The Rehabilitation of Ontario's Kam Kotia Mine

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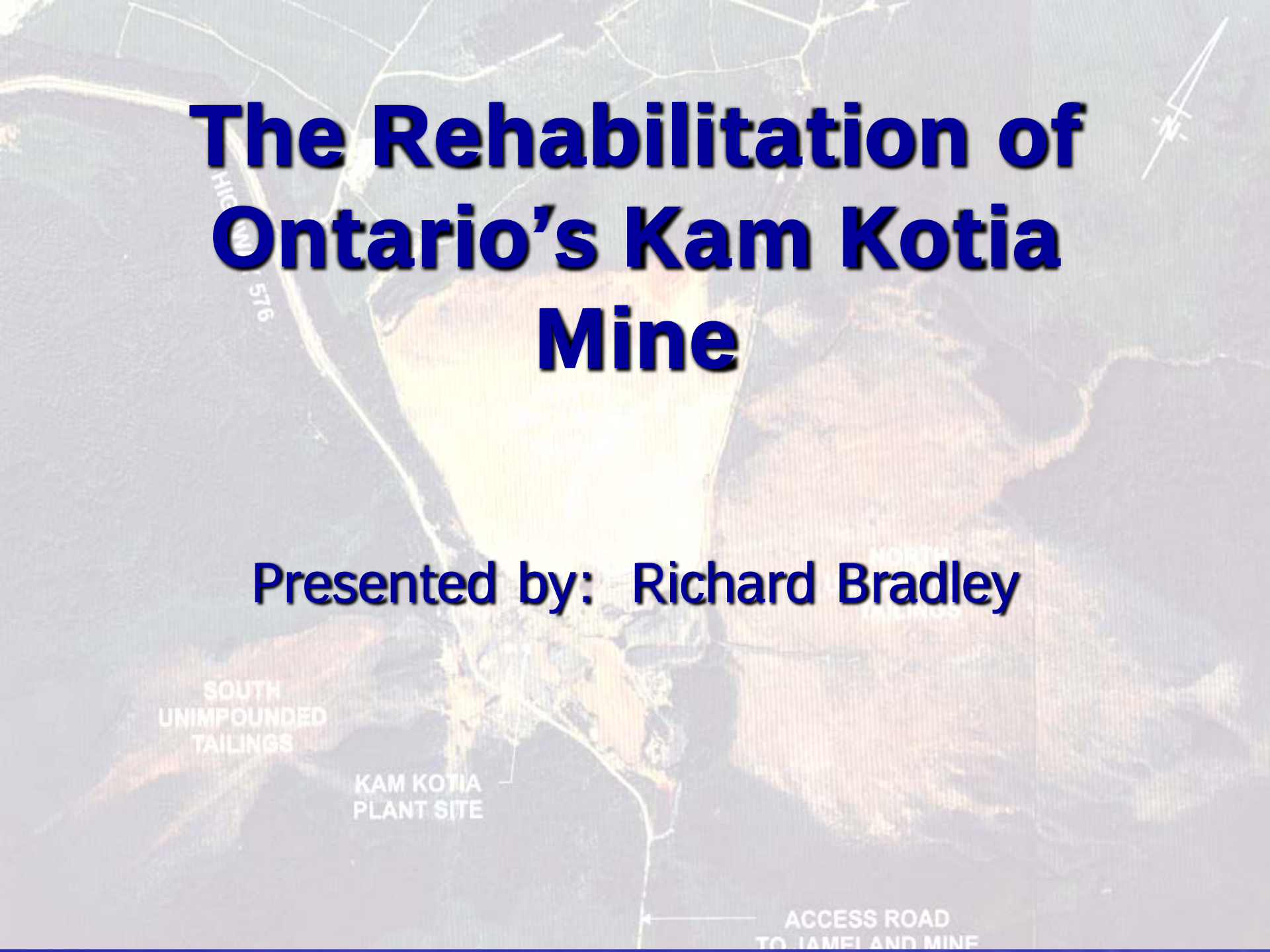


Background

- Kam Kotia is a former Cu/Zn mine near Timmins, Ontario
- There are about 6 million tonnes of acid generating tailings, originally covering more than 500 ha
- Environmental impacts are locally significant
  - acidic leachate, high metal levels
  - dusting
  - aesthetics
  - physical safety

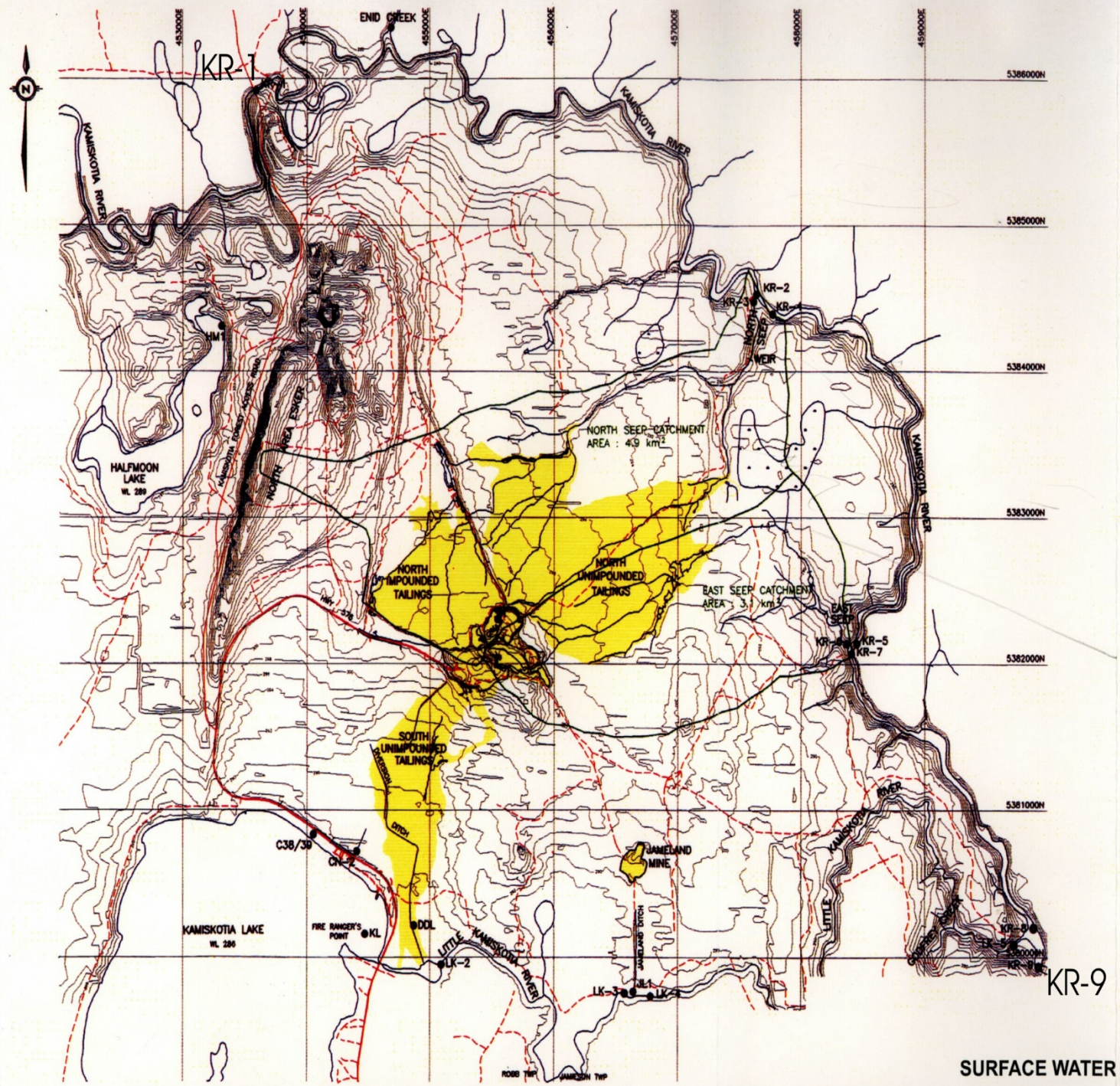
MINE HISTORY

- Principle exploration 1926-1928, exploration shaft
- Mining * 1943-1944 - 169,000 tonnes open pit
- Mining 1961-1972 - 5,840,000 tonnes, mainly underground
- Production 6.6 MT @ 1.1% Cu, 1.17% Zn, 0.10 oz/Ag
- Site became the responsibility of the Crown in 1988


HIGHWAY 576
NORTH
IMPOUNDED
TAILINGS
(NIT)
NORTH
UNIMPOUNDED
TAILINGS
(NUT)
SOUTH
UNIMPOUNDED
TAILINGS
(SUT)
KAM KOTIA
PLANT SITE
ACCESS ROAD
TO JAMELAND MINE

HYDROLOGY

- North and East seeps drain NUT, E1/2 of NIT and N1/2 plant site ⇒ Kamiskotia River
- South seep drains SUT, S1/ of NIT and plant site to Little Kamiskotia River ⇒ Kamiskotia River



LEGEND

- SURFACE WATER SAMPLING LOCATIONS
- TAILINGS AREA
- TRAILS
- ROADS
- WATERSHED BOUNDARIES

NOTES:

1. CONTOUR INTERVAL IS 2 METRES.
2. THE INFORMATION ON THIS DRAWING HAS BEEN OBTAINED FROM THE MINISTRY OF NORTHERN DEVELOPMENT AND MINES, DRAWINGS #NE5000, NW5000, SE5000 AND SW5000.

500 0 1000m

FIGURE 2.5-6

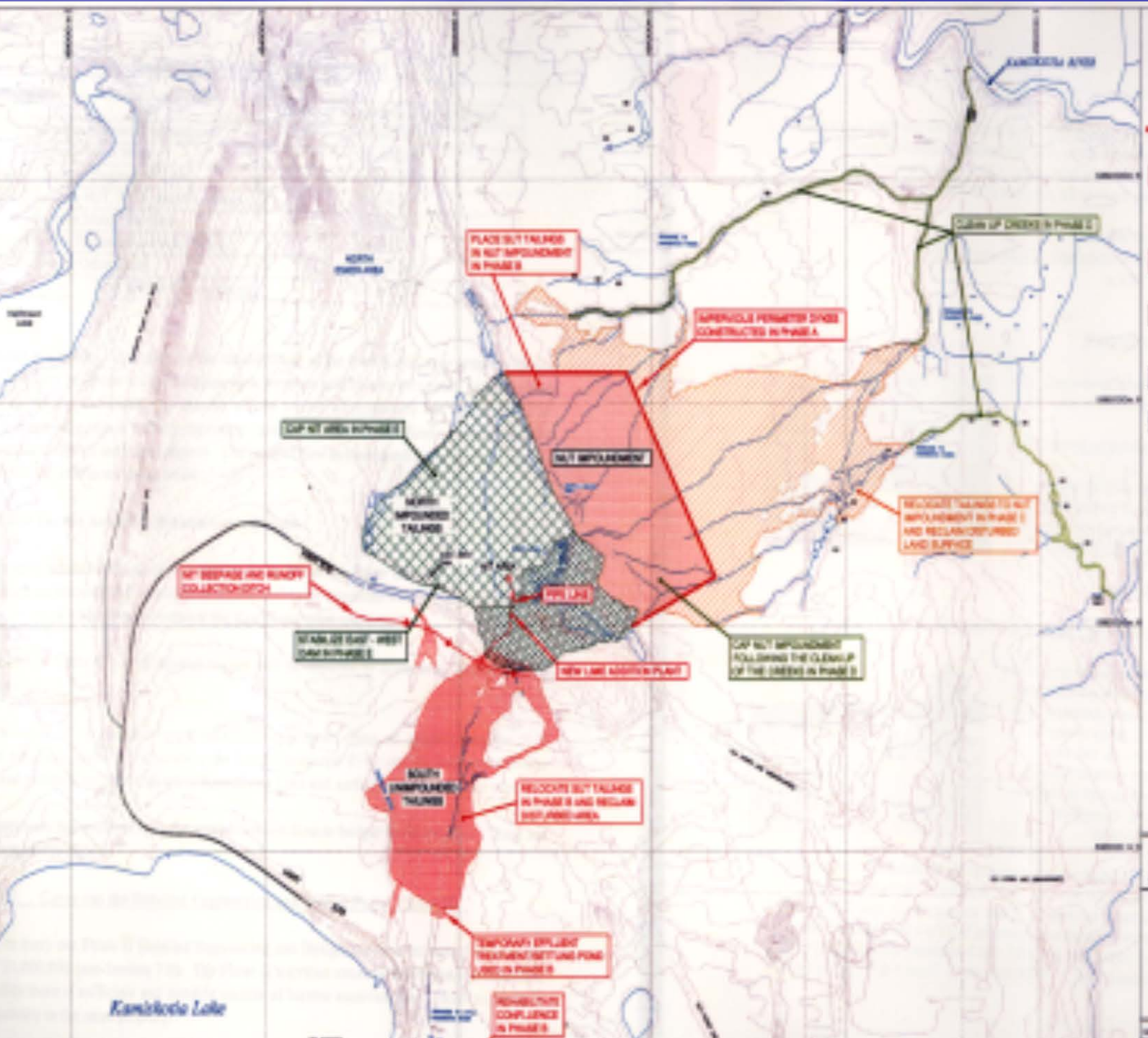
SURFACE WATER QUALITY MONITORING STATIONS

SOURCE: FIGURE A.1 (ELC, 1997)


93 6 23

BACKGROUND

- The total rehabilitation of the abandoned Kam Kotia Mine site is to be conducted as a proposed five-phase program.
- This rehabilitation plan was developed during fiscal 2000/01, and predicted a total rehabilitation cost of more than $41 million.
- The cost estimates were as follows, including a 30% contingency:
  - Phase “A”: $4.985 million
  - Phase “B”: $3.285 million
  - Phase “C”: $8.190 million
  - Phase “D”: $3.372 million
  - Phase “E”: $11.766 million
  - Effluent treatment for 50 years: $9.698 million



LEGEND

PHASE A

PUMPING STATION AND ADD WATER POND

IMPERVIOUS PERIMETER DYKES

PHASE B

SILT TAILINGS PLACED IN SILT IMPOUNDMENT. SILT TAILINGS TO BE DRAINED. SILT AREA TO BE CAPPED AND REVEGETATED

PHASE C

DRAINAGE SILT TAILINGS AND RELOCATE TO SILT IMPOUNDMENT

PHASE D

REHABILITATE NORTH AND EAST SIDE CREEKS

PHASE E

CONSTRUCT COMPOSITE COVER ON SILT TAILINGS AREA

REHABILITATED MINE PLANT SITE

NOTES:

KAM KOTIA
REHABILITATION PROJECT

REHABILITATION PLAN
GENERAL ARRANGEMENT
PHASES A TO E

BACKGROUND

- Phase A: Treatment plant with collection system; NUT impoundment.
- Phase B: SUT tails into NUT impoundment.
- Phase C: NUT tails into NUT impoundment.
- Phase D: cap NUT impoundment.
- Phase E: NIT cover.

PHASE “A”

- Phase “A” involved the construction of a Lime Addition Treatment Plant, as well as all of its required infrastructure, and the construction of a new NUT impoundment dam structure.
- The combined cost of these Phase “A” bids was $9.85 million, and the work was completed by July 2002.
- **Realized that the combined costs of Phases “A” and “B” would approach $14 million.**

PHASE “B”

- Phase “B” involved the relocation of the SUT tailings to within the new NUT impoundment area.
- Upon completion of the work, more than 340,000 m^3 of SUT tailings had been relocated and buffered with Envirolime, at a cost of $3.4 million.
- Phase “B” work was completed by mid-March 2003.


HITACHI


CATERPILLAR

PHASE “C"

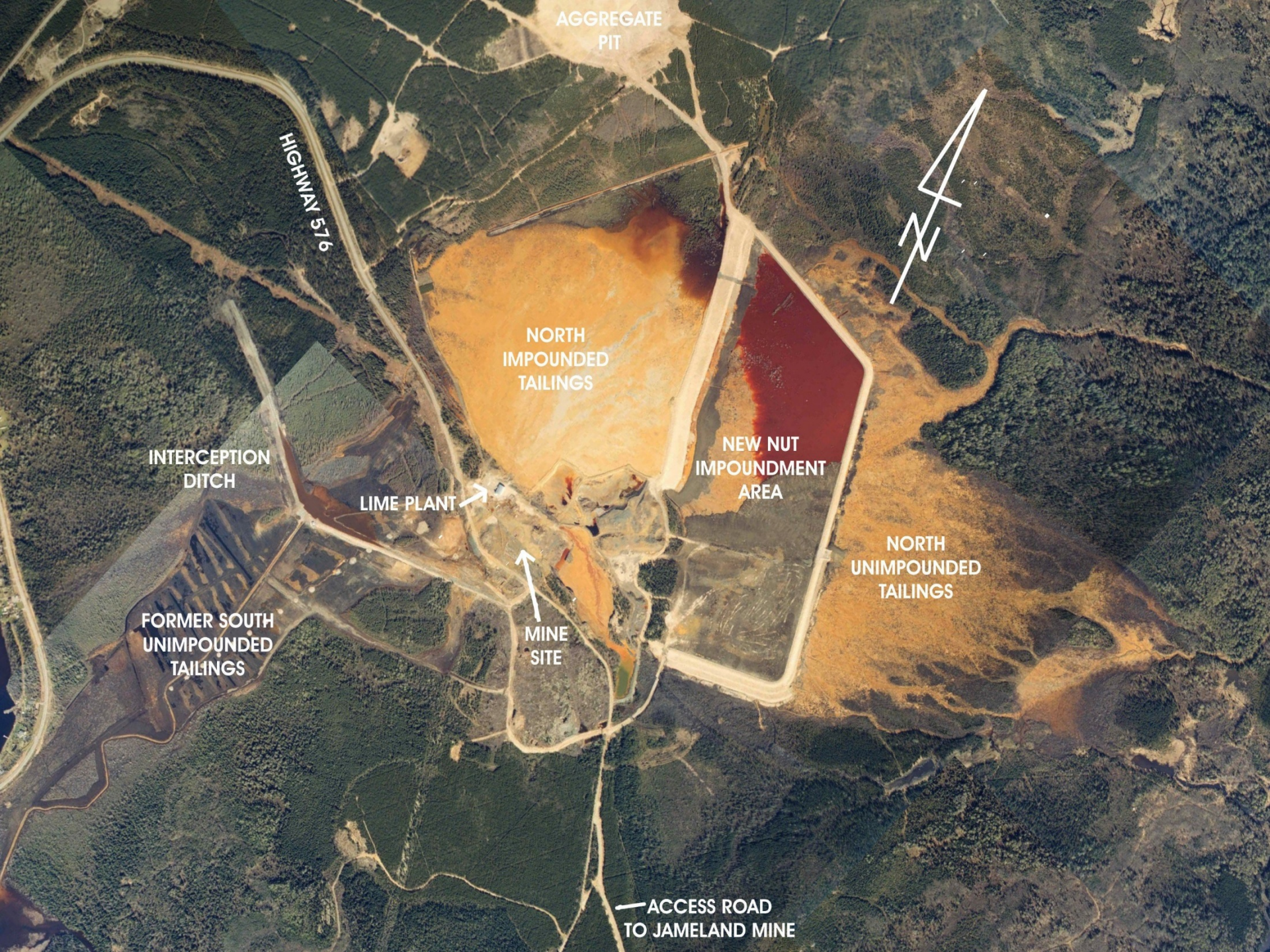
- Phase “C” involved the relocation of the NUT tailings to within the new NUT impoundment area.
- Upon completion of the work, more than 611,000 m^3 of NUT tailings had been relocated and buffered with Envirolime, at a cost of $6.9 million.
- The Phase “C” work was completed by late-March, 2004.

However…..

…. in abandoned mine rehabilitation,

like any construction project, ….

Things don't always go exactly as planned!


AGGREGATE PIT
HIGHWAY 576
N
NORTH IMPOUNDED TAILINGS
NEW NUT IMPOUNDMENT AREA
INTERCEPTION DITCH
LIME PLANT
NORTH UNIMPOUNDED TAILINGS
FORMER SOUTH UNIMPOUNDED TAILINGS
MINE SITE
ACCESS ROAD TO JAMELAND MINE

NUT Water Quality, October, 2003

Parameter	Units	Result
pH		2.58
Acidity	mg/L as CaCO3	3980
Al	mg/L	104
As	mg/L	0.08
Co	mg/L	3.87
Cu	mg/L	25.5
Fe	mg/L	1320
Zn	mg/L	188

Contaminated NUT Area Water

- Timmins received two years of anomalously high precipitation.
- The NUT Impoundment Area filled with approximately 600,000 m3 of water at a pH of about 2.7, and containing very high acidity and metals.
- In order not to delay the project, a decision was made to stack the NUT tailings in the impoundment area during Phase “C”.

Contaminated NUT Area Water

- Efforts were made to conduct the “in-situ” treatment of the NUT “Pond” during the winter of 2003/04.
- 706 tonnes of lime were added to the Pond, followed by over 2,000 tonnes of caustic (e.g. NaOH).
- Managed to raise the pH sufficiently to allow the discharge of the contaminated water for ~ 3 hours.
- Eventually ceased the treatment after having spent $1.8 million.

Contaminated NUT Area Water

- Efforts to neutralize the NUT ceased in the spring of 2004.
- By this time the NUT tails had been stacked within the NUT impoundment, but not leveled as planned.
- A consultant was hired to recommend how the NUT could best be emptied.
- Recommended a method involving neutralization with caustic and subsequent filtration using geotextile bags.


NORTH
IMPOUNDED
TAILINGS
INTERCEPTION
DITCH
NUT
IMPOUNDED
AREA
LIME PLANT
FORMER NORTH
UNIMPOUNDED
TAILINGS
MINE
SITE
FORMER SOUTH
UNIMPOUNDED
TAILINGS
N

Contaminated NUT Area Water

- A contract was awarded in the spring of 2005 to conduct the treatment and discharge of the contaminated NUT water and to place the stacked NUT tailings into their proper location.
- The work was completed on schedule: the NUT emptied in the fall of 2005, and the tailings in NUT leveled by the spring of 2006.
- The final cost of this contract was $9.4 million.


13/09/2005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NIT Area Cover

- The NIT area “dry” cover was to have been built as part of Phase “E”.
- In order for the KKM rehabilitation work to continue, the first two layers of that cover were constructed during the winter of 2004/05, at a cost of $3.4 million.


2005. 2. 18

Rehabilitation Yet To Be Done ...

- Complete the NIT cover (GCL, clay, granular B, soil, reveg) – this work is expected to cost more than $10 million, so it will have to be conducted during two separate fiscal years.
- Collect the remainder of the unimpounded tailings.
- Conduct Phase “D”, which involves the construction of the “moist” cover over the NUT impoundment area.
- Conduct the remainder of Phase “E”, which will include the rehabilitation of the open pit and all of the physical hazards on the site, such as the shaft and the thin crown pillar.

Recommendations

- Diversify funding- The OMA partnered with MNDM on the revegetation of the NUT impoundment dams.
- Contingency- Build a “contingency” allowance into your bids so that you can deal with the unforeseen – a 50% cost increase is not unusual.

Recommendations (cont'd)

- Be flexible- stacking of the tailings, pumping water from the bags, discharge location.
- Watch the weather- can have a major impact on your project.
- Don't be discouraged- unforeseen things WILL happen.

The final cost for the rehabilitation of the Kam Kotia Mine site is now expected to be in the range of…..

$55 million