010

THE
ENVIRONMENTAL
APPLICATIONS
GROUP LIMITED

Suite 1006, P.O. Box 2041
20 Eglinton Avenue West
Toronto, Ontario, M4R 1K8
Telephone: (416) 322-5701
Telecopier: (416) 322-5706

BUTLER-ANTOINE KYANITE PROJECT
KYANITE MINING CORPORATION

AQUATIC RESOURCES SURVEY
INTERIM REPORT

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

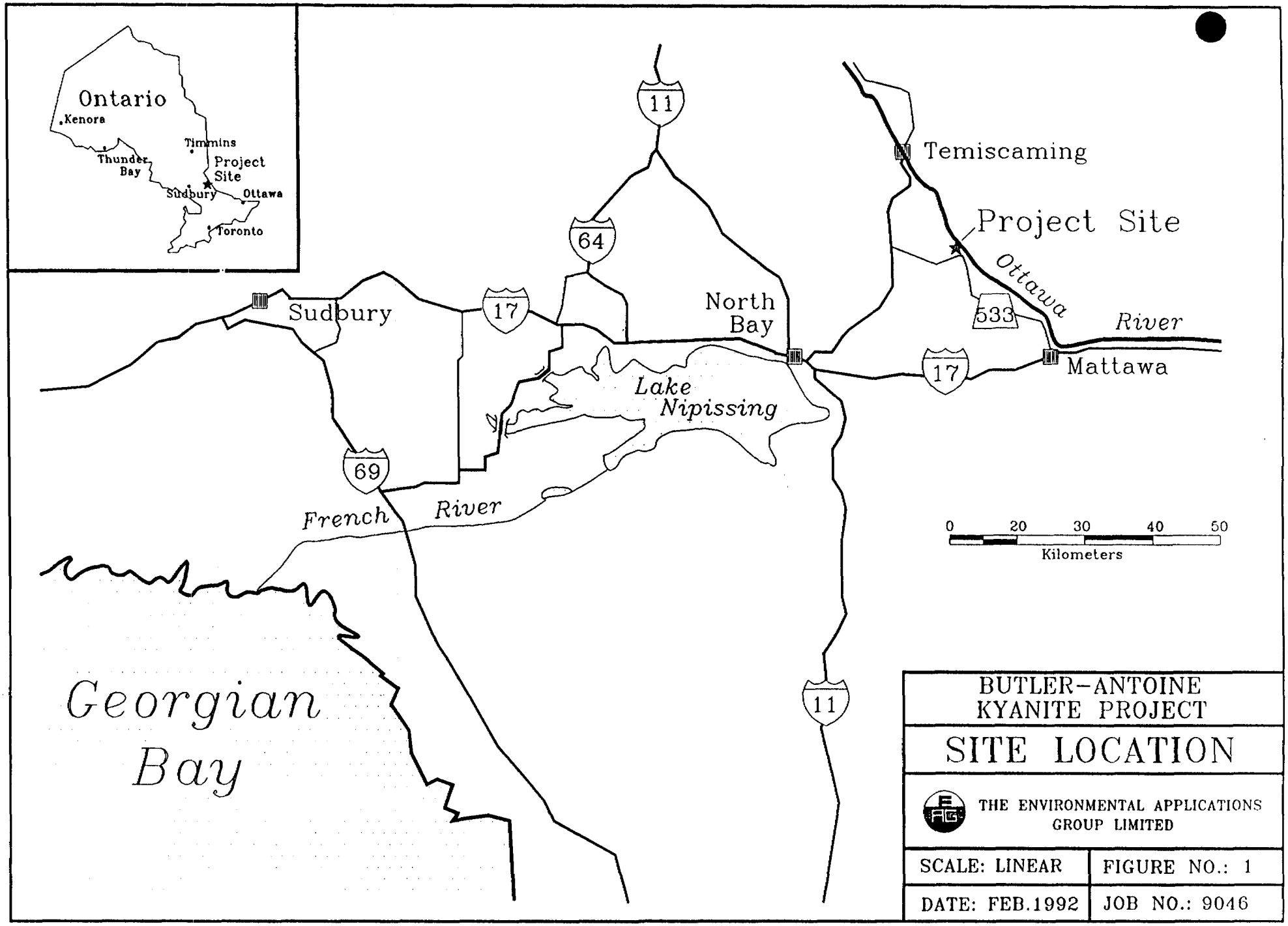
1.0 INTRODUCTION

Ron Blais and Associates enlisted the services of The Environmental Applications Group Limited to document the baseline conditions of the Butler-Antoine Kyanite site located east of North Bay, Ontario. The site is being proposed for a kyanite extraction and milling industry. Field investigations were carried out at the end of September 1991 to document local aquatic resources. The field program included water, sediment and benthos collections, fish community sampling, aquatic habitat description and documentation of stream crossings. This report describes the aquatic resources of the site and fulfills partial information requirements for the liquid industrial waste application

1.1 STUDY SITE

The study site was located in Butler-Antoine Township approximately 50 km east-northeast of North Bay, Ontario and was bounded to the east by the Ottawa River (Figure 1). Principal road access is along Highway 533. A main access road leads from the highway and reaches to the north end of the property. A number of secondary roads diverge from the main access road providing access to a large portion of the study area. These roads date back to local mining exploration and lumber activities.

The site contained one large water body, Crocan Lake, located on crown land and under control of the Ontario Ministry of Natural Resources. The physiography of the site provides a variety of local relief which is exhibited in the large number of perched bog ponds and intermittent streams which occur between the bedrock knob dominated topography.


Ontario
Kenora
Thunder Bay
Timmins
Project Site
Sudbury
Ottawa
Toronto
11
64
17
69
533
Temiscaming
Project Site
Ottawa River
Sudbury
North Bay
Mattawa
Lake Nipissing
French River
Georgian Bay
0 20 30 40 50
Kilometers
BUTLER-ANTOINE KYANITE PROJECT
SITE LOCATION
THE ENVIRONMENTAL APPLICATIONS GROUP LIMITED
SCALE: LINEAR
FIGURE NO.: 1
DATE: FEB.1992
JOB NO.: 9046

The study area is frequented by local hunters for upland game and moose. A single cottage is located on one of the secondary site roads just north of Crocan Lake. Ample evidence of past logging activities is observed throughout the project site.

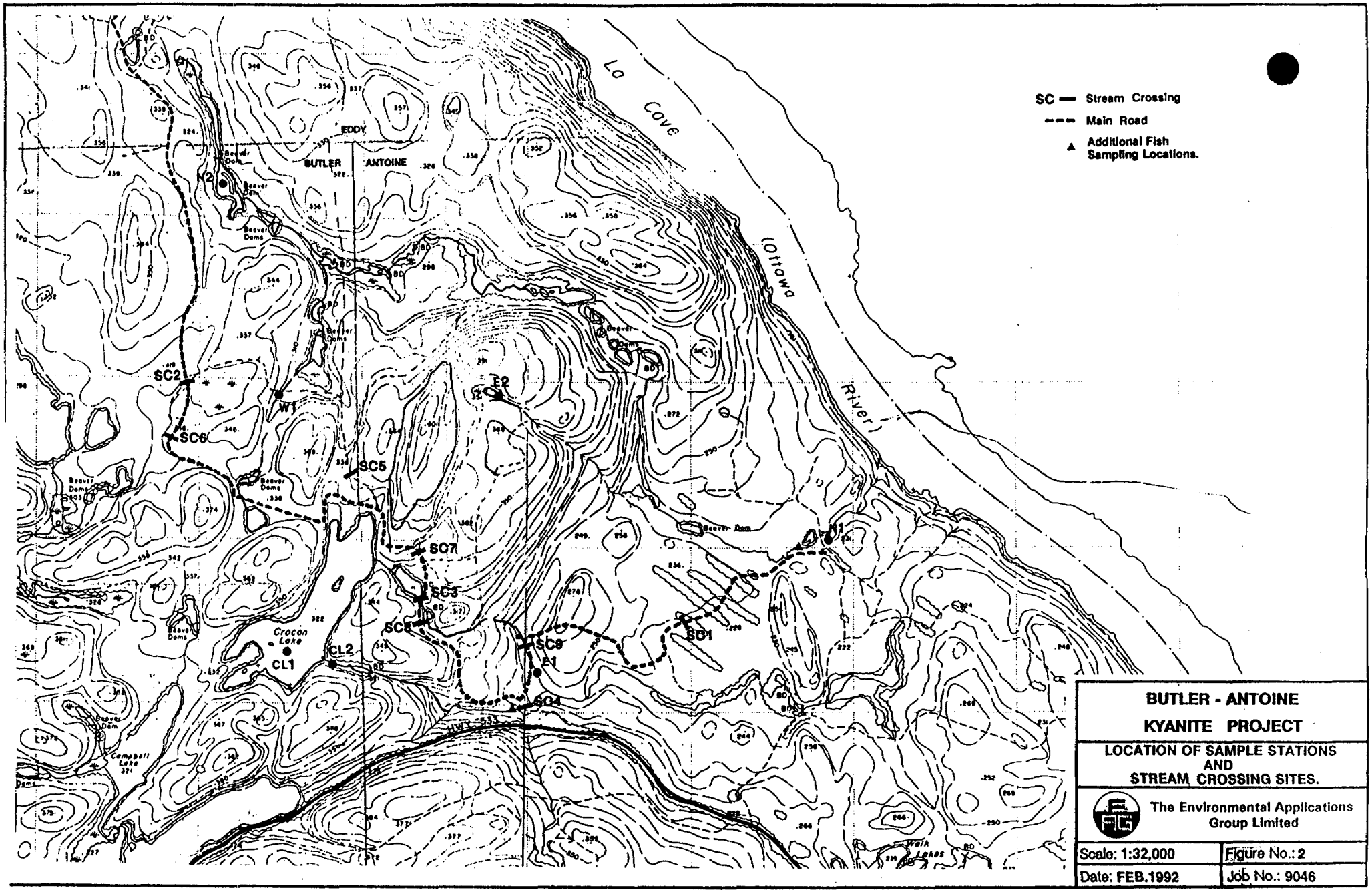
1.2 PHYSIOGRAPHICAL SETTING

The surrounding topography of the study area is typified by steep slopes with variable rugged and broken terrain. The project site is located in an area of sloping relief between the lowland Ottawa River and higher upland relief. The dominant landform is bedrock knob with a subordinate landform of ground moraine and till and organic veneer over bedrock. The local relief is characterized as jagged, rugged and cliffed. Drainage is considered dry to mixed wet.

2.0 FIELD STUDY METHODOLOGY

2.1 WATER QUALITY

Surface water was sampled from 7 stations within the study area to characterize the water quality conditions of the site. Samples were analyzed for general and physical parameters as well as metals. The locations of the sampling stations are outlined in Figure 2. Four sample stations were streams (E1, CL1, N1 and W1), 2 were beaver ponds (N2 and E2) and 1 a lake site (Crocan Lake). Field records included water temperature, dissolved oxygen and secchi depth measurements for water clarity.



BUTLER - ANTOINE
KYANITE PROJECT

LOCATION OF SAMPLE STATIONS AND STREAM CROSSING SITES.

The Environmental Applications Group Limited

Scale: 1:32,000	Figure No.: 2
Date: FEB.1992	Job No.: 9046

2.2 SEDIMENT QUALITY

Sediment sampling occurred at each of the 7 sample stations (Figure 2). Samples were collected using a 15.2 cm x 15.2 cm (6 inch x 6 inch) Ekman dredge. Each sample was a composite of 10 replicates taken randomly in the vicinity of the sample point. Samples were analyzed for arsenic, cadmium, copper, iron, lead, mercury, nickel, zinc and organic content (LOI).

2.3 FISHERIES

Fisheries investigations were carried out to document the fish communities in the streams located in the study site. Fish sampling was carried out using minnow traps, a 15.2 m (50 ft.) long gill net with a 5 cm (2 inch) stretched mesh opening and a 3.3 m x 1.4 m (11 ft. x 4.5 ft. beach seine. Due to the small size and intermittent nature of the streams, minnow traps were principally used. Sampling occurred at sites E1 (minnow traps), N1 (minnow traps, beach seine and trap net), N2 (seine net and minnow traps). For the remaining sites records were based on visual observation of fish presence. Sampling was not permitted in Crocan Lake due to an introduced splake population (D. Maraldo, MNR North Bay, pers. comm.). The location of the fish sampling stations is shown in Figure 2.

2.4 STREAM CROSSINGS

All locations of stream crossings along the main road through the study area were documented. At each crossing the upstream and downstream characteristics were

described according to habitat type, vegetation cover, stream bank characteristics, substrate and flow conditions. Observations were reviewed to provide an evaluation of potential fish habitat.

3.0 ENVIRONMENTAL CONDITIONS

3.1 WATER QUALITY

3.1.1 General and Physical

The results of water quality analyses are shown in Table 1. Water quality at the site was good and was typical of oligotrophic conditions as influenced by the controlling shallow bedrock in the area. Oligotrophic conditions were demonstrated by the lower pH values which ranged from 5.65 to 6.73 and low conductivity, which ranged from 24 to 44 μs/cm, indicating low ion presence in the water. High conductivity values usually indicate more eutrophic conditions. Similarly, alkalinity values were also low, ranging from 2 to 9 mg/L.

Phosphorus and nitrogen content in the water provide measures of nutrient availability and furthermore, conditions of nutrient enrichment. Generally, nutrient levels in the samples were low. Nitrate levels for all samples was <0.1 mg/L and ammonia ranged from 0.022 to 0.03 mg/L. Phosphorus levels ranged from <0.005 mg/L at Crocan Lake to 0.03 mg/L at site E1. These low nutrient levels indicate a non-enriched system. All general and physical parameters met Provincial Water Quality Objectives for Protection to Aquatic Life (PWQO).

TABLE 1

WATER QUALITY
AQUATIC RESOURCES SURVEY
BUTLER ANTOINE KYANITE PROJECT

PHYSICAL & GENERAL	Units	CL1	CL2	E1	E2	N1	N2	W1
pH		6.26	6.20	6.33	5.65	6.54	6.44	6.73
Conductivity	uS/cm	27	35	44	24	40	45	25
Total suspended solids	mg/L	<2.0	6.0	2.0	<2.0	<2.0	<2.0	<2.0
Total alkalinity	mg/L	2	3	8	2	7	8	9
Nitrate-N	mg/L	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Ammonia-N	mg/L	0.030	0.028	0.022	0.025	0.024	0.024	0.026
Total phosphorus	mg/L	<0.005	0.006	0.030	0.028	0.026	0.028	0.021
MINOR CATIONS								
Arsenic	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Cadmium	mg/L	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Copper	mg/L	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Iron	mg/L	<0.005	0.064	1.02	0.20	0.41	0.14	0.22
Lead	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Mercury	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Nickel	mg/L	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Zinc	mg/L	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005

3.1.2 Metals

Water samples were also analyzed for metals including arsenic, cadmium, copper, iron, lead, mercury, nickel and zinc. The results of metals analyses are shown in Table 1. All samples were below PWQO (0.3 mg/L) but for iron at stations E1 (1.02 mg/L) and N1 (0.41 mg/L). These higher iron levels are not uncommon, as they are largely controlled by the minerology of the site.

3.2 SEDIMENT QUALITY

Sediment analyses results are shown in Table 2. Site CL1 (Crocan Lake) had the highest metal concentrations compared with the other sites. In Crocan Lake cadmium was recorded at 1.6 μg/g, copper (50 μg/g), iron (2.7%), nickel (59 μg/g), zinc (200 μg/g) and lead (48 μg/g). Crocan Lake has a deep basin and would tend to accumulate sediments which result from deposition of soil material carried in surface runoff. This may account for station CL1 (Crocan Lake) having the highest metal concentrations at the study site.

Site E2 had concentrations of cadmium (1.2 μg/g), copper (33 μg/g) and zinc (180 μg/g). Levels of copper, nickel and zinc at site N2 were 40 μg/g, 32 μg/g and 120 μg/g, respectively. The nickel level at site E1 was 25 μg/g.

These values are considered as natural background levels and reflect the metal content found in surrounding bedrock material as there have been no development activities at the site that would have contributed to metals loading of the aquatic environment..

TABLE 2

SEDIMENT QUALITY
AQUATIC RESOURCES SURVEY
BUTLER ANTOINE KYANITE PROJECT

PHYSICAL & GENERAL	Units	CL1	CL2	E1	E2	N1	N2	W1
Arsenic	ug/g	6.4	0.58	0.21	2.0	0.57	0.94	0.55
Cadmium	ug/g	1.6	<0.2	<0.2	1.2	<0.2	<0.2	0.4
Copper	ug/g	50	4.3	3.8	33	11	40	4.8
Iron	%	2.7	0.23	0.34	0.26	0.13	0.064	1.1
Lead	ug/g	48	9.9	5.9	49	9.9	28	12
Mercury	ug/g	0.19	0.02	0.02	0.19	0.036	0.22	0.036
Nickel	ug/g	59	21	25	7.6	4.1	32	16
Zinc	ug/g	200	25	12	180	32	120	21
Loss on ignition	%	47.4	45.6	12.9	60.8	47.9	49.4	39.7

The relatively low organic content of the sediments indicated the high mineral component of the sediments which typically reflects the surficial soils of the site. Organic content ranged from 12.9% at site E1 to 60.8% at site E2.

3.3 FISHERIES

At site E1, minnow traps were placed in the stream, downstream of the road crossing and in the beaver pond located immediately upstream of the road crossing. The traps at this location were set for a total of 92.5 hours each and were checked regularly.

At site N2, 2 minnow traps were set downstream of the road crossing for a period of 18 hours and a beach seine (3 hauls) was used to sample fish in the ponded area located immediately above the road crossing. Two minnow traps (22 hours each) and 2 trap nets (48 hours each) were set upstream of N2 in the meandering stream in wet meadow habitat.

At site CL2, the Crocan Lake discharge, schools of forage fish were observed moving up and down the stream. Numbers of fish were estimated and identification of the species obtained by capturing fish using a dip net. No fish were observed at sites E2 and W1.

A total of 74 fish were captured and an additional 60 fish observed during the sampling period. The most common species encountered was the northern redbelly dace (Chrosomus eos) which was collected/observed from 4 of 7 sites for a total of 93 fish. Other species encountered included the central mudminnow (Umbra limi) (6), the brook stickleback (Culaea inconstans) (9) and finescale dace (Chrosomus neogaeus). All of

these species are representative of fish species typically found in small streams and bog ponds in northern Ontario (Scott and Crossman 1973).

3.4 AQUATIC HABITAT

3.4.1 Crocan Lake

i) Habitat Characteristics

Crocan Lake exhibits a deep basin and is a characteristic oligotrophic shield lake (see section 2.1.1). Water clarity on September 23, 1991 was 6.5 m. This value compared with the secchi depth recorded in June 1970 (6.7 m) suggests that water clarity was similar and the lake had remained unchanged and was not greatly influenced by suspended particles or algae.

The vertical oxygen profile also indicates that oxygen levels suitable for supporting fish reach a depth of 15 m (49 ft.) and that to a depth of 21 m (69 ft.) aerobic conditions persisted (2.5 mg/L; Figure 3).

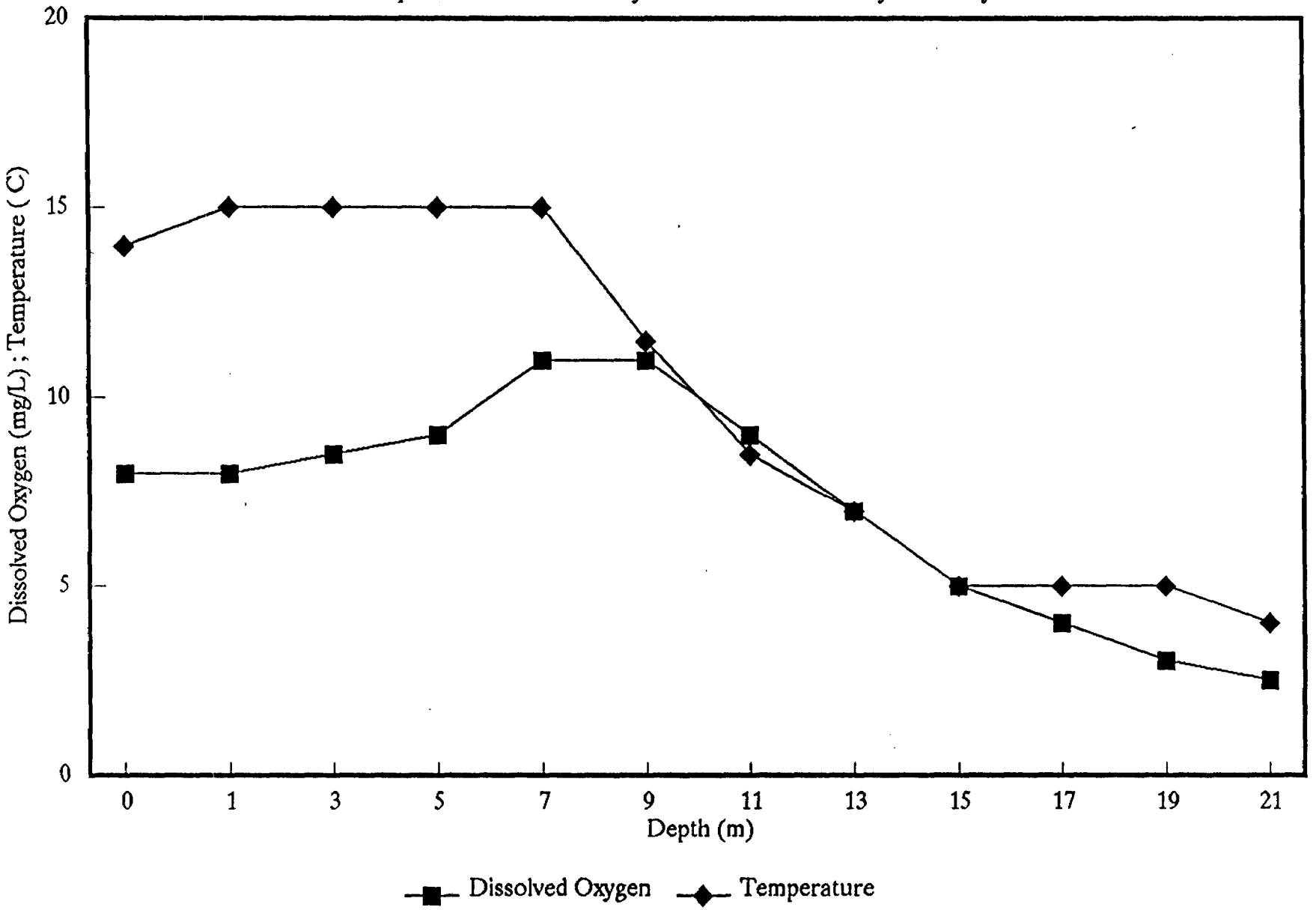
Lake morphometry (Figure 4) consisted of a steeply sloping basin in the south end of the lake which had a maximum depth of 27 m (90 ft.), and a generally flat basin in the north end of the lake with a maximum depth of 9 m (30 ft.).

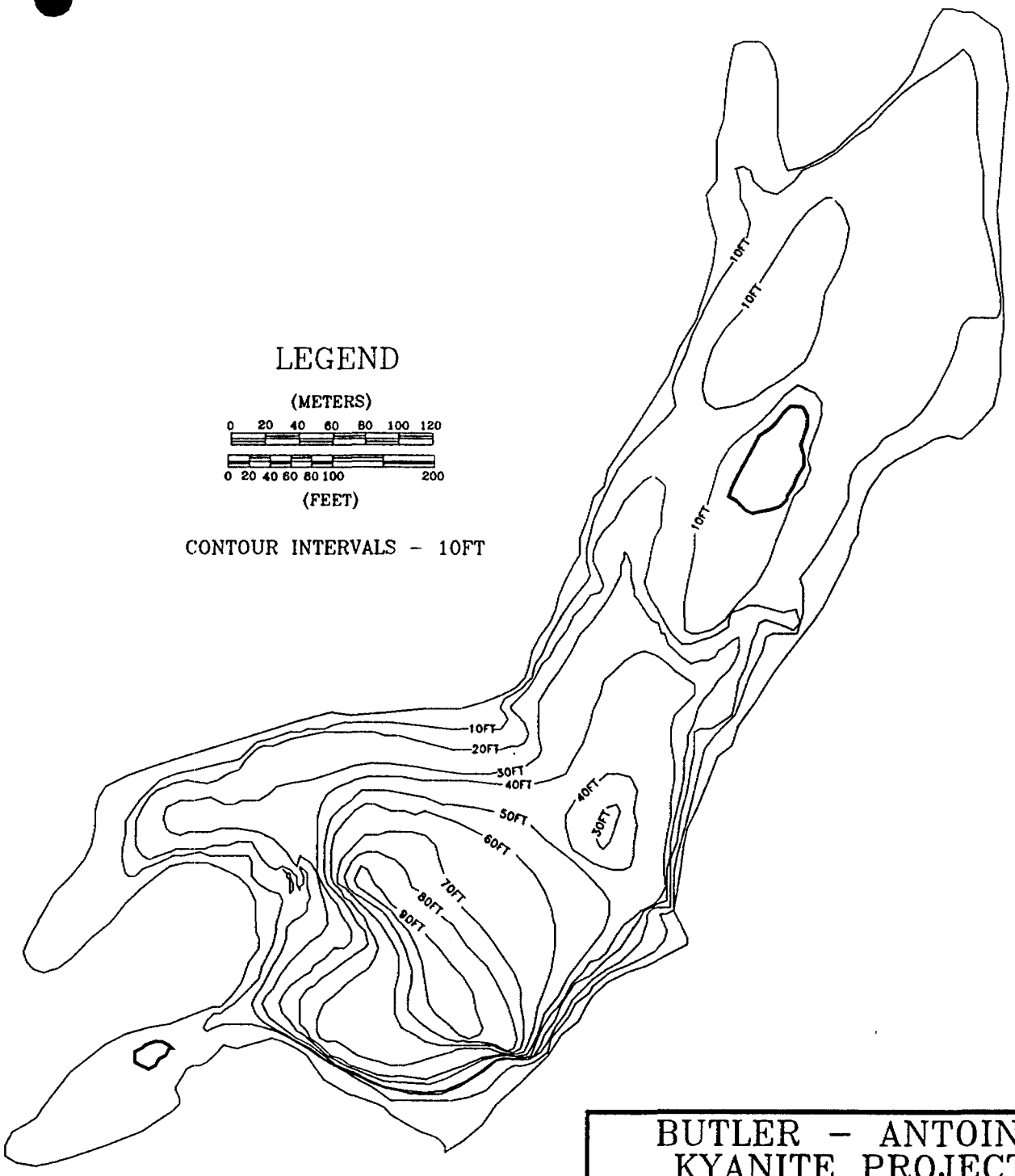
Some shallow, flat areas of the littoral zone are covered with woody debris and silt. Such conditions were predominant in the north end of the lake. Dredge sampling for sediments

Figure 3

Crocan Lake Oxygen/Temperature – Depth Profile

Aquatic Resources Survey – Butler–Antoine Kyanite Project





BUTLER - ANTOINE KYANITE PROJECT

CROCAN LAKE BATHYMETRY

THE ENVIRONMENTAL APPLICATIONS GROUP LIMITED

SCALE: 1:1100	FIGURE NO.: 4
DATE: FEB.1992	JOB NO.: 9046

at the 5 to 6 m depth (20 m offshore) collected soft, loose organic material. This material was not suitable substrate for splake spawning, the major species in the lake. However, sufficient spawning habitat must be present as splake productivity in the lake has been identified as good (MNR 1985).

ii) Vegetation

The vegetation communities surrounding the lake include a shoreline community of shrubs, grasses and sedges which occupy the northern end of the lake and narrow areas around the lake perimeter and the dominant upland forest community. The shoreline community consists mostly of sweet gale (Myrica gale) with some grass and sedge species. White spruce (Picea glauca) and white pine (Pinus strobus) shrubs also occur in this community.

Immediately upslope of the shoreline was the upland mixed forest community which consisted of a closed canopy forest of white pine, white spruce, eastern hemlock (Tsuga canadensis), eastern white cedar (Thuja occidentalis), sugar maple (Acer saccharum), white birch (Betula papyrifera) and yellow birch (Betula lenta). Shrub cover was variable and included species such as blueberry (Vaccinium sp.), dogwood, hobble-bush (Viburnum alnifolium) while ground cover was restricted to bunchberry (Cornus canadensis), northern blue-bead lily (Clintonia borealis) and large-leaved aster (Aster macrophyllus).

Where rock faces occur the canopy was more open and was dominated by white pine and white spruce. The shoreline vegetation does not provide shading effect.

iii) Fish

Crocan Lake had supported a stocked brook trout population since the early 1960's. In 1983, splake (Brook Trout x Lake Trout) were introduced to the lake to replace the nonproductive brook trout population. Creel surveys carried out in 1984 and 1985 indicated that the splake fishery was good for short duration but due to heavy pressure was vulnerable to winter angling. The CUE (catch per unit effort) for January 1984 and January 1985 was 0.28 and 0.35, respectively, compared with the total CUE for the months of January to March for each of the years; 0.19 and 0.28, respectively (MNR 1985).

3.4.2 Streams

i) Habitat Description

Generally, two categories of streams were found on the site. These were described as permanent base flow streams and intermittent streams. Sampling and site descriptions were carried out in greater detail for the base flow type streams in which flowing water was observed during the dry fall period. The nature of intermittent streams at the site are discussed in section 2.6.. Stream conditions at the site consisted of mostly narrow, shallow streambeds intermixed with areas of beaver pond. Beaver dams and associated buildup of woody debris and variable relief at the site restricted fish movement and access to other areas of the site.

Streams with flowing water were usually shallow with an average depth of 5 cm to 15 cm.

Maximum depths approaching 60 cm were recorded in ponded sections. Channel widths varied from 0.5 m to 3.5 m, with the greatest width recorded at Timber Creek (6 m) at the main access road crossing.

Stream substrate material consisted of varying percentages of medium to coarse sand, cobble, boulder and silt. Boulders were present only at the Timber Creek crossing and N1. A small percentage of boulder cover was found at sites W1 and CL2. Cobble accounted for 50% of the substrate composition in Timber Creek above the road crossing. Substrate conditions of pebble bottom below shallow swift moving water at CL2 (Crocan Lake outlet) had been identified as suitable for supporting brook trout spawning (MNR 1970).

ii) Vegetation

Plant communities surrounding the stream sites were mostly closed canopy deciduous to mixed lowland forest dominated by eastern white cedar, yellow birch, white birch with variable representation of white spruce and black spruce. Eastern white pine and sugar maple were found in more upland relief sites.

Shrub cover on the streambank varied from 5% to 60% cover. Vegetation consisted of yellow birch, sugar maple, some speckled alder and eastern white cedar saplings and seedlings. Ground cover was restricted to species of fern, moss, and a few herb species.

iii) Fish

The fish species composition observed in stream habitat was generally similar that described in section 2.3. The same species found to occupy flowing stream areas occupied swamps and ponds associated with, but isolated from, the streams. The open water swamp areas and ponds may offer better habitat in the form of depth as these are less prone to the influence of low flow conditions, and the swamps have some submerged and emergent aquatic plant growth and woody debris structure providing cover.

3.4.3 Beaver Ponds

i) Habitat Characteristics

Beaver ponds, do not usually support diverse aquatic life due to limited habitat. Beaver pond substrate was a homogeneous organic silt which was poor substrate for fish spawning and supporting aquatic macrophyte growth, which forms important structure for fish and invertebrates. Also, due to the bedrock controlled topography, beaver ponds were perched, exhibited little or no flow, and therefore had poor water circulation and oxygenation potential. Examples of these conditions occurred at site E2 where pH was recorded at 5.65 which can be considered slightly acidic and not suitable to supporting diverse or abundant aquatic life. Beaver ponds are generally isolated water bodies which restrict fish movement due to dam building and water level manipulation.

ii) Vegetation

Vegetation surrounding beaver ponds were lowland coniferous forest communities which consisted of black spruce, white spruce and eastern white cedar. A narrow band of shrub, grass and sedge species occupied the area between the forest edge and the pond edge. Sites N2 and E2 both had floating mats of sphagnum with shrub cover provided by leatherleaf and sweet gale.

Shoreline vegetation around beaver ponds was susceptible to change as a result of reduced or increased beaver activity and subsequent water level control in a section of stream. Apart from the limited deeper portion of the beaver pond at N2, the pond was shallow with a large amount of exposed sediment flats.

iii) Fish

Fish abundance in the beaver ponds at the site appeared to be limited. Trapping exercises resulted only in the capture of 1 northern redbelly dace. In other similar standing water habitats at the site, fish presence was easily observable. The lack of fish observations would suggest that beaver ponds at this site support a very limited fish community and possibly low abundance.

3.5 BENTHIC INVERTEBRATE COMPOSITION

- data presently being prepared

3.6 STREAM CROSSINGS

Several stream crossings were encountered throughout the road network of the site. All identifiable stream crossings were documented and described including flow conditions, substrate, vegetation and habitat type. Stream crossing locations are shown in Figure 2 and stream crossing descriptions are provided in Table 3.

All stream crossings were intermittent but for the Timber Creek crossing and the crossing just upstream of site E1. The relief and topography of the site provide for intermittent flow from storm events and spring runoff. Drainage was rapid downslope to the streams and creeks which enter the Ottawa River.

Generally, stream crossings were characterized by an upstream wetland of wet to moist conditions and a downstream intermittent ponded or dry streambed. The upstream wetland types ranged from an open water treed swamp (SC3) to a narrow swale of grass and shrubs surrounded by mesic to hydric tree and shrub species such as yellow birch and speckled alder. Substrate was mostly composed of organic soils over sand.

Upstream sections of stream crossings SC2 and SC3 both were more distinguished as wetland habitats (treed swamp/wet meadow and open water treed swamp, respectively). Both of these contained emergent aquatic plant species such as bulrush (Scirpus cyperinus), burreed (Sparganium sp.) and bluejoint (Calamagrostis canadensis) and submerged species (Potamogeton epihydrus). Other upstream habitat types consisted of swamp/marsh (SC1, SC7), marsh/upland forest (SC5, SC6) and cattail marsh (S8).

TABLE 3
STREAM CROSSING DESCRIPTIONS
BUTLER-ANTOINE KYANITE PROJECT

STREAM CROSSING	WATER FLOW		SUBSTRATE		CHANNEL WIDTH (m)		HABITAT		VEGETATION COVER	
	U	D	U	D	U	D	U	D	U	D
SC1	Ponded	Diffuse	Organic	Organic	None	None	Semi-open Treed Swamp/Marsh	Semi-closed Treed Swamp/Marsh	T - yb, silm S - sa AE - cat, bul, bur	T - yb, silm S - sa AE - cat, bul, bur
SC2	Ponded	Dry	Organic	Sand - 40 Gravel - 30 Cobble - 30	None	1.5 - 2.5	Open water Treed Swamp/ Wet Meadow	Upland Forest	S - sa AE - bul, gr AS - pw	T - yb, bfir S - sa
SC3	Ponded	Intermittent	Organic	Thin organic over coarse sand	None	0.25	Open water Treed Swamp	Upland Forest	AS - pw AF - bl	T - wb, eh S - sa

LEGEND

1) Channel Width; ww - wet width
2) Vegetation Cover

i) Trees; yb - yellow birch, wb - white birch, silm - silver maple, sugm - sugar maple bfir - balsam fir, eh - eastern hemlock, wc - white cedar
ii) Shrubs; sa - speckled alder, rodog - red-osier dogwood, hob - hobblebush
iii) Ground; sedg - sedge, gr - grass

Aquatics
AE - Aquatic Emergents; cat - cattails, bur - burreed, bul - bulrush
AS - Aquatic Submergents; pw - pondweed, bw - bladderwort
AF - Aquatic Floating; bl - bullhead lily

TABLE 3 (cont'd)

STREAM CROSSING	WATER FLOW		SUBSTRATE		CHANNEL WIDTH (m)		HABITAT		VEGETATION COVER	
	U	D	U	D	U	D	U	D	U	D
SC4	Flowing	Flowing	Cobble - 50 Boulder - 30 Gravel - 10 Sand - 10	Sand - 90 Gravel - 5 Boulder - 3 Organic - 2	6 ww - 3.5	3.5 ww - 2.5	Riverine/ Closed Canopy	Riverine/ Open Canopy	T - yb, sugm, eh S - sugm, yb	T - yb, wc S - sa, rodog AE - cat, sedge
SC5	Intermittent	Dry	Organic	Sand Cobble	None	1.5	Marsh/Upland Forest	Closed Canopy Upland Forest	T - yb, sugm S - sa, yb, AE - bul, cat	T - sugm S - sugm, yb G - ferns
SC6	Intermittent	Dry	Organic	Boulder - 50 Gravel - 25 Sand - 15 Cobble - 5	None	0.5	Upland Forest/Wet Meadow	Upland Forest	T - yb,sm S - sa G - sedg, gr	T - yb, sm S - sa, hob

LEGEND

1) Channel Width; ww - wet width
2) Vegetation Cover

i) Trees; yb - yellow birch, wb - white birch, slm - silver maple, sugm - sugar maple bfir - balsam fir, eh - eastern hemlock, wc - white cedar
ii) Shrubs; sa - speckled alder, rodog - red-osier dogwood, hob - hobblebush
iii) Ground; sedg - sedge, gr - grass

Aquatics
AE - Aquatic Emergents; cat - cattails, bur - burreed, bul - bulrush
AS - Aquatic Submergents; pw - pondweed, bw - bladderwort
AF - Aquatic Floating; bl - bullhead lily

TABLE 3 (cont'd)

STREAM CROSSING	WATER FLOW		SUBSTRATE		CHANNEL WIDTH (m)		HABITAT		VEGETATION COVER	
	U	D	U	D	U	D	U	D	U	D
S7	Ponded	Dry	Organic/silt	Gravel - 90 Sand - 10	None	0.3	Open Swamp	Wet Meadow	T - yb, sugm, eh G - sedg, gr	T - sugm, yb S - sugm, yb G - sedg, gr
S8	Ponded	Dry	Organic	-	None	None	Cattail Marsh	Lowland Forest/Wet Meadow	AE - cat (T - sugm, eh, yb)	T - sugm, yb, eh G - gr, sedg
S9	Ponded/ Flowing	Flowing	Organic	Sand	None	0.5 - 1.5	Open Treed Swamp/ Wet Meadow	Lowland Shrub	AS - pw, bw, algae (T - wp, ws, wb)	S - sa (T - wp, ws)

LEGEND

1) Channel Width; ww - wet width
2) Vegetation Cover

i) Trees; yb - yellow birch, wb - white birch, silm - silver maple, sugm - sugar maple bfir - balsam fir, eh - eastern hemlock, wc - white cedar
ii) Shrubs; sa - speckled alder, rodog - red-osier dogwood, hob - hobblebush
iii) Ground; sedg - sedge, gr - grass

Aquatics
AE - Aquatic Emergents; cat - cattails, bur - burreed, bul - bulrush
AS - Aquatic Submergents; pw - pondweed, bw - bladderwort
AF - Aquatic Floating; bl - bullhead lily

Downstream conditions usually consisted of a narrow dry streambed running through upland forest with a streambank border of grass and shrub. The dry streambed exhibited substrate materials consisting mostly of sand and gravel with varying amounts of cobble and boulder.

The open water treed swamp (SC3), Timber Creek crossing (SC4), the open water treed swamp/wet meadow (SC8) and possibly treed swamp/wet meadow (SC2) habitats were capable of supporting small populations of forage fish. This was observed in the upstream pond at road crossing site SC8 (upstream E1) site where forage fish were found. The remaining water crossings on the upstream side are either dry or have very limited ponded water and therefore would not provide habitat for fish.

4.0 SITE DEVELOPMENT

This report covered only the proposed pumphouse site at Crocan Lake. Description of the remainder of site development and potential impacts will be presented in a subsequent report as part of the liquid industrial waste application.

4.1 PUMPHOUSE SITE

A site on the northeast shore of Crocan Lake was preliminarily identified as a possible site for the pumphouse (Figure 2). The proposed site was a small (40 m long x 30 m wide) bog typical of northern Ontario lowland environments. The bog had a sphagnum ground cover in addition to several ericaceous shrub species which included labrador tea (Ledum groenlandicum), bog rosemary (Andromeda glaucophylla) and bog laurel (Kalmia

polifolia). Sedge (Carex rostrata) and pitcher plant (Sarracenia purpurea) are also present. Sweet gale and leatherleaf also provided shrub cover. At the west edge of the bog, at the lake shoreline, sweet gale, leatherleaf and Vaccinium sp. formed the plant cover. On the north, east and south sides the bog was surrounded by an upland forest of eastern hemlock, white pine, white spruce and yellow birch.

Immediately at the shoreline, the water was 0.5 m deep and increased in depth to 2.5 m at approximately 5 m distance out from the shoreline. The substrate in this area was mostly woody debris over sand/silt.

Based on these results it would be more appropriate to consider a site toward the south end of the lake where water depths are greater and structures can be erected on a stable surface. Any location in the south end of the lake would have to take into consideration splake presence and habitat.

4.0 SUMMARY

The aquatic environment at the Butler-Antoine Kyanite site consisted mostly of intermittent and low base flow streams. Timber Creek located at the southern edge of the study site and Crocan Lake were the largest permanent water bodies at the site. Other streams were either intermittent or had limited flow. Most stream crossings encountered along the site access roads were dry on the downstream section and were either ponded or exhibited moist soil conditions on the upstream section.

The intermittent nature of stream and beaver pond complexes greatly reduced habitat

availability for fish. But for Crocan Lake and possibly, Timber Creek, the site is limited to supporting forage fish, which are represented by northern redbelly dace, central mudminnow, finescale dace and brook stickleback. Crocan Lake supports an introduced splake fishery and is considered an important fishery. The fishery does receive winter pressure from anglers.

Water quality was good and exhibited oligotrophic conditions as a result of the sand over bedrock controlled landscape. Background metal levels in sediments were documented and represent natural levels.

5.0 RECOMMENDATIONS

In support of site location approval and the Liquid Industrial Waste Application, further baseline information and an environmental impact assessment is required. The following outlines environmental aspects of the project that need to be addressed:

1) Fisheries - Timber Creek - baseline environmental conditions (MNR records)
2) Wildlife - wildlife use of the site - MNR records and habitat description
3) Vegetation - communities description and mapping
4) Archaeology - resource potential at the site
5) Soils - general and site specific
6) Land Use/Recreation - use of the site
7) Impacts - site specific from layout of site infrastructure
   - short term impacts from construction
   - long term impacts from operation
8) Mitigation Strategy Development
   - dependent upon identified impacts to water quality, fisheries rresources, widlife etc.

The above work items are general by may require either more or less attention depending upon the site plan and operation design. Development of final site plan and operation characteristics and schedule will help to focus on the types of mitigation, if any, that might be required.

6.0 REFERENCES

Maraldo, D. 1991. District Fisheries Biologist. Ontario Ministry of Natural Resources. Personal communication.

Ontario Ministry of Natural Resources. 1970. Crocan Lake - Lake Survey Summary Sheet. North Bay District.

Ontario Ministry of Natural Resources. 1985. Winter Creel Census - Crocan Lake, 1984-1985. North Bay District.

Scott, W.B. and E.J. Crossman. 1973. Freshwater Fishes of Canada. Fisheries Research Board of Canada, Ottawa, 1973. Bulletin 184.

R.M. Blais & Associates Limited *Civil and Mining Engineers*

PINEWOOD PARK DRIVE
P.O. BOX 237

NORTH BAY, ONTARIO
P1B 8H2

Office: 705-474-4110
Home: 705-474-4793

ASSESSMENT WORK - ENVIRONMENTAL STUDIES

MINE - MILL - TAILINGS

ENVIRONMENTAL APPLICATIONS GROUP LTD.
Suite 1006
P.O. Box 2041
20 Eglington Avenue, West
TORONTO, Ontario
M4R 1K8

RE: KYANITE MINING CORPORATION
BUTLER/ANTOINE KYANITE PROJECT

SUMMARY OF INVOICES - July 8, 1992

	Invoice No.	Invoice Amt.	G.S.T.	Assessment $
Sept. 30/90	1662	$1,548.58	---	$1,548.58
Oct. 31/90	1723	3,245.38	---	3,245.38
Nov. 30/90	1748	1,440.48	---	1,440.48
May 31/91	2082	327.99	21.46	306.53
June 30/91	2158	672.24	43.98	628.26
Sept. 27/91	9005	12,038.76	787.58	11,251.18
Dec. 31/91	12021	5,356.70	350.44	5,006.26
Feb. 24/92	201029	1,225.15	80.15	1,145.00
April 6/92	203006	2,409.85	157.65	2,252.20
May 27/92	204028	2,477.30	162.07	2,315.23
June 12/92	205021	265.58	17.37	248.21
		$31,008.01	$1,620.70	$29,387.31

TOTAL ASSESSMENT DOLLARS..... $29,387.31

THE
ENVIRONMENTAL
APPLICATIONS
GROUP LIMITED

Suite 1006, P.O. Box 2041
20 Eglinton Avenue West
Toronto, Ontario, M4R 1K8
Telephone: (416) 322-5701
Telecopier: (416) 322-5706

2.14677

December 4, 1991

Mr. Ron Blais
Ron Blais and Associates
P.O. Box 237
North Bay, Ontario
P1B 8H2

Dear Mr. Blais:

Please find enclosed results of water quality and sediment analyses from the aquatic environment survey carried out at the Antoine-Butler Kyanite site in September 1991. A figure showing the location of the sample sites is also enclosed.

Water quality at the site is good. The general and physical parameters all indicate water conditions typical of oligotrophic systems which are influenced by shallow bedrock conditions. This can be observed in the low conductivity and alkalinity observed at each site. Lower pH values are also indicative of such conditions as there is limited buffering capacity. The lowest pH recorded was 5.65 at site E2, located at the downstream end of a bog pond. The low reducing conditions of the pond may account for the low pH value.

All metals are below Provincial Water Quality Objectives, but for iron at site E1 which has a concentration of 1.02 mg/L. The PWQO for iron (0.3 mg/L) is based on aesthetic considerations only and iron levels above this value are not uncommon.

Sediment quality is generally good. For comparison purposes only, the following discussion refers to MOE Open Water Disposal Guidelines for disposal of dredged material into Lake Ontario. Sediments exceeding these guidelines can only be disposed of in registered disposal sites. Several parameters exceeded OWDG; however, it should be noted that these guidelines were developed for Lake Ontario lakefill projects only and do not necessarily outline background sediment conditions in all environments. Site CL1 (Crocan Lake) had the highest metal concentrations compared with the other sites. Cadmium (1.6 ug/g), copper (50 ug/g), iron (2.7%), nickel (59 ug/g) and zinc (200 ug/g)

.../2

were above OWDG while lead (48 ug/g) was just below the limit. Site E2 had elevated levels of cadmium (1.2 ug/g), copper (33 ug/g) and zinc (180 ug/g). Lead approached the limit at a concentration of 49 ug/g. Copper (40 ug/g), nickel (32 ug/g) and zinc (120 ug/g) at site N2 exceed the OWDG. Nickel at site E1 was at the OWDG limit of 25 ug/g.

Please do not hesitate to contact me if you have any questions with regard to these analyses results.

Yours very truly,
THE ENVIRONMENTAL APPLICATIONS GROUP LIMITED

Jeff Warren

Jeff Warren B.Sc.
Senior Biologist

EMS ANALYTICAL SERVICES
A DIVISION OF THE ENVIRONMENTAL
APPLICATIONS GROUP LIMITED

475 COCHRANE DRIVE, UNIT 13
MARKHAM, ONTARIO
L3R 9R5
Tel:(416) 479-6107
Fax:(416) 479-4920

CERTIFICATE OF ANALYSIS

Sample(s) from:
Sample(s): 7 Water samples
Page: 1 of 3

Project No. 9046
Date Sampled:
Date Received: Oct 1,1991
Work Order No: 91-0899

Physical and General	Units	CL 1 Sept 23	CL 2 Sept 23	E 1 Sept 21
Sample Number		91-10-009	91-10-010	91-10-011
pH		6.26	6.20	6.33
Conductivity	uS/cm	27	35	44
Total Suspended Solids	mg/L	<2.0	6.0	2.0
Total Alkalinity	mg/L	2	3	8
Nitrate-N	mg/L	<0.1	<0.1	<0.1
Ammonia-N	mg/L	0.030	0.028	0.022
Total Phosphorus	mg/L	<0.005	0.006	0.030
MINOR CATIONS				
Arsenic	mg/L	<0.001	<0.001	<0.001
Cadmium	mg/L	<0.002	<0.002	<0.002
Copper	mg/L	<0.005	<0.005	<0.005
Iron	mg/L	<0.005	0.064	1.02
Lead	mg/L	<0.01	<0.01	<0.01
Mercury	mg/L	<0.0001	<0.0001	<0.0001
Nickel	mg/L	<0.005	<0.005	<0.005
Zinc	mg/L	<0.005	<0.005	<0.005

Signature Suman Punani **Date** Nov 8/91
Suman Punani (MSc., C.Chem)

EAG ANALYTICAL SERVICES
A DIVISION OF THE ENVIRONMENTAL
APPLICATIONS GROUP LIMITED

475 COCHRANE DRIVE, UNIT 13
MARKHAM, ONTARIO
L3R 9R5
Tel:(416) 479-6107
Fax:(416) 479-4920

CERTIFICATE OF ANALYSIS

Sample(s) from:
Sample(s): 7 Water samples
Page: 2 of 3

Project No. 9046
Date Sampled:
Date Received: Oct 1,1991
Work Order No: 91-0899

Physical and General	Units	E 2 Sept 22 5:00 PM	N 1 Sept 21	N 2 Sept 24
Sample Number		91-10-012	91-10-013	91-10-014
pH		5.65	6.54	6.44
Conductivity	uS/cm	24	40	45
Total Suspended Solids	mg/L	<2.0	<2.0	<2.0
Total Alkalinity	mg/L	2	7	8
Nitrate-N	mg/L	<0.1	<0.1	<0.1
Ammonia-N	mg/L	0.025	0.024	0.024
Total Phosphorus	mg/L	0.028	0.026	0.028
MINOR CATIONS				
Arsenic	mg/L	<0.001	<0.001	<0.001
Cadmium	mg/L	<0.002	<0.002	<0.002
Copper	mg/L	<0.005	<0.005	<0.005
Iron	mg/L	0.20	0.41	0.14
Lead	mg/L	<0.01	<0.01	<0.01
Mercury	mg/L	<0.0001	<0.0001	<0.0001
Nickel	mg/L	<0.005	<0.005	<0.005
Zinc	mg/L	<0.005	<0.005	<0.005

Signature Suman Punani **Date** Nov 8th 91

Suman Punani (MSc., C.Chem)

EAG ANALYTICAL SERVICES
A DIVISION OF THE ENVIRONMENTAL
APPLICATIONS GROUP LIMITED

475 COCHRANE DRIVE, UNIT 13
MARKHAM, ONTARIO
L3R 9R5
Tel:(416) 479-6107
Fax:(416) 479-4920

CERTIFICATE OF ANALYSIS

Sample(s) from:
Sample(s): 7 Water samples
Page: 3 of 3

Project No. 9046
Date Sampled:
Date Received: Oct 1,1991
Work Order No: 91-0899

Physical and General	Units	W 1 Sept 25
Sample Number		91-10-015
pH		6.73
Conductivity	uS/cm	25
Total Suspended Solids	mg/L	<2.0
Total Alkalinity	mg/L	9
Nitrate-N	mg/L	<0.1
Ammonia-N	mg/L	0.026
Total Phosphorus	mg/L	0.021
MINOR CATIONS		
Arsenic	mg/L	<0.001
Cadmium	mg/L	<0.002
Copper	mg/L	<0.005
Iron	mg/L	0.22
Lead	mg/L	<0.01
Mercury	mg/L	<0.0001
Nickel	mg/L	<0.005
Zinc	mg/L	<0.005

Signature Suman Punani **Date** Nov 8th '91
Suman Punani (MSc., C.Chem)

EAC ANALYTICAL SERVICES
A DIVISION OF THE ENVIRONMENTAL
APPLICATIONS GROUP LIMITED

475 COCHRANE DRIVE, UNIT 13
MARKHAM, ONTARIO
L3R 9R5
Tel:(416) 479-6107
Fax:(416) 479-4920

CERTIFICATE OF ANALYSIS

Sample(s) from:
Sample(s): 7 Sediment Samples
Page: 1 of 3

Project No. 9046
Date Sampled:
Date Received: Oct 1,1991
Work Order No: 91-0898
91-11076

Physical and General	Units	CL1 Sept 23	CL 2 Sept 23	E 1 Sept 21
Sample Number		91-10-002	91-10-003	91-10-004
Arsenic	ug/g	6.4	0.58	0.21
Cadmium	ug/g	1.6	<0.2	<0.2
Copper	ug/g	50	4.3	3.8
Iron	%	2.7	0.23	0.34
Lead	ug/g	48	9.9	5.9
Mercury	ug/g	0.19	0.02	0.02
Nickel	ug/g	59	21	25
Zinc	ug/g	200	25	12
Loss On Ignition	%	47.4	45.6	12.9

Signature _____ **Date** Nov 29th '91
Suman Punani(MSc.,C.Chem)

ASSOCIATION OF THE CHEMICAL PROFESSION ONTARIO
CHARTERED
Suman Punani
CHEMIST

EAG ANALYTICAL SERVICES
A DIVISION OF THE ENVIRONMENTAL
APPLICATIONS GROUP LIMITED

475 COCHRANE DRIVE, UNIT 13
MARKHAM, ONTARIO
L3R 9R5
Tel:(416) 479-6107
Fax:(416) 479-4920

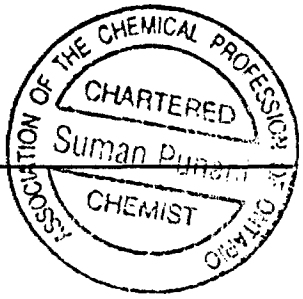
CERTIFICATE OF ANALYSIS

Sample(s) from:
Sample(s): 7 Sediment Samples
Page: 2 of 3

Project No. 9046
Date Sampled:
Date Received: Oct 1,1991
Work Order No: 91-0898
91-11076

Physical and General	Units	E 2 Sept 22	N 1 Sept 21	N 2 Sept 24
Sample Number		91-10-005	91-10-006	91-10-007
Arsenic	ug/g	2.0	0.57	0.94
Cadmium	ug/g	1.2	<0.2	<0.2
Copper	ug/g	33	11	40
Iron	%	0.26	0.13	0.064
Lead	ug/g	49	9.9	28
Mercury	ug/g	0.19	0.036	0.22
Nickel	ug/g	7.6	4.1	32
Zinc	ug/g	180	32	120
Loss On Ignition	%	60.8	47.9	49.4

Signature Suman Punani **Date** Nov 29/91
Suman Punani(MSc.,C.Chem)



EAG ANALYTICAL SERVICES
A DIVISION OF THE ENVIRONMENTAL
APPLICATIONS GROUP LIMITED

475 COCHRANE DRIVE, UNIT 13
MARKHAM, ONTARIO
L3R 9R5
Tel:(416) 479-6107
Fax:(416) 479-4920

CERTIFICATE OF ANALYSIS

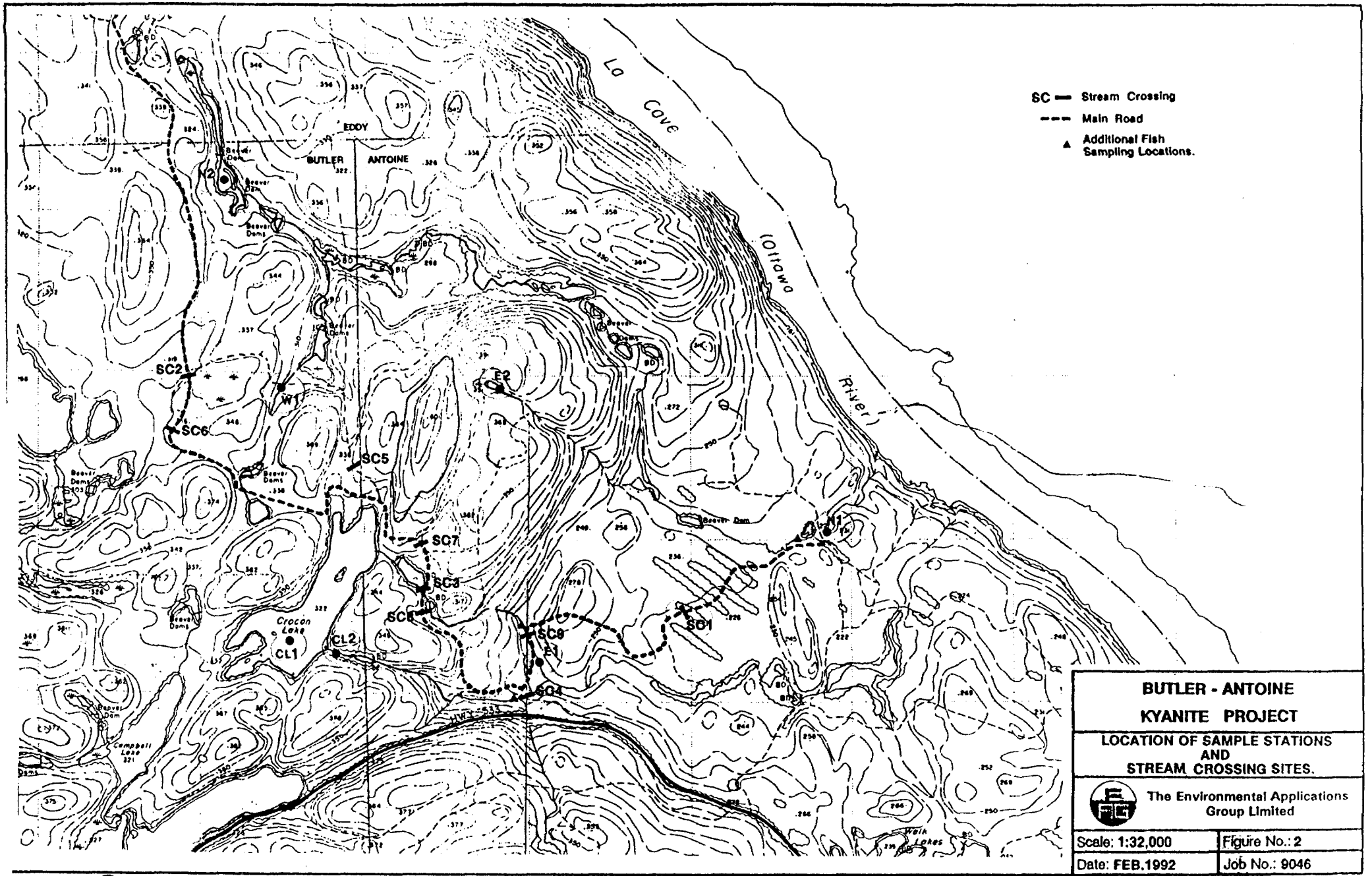
Sample(s) from:
Sample(s): 7 Sediment Samples
Page: 3 of 3

Project No. 9046
Date Sampled:
Date Received: Oct 1,1991
Work Order No: 91-0898
91-11076

Physical and General	Units	W 1 Sept 25
Sample Number		91-10-008
Arsenic	ug/g	0.55
Cadmium	ug/g	0.4
Copper	ug/g	4.8
Iron	%	1.1
Lead	ug/g	12
Mercury	ug/g	0.036
Nickel	ug/g	16
Zinc	ug/g	21
Loss On Ignition	%	39.7

Signature Suman Punani **Date** Nov 29th 91
Suman Punani (MSc., C.Chem)

ASSOCIATION OF THE CHEMICAL PROFESSION OF ONTARIO
CHARTERED
Suman Punani
CHEMIST



BUTLER - ANTOINE

KYANITE PROJECT

LOCATION OF SAMPLE STATIONS AND STREAM CROSSING SITES.

The Environmental Applications Group Limited

Scale: 1:32,000	Figure No.: 2
Date: FEB.1992	Job No.: 9046

THE
ENVIRONMENTAL
APPLICATIONS
GROUP LIMITED

Suite 1006, P.O. Box 2041
20 Eglinton Avenue West
Toronto, Ontario, M4R 1K8
Telephone: (416) 322-5701
Telecopier: (416) 322-5706

March 5, 1992

Mr. Ron Blais
Ron Blais and Associates
P.O. Box 237
North Bay, Ontario
P1B 8H2

Dear Mr. Blais:

Please find enclosed results of Loss on Ignition (organic content) analyses of sediment samples collected at the Butler-Antoine project site in September 1991. As expected, the ponded or lake sample sites (CL1, E2, N1 and N2) had a higher organic content compared with the stream sample sites (E1 and W1). However, site CL2, the discharge stream from Crocan Lake, had a higher organic content compared with the other stream sites. This was a result of the ponar grab sample including some of the thin organic layer which covered the dominant pebble substrate.

Please do not hesitate to contact me if you have any questions with regard to these analyses results.

Yours very truly,
THE ENVIRONMENTAL APPLICATIONS GROUP LIMITED

Jeff Warren

Jeff Warren B.Sc.
Senior Biologist

EAG ANALYTICAL SERVICES
A DIVISION OF THE ENVIRONMENTAL
APPLICATIONS GROUP LIMITED

475 COCHRANE DRIVE, UNIT 13
MARKHAM, ONTARIO
L3R 9R5
Tel:(416) 479-6107
Fax:(416) 479-4920

CERTIFICATE OF ANALYSIS

Sample(s) from:
Sample(s): 7 Sediment Samples
Page: 1 of 3

Project No. 9046
Date Sampled:
Date Received: Nov 26,1991
Work Order No: 91-11076

Physical and General	Units	CL1 Sept 23	CL 2 Sept 23	E 1 Sept 21
Sample Number		91-11076-01	91-11076-02	91-11076-03
Loss On Ignition	%	47.4	45.6	12.9

Physical and General	Units	E 2 Sept 21	N 1 Sept 23	N 2 Sept 24
Sample Number		91-11076-03	91-11076-04	91-11076-05
Loss On Ignition	%	60.8	47.9	49.4

Physical and General	Units	W 1 Sept 23
Sample Number		91-11076-07
Loss On Ignition	%	39.7

Signature Suman Punani **Date** Nov 29th 91

Suman Punani (MSc., C.Chem)

THE CHEMICAL INSTITUTE OF CANADA
Chartered
Suman Punani
CHEMIST
ASSOCIATE

Mining Lands
PAGE 2

Ministry of Northern Development and Mines
Ontario

Report of Work Conducted After Recording Claim

Mining Act

Transaction Number: W9270.00028

Personal information collected on this form is obtained under the authority of the Minin this collection should be directed to the Provincial Manager, Mining Lands, Ministry Sudbury, Ontario, P3E 6A5, telephone (705) 670-7264.

31L11SE0001 2.14677 ANTOINE

900

Instructions:
- Please type or print and submit in duplicate.
- Refer to the Mining Act and Regulations for require[illegible] work or consult the Mining Recorder.
- A separate copy of this form must be completed for each Work Group.
- Technical reports and maps must accompany this form in duplicate.
- A sketch, showing the claims the work is assigned to, must accompany this form.

Recorded Holder(s): KYANITE MINING CORPORATION		Client No.: 215741
Address: P.O. BOX 486, Highway 15 South DILLWYN, VIRGINIA, U.S.A. 23936		Telephone No.: 804-983-2086
Mining Division: SUDBURY	Township/Area: BUTLER & ANTOINE TWPS.	M or G Plan No.: G-1722 G-458
Dates Work Performed: From: ~~SEPTEMBER 1, 1990~~ SEPT. 19, 1991 RMB	To: ~~JUNE 18, 1992~~ MAY 1992 RMB	

Work Performed (Check One Work Group Only)

	Work Group	Type
	Geotechnical Survey	
	Physical Work, Including Drilling	
	Rehabilitation	
	Other Authorized Work	ENVIRONMENTAL STUDIES
	Assays	
	Assignment from Reserve	

Total Assessment Work Claimed on the Attached Statement of Costs $ 8300

Note: The Minister may reject for assessment work credit all or part of the assessment work submitted if the recorded holder cannot verify expenditures claimed in the statement of costs within 30 days of a request for verification.

Persons and Survey Company Who Performed the Work (Give Name and Address of Author of Report)

Name	Address
ENVIRONMENTAL APPLICATIONS GROUP LIMITED	SUITE 1006, P.O. BOX 2041 M4R 1K8 20 EGLINTON AVE. WEST, TORONTO, ONTARIO TEL. 416-322-1754
JOHN SPARLING	ABOVE
JEFF WARREN	ABOVE

RECEIVED
AUG 10 1992
MINING LANDS BRANCH

(attach a schedule if necessary)

Certification of Beneficial Interest * See Note No. 1 on reverse side

I certify that at the time the work was performed, the claims covered in this work report were recorded in the current holder's name or held under a beneficial interest by the current recorded holder.	Date: July 21, 1992	Recorded Holder or Agent (Signature): R.M. Blais

Certification of Work Report

I certify that I have a personal knowledge of the facts set forth in this Work report, having performed the work or witnessed same during and/or after its completion and annexed report is true.

Name and Address of Person Certifying	Telephone No.	Date	Certified By (Signature)
RONALD M. ELLIS, P.O. BOX 237, 160 PINEWOOD PARK DR., NORTH BAY, ONTARIO P1B 8H2	705-474-4110	JULY 21, 1992	R.M. Blais

For Office Use Only

Total Value Of Recorded	Date Recorded	Mining Recorder	Received Stamp
$5,200	July 23, 1992		SUDBURY MINING DIV. RECEIVED JUL 23 1992
	Deemed Approval Date: October 21/92	Date Approved: Mining Recorder	

Work Report Number for Applying Reserve	Claim Number (see Note 2)	Number of Claim Units	Value of Assessment Work Done on this Claim	Value Applied to this Claim	Value Assigned from this Claim	Reserve Work to be Claimed at a Future Date
	~~T57544~~ ~~T5754~~	1	5534	0	4800	734
	1084569	1	1766	400	0	2366
	1084580	1	0	400		
	1084581	1	0	400		
	1084582	1	0	400		
	1084583	1	0	400		
	1084584	1	0	400		
	1084585	1	0	400		
	1084586	1	0	400		
	1084587	1	0	400		
	1084588	1	0	400		
	1084589	1	0	400		
	1084568	1	0	400		
	1117778	1	0	400		
	14		8300	5200	4800	3100
	Total Number of Claims		Total Value Work Done	Total Value Work Applied	Total Assigned From	Total Reserve

RECEIVED
AUG 10 1992
MINING LANDS BRANCH

Credits may be claimed in this report may be cut back. In order to minimize the adverse effects of such deletions, please indicate how you would like credits cut back in the event that the deletion of credits is required. Please mark (✓) one of the following:

1. Credits are to be cut back starting with the claim listed last, working backwards.
2. Credits are to be cut back equally over all claims contained in this report of work.
3. Credits are to be cut back as provided on the attached schedule.

In the event that you have not specified your choice of priority, option one will be implemented.

Note 1: Examples of beneficial interest are unrecorded transfers, option agreements, memorandum of agreements, etc., with respect to the mining claims.

Dec. 13/84

MAP SYMBOLOGY

Aerial Cableway
Boundary
International
Interprovincial
District, Township, Indian Reserve
Approximate
Lot, Concession
Approximate
Park Boundary
Bridge
Bldg. Outpost
Building
Chimney
Cliff, Pit, Pile
Contours
Interpolated
Approximate
Depression
Control Points
Horizontal
Vertical
Culvert
Falls
Double line river
Fence, Hedge, Wall
Feature Outline (Construction features, etc.)
Flooded Land
Lock
Marsh or Swamp
Mast
Mine Head Frame
Outcrop
Pipeline (above ground)
Railroad
Single Track
Double Track
Abandoned
Turntable
Road
Highway, County, Township
Access (road of doubtful maintenance or significant driveway)
Trail, Bush Road (portage, utility)
Rapids
Double line river with multiple rapids
Reservoir
River, Stream, Canal
Approximate
Direction of flow
Rock
Significant
Shoal
Spot Elevation (lake elevations)
Tower
Transmission Line
Poles
Pylons
Tunnel
Utility Poles
Wharf, Dock, Pier
Wooded Area

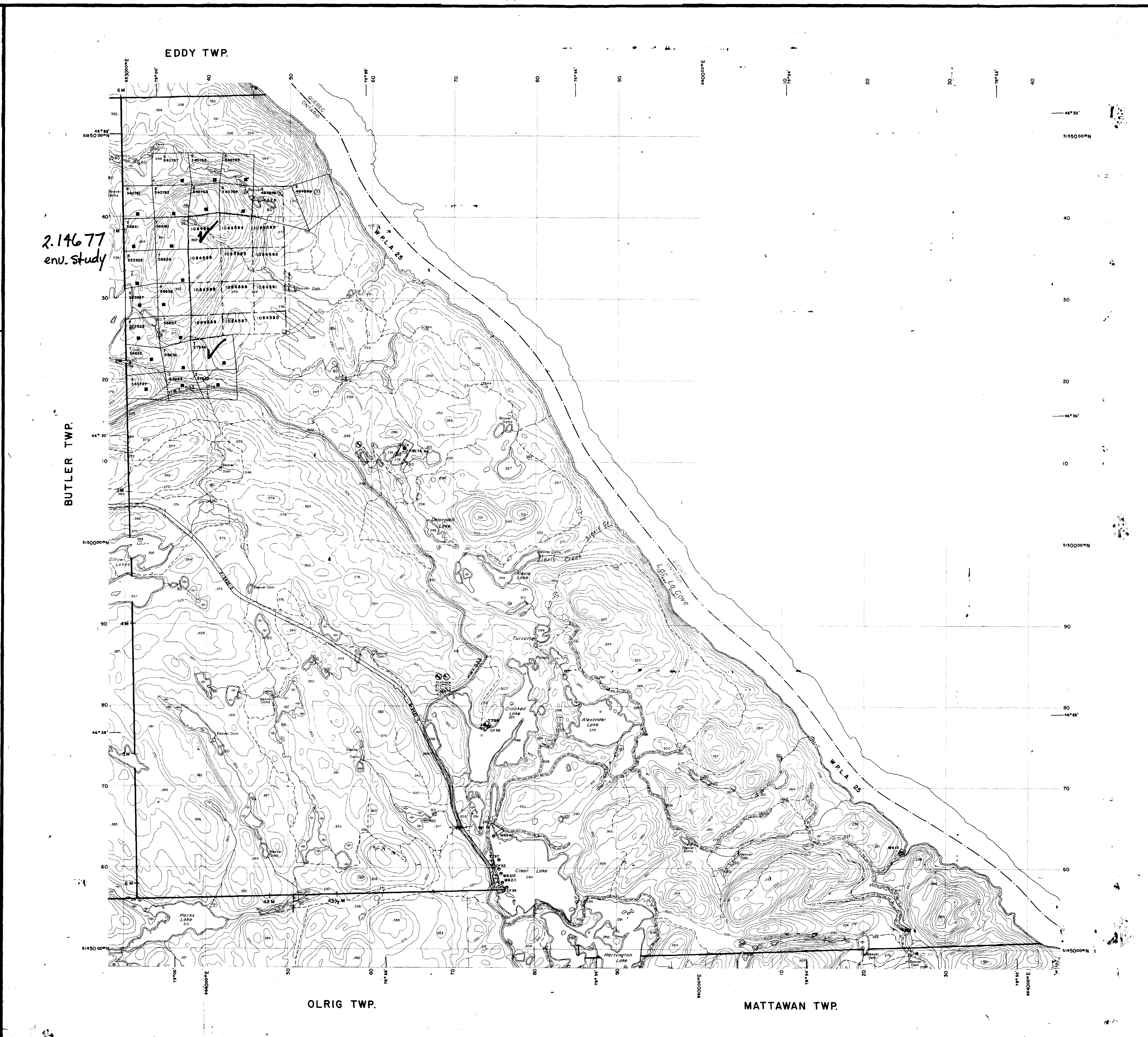
AREAS WITHDRAWN FROM DISPOSITION

M.R.O. – MINING RIGHTS ONLY
S.R.O. – SURFACE RIGHTS ONLY
M.+ S. – MINING AND SURFACE RIGHTS

Description | Order No. | Date | Disposition | File

SAND AND GRAVEL

GRAVEL 19598
M.T.C. GRAVEL PIT 4C-12
M.T.C. GRAVEL PIT 4C-38



LEGEND

HIGHWAY AND ROUTE No.
OTHER ROADS
TRAILS
SURVEYED LINES:
TOWNSHIPS, BASE LINES, ETC.
LOTS, MINING CLAIMS, PARCELS, ETC.
UNSURVEYED LINES:
LOT LINES
PARCEL BOUNDARY
MINING CLAIMS ETC.
RAILWAY AND RIGHT OF WAY
UTILITY LINES
NON-PERENNIAL STREAM
FLOODING OR FLOODING RIGHTS
SUBDIVISION OR COMPOSITE PLAN
RESERVATIONS
ORIGINAL SHORELINE
MARSH OR MUSKEG
MINES
TRAVERSE MONUMENT

DISPOSITION OF CROWN LANDS

TYPE OF DOCUMENT	SYMBOL
PATENT, SURFACE & MINING RIGHTS	●
" , SURFACE RIGHTS ONLY	◐
" , MINING RIGHTS ONLY	◑
LEASE, SURFACE & MINING RIGHTS	■
" , SURFACE RIGHTS ONLY	◧
" , MINING RIGHTS ONLY	◨
LICENCE OF OCCUPATION	▼
ORDER-IN-COUNCIL	OC
RESERVATION	⊙
CANCELLED	●
SAND & GRAVEL	⊙

NOTE: MINING RIGHTS IN PARCELS PATENTED PRIOR TO MAY 6, 1913, VESTED IN ORIGINAL PATENTEE BY THE PUBLIC LANDS ACT, R.S.O. 1970, CHAP. 380, SEC. 63, SUBSEC. 1

SCALE 1:20 000

DATE OF ISSUE
AUG 5 1992
SUDBURY
MINING RECORDER'S OFFICE

RECEIVED
AUG 10 1992
MINING LANDS BRANCH

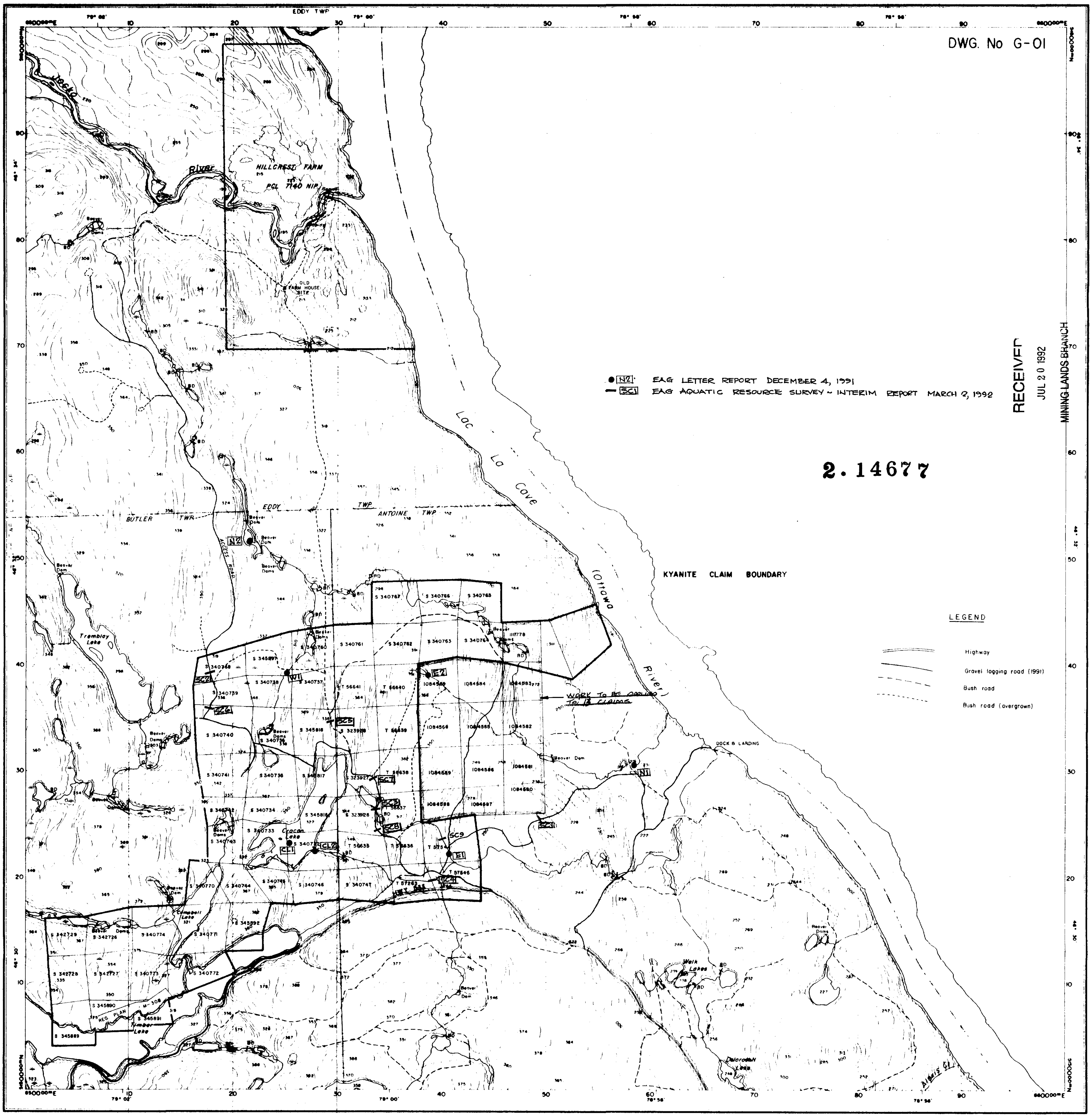
THE INFORMATION THAT APPEARS ON THIS MAP HAS BEEN COMPILED FROM VARIOUS SOURCES AND ACCURACY IS NOT GUARANTEED. THOSE WISHING TO STAKE MINING CLAIMS SHOULD CONSULT WITH THE MINING RECORDER, MINISTRY OF NORTHERN DEVELOPMENT AND MINES, FOR ADDITIONAL INFORMATION ON THE STATUS OF THE LANDS SHOWN HEREON.

TOWNSHIP
ANTOINE
M.N.R. ADMINISTRATIVE DISTRICT
NORTH BAY
MINING DIVISION
SUDBURY
LAND TITLES / REGISTRY DIVISION
NIPISSING

Ministry of Natural Resources
Ontario
Land Management Branch

Date NOVEMBER, 1984.
Number G-458

31L11SE0001 2.14677 ANTOINE
200



Ontario

Ministry of Natural Resources

Sheet

20 17 6500 51500

Map base by Surveys and Mapping Branch
Air photography 1978 Published 1982
Cadastral revised

Scale 1:20 000

Metres 1000 0 1000 2000 Metres

Feet 1000 0 1000 2000 3000 4000 5000 6000 7000 8000 9000 10000 Feet

Contour Interval 10 Metres

NOTES

North American Datum 1927
Universal Transverse Mercator (6°) projection
Zone 17 Central Meridian 81° W
Grid interval 1000 metres
Legend and explanatory notes obtainable from Public Service Centre Ministry of Natural Resources, Queen's Park, Toronto

ADJOINING SHEETS

	20 17 6500 51600	
20 17 6400 51500	20 17 6500 51500	20 17 6600 51500
	20 17 6500 51400	

31L11SE0001 2.14677 ANTOINE

210