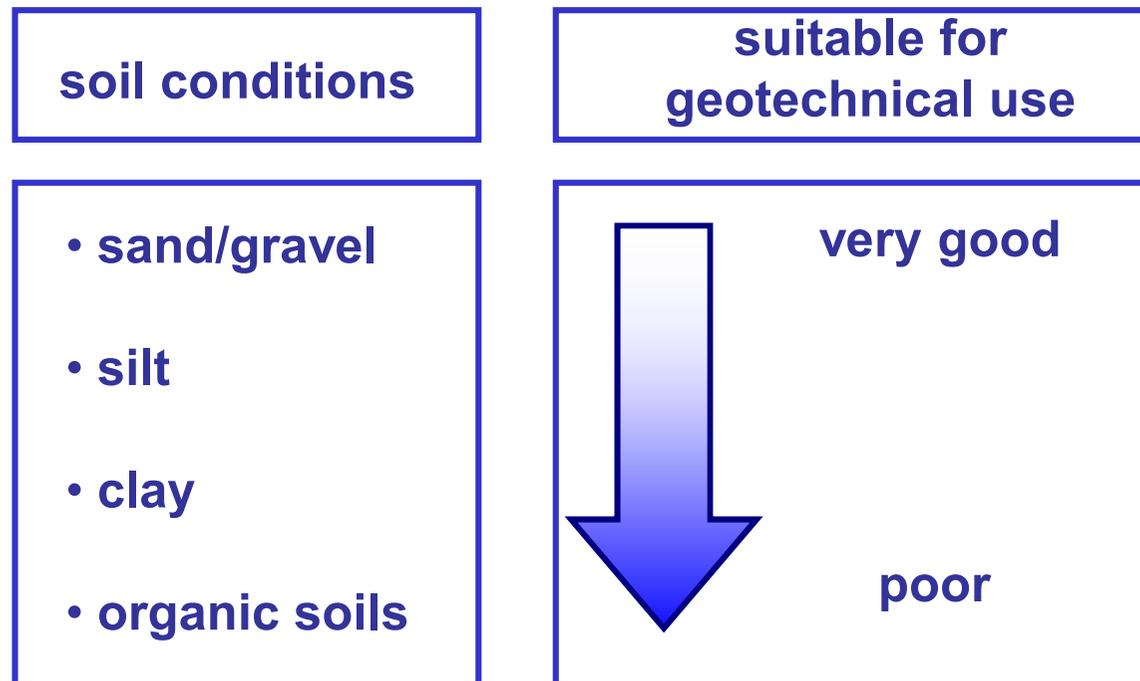


Syncrude Oilsand Mine, Fort McMurry, Canada



Tailings Dam Sealing with Cut-off Systems

Cutter Soil Mixing



Tailings Dam Sealing with Cut-off Systems

Two-Phase Cut-off System



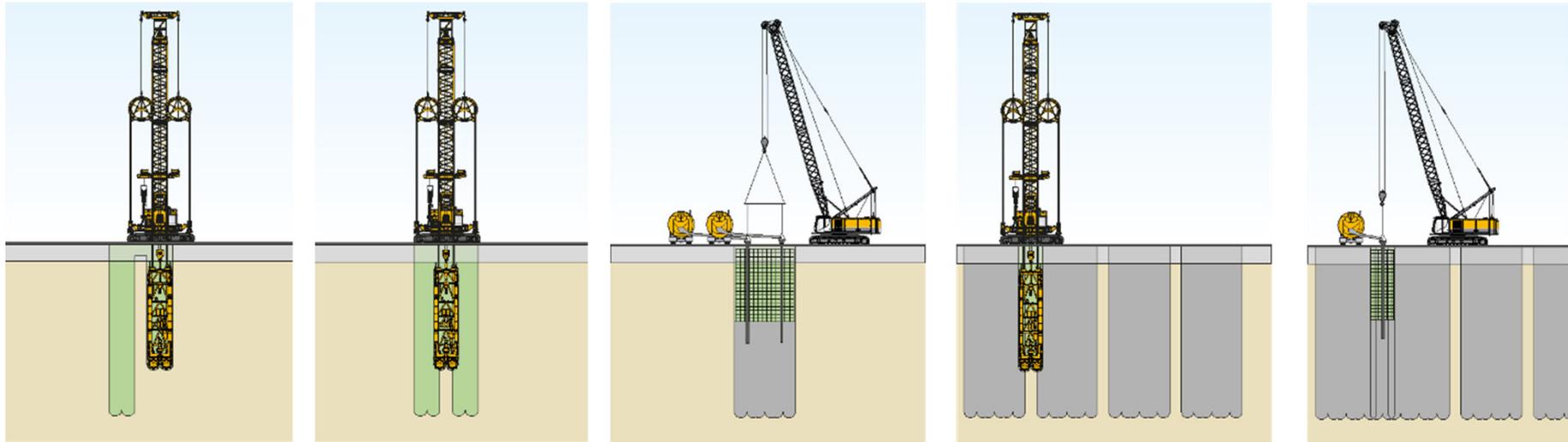
Two-Phase Cut-off System

- Excavation by grab and cutter under bentonite slurry
- Up to 250 m depth
- Excavation through all types of soils and rocks in boulders
- Seating into competent, impermeable layer
- Replace bentonite slurry by special flexible concrete

DIAMIK Diamond Mines, Canada

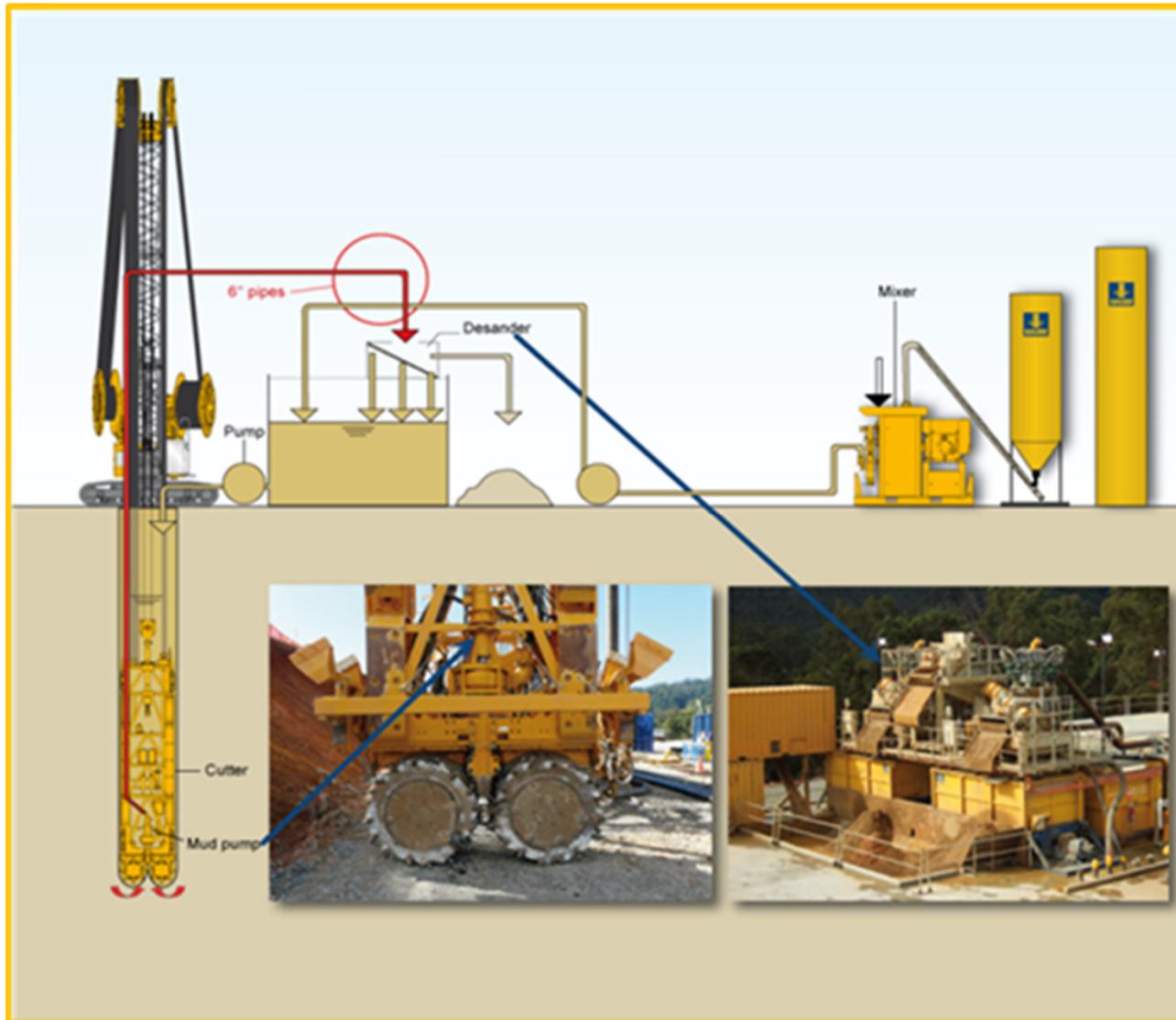
Tailings Dam Sealing with Cut-off Systems

Two-Phase Cut-off System



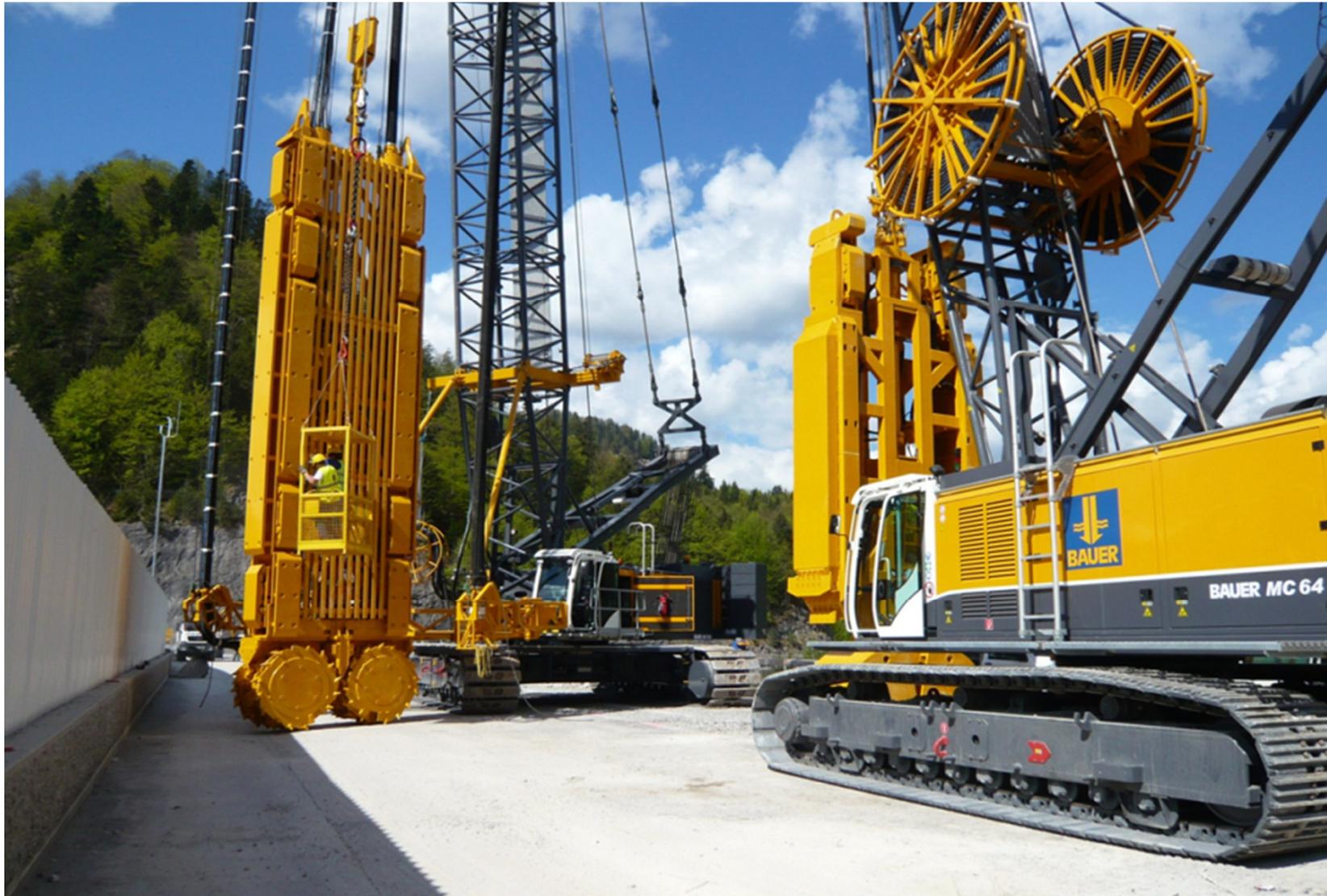
Tailings Dam Sealing with Cut-off Systems

Two-Phase Cut-off System



Tailings Dam Sealing with Cut-off Systems

Two-Phase Cut-off System



Tailings Dam Sealing with Cut-off Systems

Case Study – RED DOG Zinc Mine, Alaska



Tailings Pond and Mining Area RED DOG Zinc Mine, Alaska



Tailings Dam Sealing with Cut-off Systems

Case Study – RED DOG Zinc Mine, Alaska



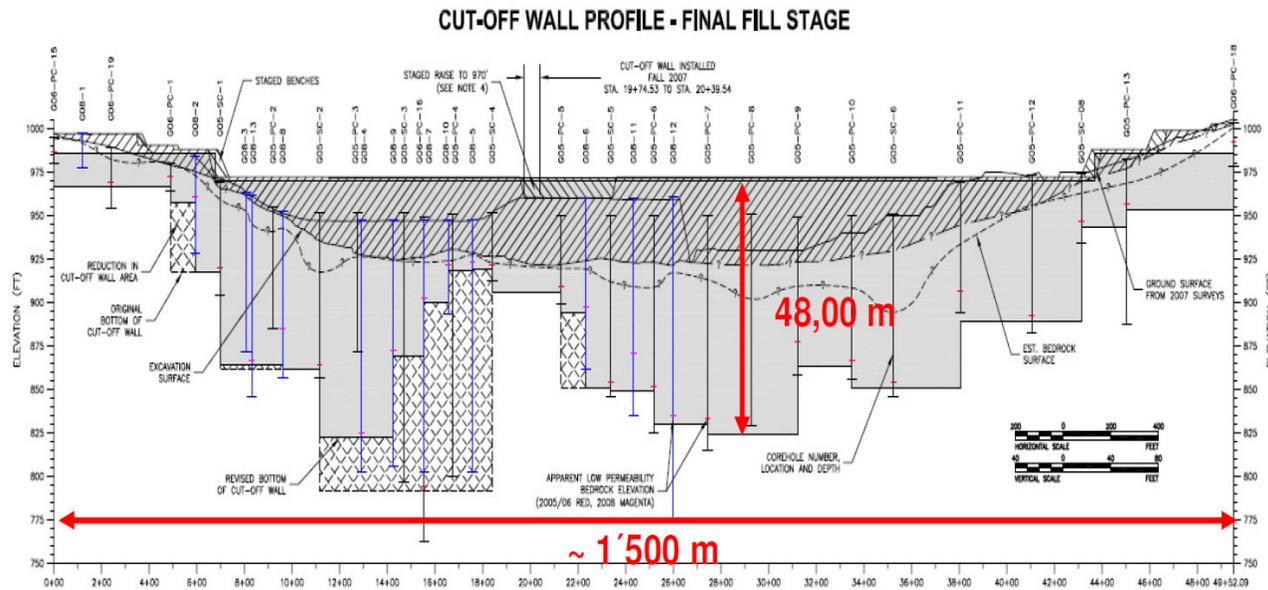
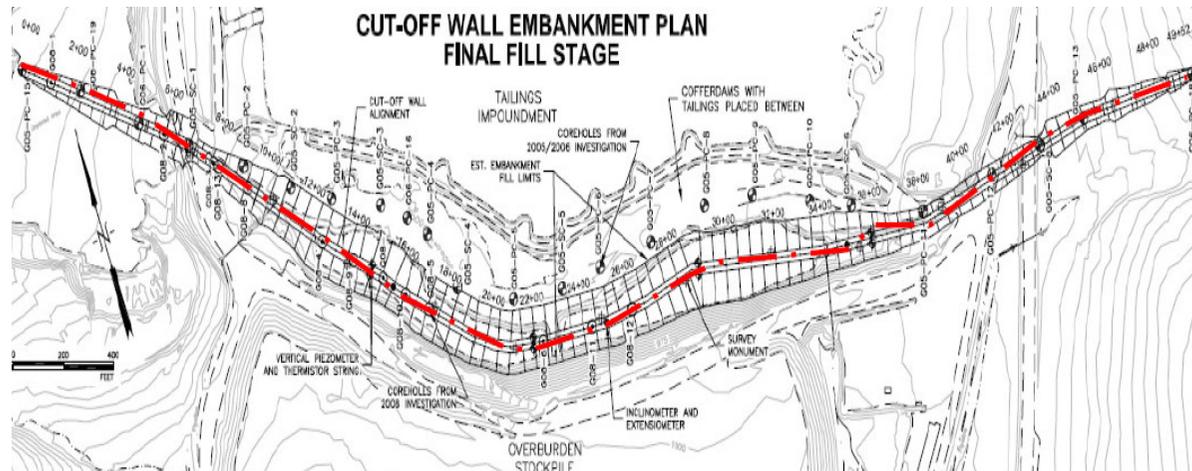
Project information – services and method

- Extension of existing mine water and tailings pond to increase of mine life from 2012 until 2031
- Raise of tailings dam by approx. 10 m
- Reduce / eliminate seepage through entire dam and underground

- Cut-off wall: Two-phase system, 53'000 m²
- Construction: 170 km north of arctic circle (summer 2008, 2009, 2010)
- Cut off wall depth: 15 – 48 m
- Wall thickness: 0.80 m
- Soil and rock: Dam fill, till, partly in permafrost, seating into rock of up to 140 Mpa
- Equipment: BAUER BC 40, HTS 50, BE 500 desander

Tailings Dam Sealing with Cut-off Systems

Case Study – RED DOG Zinc Mine, Alaska



Tailings Dam Sealing with Cut-off Systems

Case Study – RED DOG Zinc Mine, Alaska



BAUER BC40 in operation at RED DOG mine, Alaska



Mining Infrastructure

Highwall- and Tailings Dam Monitoring Systems



Complete performance package from rehabilitation to final cloud based monitoring systems

- Planing, design and installation of the monitoring systems tailored to the application and customer requirements
- Ongoing monitoring services and consultation
- Full maintenance of all relevant monitoring devices and systems
- Analysis and interpretation of monitoring data
- Online cloud based with 24/7 access globally
- Recommendations of actions to be taken

Thank you for your attention!

www.bauer.de

