

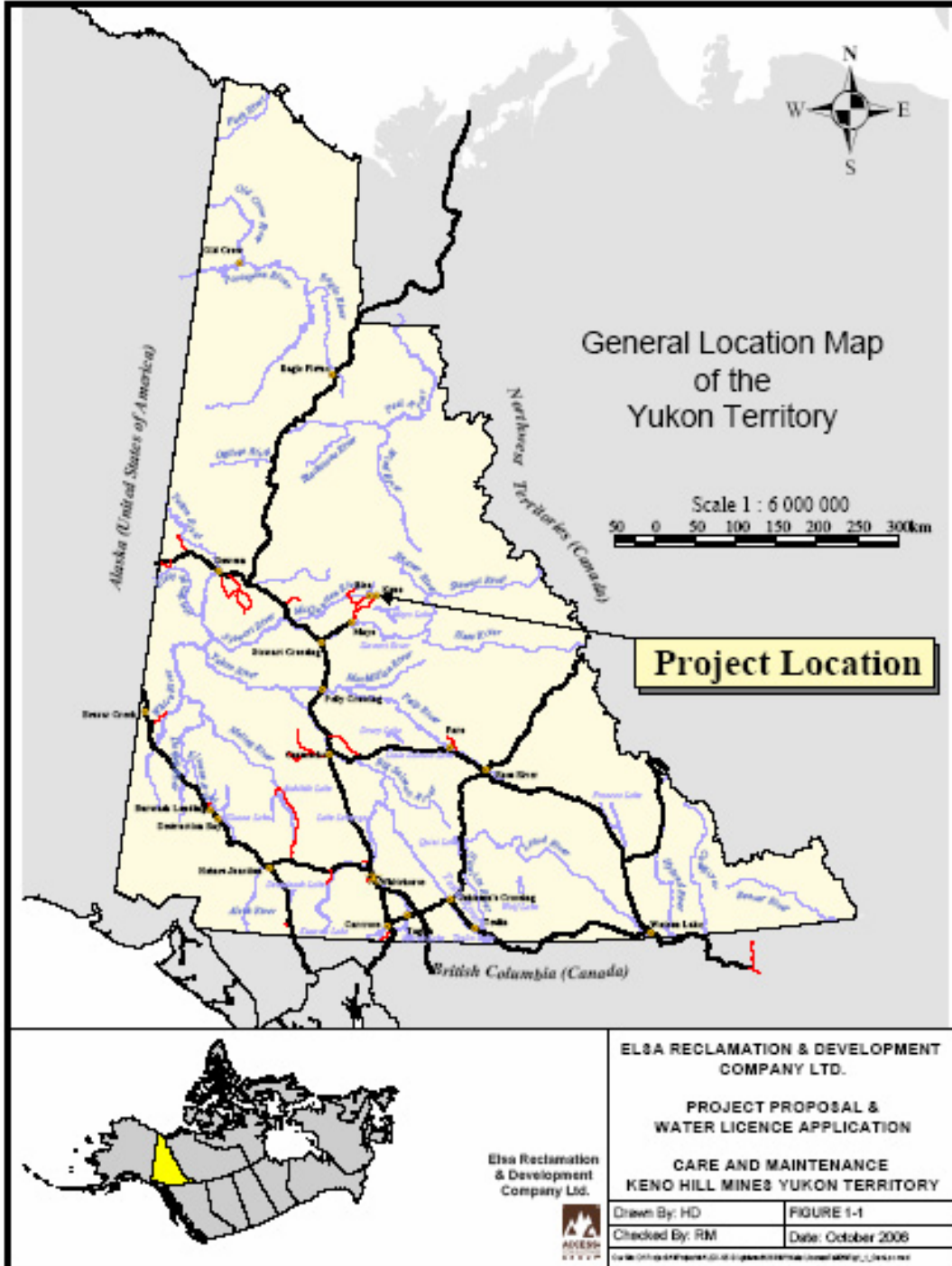
# Mine Drainage Issues at Keno Hills Mine, Yukon



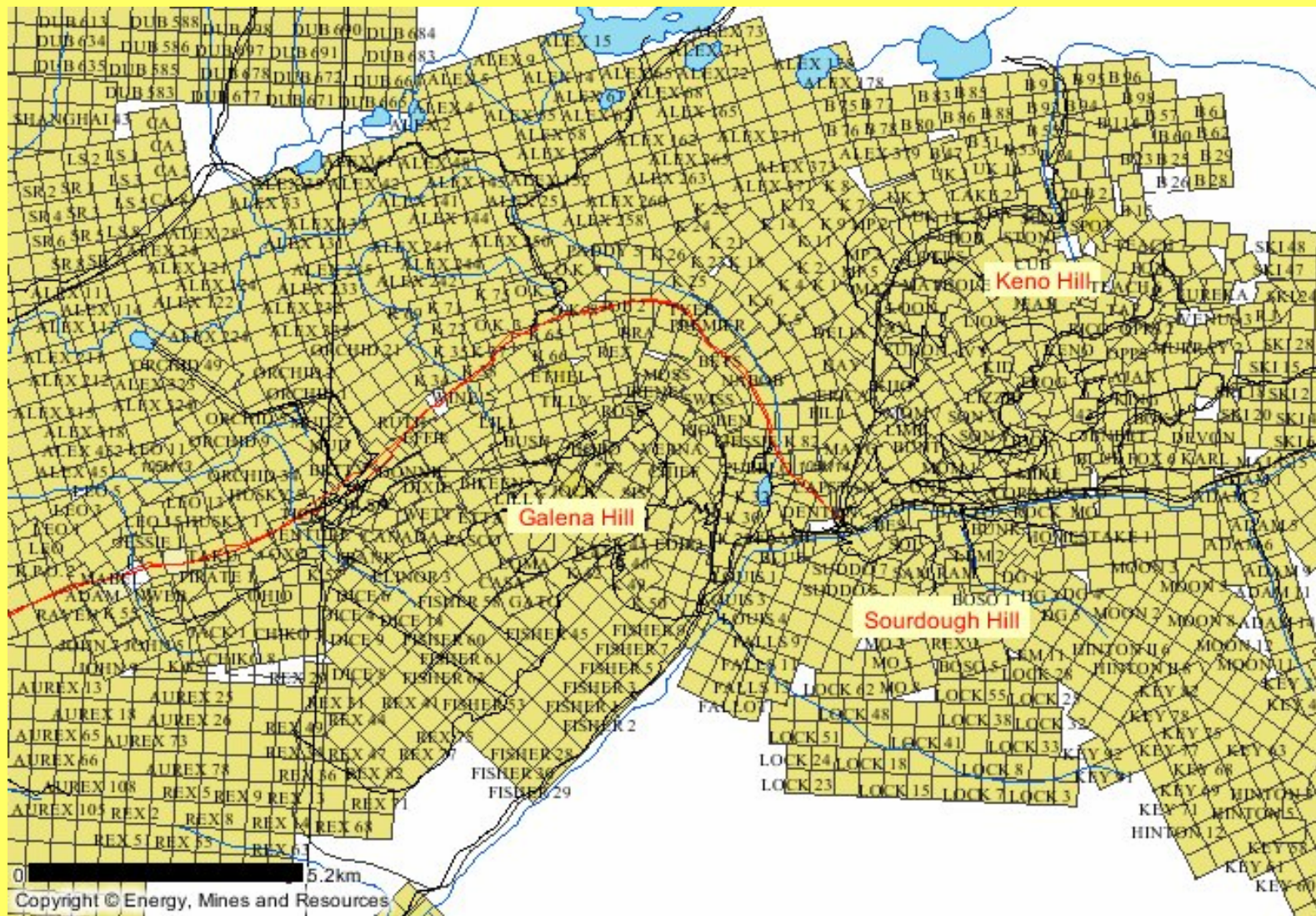
# Keno Hill Mines (formerly UKHM)

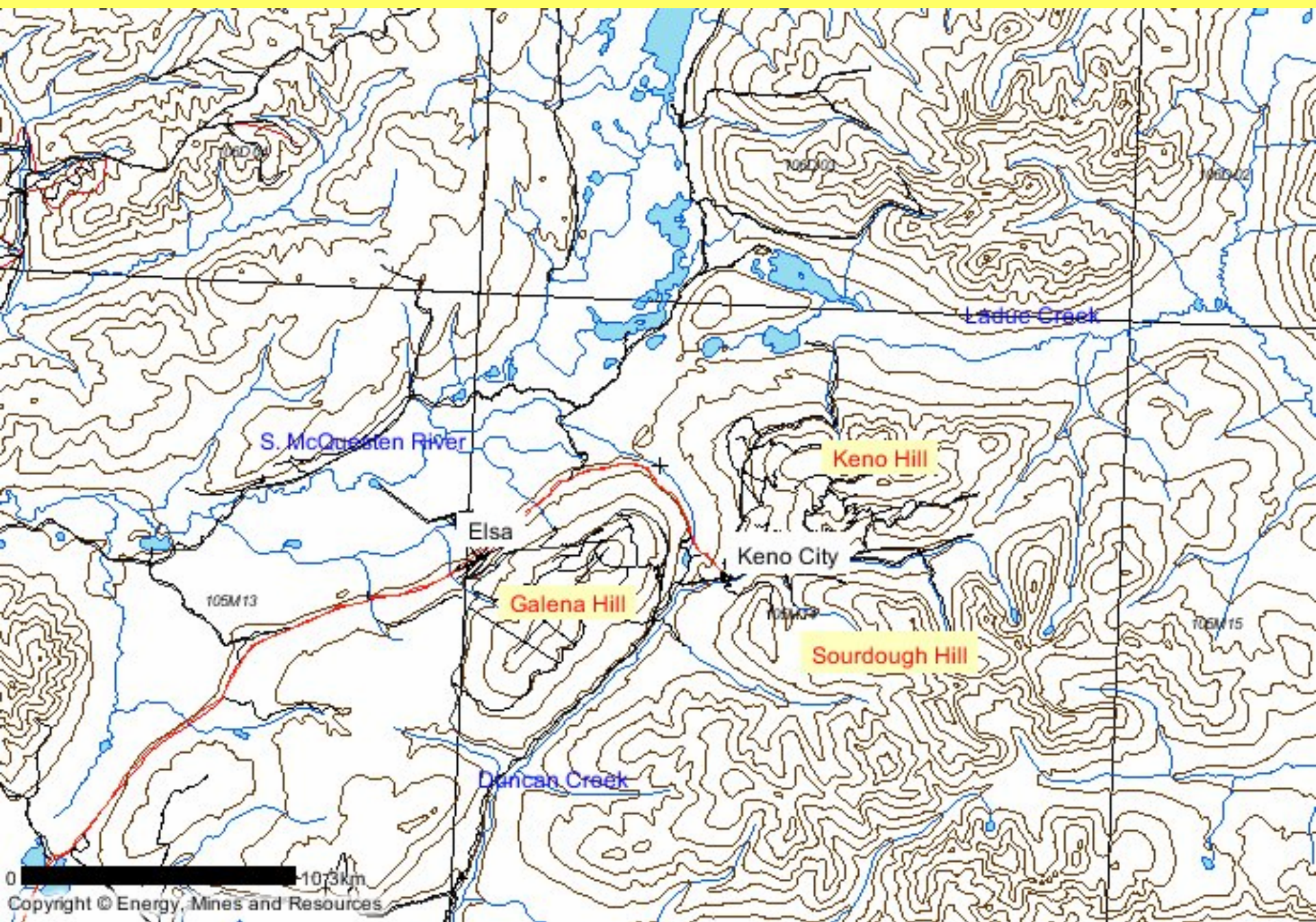
45 km NE of Mayo

452 km N of Whitehorse



Mine site covers 15,000 hectares (150 sq.km)  
678 mining leases, 121 claims, and 2 crown grants,





# Geology



- Phyllite and schist over and under 700m Quartzite
- Cut by greenstone sills
- A granitic intrusion below caused faulting and hydrothermal activity
- argentiferous galena, freibergite, pyrargyrite (ruby silver), sphalerite, pyrite. Siderite is the main gangue mineral

# Early Mining History



1895-placer gold found in area

1903-Silver King staked

1913-Silver King highgraded

1919-Beauvette on Keno Hill

1921-Wernecke/Treadwell

1924-1933 136 tonne  
concentrator

1935-mill moved to Elsa

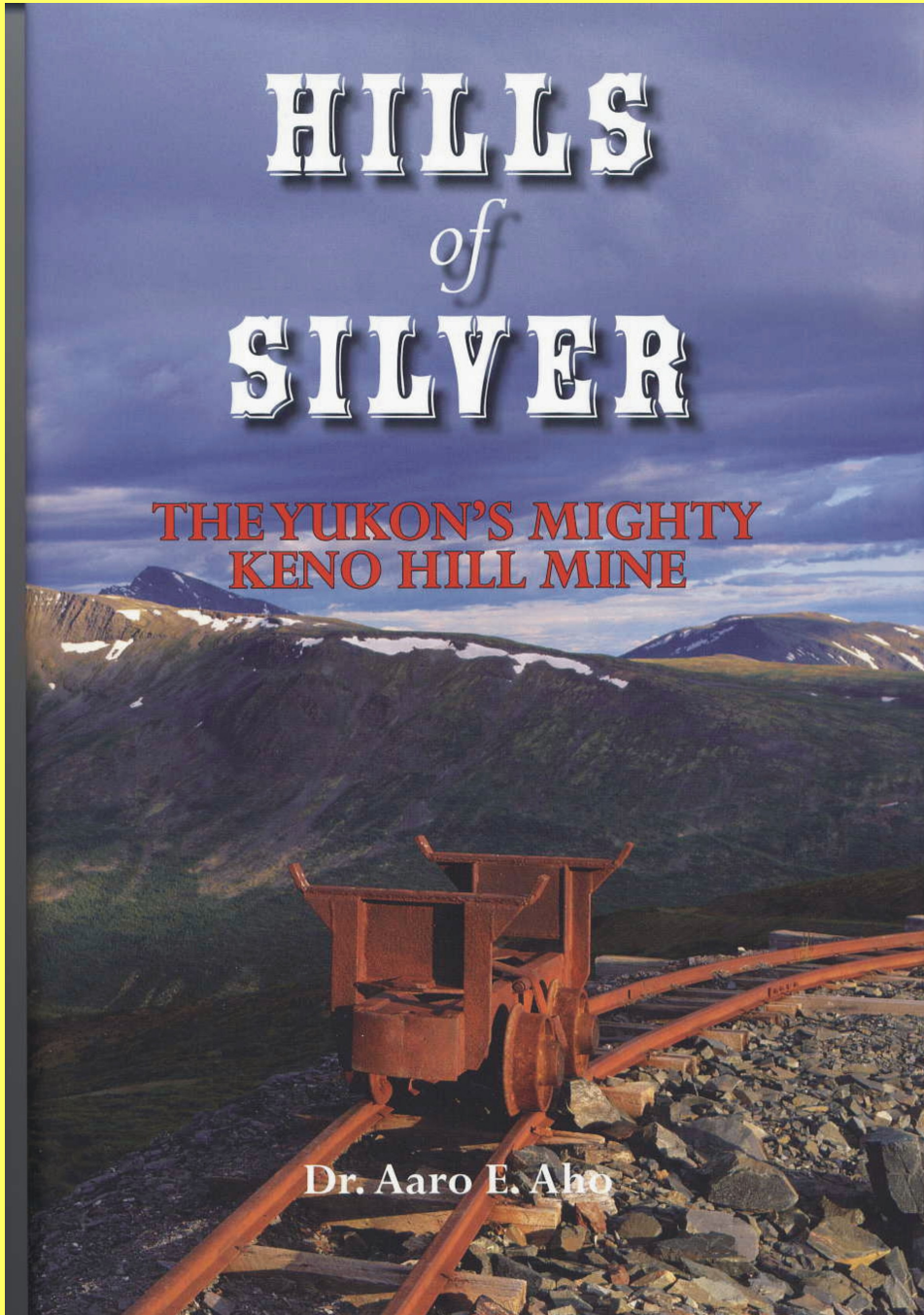
1941-47 no activity

1947-91 various companies

# HILLS *of* SILVER

THE YUKON'S MIGHTY  
KENO HILL MINE

Dr. Aaro E. Aho





From 1921-88  
there were  
4.872M Tonnes of  
ore milled yielding

- 6.769M kg silver
- 273.62M kg lead
- 153.2 M kg zinc

# Recent History

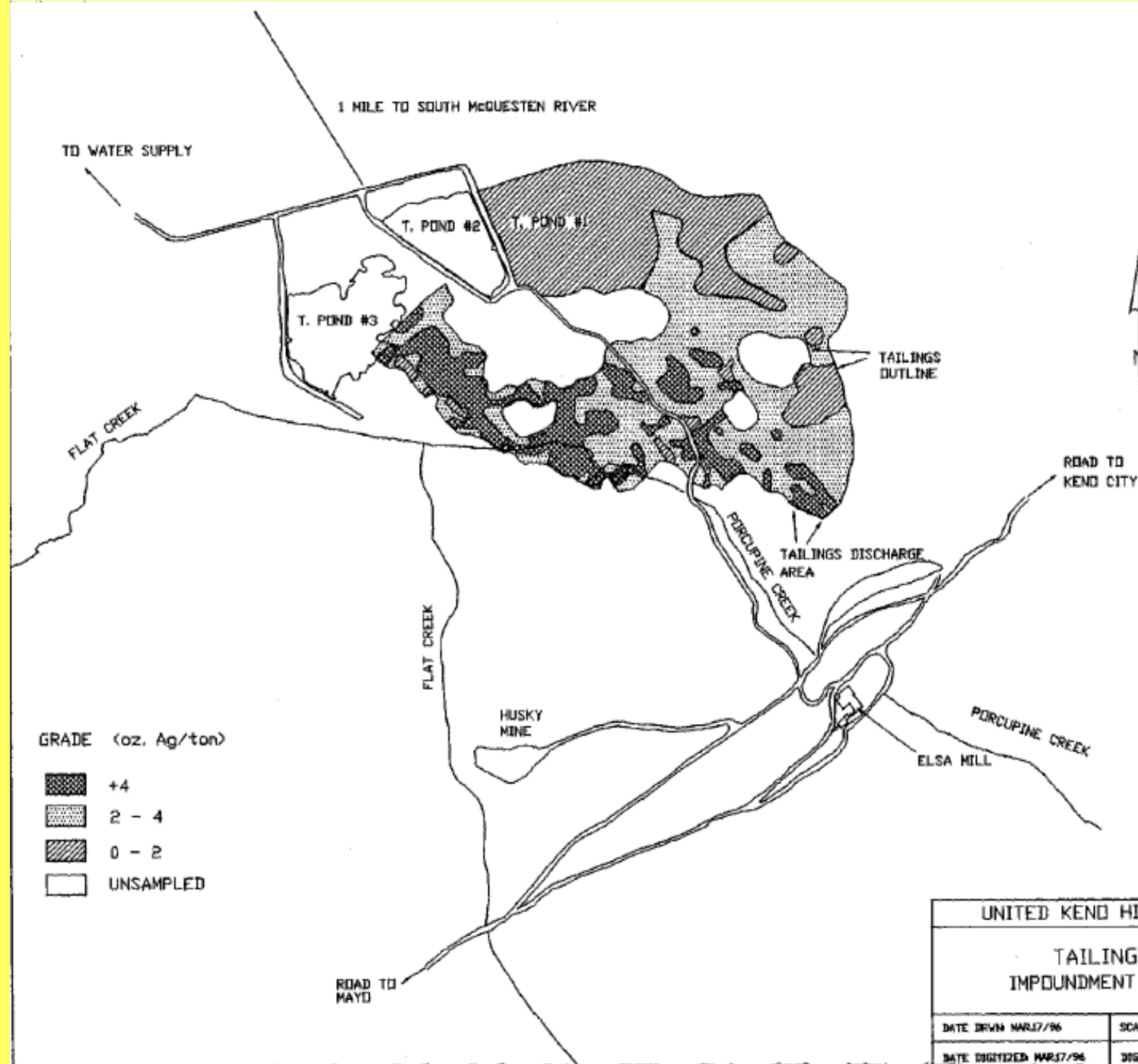
- 1990-2000 UKHM managed site with limited exploration but no production.
- 2001 site declared abandoned DIAND contracted the Care and Maintenance
- 2002-03 AMT operated C&M but dropped project in 2003
- 2003 Nevada Pacific Gold for a few months, then quit.
- 2003 site again declared abandoned
- 2005 Alexco chosen as preferred purchaser and took over C&M in June 2006 .



# **UKHM – Tailings Ponds**



**Approximately 75 years of tailings deposition below Elsa, 4.6M Tons.**



# A 1996 study on reprocessing the tailings by G. Hawthorn P.Eng.

This project was undertaken to evaluate the potential to economically recover additional metal values from the 4.6 million tons of Keno Hill flotation tailing which grades 3 - 4 oz/t Ag, 0.8 % lead, and 0.9 % Zn.

The study determined that the higher grade portion of the tailing, containing some 1.0 million tons at 5.35 oz/t Ag, responds well to cyanide heap leaching with a silver recovery of 50 - 60 %. The testing data suggests that heap leaching is economically feasible at the current silver price of \$ US 5.50 / ounce and a currency exchange rate of 1.35 in favour of the US dollar.

The response to gravity and flotation concentration was poor.

# Tailings Desert (dry portion)





Sometimes even the problems can look beautiful.

Remnants of the Wernecke Camp.  
Sadie Ladue, Lucky Queen, and Wernecke all are  
in the Ladue Creek Watershed, in the MacKenzie  
River system



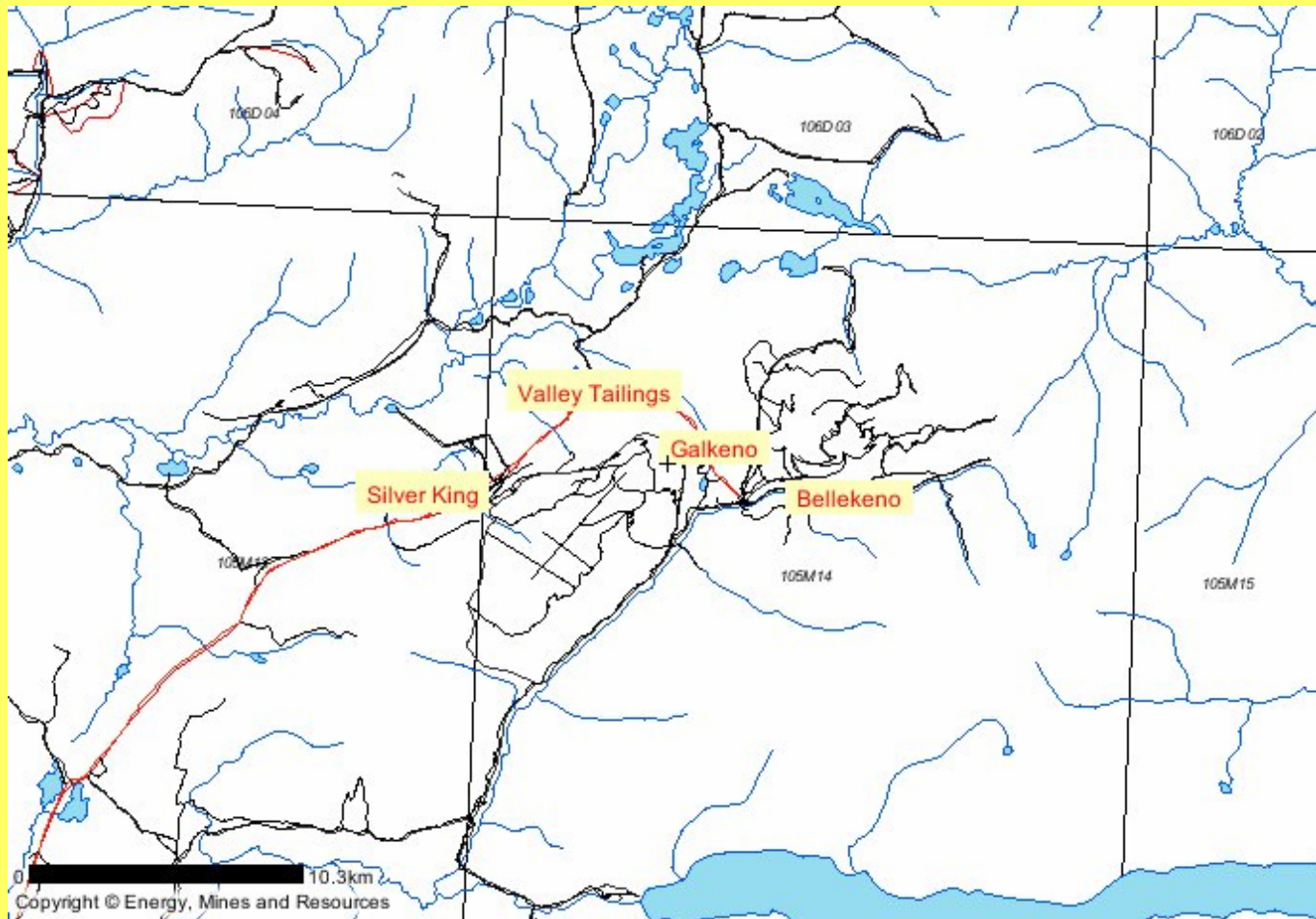
Tailings from the Wernecke mill were discharged down the slope to the small lake in the top of the photo. 250K-400K tonnes



The tailings from 102,000 Tonnes of ore processed at the Mackeno mill were discharged into and beside Cristal Lake



# Water Treatment Sites



# Bellekeno lime treatment settling ponds



# Mine Adit Discharge Treatment

Silver King, Bellekeno, Galkeno 900, lime treated

Flows – 3-10 L/sec

Raw discharge – max. 10ppm zinc

Treated discharge – generally less than 0.5ppm

**HECTOR - CALUMET  
LEVEL ELEVATIONS (RAIL IN FT)**

LEVEL	SW HECTOR FAULT	BETWEEN HECTOR CALUMET FAULTS	NE CALUMET FAULT	VEIN LEVEL COLOUR
100	4705	4725	-	GREEN
300	4585	4585	4595	WHITE
400	4465	4465	4475	MAGENTA
500	4340	4360	4370	RED
650	4215	4215	4225	BLUE
775	4090	4095	4110	CYAN
900	3985	3970	3985	BROWN
1040	3825	3830	3845	GREY
1165	3705	3705	3715	DARK GREEN
FAULTS	-	-	-	-

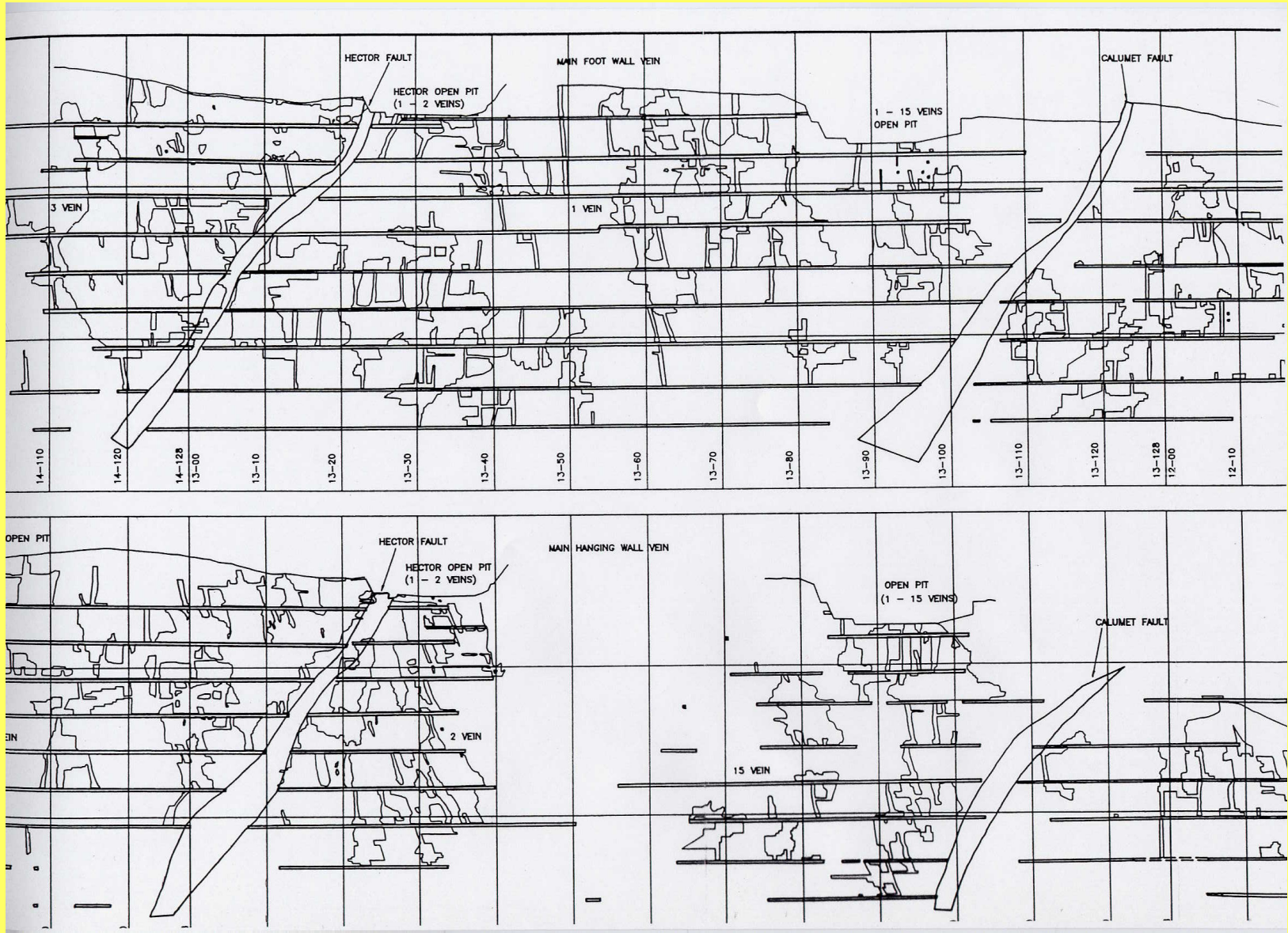
**HECTOR - CALUMET  
LEVEL ELEVATIONS (RAIL IN FT)**

LEVEL	MCLEOD VEIN WORKINGS	SIME VEIN WORKINGS	VEIN LEVEL COLOUR
100	4290	-	ORANGE
200	4165	4155	MAGENTA
300	4050	4040	BLUE
400	3935	3840	CYAN
500	3800	3800	GREEN
900	3255	-	DARK GREEN
OPEN PIT	-	-	WHITE
OPEN PIT VEIN	-	-	-
FAULTS	-	-	-

LEVEL	HECTOR - CALUMMET LEVEL ELEVATIONS (RAIL IN FT)				VEIN LEVEL COLOUR
	SIN HECTOR CALUMMET	BETWEEN HECTOR CALUMMET	NE CALUMMET	FAULT	
100	4705	4725	-		GREEN
300	4585	4585	4595		WHITE
400	4465	4465	4475		MAGENTA
500	4340	4360	4370		RED
650	4215	4215	4225		BLUE
775	4090	4095	4110		CYAN
900	3985	3970	3985		BROWN
1040	3825	3830	3845		GREY
1165	3705	3705	3715		DARK GREEN
FAULTS	-	-	-		

GALDENO ELEVATIONS (MAG. IN FT)			
LEVEL	MCGLEDO VEIN WORKINGS	SISE VEIN WORKINGS	VEIN, LEVEL COLOUR
100	4290	--	ORANGE
200	4165	4155	MAGENTA
300	4050	4040	BLUE
400	3935	3840	CYAN
500	3800	3800	GREEN
900	3255	--	DARK GREEN
OPEN PIT	--	--	WHITE
OPEN PIT VEIN	--	--	
FAULTS	--	--	

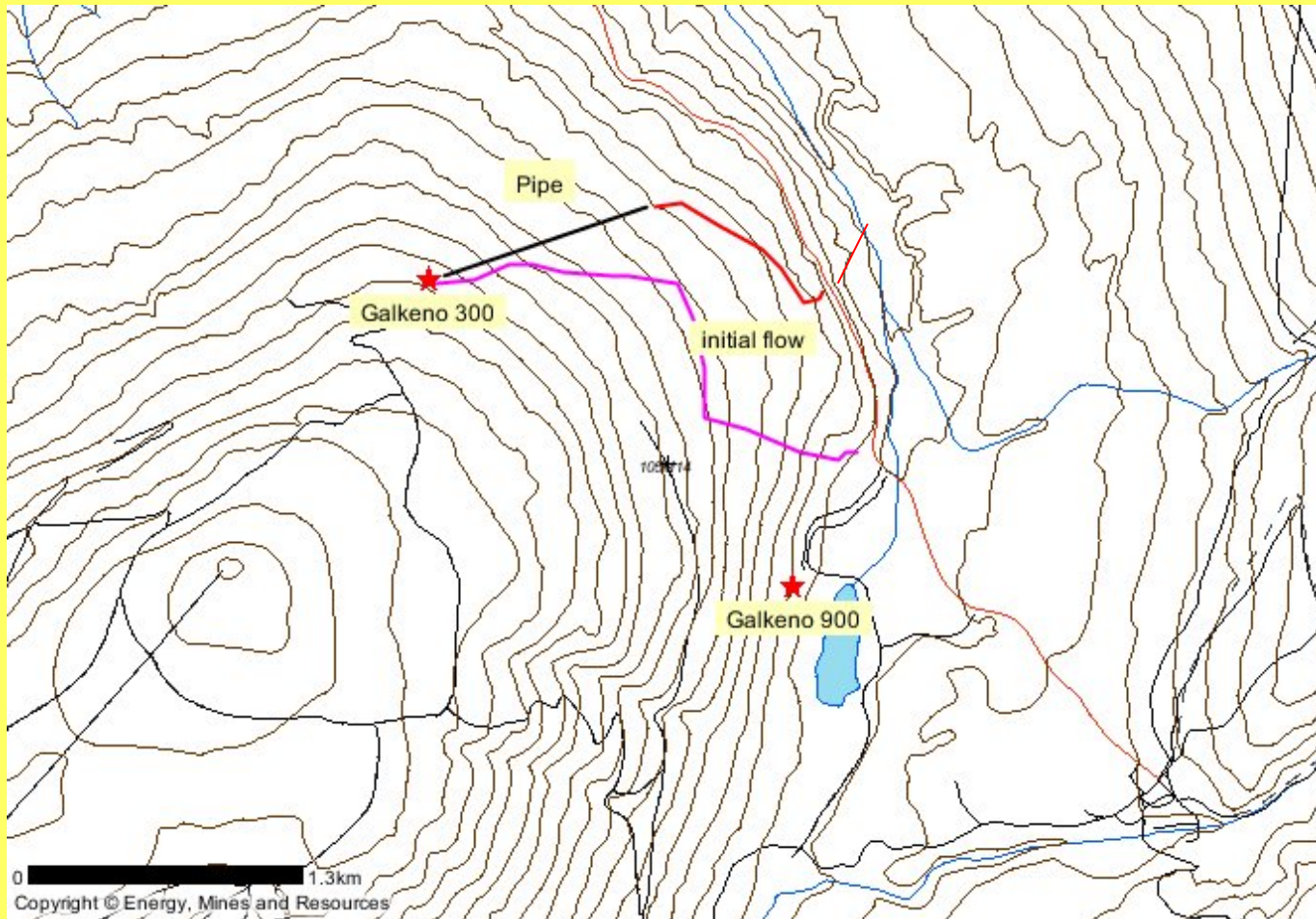
# Hector Mine section



# Galkeno 300 Drainage

- No significant drainage before 1999
- By 2002 flows from 3 – 20 L/sec, ave. 10 L/sec
- 80 – 140 ppm zinc
- Discharge stream flows intermittently (goes to ground) for ~1 km to road, then to Christal Creek
- Aufeis (glaciation) development at road
- Increased zinc loading downstream

# Galkeno 300 drainage paths



# Galkeno 300

Before

After



# Galkeno 300

Before



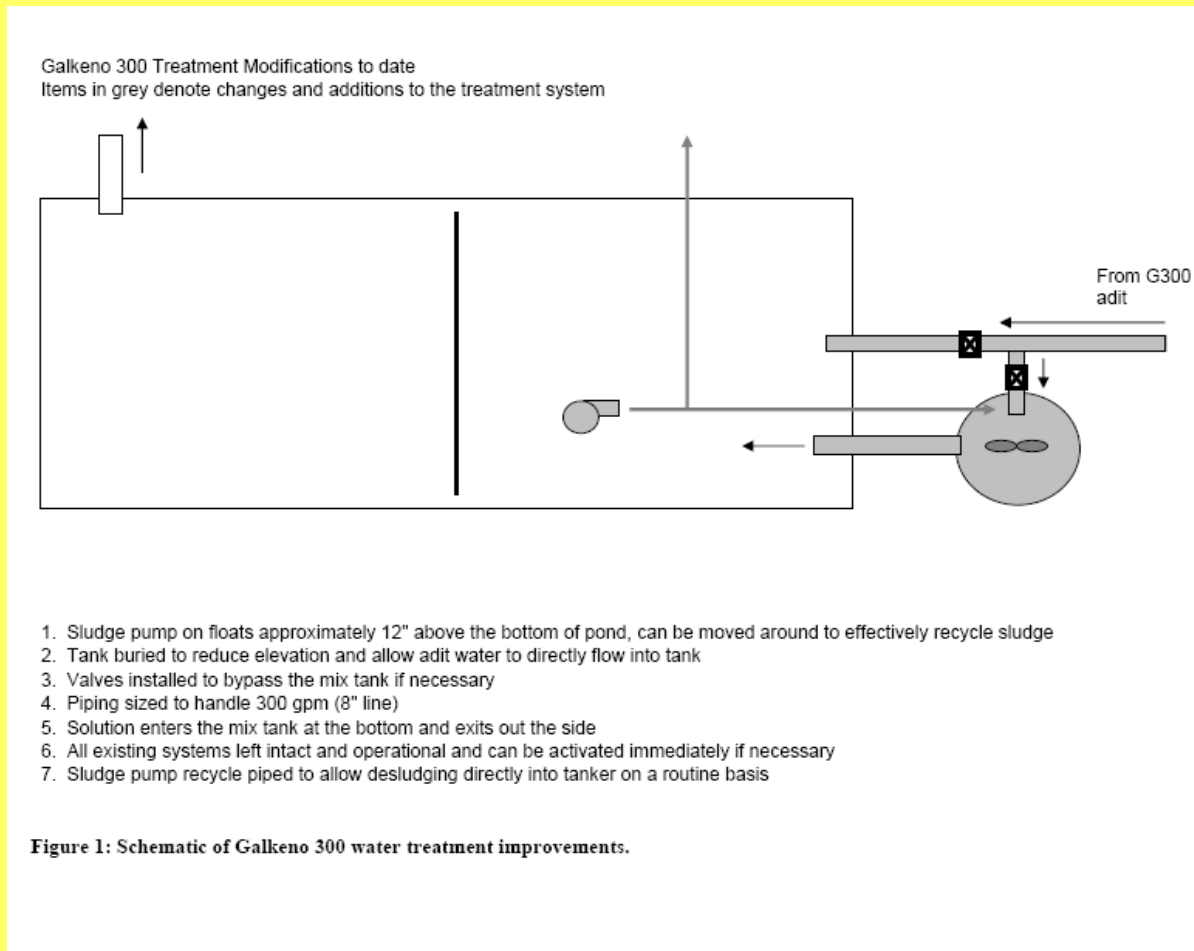
After



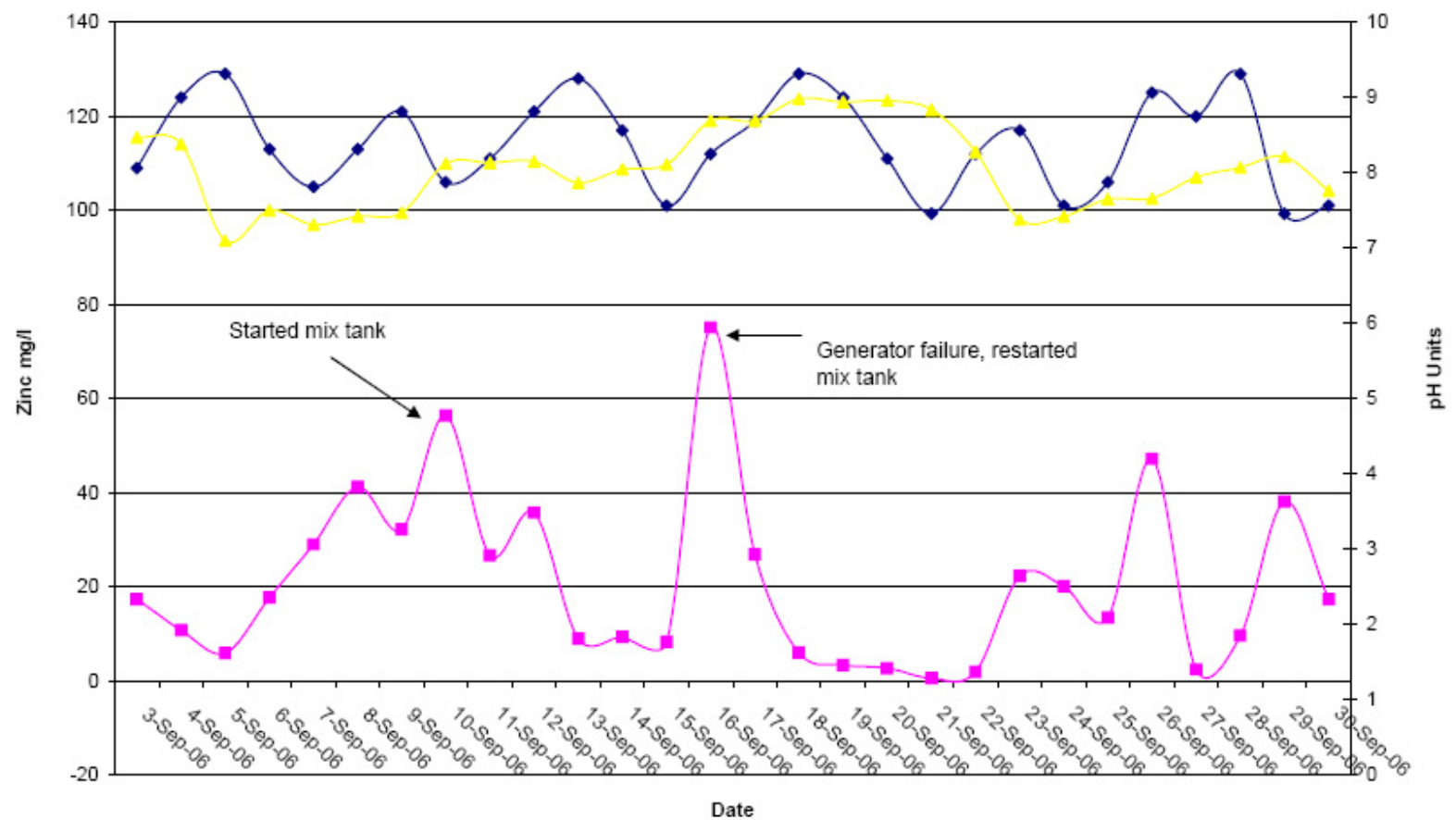
# Settling pond at Galkeno 300



# New mixing tank with sludge recirculation



Appendix A, Figure 2  
Galkeno 300 Adit Water Quality



# Site Challenges

- Remoteness and harsh climate
- Extensive development prior to environmental regulation
- Lack of appropriate data
- Unexpected changes in discharges
- Lack of stable ownership



**Sunset at Elsa – 3 PM**