ELSA TAILINGS
SITE 79

1. LOCATION AND ACCESS

The Elsa tailings impoundment is located in the South McQyesten River valley to the northwest of Galena Hill, near the head of Flat Creek site (site #79, Figure 1). Flat Creek is a tributary to the South McQuesten River from the south. The elevation of the tailings is approximately 2250 feet (686m). The NTS coordinates for the site are 7 088 500N 475 100E.

Access to the site from Keno City is via Highway 2 to the town of Elsa. A gravel road located just west of Porcupine Creek leads downhill into the valley and to the tailings dams. The same road leads to the small lake that is the Elsa City water supply (Figure 2). The roads are all-weather gravel roads that are passable by 4WD and possibly 2WD vehicles.

2. SITE PHYSIOGRAPHY

The tailings were deposited in a bog in the headwaters of the Flat Creek drainage. Flat Creek is separated from the South McQuesten River by a low hill, and separated from Star, Sandy, and Christal Creeks to the northwest, by a low ridge. The Elsa mine and townsite are drained by Porcupine Gulch and Brefalt Creek, tributaries to Flat Creek. Flow from Porcupine Creek has been diverted around the bulk of the tailings by the Porcupine diversion ditch, although it still cuts through some tails.

The tailings form two lobes. Older tailings are deposited near Porcupine Creek, in the area behind Dam No. 3, and the more recent tailings are located behind Dam No. 1.

3. GEOLOGY AND MINERALIZATION

The Elsa tailings were derived from ore mined from at least 35 different deposits in the Keno area so that there is great variability in the composition of the tailings. There were also changes in the mill process over time, which added to the variability. At times, zinc was not recovered because of low head grades. Between 1952-1967 and 1979-1982, cyanide was added to the floatation tailings to recover about 50% of the silver. A good overview of the district geology and geochemistry is given in UKHM (1996).

There has been no recent study of the tailings to determine their mineralogical composition. However, the milling records and metallurgical testing for the Elsa mill were reviewed as part of the United Keno Hill Mining companies' 1996 pre-feasibility study. This review concluded that (UKHM, 1996):

- A mineralogical study in the 1970's indicated lead to be present as cerrusite (lead carbonate) and anglesite (lead sulphate);

- Prior to 1970, most of the ore was sulphide-rich material derived from underground mines. After 1970, the ore was a blend of "non-sulphide" material from the open pits and sulphide material from the underground mines.

4. SITE HISTORY

Mining and processing began at Elsa about 1920 (Hawthorn, 1996). In 1936, the Wernecke Mill was moved to Elsa where it operated until 19 42. Operation resumed after the war until 1949 when the mill was destroyed by fire. During operation, tailings were piped about 500 m from the mill and discharged south down the hillside to form an alluvial fan in the valley bottom. Most of the tailings deposited in the Flat Creek bog, but some were washed downstream.

A second, larger mill was built in 1949 and mining continued until 1989. Tailings continued to be discharged down Porcupine Creek until 1962 when the first tailings dam was built. At this time the tailings discharge point was moved east of Porcupine Creek. Dam No. 1 was breached several times during the 1960's, and in 1972 a second dam was built downstream of Dam No. 1, primarily as a settling pond for lime-treated water from Dam No.1. In 1979, Dam No. 3 was built further downstream. All three dams are constructed of local gravel and development waste from the underground mines (principally the Husky mine) on variably frozen peat and silty till.

In 1979, the Porcupine diversion ditch was constructed to divert the flow of Porcupine Creek around most of the tailings, reducing erosion, and to limit the amount of water impacted by the tailings.

The total amount of tailings deposited is estimated to be about 4.6 million tons (Hawthorn, 1996) and most are held behind Dam No. 1. A small quantity of tailings was reportedly used as underground backfill, and some has been washed downstream. Tailings have been reported as much as 20 km downstream at the log jam on the McQuesten River. These tailings were probably deposited before construction of Dam No.1, or as a result of breaches of that dam. There have been reports of seepage of pond water through the peat below the tailings, but this has not been investigated (B.Dunn, pers.comm.).

In 1996, a toe berm was placed to reinforce Dam No. 1 (Photo 79-1). Five tailings cells were also constructed behind Dam No. 1 to hold future tailings, however, these cells have not been used (Photo 79-2). During this time, work was done on the Porcupine diversion ditch, and active lime treatment of the pre-1960 tailings decant was begun.

The Elsa mill and townsite are currently mothballed but are in working order (B.Dunn, pers.comm.).

5. MINE DEVELOPMENT

5.1 Mine Openings and Excavations

This report discusses only the Elsa tailings impoundment. No mine openings are associated with the impoundment.

5.2 Waste Rock Disposal Areas

No waste rock disposal areas are associated with the tailings. However, waste rock, primarily from the Husky Mine, was used as fill to raise Dams No. 1 and 2 after they had subsided. The rock samples collected on the surface of Dam No. 3 is likely composed of Husky waste that was used as fill on the dam. Results of analysis of these sample are provided in Table 1.

5.3 Tailings Impoundments

There are three tailings dams at the Elsa site with associated tailings and ponds (Figure 2). The total surface area of the tailings is approximately 185 acres (75 ha) but the depth is uncertain (UKHM, 1996). Dams No. 1 and 2 are earthen filled structures built with unzoned construction on frozen peat-rich soils. Dam No. 3 was reportedly constructed with a glacial till upstream core and extended banket, and a downstream body of waste rock separated from the glacial till by a graded filter (B.Dunn, pers.comm.). The soils have thawed since construction, causing portions of the dams to subside. UKHM has continued to add mine rock to the low points in the dams every few years.
Eleven test pits were excavated by backhoe in 1996 by UKHM (1996). Therefore, only one additional pit was dug in 1999. The 1996 data is provided in Appendix I. The 1999 data is listed in Table 2.

Tailings Dam No. 1 and Pond

Dam dimensions (L x W x H): 300 m x ~6m roadway x ~6m

Description: The dam is composed of gravel and glacial till. In 1972, additional gravel was added to the center section of this dam which failed around a decant structure. Since this time gravel or mine waste rock was added to the upper surface of the dam every few years as warranted by the continuing subsidence of the structure.

Pond area (L x W x Depth): 1150 m x 625 m x 1m. Depth of tailings varies from ~5m against the dam to ~ 2 m at the east edge near the valley slopes Photo 79-3.

Oxidation: Most of the tailings behind Dam No. 1 are unsaturated. The surface of the tailings are dark brown (Photo 79-4). UKHM (1996) did not report iron staining in pits 1, 8 , 10 and 11 but did report "orange brown sands in pit 11" at a depth of 100cm.

Locations and area of saturated tailings: An area of approximately 26,000 m^2 is saturated.

Breakthroughs: The dam was breached several times from 1962 to 1972. A toe berm was placed on the downstream side of Dam No. 1 in 1996 (Photo 79-1). The toe berm extends about halfway up the dam and is approximately 5 m wide. It is constructed of gravel underlain by a layer of synthetic mesh added to limit piping of the dam. The mesh is porous but keeps the fines from being washed away with any seepage through the dam. No evidence of erosion of Dam No. 1 or the toeberm was seen.

Decant structures and piping: The decant structure on Dam No. 1 consists of a ~1.2m diameter galvanised, corregated pipe with a stop log weir on the upstream end and a lime addition mixing box at the discharge.

Pump house: There is no pump house associated with Tailings Pond No. 1

Tailings Dam No. 2 and Pond (Photo 79-5)

Dimensions (L x W x H): 400 m x 5 m x 4 m

Surface composition: Gravel, glacial till and mine waste rock.

Some tension cracks were seen in the dam (Photo 79-6). Ponding immediately below the dam has abundant red iron oxide precipitate (Photo 79-7). Grasses are growing in this ponded water.

Pond area (L x W x Depth): 320 m x 150 m x 1m. Depth of tailings is unknown, but is probably less than a meter, as the only tailings deposited here would have come from the failure events (Photo 11-25).

Oxidation: All of the tailings behind Dam No. 2 are saturated (Photo 79-8). UKHM (1996) reported no evidence of oxidation in this material.

Locations and area of saturated tailings: The full area of the tailings, approximately 48,000 m^2, are saturated.

Breakthrough: No evidence of breakthrough was seen.

Decant structures and piping: The decant structure is shown in Photos 79-9 (upstream) and 79-10 (downstream). The decant structure is constructed of wood and measures approximately 2.5 m high by 2 m wide. The decant is in poor condition.
Pump house: There is no pump house associated with Tailings Pond No. 2

One sample was collected of the Pond Water (79-WQ-07) and one other seepage at the base of the dam (79-WQ-08). Results of the analyses are presented in Table 3.

Tailings Dam No. 3 (Photo 79-11)

Dimensions (L x W x H): 375 m x 8 m x 3 m
Surface composition: Gravel and glacial till. Some tension cracks were seen in the dam (Photo 79-12). Tension cracks can also be seen on areas of the dam. There is some iron oxidation at a depth of about 10 cm in the gravel that composes the dam.
Pond area (L x W x Depth): Approximately 360,000 m^2. Depth of tailings is unknown, but is probably less than half a meter, as estimated from the test pits downstream of the structure.
Oxidation: UKHM (1996) test pits were dug near the original tailings discharge point. All of these pits showed oxidation to a maximum depth of 120cm.
Locations and area of saturated tailings: Approximately 72, 000m^2 of the tailings are saturated.
Breakthroughs: No evidence of breakthroughs was seen.
Decant structures and piping: The decant structure is composed of a wooden v-notch weir on the upstream side (Photo 79-13) and a metal pipe on the downstream side (Photo 79-14). Some subsidence can be seen around the weir in Photo 79-13. The decant is in fair condition. There is an emergencey overflow ~ 50 m south of the decant structure, this consists of an open 1.2m diameter corregated, galvanized pipe whose invert is ~0.3 m above the water level.
Pump house: There is no pump house associated with Tailings Pond No. 3

Minesite Water Treatment

There are two lime treatment plants on site, one at Dam No. 1 and one at Dam No. 3. The plants are operated when zinc concentrations in the ponds are above a target level. This is generally in the spring when runoff is highest. Neither plant was operating at the time of the site visit.

Dam No. 1 Treatment Plant (Photo 79-15)

Tank Dimensions:8 m Long x 2 m diameter

Location: At southeast end of Dam No. 1

Drainage: Inflow to pond No. 1 is from a catchment area of ~ 4 sq. km hillside with diversion ditches catching any areas above the highway.

Description and type: 1000 gal propane tank (8m long x $2m^2$). Tank is insulated and has a recirculating pump to keep lime in a slurry and unfrozen. A V-notch weir helps regulate flow.

Impacted vegetation: Vegetation does not appear impacted, except in the pre-1960 depositional area and the areas of coarse tailings on the valley slopes were there is little indication of any revegetation.

Dam No. 2 Treatment Plant (Photo 79-16)

Tank Dimensions: 8 m Long x 2 m diameter

Location: Near the southern end of Dam No. 2.

Purpose: To treat the seepage from the pre-1960 tailings depositional area

Drainage: ~ 1 sq. km

Description and type: 1000 gal propane tank (8m long x $2m^2$). Tank is insulated and has a recirculating pump to keep lime in a slurry and unfrozen. A V-notch weir helps regulate flow.

Impacted vegetation: Vegetation does not appear impacted.

6. MINE SITE INFRASTRUCTURE

6.1 Buildings

There are several small buildings on site, which are discussed below. There is also a pump house and pressure pump house related to the Elsa townsite freshwater supply located to the northwest of the tailings.

Building 79A and 79B - Transmission Buildings and Satellite Dishes

Each of these stations has a small, wooden building measuring 2m x 2 m x 3 m (L x W x H) with a large satellite dish adjacent to it. 79A is located on the road to the freshwater supply and has a door painted green (Photo 79-17). 79B is located at the northwest end of tailings pond No. 2 and is entirely painted green. The contents of the buildings were not examined. No asbestos was seen but the buildings were not opened.

Building 79C - Northwestel Building and Satellite Dish

This fiberglass building measures approximately 3 m x 2 m x 5 m and is located near Building 79B, at the northwest end of tailings pond No. 2 (Photo 79-18). It also has a large satellite dish next to it. The building was not opened but there appears to be no hazardous material associated with it.

Building 79D - PCB Storage

Building is also located at the northwest side of the tailings pond No. 2. It is a composed of a wooden frame with metal sheeting on the sides and roof, and measures 8 m x 5 m x 3 m. It has a wooden fence around it measuring 10 m x 7 m x 2 m. Building was locked.

Buildings 79E and 79F - Explosive Magazines

The two explosive magazines measuring 7 m x 2 m x 3 m and have metal siding and roofs. Building 79E is located near the southern end of tailings Dam No.1 and 79 F is located nearly due east of 79E approximately 150m. Both are locked and the contents unknown.

6.2 Fuel Storage (Photo 79-19)

Drum Storage Area(s): Approximately 20 empty barrels are stored in the "boneyard" (spare parts area).

6.3 Rail and Trestle

There were no rails or trestles seen associated with the tailings.

6.4 Milling and Processing Infrastructure

There was no mine infrastructure seen associated with the tailings impoundment.

6.5 Electrical Equipment

Transformers: A 6,900 volt transformer is in use on the site. It is located on the west side of the water pressure house. The transformer was locked behind a wooden fenced area 8m x 5m , the transformer is sitting on a wooden foundation. Three other transformers are also stored in this enclosure. These transformers are on a wooden platform, and surrounded by a wooden fence measuring 8 m x 5 m x 2.5 m.

7. SOLID WASTE DUMPS

There are no solid was dumps associated with the tailings impoundment. However, there is a "boneyard" (spare parts area) located east of the road from Elsa townsite to the tailings (Figure 2). The site has 8 abandoned vehicles (Photo 79-20) with batteries located near them, and several household appliances (Photo 79-21). Empty barrels are also stored in this area.

8. POTENTIAL CONTAMINANTS OF CONCERN

Contaminants of concern include metals from the tailings.

9. WATER QUALITY

9.1 Tailings Impoundment

Six surface water sampled and three groundwater samples were collected around the tailings area. Surface water samples were collected from the Dam No. 2 pond (79-WQ-07) and from the seepage at the base of Dan No. 2 (79-WQ-02). Samples 79-WQ-05 and 79-WQ-06 were collected from the Porcupine Creek diversion ditch and Flat Creek, respectively.

The groundwater samples were collected from piezometers installed by UKHM in 1996. No upstream water sample was collected because there was no flow in Porcupine Creek above the tailings area.

9.2 Elsa Freshwater Supply

The fresh water supply for the town of Elsa is a small unnamed lake in the South McQuesten River valley to the northwest of the tailings impoundment (Figure 2). The lake is located in a separate drainage from the tailings impoundment, and therefore, should not be in danger of contamination from the tailings. However, the lake water is monitored on a quarterly basis by UKHM & Public Health. Also, sample 79-WQ-01 was collected from the lake.

Lake water is pumped from the lake by a 25 hp electric power pump. The pump is housed in a small shed (L x W x D = 4 m x 4 m x 3 m) constructed with a wood frame and corrugated metal walls and roof (Photo 79-22). Electric lines connect with the pump. The water supply pipe is approximately 15 cm in diameter and is insulated with metal-wrapped fiberglass.

The piping carries water approximately 100 m to the pressure pump house which contains a 75 hp electric pump (Photo 79-23). This pump is large enough to pump the water to the Elsa townsite a distance of 5 km with an elevation gain of 150 meters. The pressure pump house is 16 m x 8 m x 8 m, wood frame construction with corrugated aluminum sheet walls and roof. The foundation is concrete. On the west side of the house is a transformer that was described in Section 6.5.

The insulated pipeline continues from the pressure pump house over the low ridge to the tailings area. It parallels Dam No. 3 and then continues up the hill to the townsite.

10. RECLAMATION

There has been no active reclamation of any of the tailings. Efforts to control erosion of the tailings include construction and maintenance of the diversion ditch, and maintenance of the three tailings dams. One section of the ditch still cuts through the tailings, however, causing some erosion.

In some areas the tailings have begun to revegetate naturally. Revegetation is directly related to the amount of water available. For example, in the bog area downstream of Dam No. 3, tailings are covered with thick moss and bushes. In contrast, most of the tailings behind Dam No. 1 are relatively dry and remain unvegetated. Dispersion of these tailings by wind is a concern.

Approximately, 100,000 m^2 of all the tailings behind the three dams has revegetated.

11. REFERENCES AND PERSONAL COMMUNICATIONS

Hawthorn, 1996. Investigation into the reprocessing of Elsa Tailings, for United Keno Hill Mines Limited. DIAND Open File 1996-3(T).

United Keno Hill Mines Limited. 1996. United Keno Hill Mines Limited – Site Characterization. Report No. UKH/96/01, prepared by Access Mining Consultants Limited.

United Keno Hill Mines Limited. 1996. United Keno Hill Mines Limited – Site Characterization, Technical Appendices I-VI. Report No. UKH/96/01, prepared by Access Mining Consultants Limited.

Table 1. Samples of Material on Dam No. 3.				
Parameter	**Detection Limit**	**Units**	**79-WST-01-01**	**79-WST-01-02**
Paste pH			8.1	5.8
S(T)		%	0.11	0.81
S(SO4)		%	0.06	0.64
AP		tonne CaCO3 eq./tonne	1.6	5.3
NP		tonne CaCO3 eq./tonne	114.8	19.5
Net NP		tonne CaCO3 eq./tonne	113.2	14.2
NP/AP			73.4	3.7
pH in Saturated Paste				
pH	0.1	pH	7.1	4.4
pH in Soil (1:2 water)				
pH	0.01	pH	8	5
ICP Semi-Trace Scan - Metals				
Aluminum	5	µg/g wet	15500	34100
Antimony	2	µg/g wet	<2	57
Arsenic	2	µg/g wet	22	1140
Barium	0.05	µg/g wet	433	635
Beryllium	0.1	µg/g wet	0.4	0.8
Bismuth	5	µg/g wet	<5	<5
Cadmium	0.1	µg/g wet	1.7	11.8
Calcium	5	µg/g wet	34700	12600
Chromium	0.5	µg/g wet	21	44.6
Cobalt	0.1	µg/g wet	7.4	6
Copper	0.5	µg/g wet	32	88.8
Iron	1	µg/g wet	21000	39000
Lead	1	µg/g wet	92	3180
Lithium	0.5	µg/g wet	12.8	15
Magnesium	1	µg/g wet	13300	3530
Manganese	0.5	µg/g wet	999	2760
Mercury	0.01	µg/g wet	<0.01	0.14
Molybdenum	1	µg/g wet	1	2
Nickel	0.2	µg/g wet	20.3	19.2
Phosphorus	5	µg/g wet	577	572
Potassium	20	µg/g wet	3800	9400
Selenium	2	µg/g wet	<2	<2
Silicon	5	µg/g wet	4220	457
Silver	0.5	µg/g wet	2.6	119
Sodium	5	µg/g wet	1140	1310
Strontium	1	µg/g wet	54	52
Sulphur	10	µg/g wet	1070	15200
Thorium	1	µg/g wet	<1	<1
Tin	1	µg/g wet	2	6
Titanium	0.2	µg/g wet	497	218
Uranium	5	µg/g wet	<5	<5
Vanadium	1	µg/g wet	46	68
Zinc	0.5	µg/g wet	155	1040
Zirconium	0.1	µg/g wet	10.2	13.9

Table 2. Elsa Tailings Solids Samples

Parameter	Detection Limit	Units	79-Tails-01	79-Tails-02	79-Tails-03	79-tails-04	79-tails-05
Depth		**cm**	**3-20**	**20-50**	**35-60**	**0-10**	**0-10**
Paste pH			7.1	7.7	6.1	6.4	6.7
S(T)		%	2.36	2.23	0.14	3.62	2.56
S(SO4)		%	0.05	0.03	0.06	0.27	0.07
AP		tonne CaCO3 eq./tonne	72.2	68.8	2.5	104.7	77.8
NP		tonne CaCO3 eq./tonne	11.9	22.0	0.5	17.3	28.8
Net NP		tonne CaCO3 eq./tonne	-60.3	-46.8	-2.0	-87.4	-49.1
NP/AP			0.2	0.3	0.2	0.2	0.4
pH in Saturated Paste							
pH	0.1	pH	6.6	7.1	5.7	6.2	6.4
pH in Soil (1:2 water)							
pH	0.01	pH	7	7.3	6.4	6.3	6.6
ICP Semi-Trace Scan - Metals							
Aluminum	5	µg/g wet	3250	6110	27800	6140	5850
Antimony	2	µg/g wet	140	150	<2	230	230
Arsenic	2	µg/g wet	1210	1200	22	1800	1100
Barium	0.05	µg/g wet	80	89.6	606	87.3	63.4
Beryllium	0.1	µg/g wet	<0.1	<0.1	0.6	<0.1	<0.1
Bismuth	5	µg/g wet	<5	<5	<5	<5	<5
Cadmium	0.1	µg/g wet	55.4	68.5	0.6	149	174
Calcium	5	µg/g wet	3050	4010	9480	2500	2990
Chromium	0.5	µg/g wet	6.1	9	35.1	8.9	10
Cobalt	0.1	µg/g wet	3.4	4.2	9.5	5.5	3.9
Copper	0.5	µg/g wet	113	105	<0.5	149	135
Iron	1	µg/g wet	107000	100000	24000	130000	100000
Lead	1	µg/g wet	6300	6500	43	7900	8100
Lithium	0.5	µg/g wet	2.1	2	19.7	2	2.2
Magnesium	1	µg/g wet	3940	3380	6280	3300	3830
Manganese	0.5	µg/g wet	40900	38700	507	50100	46900
Mercury	0.01	µg/g wet	0.38	0.26	0.09	1	0.36
Molybdenum	1	µg/g wet	3	3	1	4	4
Nickel	0.2	µg/g wet	10.7	11.4	23.5	15.4	11.2
Phosphorus	5	µg/g wet	231	185	858	177	265
Potassium	20	µg/g wet	930	2120	6700	2060	1810
Selenium	2	µg/g wet	<2	<2	<2	<2	<2
Silicon	5	µg/g wet	197	297	581	209	311
Silver	0.5	µg/g wet	79.8	63.9	0.6	149	72
Sodium	5	µg/g wet	171	189	1310	166	112
Strontium	1	µg/g wet	<1	<1	51	<1	<1
Sulphur	10	µg/g wet	28100	28300	1310	46700	27400
Thorium	1	µg/g wet	<1	<1	<1	<1	<1
Tin	1	µg/g wet	4	6	1	4	5
Titanium	0.2	µg/g wet	34.6	26.9	802	26.1	21
Uranium	5	µg/g wet	<5	<5	<5	<5	<5
Vanadium	1	µg/g wet	7	10	63	10	10
Zinc	0.5	µg/g wet	4960	6260	119	9250	9960
Zirconium	0.1	µg/g wet	7.3	6.9	17.3	6.7	7.6

Table 3. Water Quality Analyses

Parameter	Detection Limit	Units	Surface Water Samples			
			79-WQ-01 - 47899-1	79-WQ-02 - 47899-2	79-WQ-03 - 47899-3	79-WQ-05 - 47899-4
ICP-USN Total Metals Scan in Water						
Aluminum	0.0008	mg/L	0.0183	0.0061	0.126	0.0175
Antimony	0.005	mg/L	<0.005	0.007	<0.005	<0.005
Arsenic	0.01	mg/L	0.02	<0.01	<0.01	<0.01
Barium	0.00004	mg/L	0.0792	0.0176	0.0444	0.0522
Beryllium	0.00001	mg/L	<0.00001	<0.00001	<0.00001	<0.00001
Bismuth	0.0004	mg/L	<0.0004	<0.0004	<0.0004	<0.0004
Boron	0.002	mg/L	<0.002	<0.002	<0.002	<0.002
Cadmium	0.00006	mg/L	0.00026	0.00032	0.00134	0.00029
Calcium	0.002	mg/L	63	82.7	135	98.9
Chromium	0.00006	mg/L	0.00021	<0.00006	0.00016	0.0002
Cobalt	0.00003	mg/L	0.00016	0.00024	0.00063	0.00049
Copper	0.00003	mg/L	0.00184	0.00324	0.00192	0.00126
Iron	0.00001	mg/L	0.152	0.168	0.709	0.152
Lead	0.0003	mg/L	0.0041	0.0261	0.0038	<0.0003
Lithium	0.001	mg/L	0.007	0.013	0.01	0.004
Magnesium	0.0005	mg/L	21.8	45.4	32.9	22.7
Manganese	0.00002	mg/L	0.396	0.0496	0.703	0.407
Molybdenum	0.00007	mg/L	0.00438	0.00026	0.00066	0.00016
Nickel	0.00001	mg/L	0.0023	0.003	0.002	0.0021
Phosphorus	0.03	mg/L	0.06	<0.03	<0.03	<0.03
Potassium	0.4	mg/L	1.2	0.9	0.7	0.5
Selenium	0.004	mg/L	0.005	<0.004	0.006	0.004
Silicon	0.004	mg/L	1.97	0.087	2.95	2.94
Silver	0.00005	mg/L	<0.00005	<0.00005	<0.00005	<0.00005
Sodium	0.004	mg/L	6.1	12.7	3.4	1.4
Strontium	0.00002	mg/L	0.307	0.272	0.298	0.276
Sulphur	0.008	mg/L	32.2	104	92.7	47.7
Thallium	0.001	mg/L	<0.001	<0.001	<0.001	<0.001
Titanium	0.00002	mg/L	0.00026	<0.00002	0.0038	0.00017
Vanadium	0.00003	mg/L	<0.00003	<0.00003	0.00019	<0.00003
Zinc	0.0002	mg/L	0.007	0.0224	0.151	0.0394
Zirconium	0.00004	mg/L				
Mercury	0.0001	mg/L	<0.0001	<0.0001	<0.0001	<0.0001
Arsenic	0.0002	mg/L	0.0106	0.0037	0.0036	0.0019
Selenium	0.0001	mg/L	0.0005	<0.0001	<0.0001	<0.0001
Total Alkalinity	5	mg CaCO3/L	152	70	70	166
Chloride	0.1	mg/L	1	2.4	2.4	1.2
Electrical Conductivity	0.01	µS/cm	500	780	780	850
Hardness (CaCO3 equiv)	5	mg/L	247	396	391	456
Nitrate-N	0.05	mg/L	<0.05	0.06	<0.05	0.05
Nitrate-N	0.2	mg/L	na	na	na	na
Nitrite-N	0.003	mg/L	<0.003	<0.003	<0.003	<0.003
pH	0.01	pH	7.88	7.83	7.53	7.78
Sulphate	1	mg/L	95.7	320	320	290
Total Dissolved Solids	5	mg/L	316	596	577	621

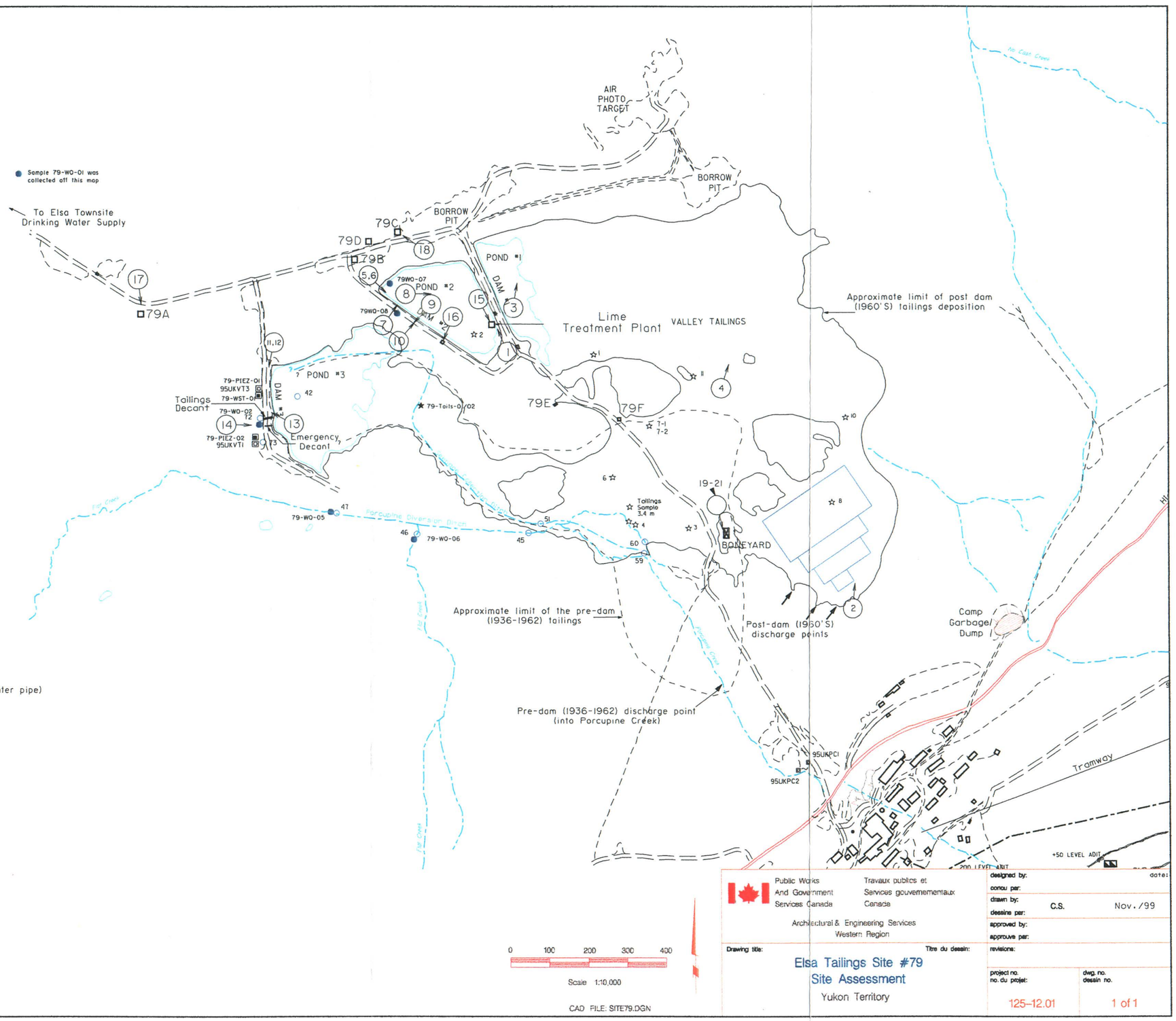
Table 3. Water Quality Analyses

Parameter	Detection Limit	Units	Surface Water Samples		
			79-WQ-06 - 47899-5	79-WQ-07 - 47899-6	79-WQ-08 - 47899-9
ICP-USN Total Metals Scan in Water					
Aluminum	0.0008	mg/L	0.0175	0.0278	0.0256
Antimony	0.005	mg/L	<0.005	0.015	<0.005
Arsenic	0.01	mg/L	<0.01	<0.01	0.02
Barium	0.00004	mg/L	0.0521	0.0172	0.043
Beryllium	0.00001	mg/L	<0.00001	<0.00001	<0.00001
Bismuth	0.0004	mg/L	<0.0004	<0.0004	0.0006
Boron	0.002	mg/L	<0.002	0.003	0.013
Cadmium	0.00006	mg/L	0.00028	0.00126	0.00089
Calcium	0.002	mg/L	99	130	140
Chromium	0.00006	mg/L	0.0001	0.0001	<0.00006
Cobalt	0.00003	mg/L	0.00047	0.00096	0.0043
Copper	0.00003	mg/L	0.00111	0.00738	0.00288
Iron	0.00001	mg/L	0.168	0.208	29.2
Lead	0.0003	mg/L	<0.0003	0.0543	0.0124
Lithium	0.001	mg/L	0.005	0.014	0.012
Magnesium	0.0005	mg/L	22.8	35.3	38.2
Manganese	0.00002	mg/L	0.406	0.388	6.24
Molybdenum	0.00007	mg/L	0.00013	0.00053	0.0001
Nickel	0.00001	mg/L	0.0019	0.0091	0.0121
Phosphorus	0.03	mg/L	<0.03	<0.03	0.05
Potassium	0.4	mg/L	0.5	2.2	2.9
Selenium	0.004	mg/L	0.007	<0.004	<0.004
Silicon	0.004	mg/L	2.93	0.32	4.46
Silver	0.00005	mg/L	<0.00005	0.00113	0.00118
Sodium	0.004	mg/L	1.4	13	12.2
Strontium	0.00002	mg/L	0.275	0.321	0.261
Sulphur	0.008	mg/L	47.6	134	137
Thallium	0.001	mg/L	<0.001	0.001	0.008
Titanium	0.00002	mg/L	0.00022	0.00037	0.00023
Vanadium	0.00003	mg/L	<0.00003	<0.00003	<0.00003
Zinc	0.0002	mg/L	0.04	0.111	0.0918
Zirconium	0.00004	mg/L			
Mercury	0.0001	mg/L	<0.0001	<0.0001	<0.0001
Arsenic	0.0002	mg/L	0.0011	0.0047	0.021
Selenium	0.0001	mg/L	<0.0001	<0.0001	<0.0001
Total Alkalinity	5	mg CaCO3/L	180	47	150
Chloride	0.1	mg/L	0.4	2.8	3
Electrical Conductivity	0.01	µS/cm	630	900	1050
Hardness (CaCO3 equiv)	5	mg/L	347	477	503
Nitrate-N	0.05	mg/L	0.07	<0.05	na
Nitrate-N	0.2	mg/L	na	na	<0.2
Nitrite-N	0.003	mg/L	<0.003	<0.003	0.007
pH	0.01	pH	7.85	7.67	6.63
Sulphate	1	mg/L	145	400	480
Total Dissolved Solids	5	mg/L	406	713	851

Table 3. Water Quality Analyses

Parameter	Detection Limit	Units	Groundwater Samples	
			79-PIEZ-01 - 47899-7	79-PIEZ-02 - 47899-8
ICP-USN Total Metals Scan in Water				
Aluminum	0.0008	mg/L	56.4	1.07
Antimony	0.005	mg/L	0.301	<0.005
Arsenic	0.01	mg/L	2.69	0.12
Barium	0.00004	mg/L	3.12	0.552
Beryllium	0.00001	mg/L	0.00511	<0.00001
Bismuth	0.0004	mg/L	0.0332	0.0011
Boron	0.002	mg/L	0.31	0.024
Cadmium	0.00006	mg/L	0.254	0.00042
Calcium	0.002	mg/L	460	273
Chromium	0.00006	mg/L	0.133	0.00183
Cobalt	0.00003	mg/L	0.0543	0.0264
Copper	0.00003	mg/L	1.14	0.0104
Iron	0.00001	mg/L	429	52.4
Lead	0.0003	mg/L	39.5	0.0151
Lithium	0.001	mg/L	0.103	0.015
Magnesium	0.0005	mg/L	272	140
Manganese	0.00002	mg/L	53.7	4.3
Molybdenum	0.00007	mg/L	<0.00007	0.00588
Nickel	0.00001	mg/L	0.193	0.0156
Phosphorus	0.03	mg/L	5.36	0.49
Potassium	0.4	mg/L	5.8	5.4
Selenium	0.004	mg/L	<0.004	<0.004
Silicon	0.004	mg/L	50.7	15
Silver	0.00005	mg/L	0.536	0.00071
Sodium	0.004	mg/L	21.9	8.9
Strontium	0.00002	mg/L	1.2	0.558
Sulphur	0.008	mg/L	535	5.86
Thallium	0.001	mg/L	<0.001	<0.001
Titanium	0.00002	mg/L	1.01	0.0285
Vanadium	0.00003	mg/L	0.0279	0.00377
Zinc	0.0002	mg/L	11.2	0.0197
Zirconium	0.00004	mg/L		
Mercury	0.0001	mg/L	<0.0001	<0.0001
Arsenic	0.0002	mg/L	2.81	0.167
Selenium	0.0001	mg/L	0.0068	0.0025
Total Alkalinity	5	mg CaCO3/L	314	878
Chloride	0.1	mg/L	5.3	6.5
Electrical Conductivity	0.01	µS/cm	2800	1650
Hardness (CaCO3 equiv)	5	mg/L	1990	1090
Nitrate-N	0.05	mg/L	<0.05	0.2
Nitrate-N	0.2	mg/L	na	na
Nitrite-N	0.003	mg/L	0.008	<0.003
pH	0.01	pH	6.82	7.37
Sulphate	1	mg/L	1600	21.7
Total Dissolved Solids	5	mg/L	2900	1250

- Building (22A: building site present reference*) Indicates Asbestos Material
- 22A Collapsed Building
- Adit
- Collapsed Adit
- Shaft
- Collapsed/Backfilled Shaft
- Mine Rock Dump
- Bedrock Open Pit
- Trench
- Stripped Overburden Stockpile
- Stripped / Disturbed Area
- Outcrop Boundary
- Highway
- Road (gravel, 2 wheel drive)
- Road (gravel, 4X4 accessible)
- Road (inaccessible)
- Trail
- Culvert
- 24501-01 1999 Soil Sample (this study)
- Pre 1999 Soil Sample (other sources)
- 25WR04-01 1999 Waste Rock Sample (this study)
- Pre 1999 Waste Rock Sample (other sources)
- WO-12-06 1999 Water Sample
- Pre 1999 Water Sample
- Tension Cracks
- Mass Movement (note: for Forms: BelleKeno)
- Groundwater Seep
- Surface Water Flow (Stream, Creek, River)
- Lake
- Settling Pond / Water Treatment Pond
- Tailings Dam / Tailings Pond / Mill Tails
- Ponded Water / Trench
- Barrels
- Abandoned Equipment (compressors, ore cars, rails, air and water pipe)
- Mine Rails / Trestle
- Collapsed Trestle
- Solid Waste Disposal Site
- Area of Soil Contamination
- *(6) Transformer Loaction (number of transformer in brackets)
- Power Line
- Power Line Collapsed
- Aerial Transmission Towers
- 5 Photo Site (arrow shows view direction)
- GPS Survey Location
- Former Building Site (Elsa)
- 1999 Tailings Sample
- Pre 1999 Tailings Sample
- 1999 Piezometer Sample
- Pre 1999 Piezometer Sample



CAD FILE: SITE79.DGN

Public Works And Government Services Canada
Travaux publics et Services gouvernementaux Canada

Architectural & Engineering Services
Western Region

Drawing title: / Titre du dessin:

Elsa Tailings Site #79
Site Assessment
Yukon Territory

designed by: / conçu par:		date:
drawn by: / dessiné par:	C.S.	Nov./99
approved by: / approuvé par:		
revisions:		
project no. / no. du projet:	125-12.01	dwg. no. / dessin no. 1 of 1

Photo 79-1. Toe berm (light-colored material) at the base of Dam No. 1, looking northwestward.

Photo 79-2. Tailings cells for future tailings, looking northward.

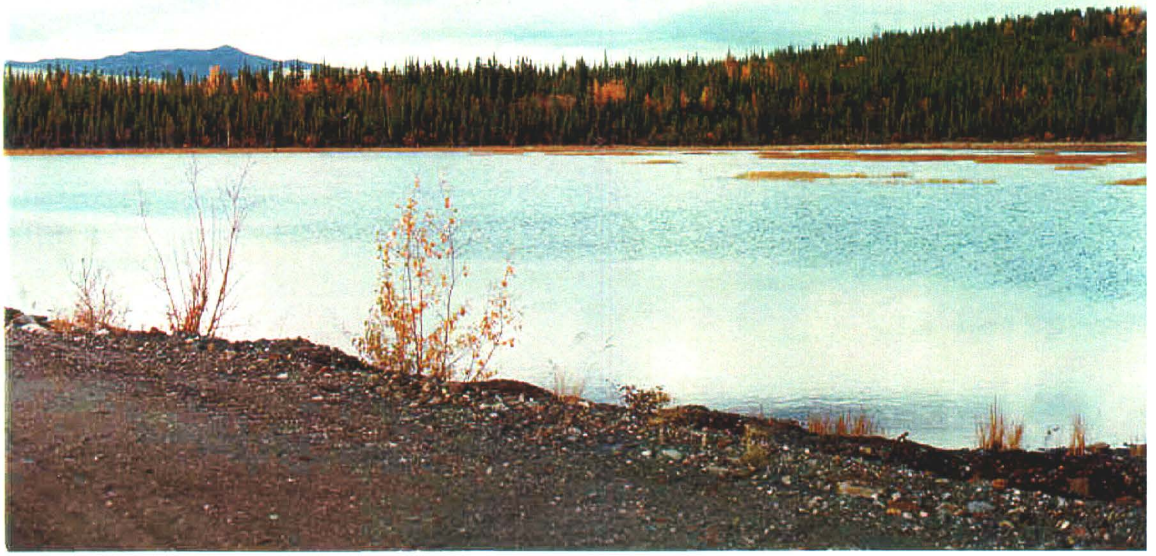


Photo 79-3. View of tailings pond No. 1, taken from Dam No. 1.

Photo 79-4. Exposed tailings behind Dam No. 1.

Photo 79-5. Tailings Dam No. 2, looking southeastward. The lime treatment plant can be seen at the far end of the dam. The Elsa townsite is in background on the hill.

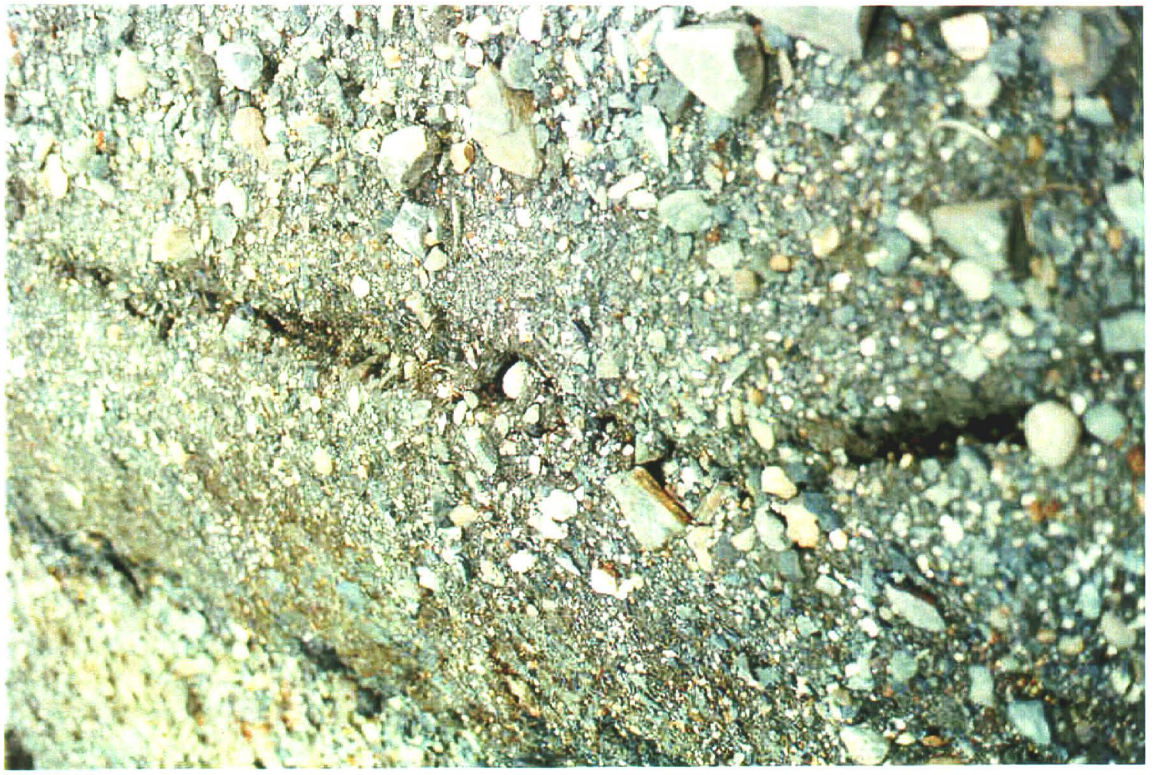


Photo 79-6. Tension cracks in tailings Dam No. 2.

Photo 79-7. Ponded water below Dam No. 2. Note red iron-oxide precipitate in water.

Photo 79-8. Tailings pond No. 2, taken looking eastward from Dam No. 2.

Photo 79-9. Decant in Dam No. 2, upstream side.

Photo 79-10. Decant in Dam No. 2, downstream side. Note lime precipitate around decant.

Photo 79-11. Tailings Dam No. 3, looking south.

Photo 79-12. Tension cracks in Dam No. 3.

Photo 79-13. Wooden decant and v-notch weir in Dam No. 3. Note subsidence around decant.

Photo 79-14. Pipe on downstream side of decant on Dam No. 3. This is also sampling site 79-WQ-02.

Photo 79-15. Lime treatment plant on Dam No. 1.

Photo 79-16. Lime treatment plant on Dam No. 2.

Photo 79-17. Transmission building (79A) and satellite dish.

Photo 79-18. Northwestel building and satellite dish (Building 79C).

Photo 79-19. Barrels stored in boneyard.

Photo 79-20. Old vehicles stored in boneyard.

Photo 79-21. Old household appliances stored at boneyard.

Photo 79-22. Pump house on unnamed lake that is the fresh water supply for the Elsa townsite.

Photo 79-23. Pressure pump house that pumps the fresh lake water to the Elsa townsite. Note picket fence to the right of the house that contains the transformer that is in use.