MANAGING SURFACE WATER AT CVRD INCO'S INTEGRATED MINING, MILLING AND SMELTING OPERATIONS IN SUDBURY ONTARIO: IMPLEMENTING MODERN SOLUTIONS TO LEGACY CHALLENGES

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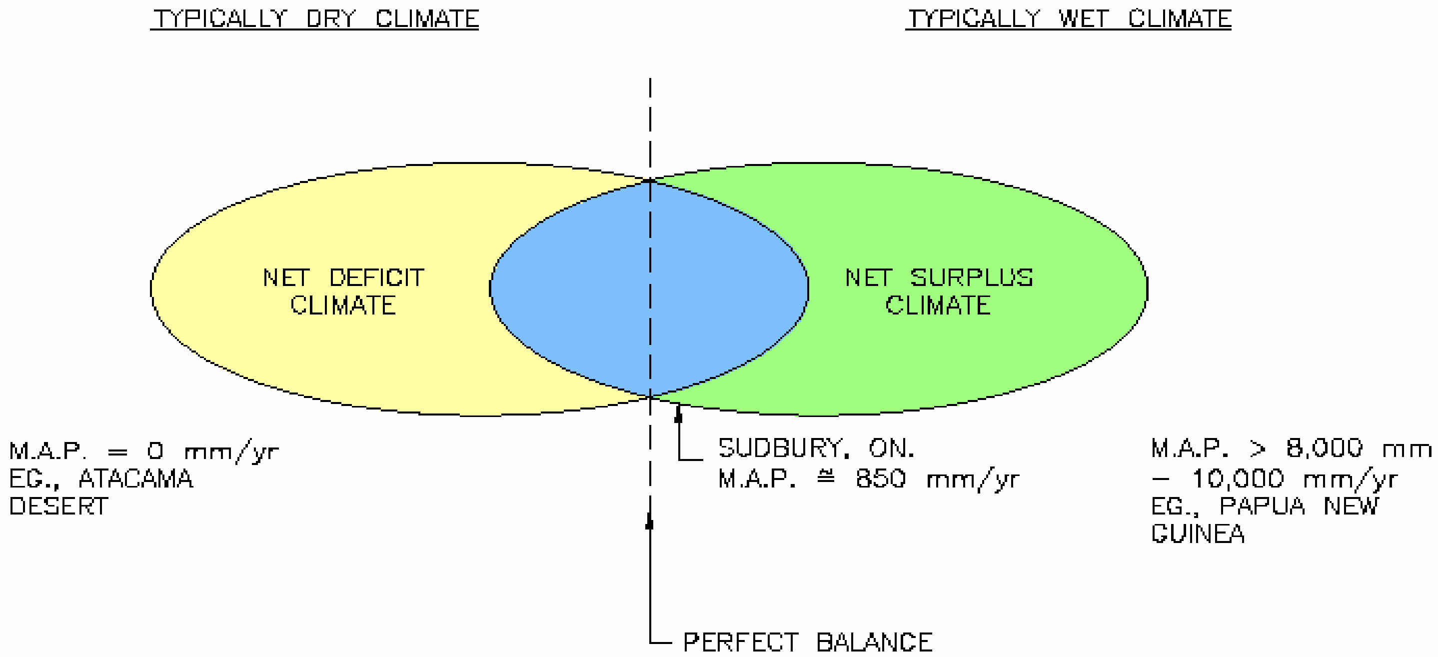
Presentation Overview

- INTRODUCTION
- BACKGROUND / HISTORICAL CONTEXT
- PROBLEM STATEMENT
- CONCEPTUAL OPTIONS REVIEW
- PREFERRED OPTION
- PREFERRED OPTION COMPONENTS
- CLOSING REMARKS / QUESTIONS

INTRODUCTION: Water Management



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Background / Historical Context

- 1883: Cu/Ni sulphide ore was discovered in Sudbury Basin
- 1929: INCO was formed by merger with MOND Nickel Co. Ltd.
- 1930: Heap roasting was discontinued
- 1937: A-area was commissioned for tailings disposal
- 1940-1960: CD-, M-, IPS-, Q-, P-areas are commissioned
- 1970: CELA Canadian Environmental Law Association founded
- 1971: Clarabelle Mill was commissioned
- 1972: CCWWTP and NCWWTP are commissioned
- 1977: MMLER Regulation came into force
- 1989: Milling is centralized @ Clarabelle Mill
- 1991: Closure Plans are required under the Mining Act
- 1994: MISA Regulation came into force
- 2002: MMER Regulation came into force

Problem Statement

- 4 MAIN COMPONENTS OF THE PROBLEM
  - Hydraulic overload
  - Dependence on water recycling
  - Plant upset or power supply interruption
  - Legal change, legacy and compatibility with closure

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Hydraulic Overload

CVRD Inco employ "Collect and Treat" strategy:

- ~ 48 km^2 drain directly
- ~ 52 km^2 including pumped inputs

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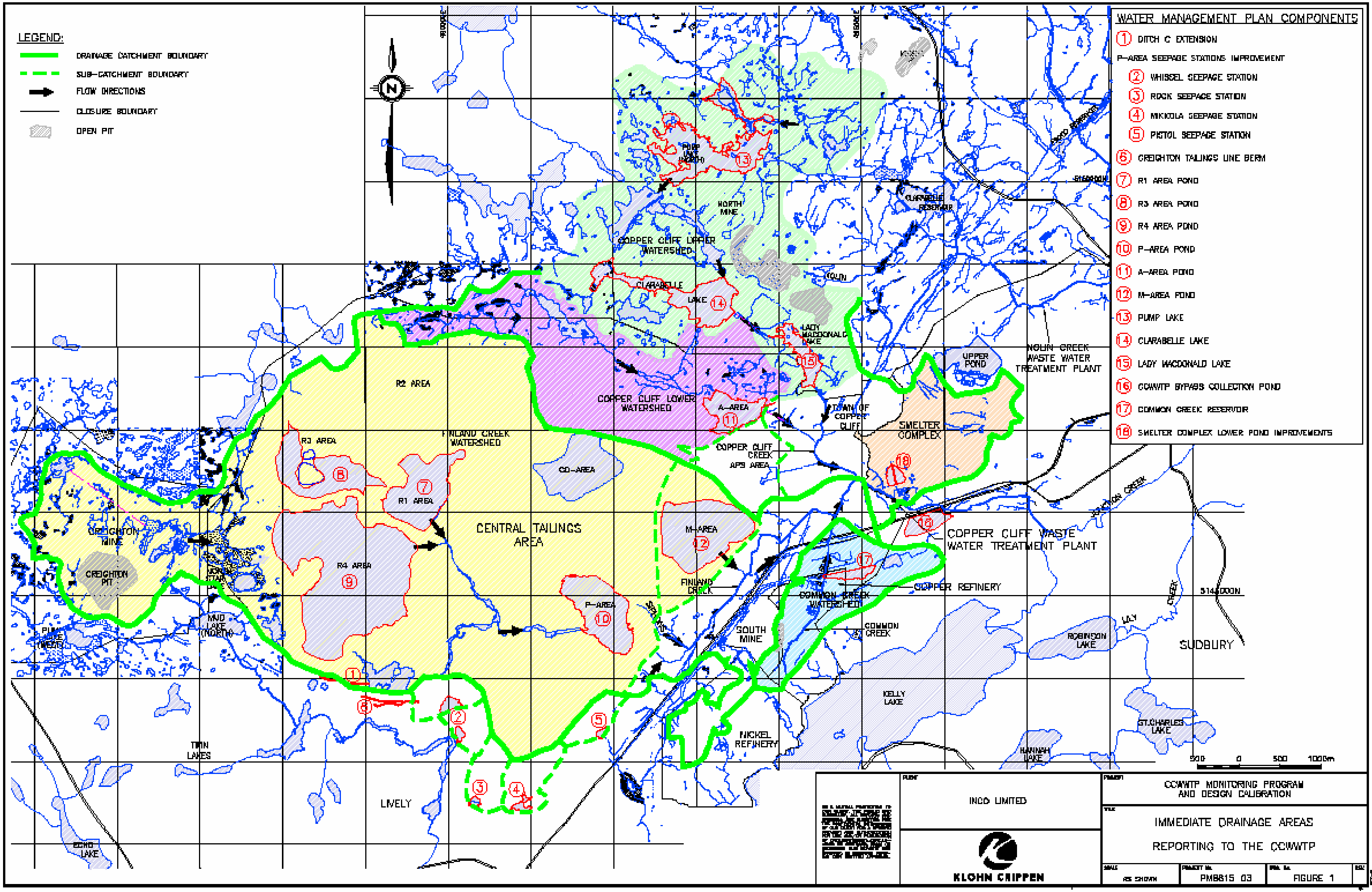

Hydraulic Overload

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Hydraulic Overload

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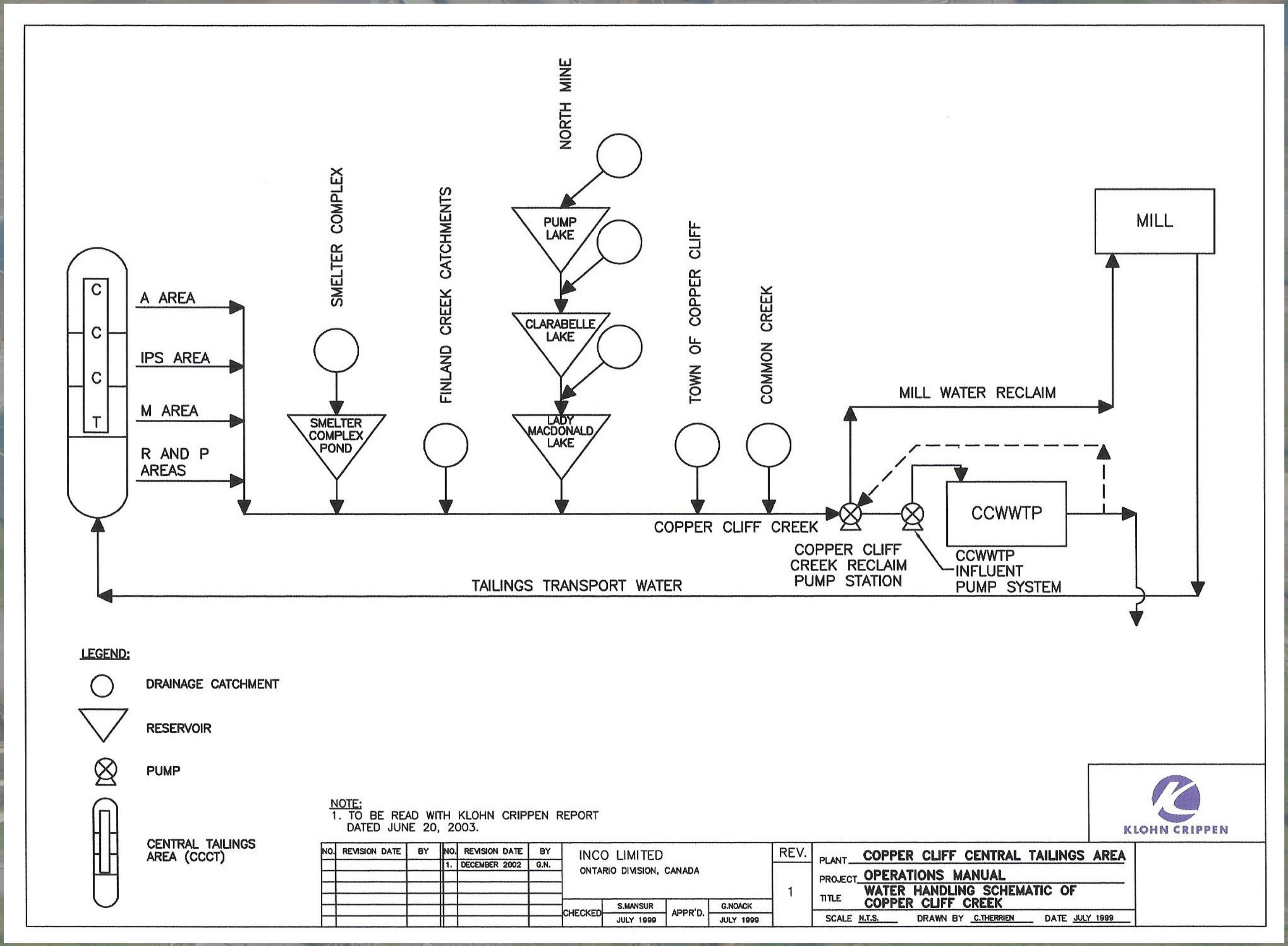
Dependence on Water Recycling



Conceptual Options Review

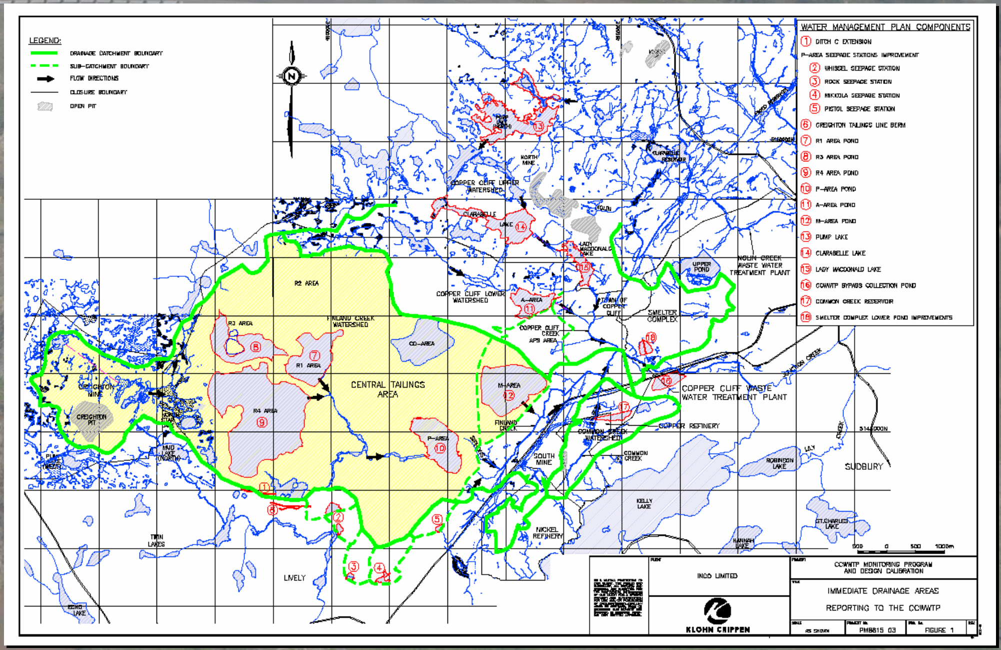
Conceptual options reviewed for whole basin included:

1. Pumping and storage in inactive underground workings
2. Pumping and storage in new surface reservoirs
3. Reservoir attenuation upstream of the Plant
4. Reservoir storage downstream of the Plant
5. Combination of upstream and downstream reservoirs
6. Plant capacity upgrades and smaller attenuating reservoirs
7. Plant capacity upgrades and no attenuating reservoirs

Central Tailings: Seepage Stations

P-Area Seepage Project (1999-2000) involved storage and pumping improvements:

- Whissel Dam (North) Seepage Pond
- Whissel Dam (South) Seepage Pond
- Rock Dam Seepage Pond
- Mikkola Dam Seepage Pond
- Pistol Dam Seepage Pond



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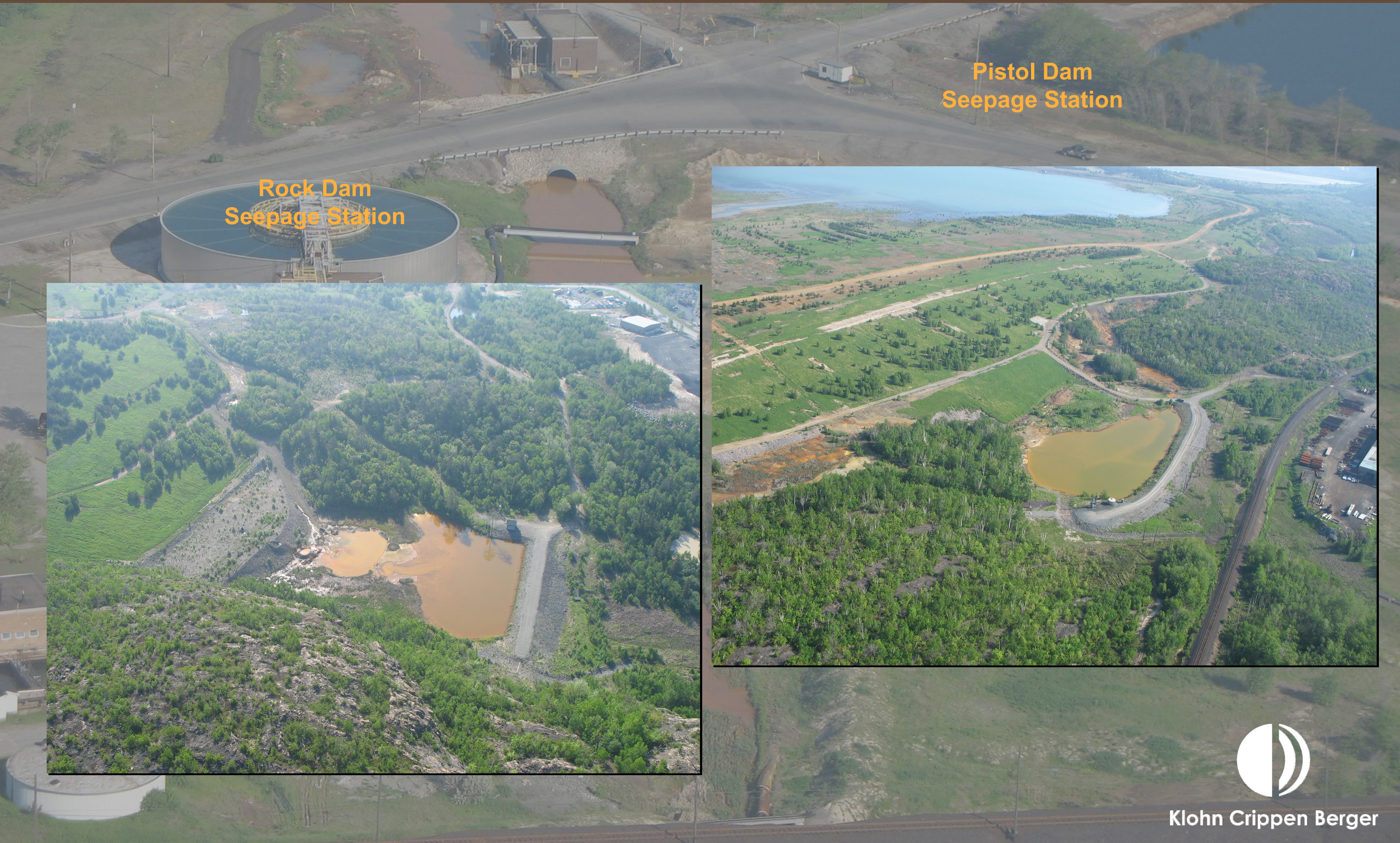
Rock Dam and Pistol Dam: Seepage Stations



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Central Tailings: Major Reservoirs

OM&S Manual and 2006 Filling Plan allow 27km^2 to be controlled with minimal capital improvement

Active Areas (R1, R2, R3 and R4)

- Incorporates sufficient freeboard into annual dam raising plans

- Defines operating water levels and levels that trigger water release to manage overtopping risk

R4 Area and No. 3 Seepage Station

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Central Tailings: Major Reservoirs

- Old Stack Areas (CD, Q, M1, M, P, IPS)
- OMS defines N.O.W.L., EDF HWF., IDF H.W.L. and interventions required to manage overtopping risk

M-Area

P-Area

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Central Tailings: Major Reservoirs

Old Stack – A Area Improvement

Seismic Improvement – 40 m high urban tailings dam

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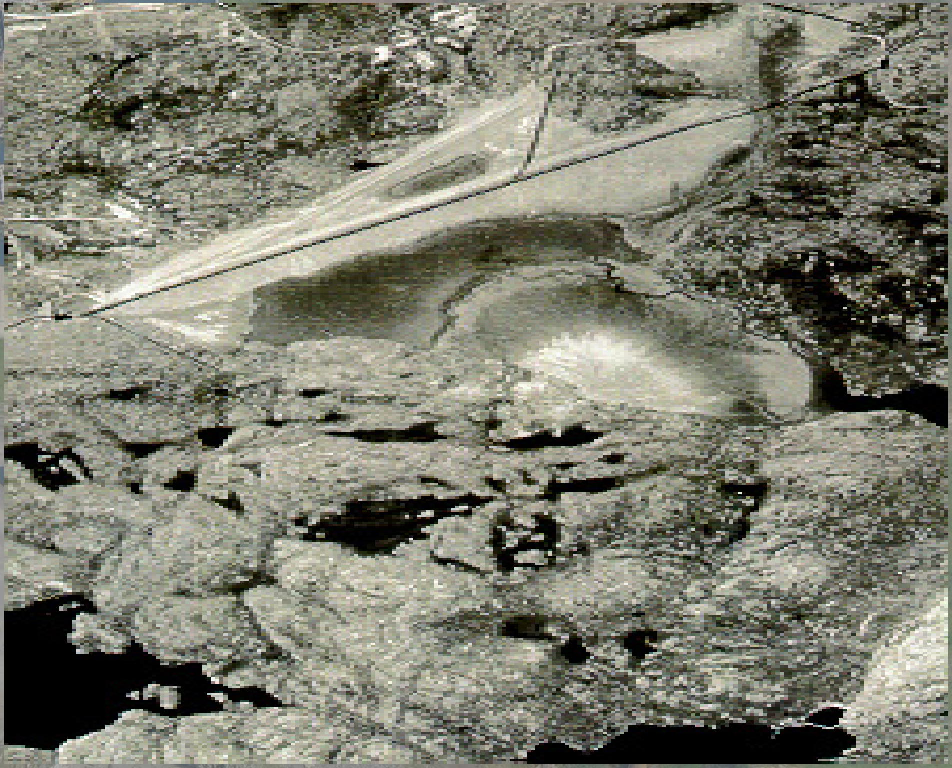
Central Tailings: Major Reservoirs

Old Stack – A Area Dam - Background

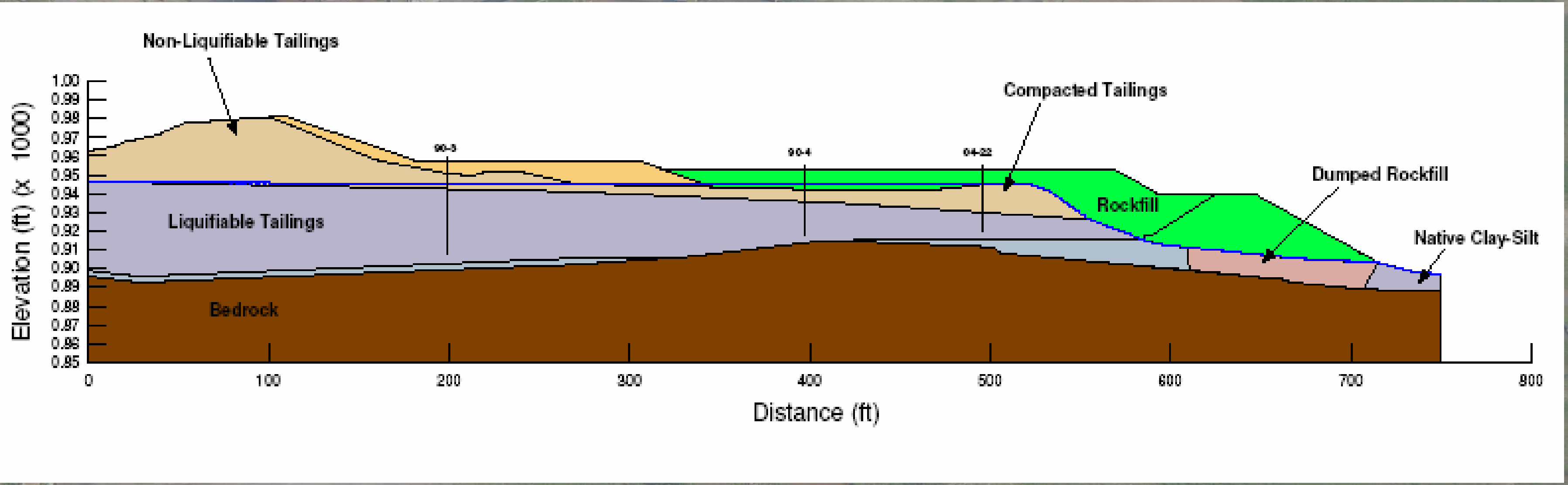
- Originally built in the 1950s as a pipe support berm
- Subsequently used for tailings storage in the 1960's
- The need to store water and increased seismic criteria in Ontario led to need for stability improvements



Central Tailings: Major Reservoirs

A Area Seismic Upgrade:

- Buttressed dam primarily with rock fill but with some compacted tailings
- Buttress was founded on bedrock near (involved removal of saturated tailings and replacement with dumped rockfill)
- Included under-drainage measures in the downstream bench



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Central Tailings: Major Reservoirs

A Area Improvement

- Seismic upgrade
- EDF storage
- New low flow decant
- Fibre optic links
- New emergency spillway
- Tunnel widening to safely pass a PMF
- Stilling basin improvement

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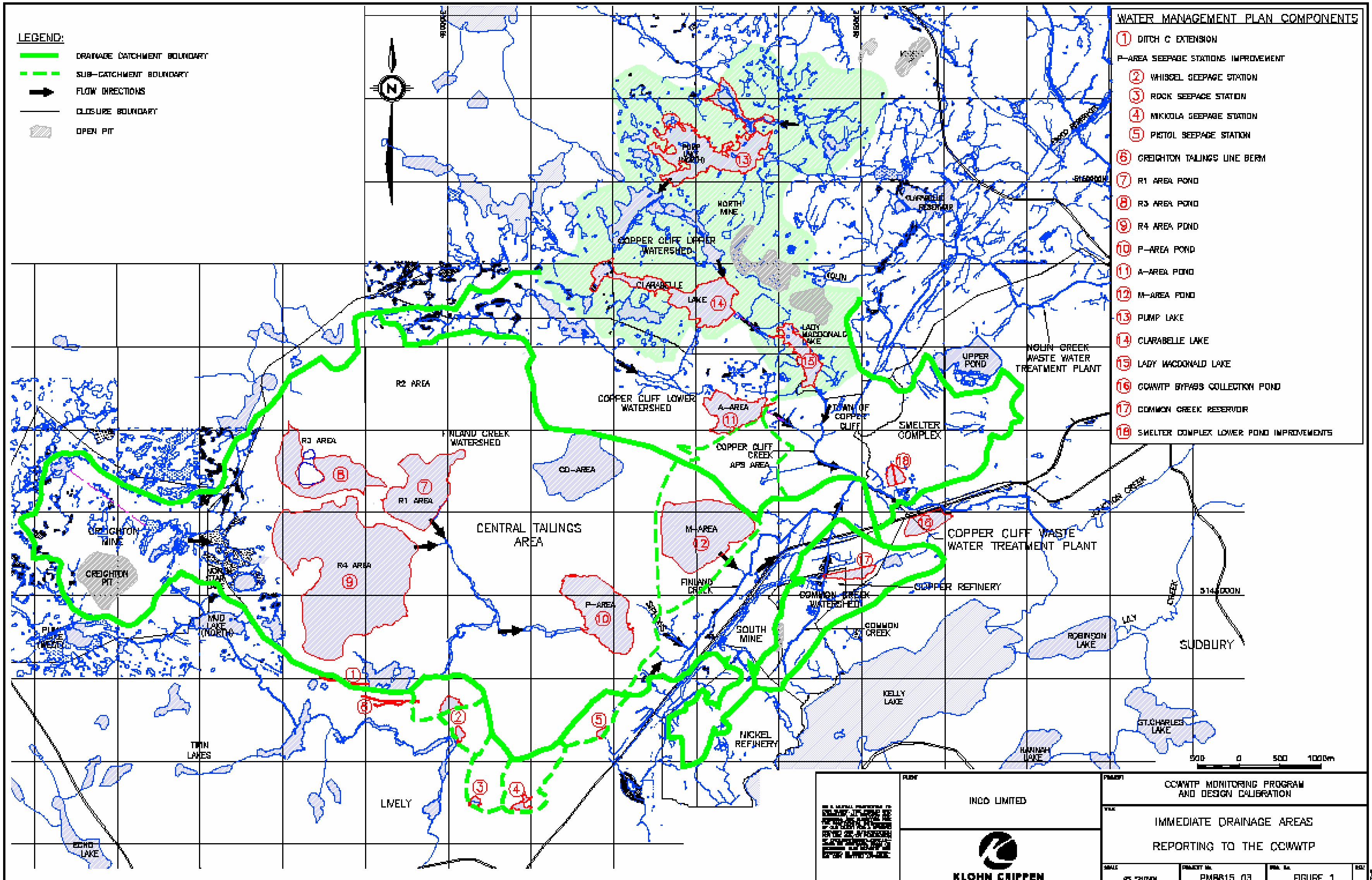

North Mine Lake Improvements

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North Mine Lakes: Major Reservoirs

- Pump Lake, Clarabelle Lake and Lady MacDonald Lake
- New dams, remote controlled decants and emergency spillways
- Decants are monitored/manipulated at CCWWTP by fibre optic links
- OMS defines N.O.W.L., EDF H.W.L., IDF H.W.L. to manage overtopping risk

Pump Lake

Clarabelle Lake

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North Mine Lakes: Major Reservoirs

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Lady MacDonald Lake

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North Mine Lakes: Major Reservoirs

Lady MacDonald Dam

- Was originally a fresh water supply dam for Copper Cliff in the early 1900's
- Was rehabilitated and raised in the 1960's to improve control of mine water inputs and discharge to the CCWWTP

Lady MacDonald Dam

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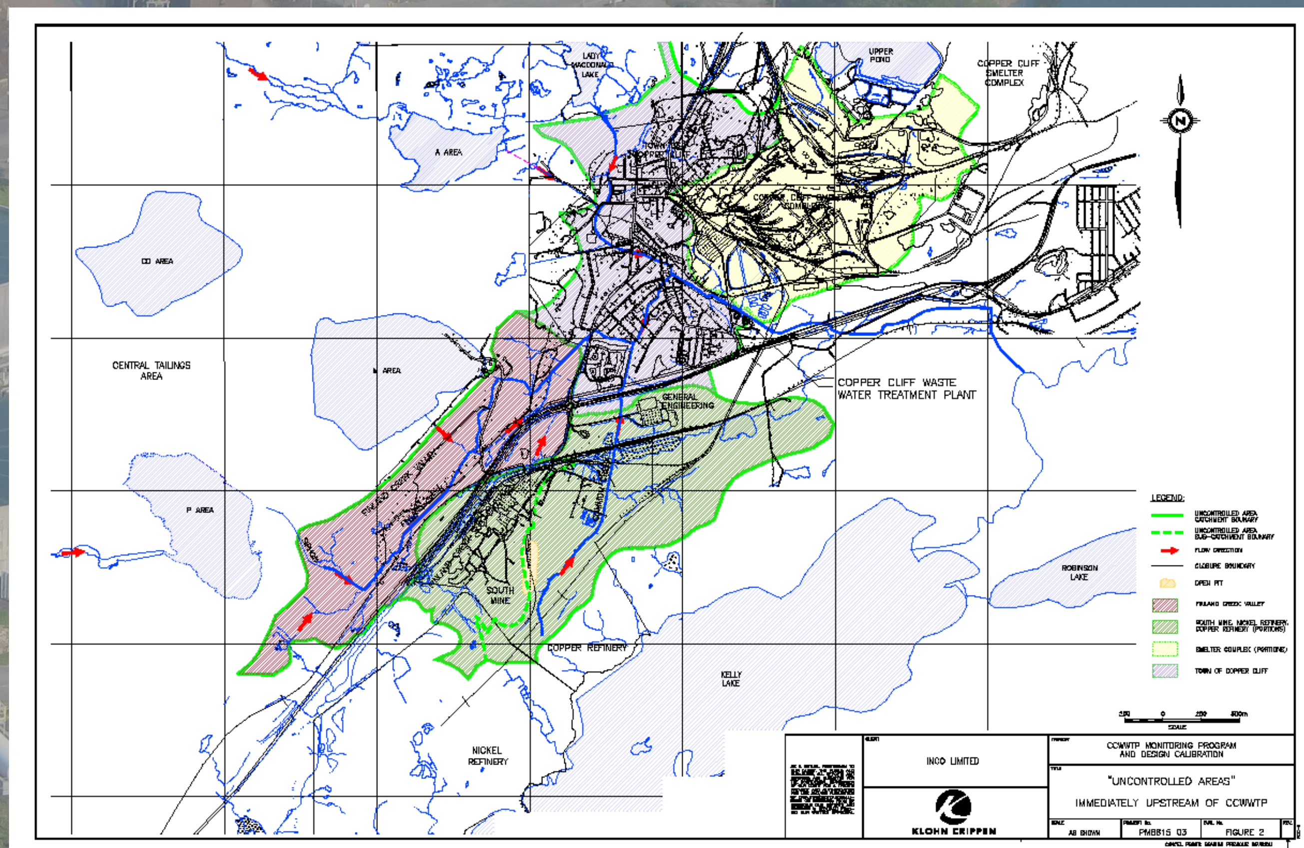
Uncontrolled Areas

> 8 km^2 catchment

- Finland Creek
- Common Creek
- Town of Copper Cliff
- South part of Smelter Complex



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RR# 55 Stormwater Retention Pond

Construction 2001

- Earth fill dam
- Remote controlled pump station
- Wave break
- Emergency spillway
- Fibre optic links
- OM&S defines N.O.W.L.,

  EDF H.W.L.

  IDF H.W.L.

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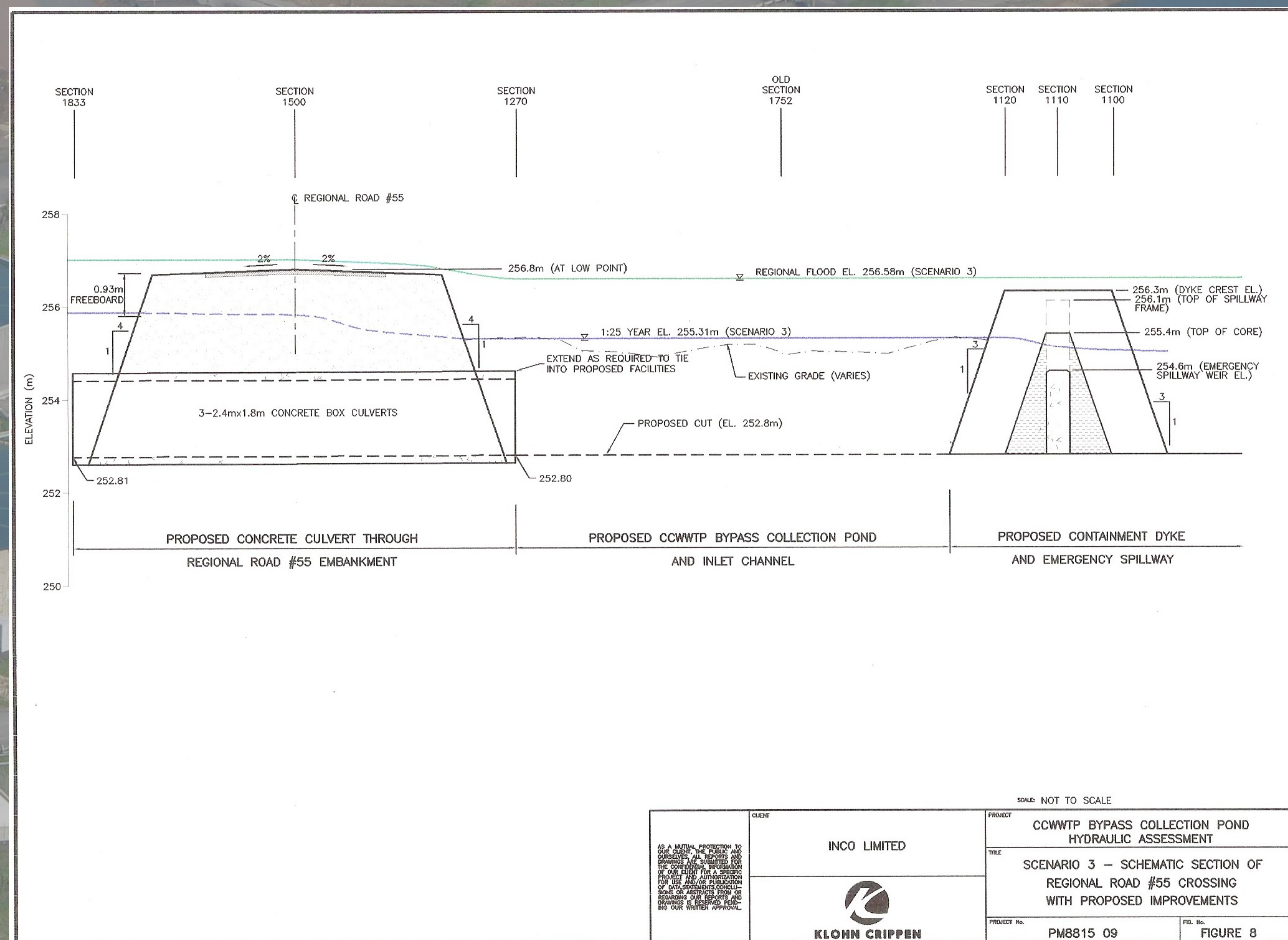
RR# 55 Stormwater Retention Pond

Construction 2001

- Operating characteristics constrained by
  - Freeboard on RR#55 in event of 1:25 year flood
  - Passage of the Regional Flood without increasing flooding in the Town of Copper Cliff



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Common Creek Improvements

Construction 2007

- Sheet pile dam
- Remote controlled decant
- Emergency spillway
- Fibre optic links
- OM&S defines N.O.W.L.,
  EDF H.W.L.
  IDF H.W.L.

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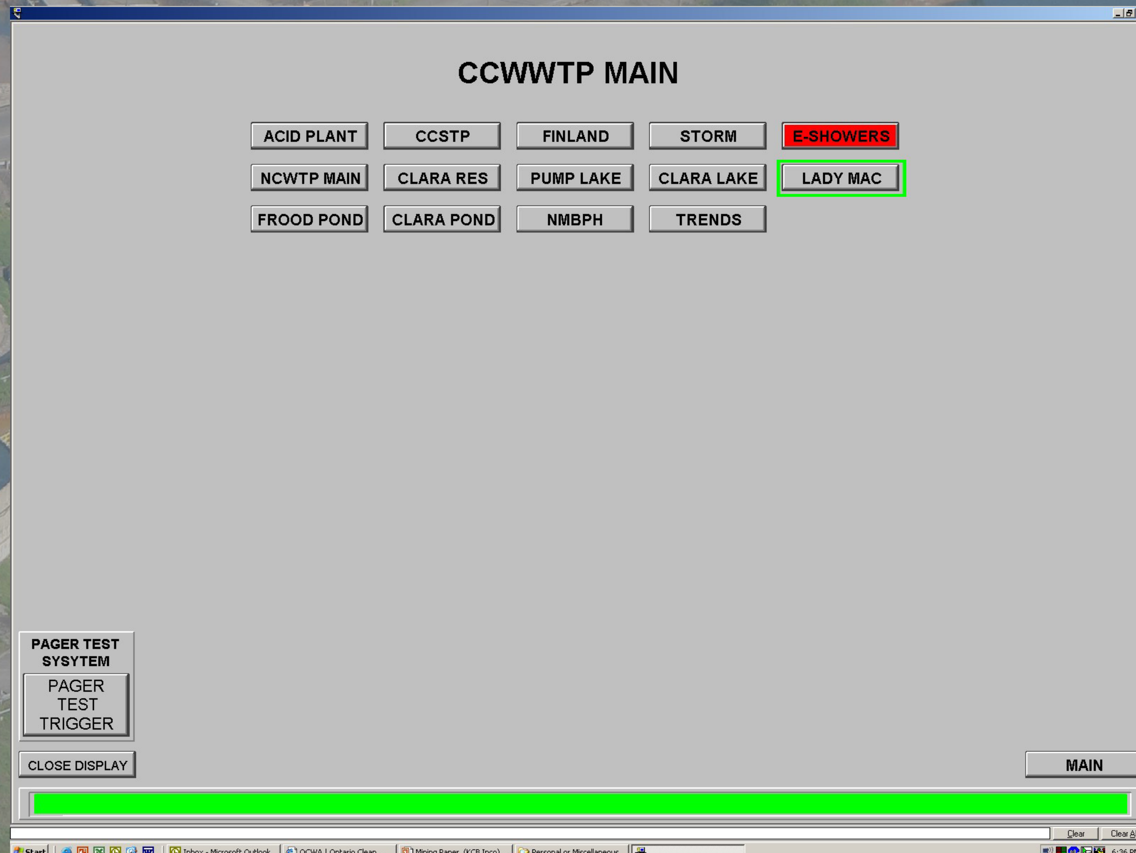
CCWWTP Control Panel

Human Interface

- Touch screen menu
- Continuous remote monitoring
- Remote manipulation
- Fail safe procedures can be built in
- Automatic call out in case of abnormal conditions / problems



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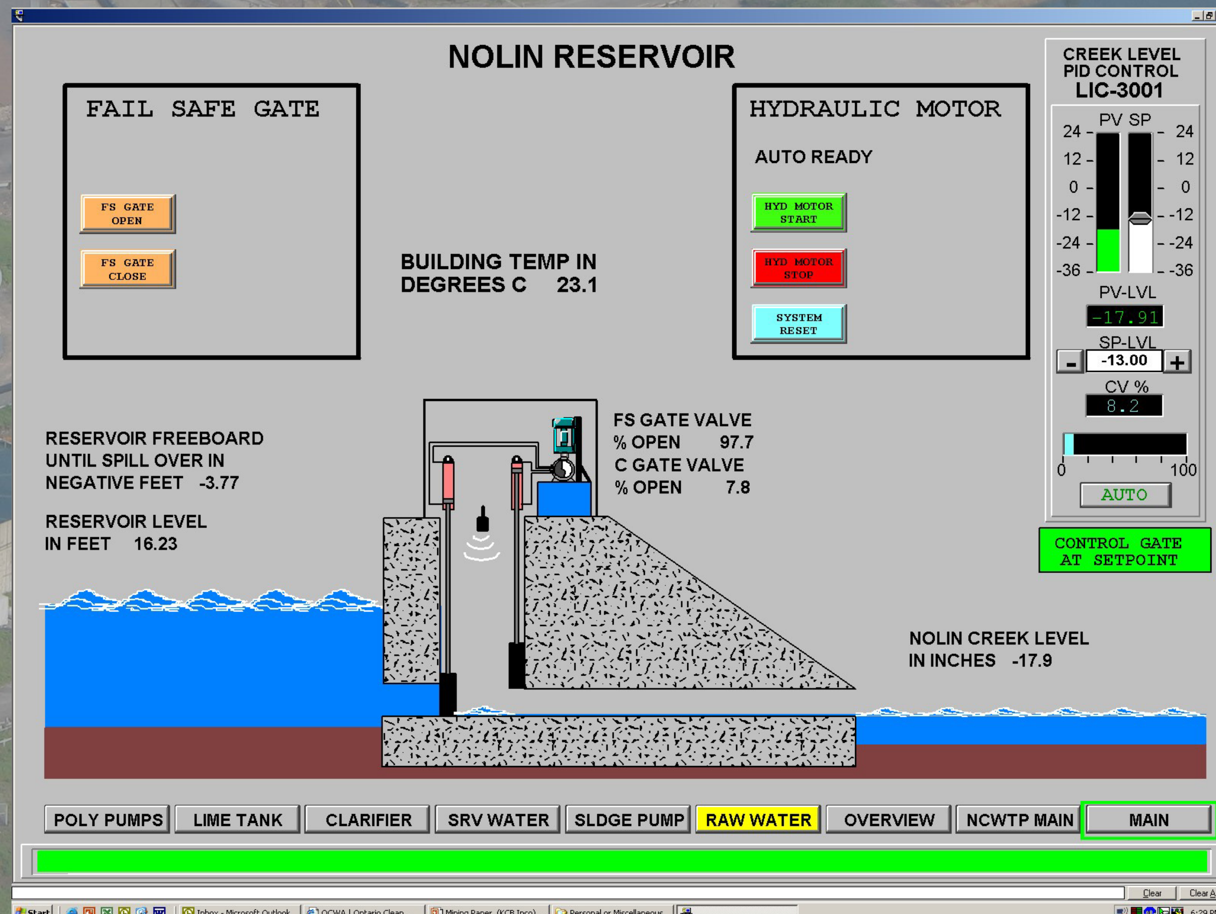
CCWWTP Control Panel

Human Interface

- Water level
- Reservoir freeboard
- Gate control
- Gate motor statistics
- Building temperature
- Trending
- Integrated with CCWWTP control systems



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Closing Remarks

Remote controlled system may seem elaborate

- Operationally superior
- Makes clear economic sense for closure (200 years)
- A modern solution to a old-legacy challenge

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