Waste Rock Management at Heath Steele

Noranda Inc.

Presentation Outline

- Site location
- Site background
- Waste rock management options
  - Removal of waste rock
  - Dry covers
  - Layering waste piles with limestone
  - Do nothing option
- Collection and treatment


Brunswick
Heath Steele
QUÉBEC
NEW BRUNSWICK
MAINE
Chaleur Bay
Gulf of St. Lawrence
Miramichi Bay
Maria
Nouvelle
Dalhousie
Carleton Centre
Caplan
Saint-Siméon
Bonaventure
Paspébiac
New Carlisle
Dalhousie Junction
Eel River Crossing
Matapédia
Atholville
Campbellton
Jacquet River
Pointe-Verte
Grande-Anse
Pointe-Canot
Bas-Caraquet
Petit Rocher
Caraquet
Lamèque
Stonehaven
Nigadoo
Beresford
Shippagan
Burnsville
Janeville
Paquetville
Inkerman
White Brook
Kedgwick
Restigouche
St.-Quentin
Bathurst
St.-Isidore
Tracadie
Val Comeau Provincial Park
Mount Carleton Resource
Nepisiguit
Notre-Dame-de-Lourdes
Ste.-Anne-de-Madawaska
Van Buren
Hamlin
Grand Falls
AROOSTOOK
Limestone
Plaster Rock
Aroostook
Fort Fairfield
Perth-Andover
Easton
River de Chute
Westfield
Mars Hill
Glassville
Bristol
Centreville
Mount Pleasant
Monticello
Littleton
Lindsay
Hartland
Stanley
McGivney
Cross Creek Station
Nashwaak Bridge
Doaktown
McNamee
Boiestown
Upper Blackville
Blackville
Renous
Quarryville
Junction
Derby
Whitney
Newcastle
Chatham
Loggieville
Beaver Brook Station
Bartibog Bridge
Neguac
Burnt Church
Hardwicke
Miramichi
Pointe-Sapin
Nelson-Miramichi
Barnaby River
St. Margarets
Kouchibouguac
Rogersville
St. Louis de Kent
Aldouane
Richibucto
Saint-Charles
Rexton
Kent Junction
Harcourt
Bouctouche
St. Anthony
St.-Paul
Notre Dame
Salmon
Chipman
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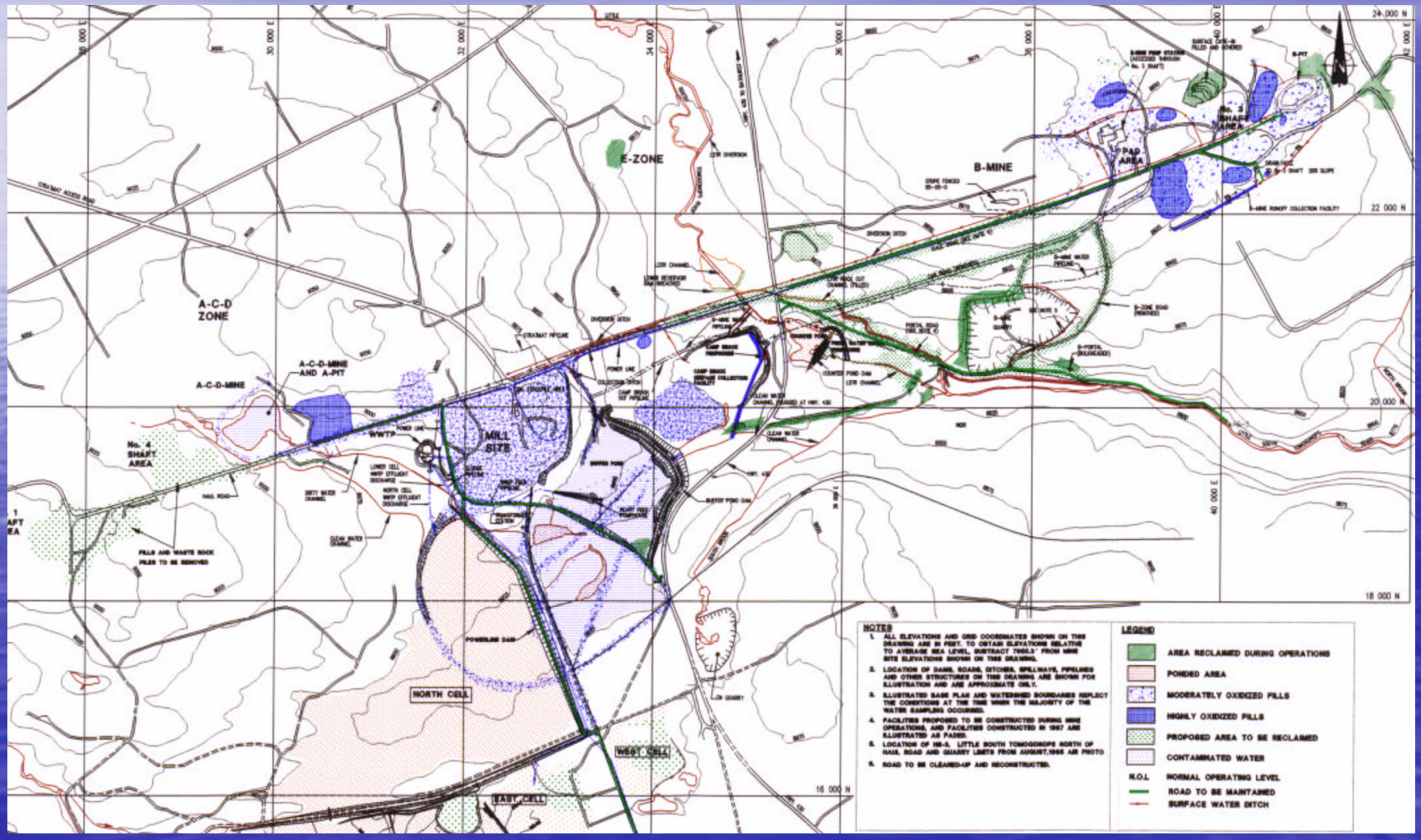
Heath Steele Site

Heath Steele Mine/ Mill Area



Heath Steele Site History

- Mining commenced in 1957
- Temporary closures on several occasions due to metal prices
- Long recent closure from 1983 to 1989
- Mine reopened in 1989 and closed in 1999 due to depleted ore reserves

Heath Steele Operations

- Three mines:
  - B-Mine- Underground and open pit
  - C-Mine- Underground and open pit
  - Stratmat- Underground and open pit
- Mill- 2700 tonnes/day producing lead, zinc and copper concentrates

Closure Objectives

- Protect public health and safety
- *Minimize environmental impacts as permitted by cost effective technologies available today*
- Allow for productive use of mine site and surrounding areas where practically possible

Mine Waste

- Waste rock was used widely on the site for roadways, construction pads and pipe beds
- The site is spread out over a large area with two Salmon streams running through the site
- AMD from waste rock is very strongly contaminated
- Bedrock is very fractured so collection of contaminated runoff is difficult

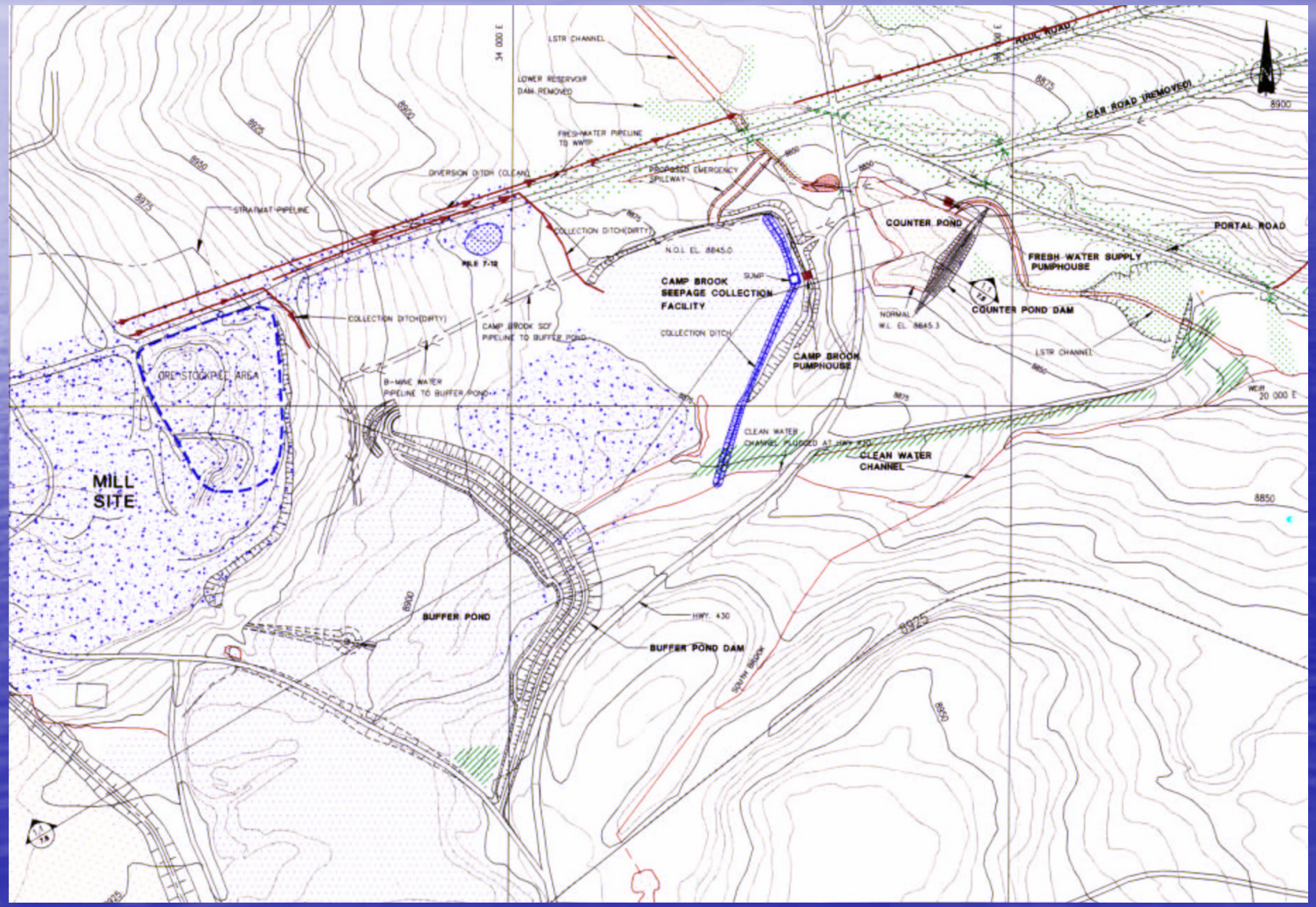
Waste Rock Management Options

- Existing piles:
  - Leave waste rock in place, as is and collect runoff for treatment
  - Excavate waste rock and move it to open pits
  - Cover waste rock with dry cover
- New Piles:
  - Incorporate limestone into pile construction and return waste rock to pit for closure

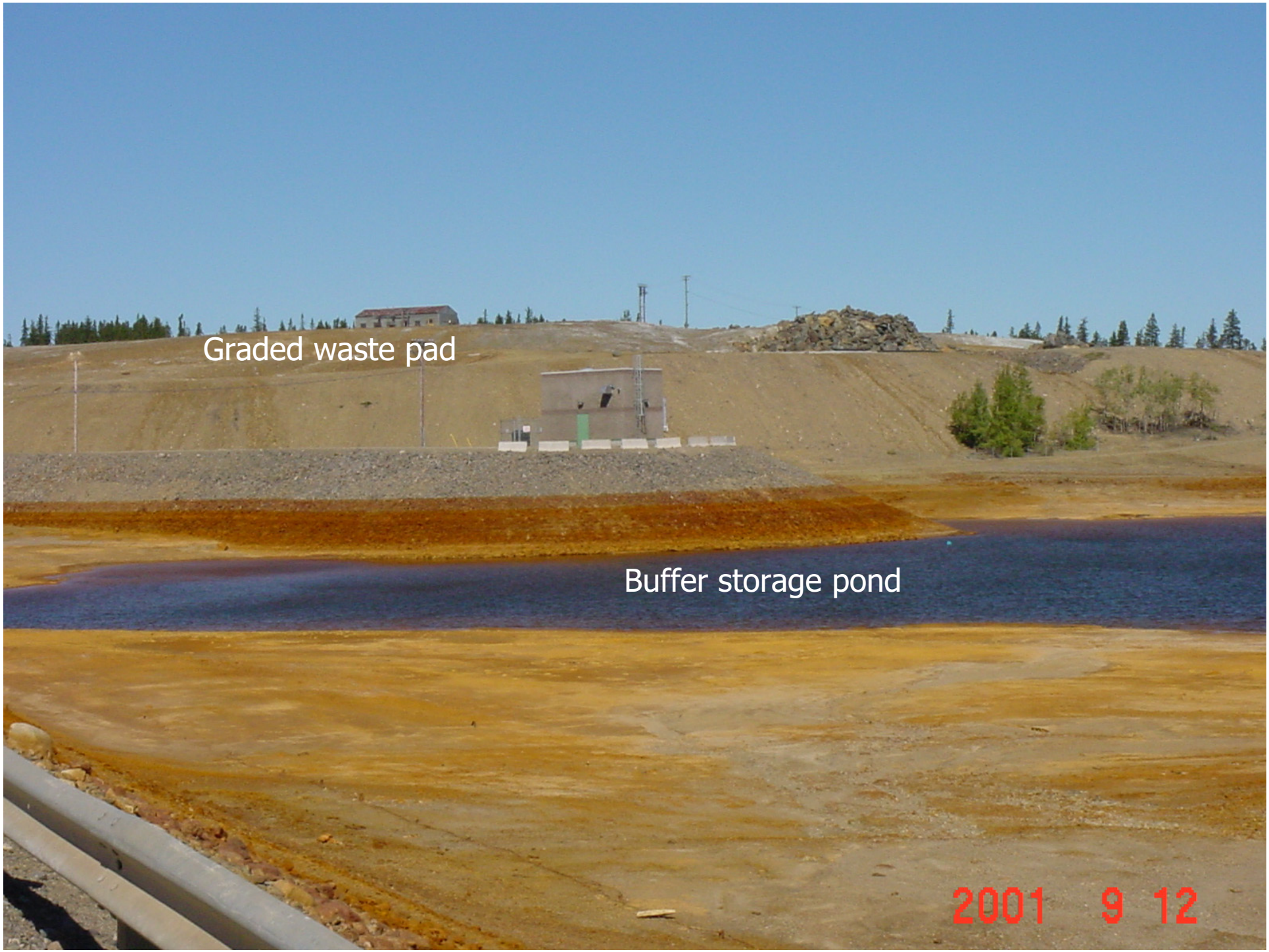
Leaving Waste Rock As Is

- Some areas can not be diverted from the collection system
- Some areas have too much waste rock to move economically
- The waste rock in these areas is graded for aesthetics and systems designed to collect the AMD contaminated runoff for treatment

Mill Area


MILL SITE
ORE STOCKPILE AREA
BUFFER POND
BUFFER POND DAM
CAMP BROOK SEEPAGE COLLECTION FACILITY
CAMP BROOK PUMPHOUSE
COUNTER POND
COUNTER POND DAM
FRESH WATER SUPPLY PUMPHOUSE
PORTAL ROAD
CAR ROAD (REMOVED)
CLEAN WATER CHANNEL
LSTR CHANNEL
LOWER RESERVOIR DAM REMOVED
FRESH-WATER PIPELINE TO WWTP
DIVERSION DITCH (CLEAN)
PROPOSED EMERGENCY SPILLWAY
STRATMAT PIPELINE
COLLECTION DITCH(DIRTY)
PILE 7-12
N.O.L EL. 8845.0
SUMP
NORMAL W.L. EL. 8845.3
CAMP BROOK SCF PIPELINE TO BUFFER POND
B-MINE WATER PIPELINE TO BUFFER POND
HWY. 430
SOUTH BROOK
WEIR
34 000 E
20 000 E
8900
8875
8850
8825

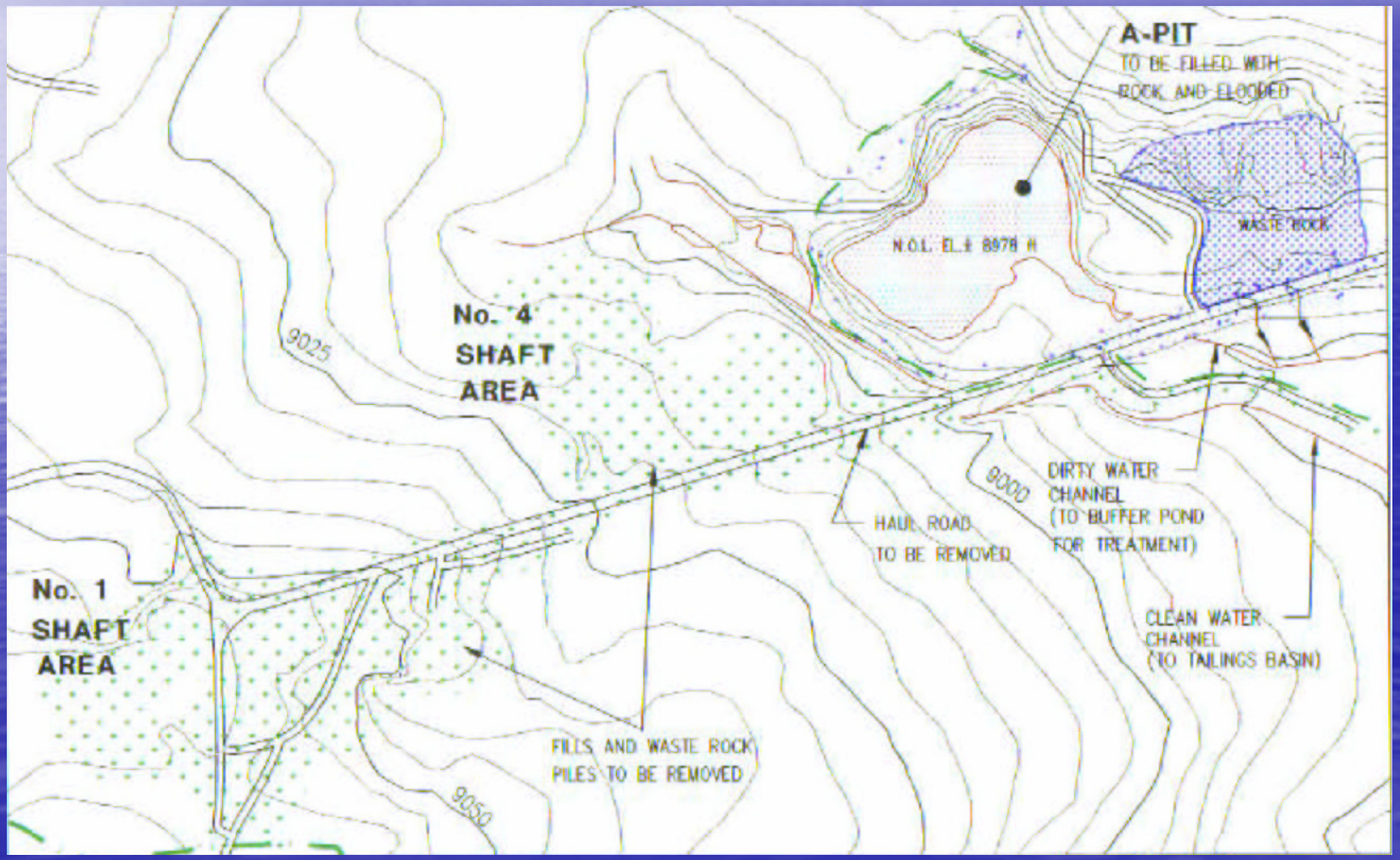

Mill waste pads


Graded waste pad
Buffer storage pond
2001 9 12

Moving Waste Rock

- Some watersheds can be diverted from the collection system if they are cleaned
- Waste rock from these areas is excavated and moved into one of the open pits
- Pits will be covered with till when they are full to divert water. The area is the limed to reduce the effects of any residual waste rock
- May take several years for ground water to flush

C-Zone Area

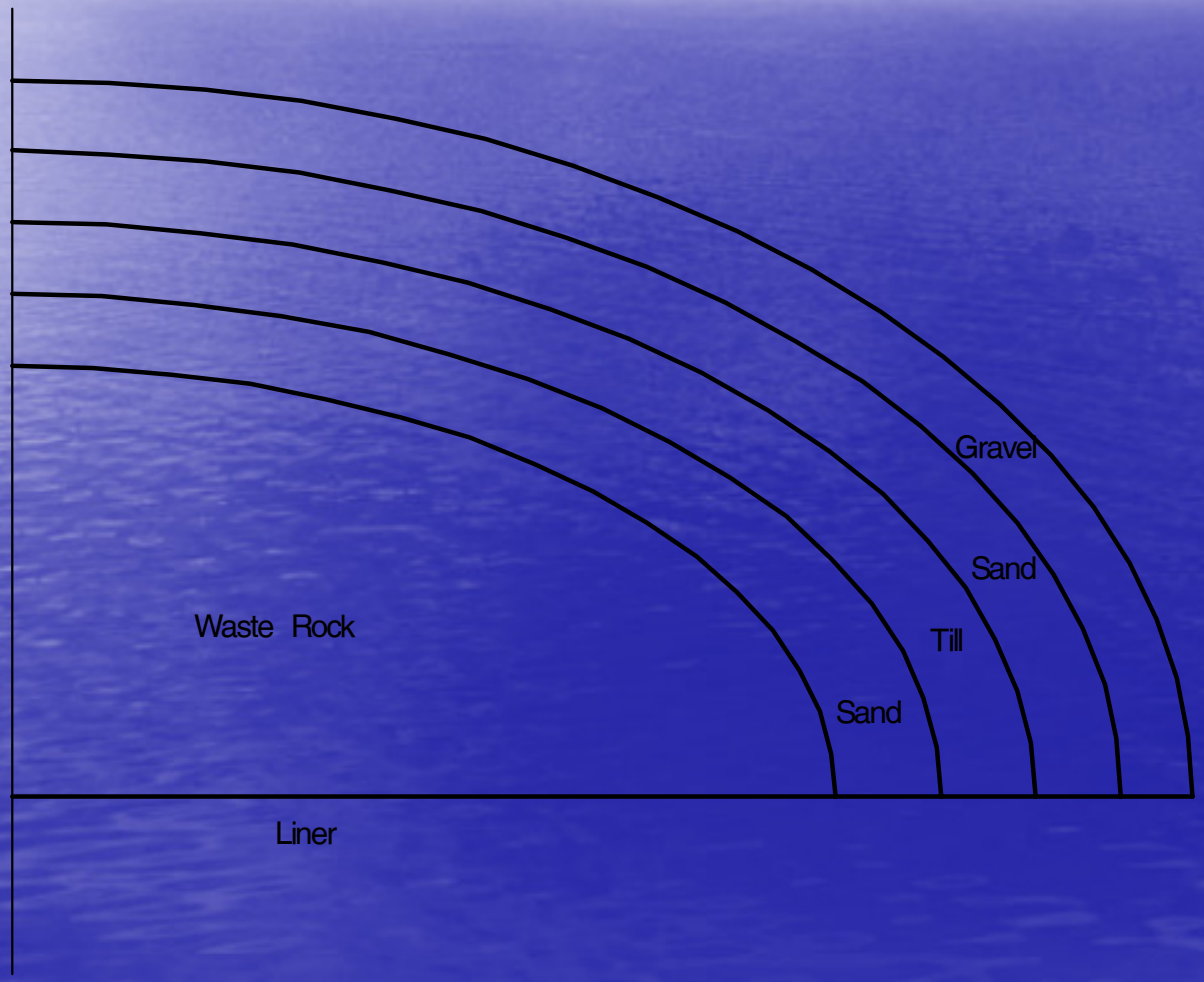

A-PIT
TO BE FILLED WITH
ROCK AND FLOODED
WASTE ROCK
N.O.L. EL.± 8978 ft
No. 4
SHAFT
AREA
9025
9000
DIRTY WATER
CHANNEL
(TO BUFFER POND
FOR TREATMENT)
HAUL ROAD
TO BE REMOVED
No. 1
SHAFT
AREA
CLEAN WATER
CHANNEL
(TO TAILINGS BASIN)
FILLS AND WASTE ROCK
PILES TO BE REMOVED
9050


Cleaned waste pads

Dry Covers

- Pile 7/12 (MEND project)
  - Four layer cover; sand/ saturated till/ sand and gravel/ erosion protection
  - Saturated till provides an oxygen barrier
  - Oxygen levels in the pile were very low, much less than 1%
  - Seepage volumes from the pile were reduced to only 2% of precipitation incident on the pile
  - Seepage still requires treatment prior to release
  - Cost is high, $28.00/ sq. m, excluding engineering and quality control costs

Pile 7/12- Engineered Cover



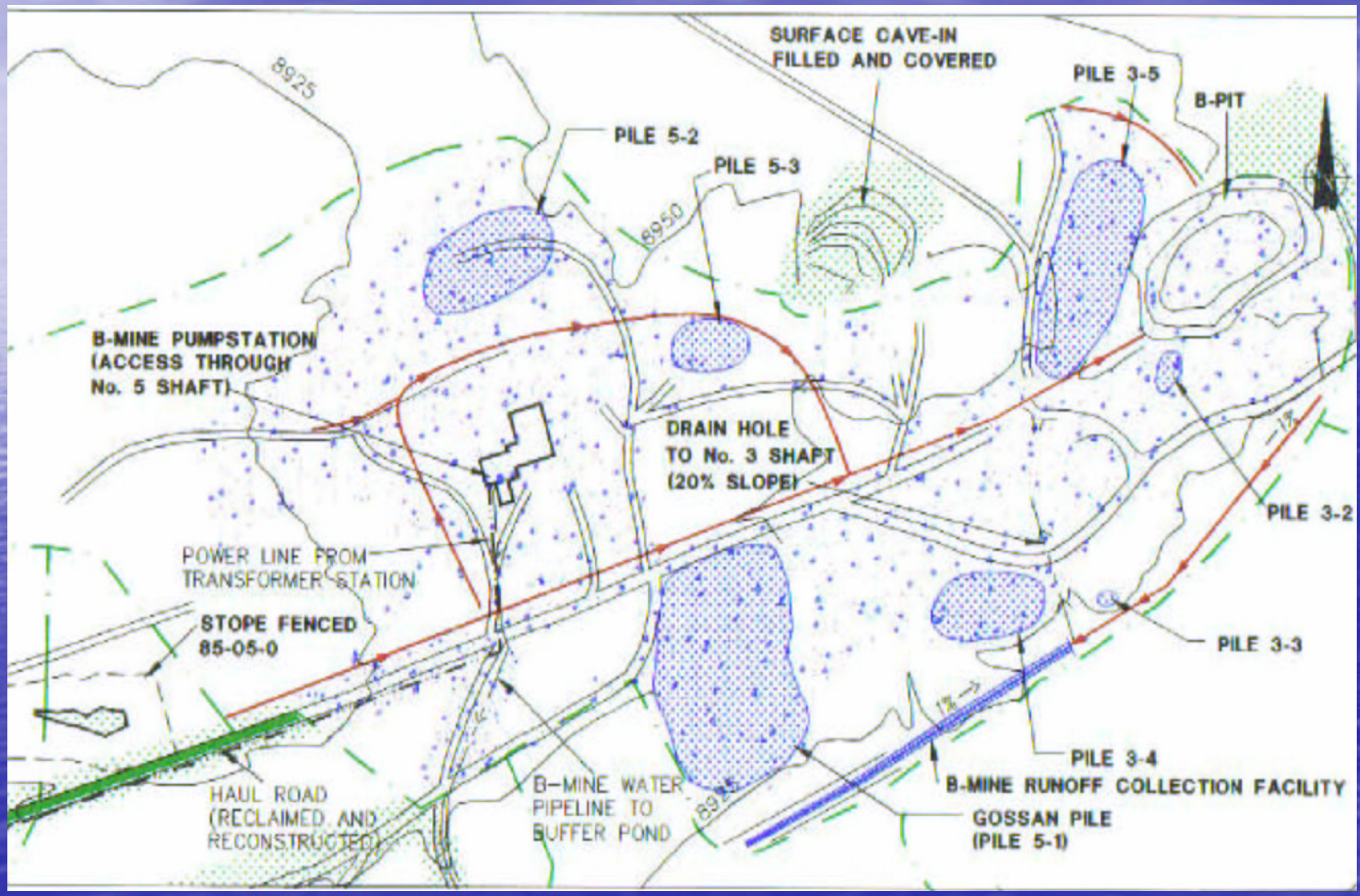

Pile 7/12- Engineered cover
2003 11 25

Stratmat Waste Rock Pile

- Design specified that the pile would be built in layers with 2-3 ft. of limestone added between each layer
- Limestone would prevent AMD generation
- Waste rock was to be returned to the pit and covered at closure
- Pile generated AMD very quickly and pit was required as buffer storage for collection and treatment of the runoff
- Perpetual collection and treatment is now the accepted closure plan for the site


Stratmat Overburden Pile
Stratmat Waste Pile
limestone

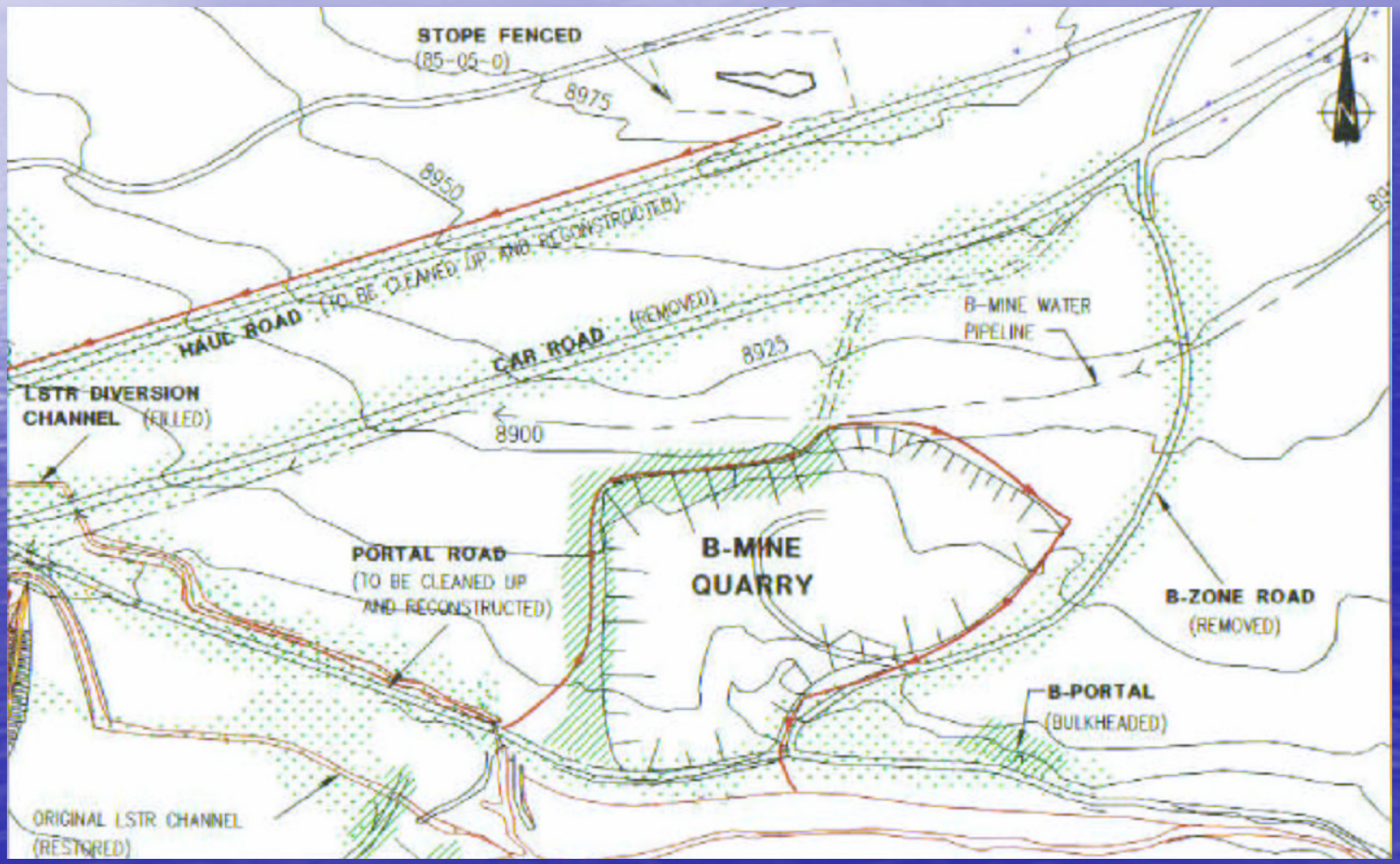
B-Mine Area


SURFACE CAVE-IN
FILLED AND COVERED
PILE 3-5
B-PIT
8925
PILE 5-2
PILE 5-3
8950
B-MINE PUMPSTATION
(ACCESS THROUGH
No. 5 SHAFT)
DRAIN HOLE
TO No. 3 SHAFT
(20% SLOPE)
PILE 3-2
POWER LINE FROM
TRANSFORMER STATION
STOPE FENCED
85-05-0
PILE 3-3
PILE 3-4
B-MINE RUNOFF COLLECTION FACILITY
HAUL ROAD
(RECLAIMED AND
RECONSTRUCTED)
B-MINE WATER
PIPELINE TO
BUFFER POND
8975
GOSSAN PILE
(PILE 5-1)


B-Mine waste pads


B-mine pump station
2001 9 12

LSTR River Area



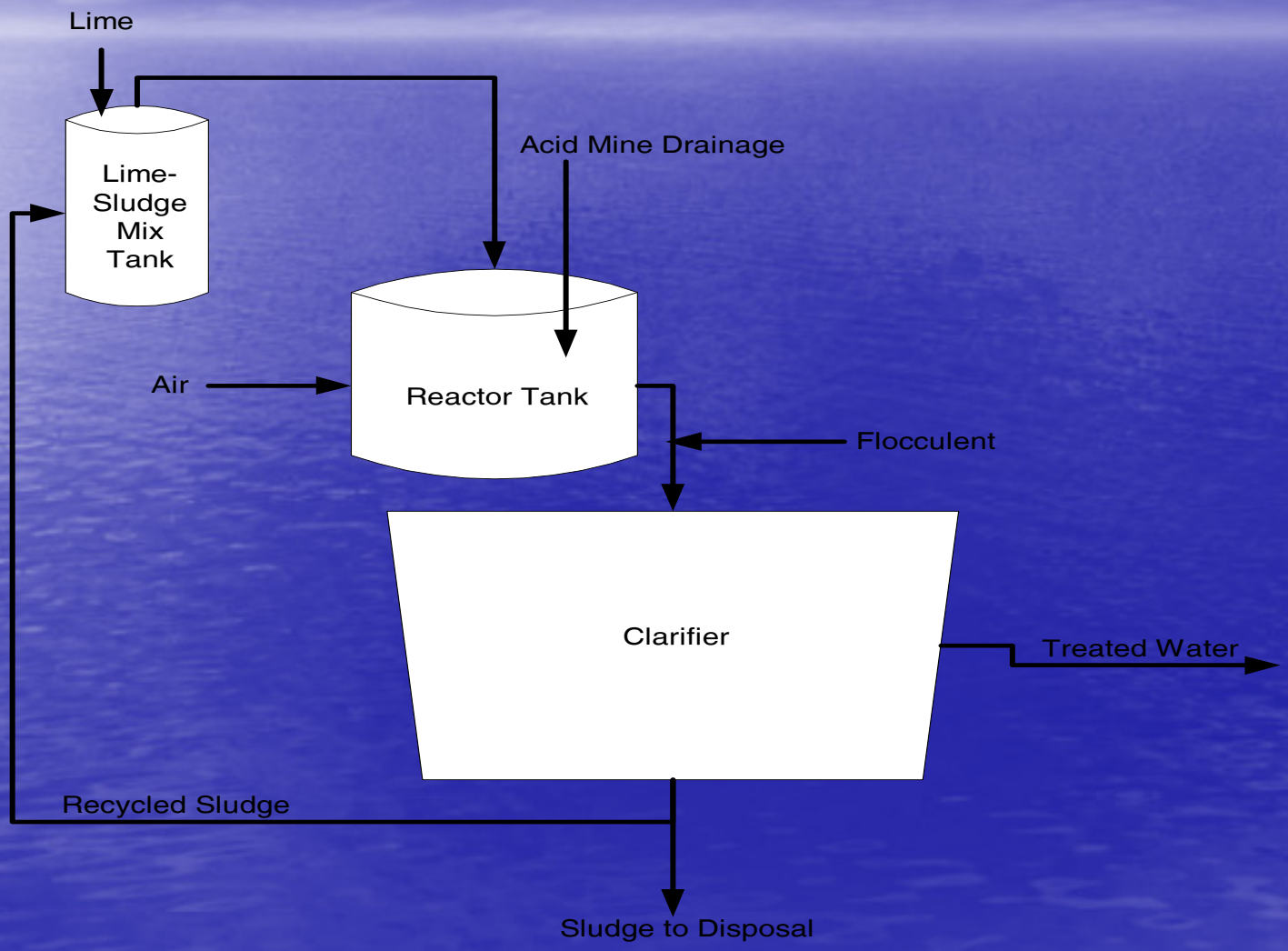
AMD Collection and Treatment

- Ditches, ponds and pumpstations must be constructed to collect AMD from waste rock (10 pumpstations)
- AMD must be treated prior to release to the environment (1 million cubic meter buffer storage pond and 20,000 L/min HDS treatment plant at Heath Steele)

Process Automation

- All AMD pumpstations are on a PLC highway with the treatment plant
- All non-normal events on the highway are alarmed to a text pager via auto dialler program
- PLC highway can be accessed via high speed satellite internet connection for off site control

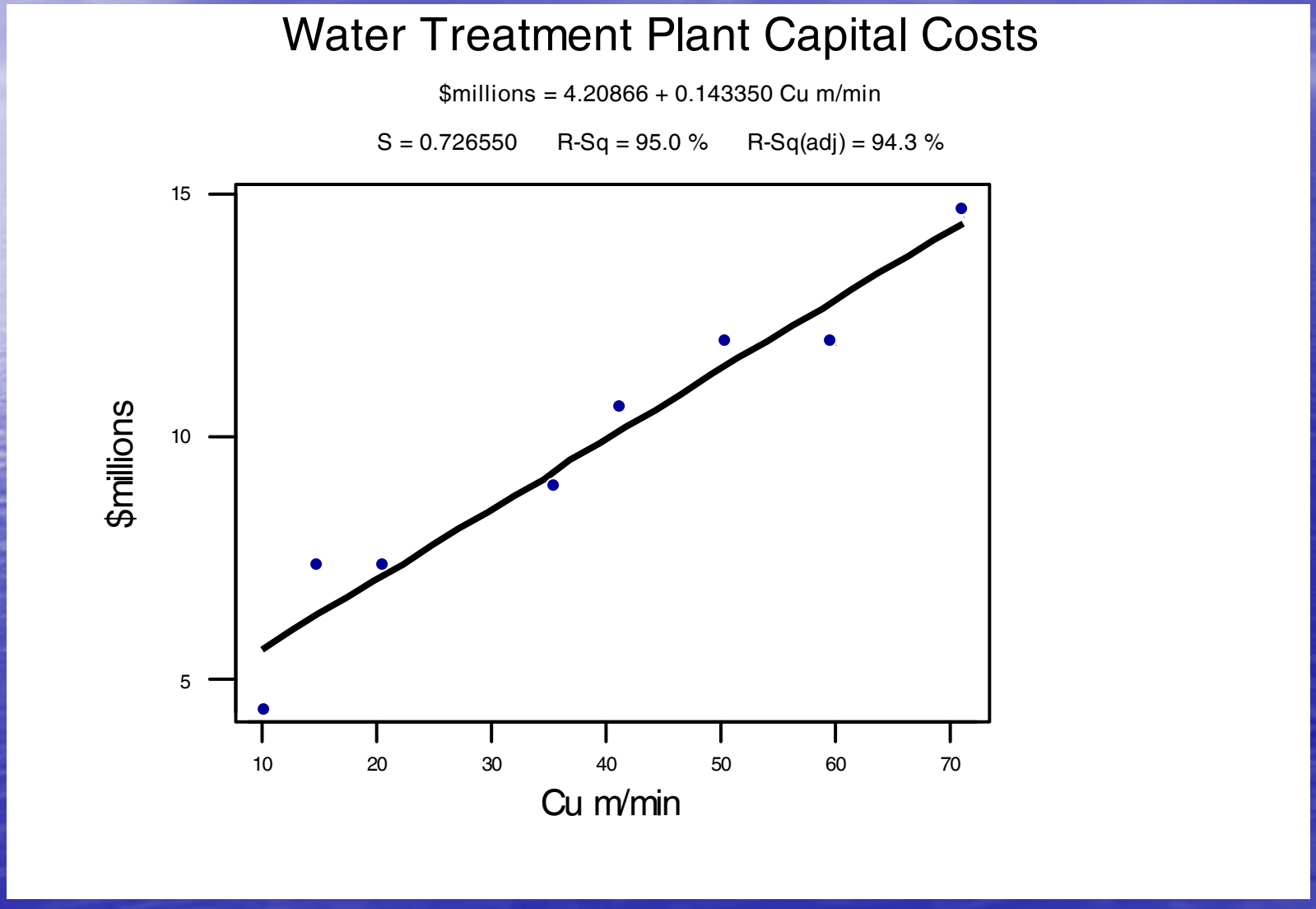
Heath Steele HDS Plant



Heath Steele Treatment Plant

Cost of Plant	$7 million
Cost of water management	$5 million
Treatment cost (reagents, power)	$0.15/ cubic meter
Maximum feed rate	20,000 L/min
Clarifier diameter	100 ft.

HDS Plant Capital Costs




Heath Steele water treatment plant

Thank You

Noranda Inc.