

PRELIMINARY REPORT
SPRUCE ROAD BULK SAMPLE SITE
MONITORING RESULTS

May 26, 1977

Introduction

International Nickel Company was granted permission from the U.S. Forest Service to remove a 10,000 ton sample of ore from the Spruce Road area for testing. The sample was taken and the area was reclaimed as requested.

During the summer of 1975 a surface discharge was noticed originating from the foot of the bulk sample site. The discharge was monitored during the fall of 1975 in an effort to determine the nature and amount of discharge emanating from the site. Upon analysis of the data, it was felt that the discharge did not constitute a pollution hazard and could serve a useful purpose in determining the nature of leachates from ore and lean ore piles. However, MPCA requested that the site be corrected, as soon as possible. Also, at about this time, INCO decided to withdraw its application to mine. Therefore, the site was reclaimed as per the attached memo. (See appendix for details).

In April 1976, the bulk sample site on the Spruce Road was inspected to determine the condition of the reclamation work and to ascertain whether any seepage continued flowing from the site after spring thaw. The site was filled and contoured as requested. The seep began to flow during snow melt. The point of discharge had moved approximately 30' west of last summer's (1975) point of discharge. A specific conductivity check demonstrated little change from past values indicating that the source of water is unchanged. It was, therefore, proposed to continue the monitoring work initiated by INCO last fall.

The objectives for the sampling are:

1. To determine a change in water quantity, if any, emanating from the site as a result of the reclamation work.
2. To determine a change in water quality, if any, emanating from the site as a result of the reclamation work.
3. To determine if any pollution hazard exists to Filson Creek from the seep emanating from the bulk sample site.

Monitoring Plan

A. Stations (See maps I, II, III)

1. INCO Site A; seep originating from bulk sample site; station number - 4749570914030-03.
2. INCO Site B; Filson Creek Tributary at mouth near Ely (above culvert crossing of Spruce Road); Station number - 05124993.

3. New Site; Filson Creek Tributary above mouth near Ely (above seep discharge into tributary); station number - 05124992.
4. Existing Site - FS #13; Upper Filson Creek, Sec. 30 near Ely. Station number - 05124980.
5. Existing Site - FS #14; Filson Creek at mouth near Ely. Station number - 05124994.

B. Sampling Frequency

<u>Station</u>	<u>Samples/Month</u>
4749570914030-03	2
05124993	2
05124992	2
05124980	1
05124994	2

C. Parameters

<u>Station</u>	<u>Analytical Schedule</u>
4749570914030-03	271
05124993	271 (Totals only)
05124992	271 (Totals only)
05124980	Existing secondary station
05124994	Existing primary station

D. Water Quantity

1. Precipitation will be obtained from a standard 8" shielded gage located approximately 500 yds. west of the bulk sample site which is associated with the pan evaporation station.
2. Flow is continuously recorded immediately above station 05124994 via a bubble gage.
3. A staff and a provisional rating curve has been established at station 05124980.

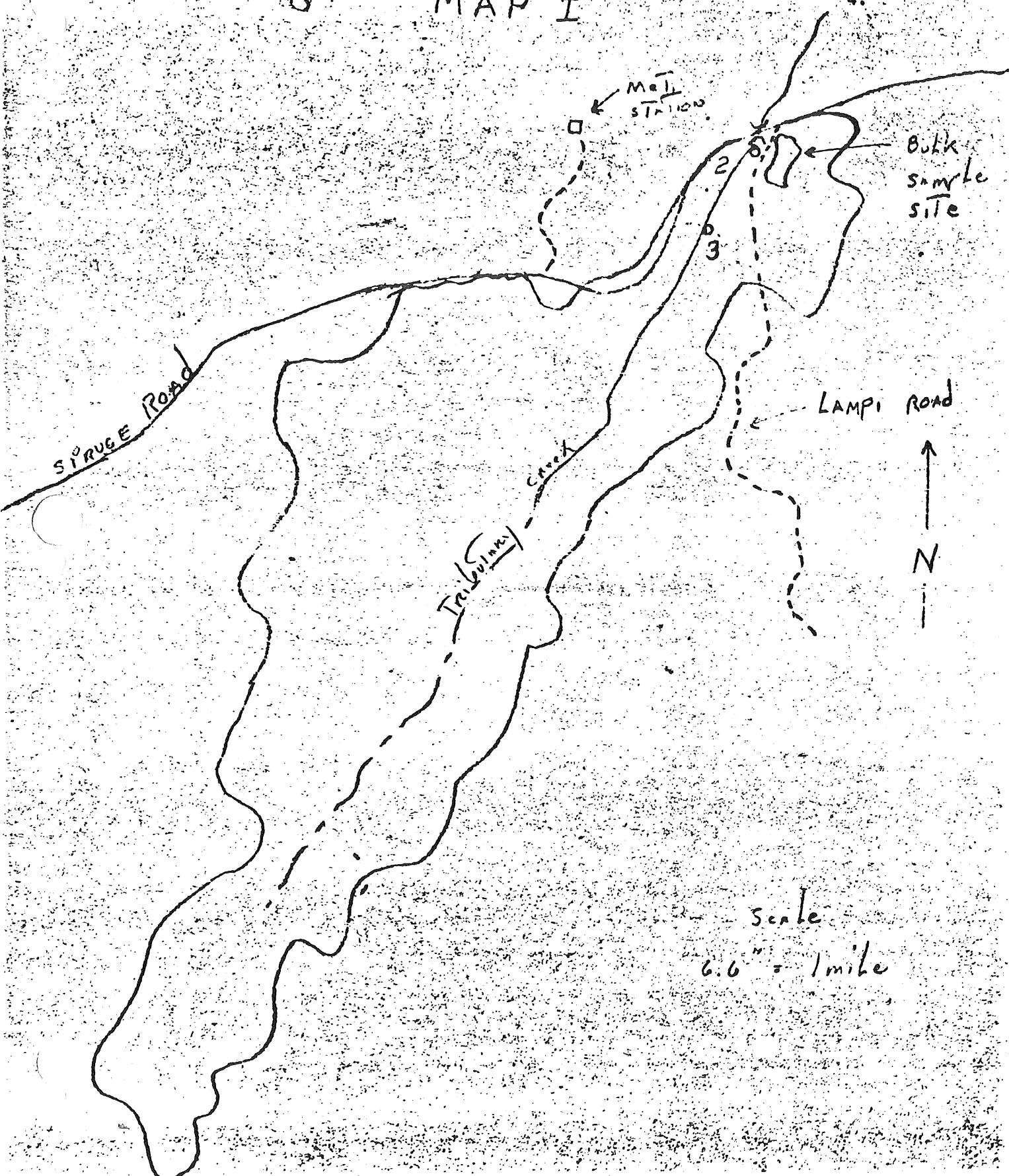
3.

4. Flows for station 05124993 will be determined at the time of sample collection. Flows at above mentioned station will also be used for station 05124992.
5. Flows obtained by INCO last fall will be used unless significant changes are apparent for station 4749570914030-03.

The duration of the monitoring will be six (6) months (May - Sept.) or until the seep ceases, whichever occurs first.

Tributary watershed

MAP I



scale

6.6" = 1 mile

SEC. 23

SEC. 24

CLEARED

AREA

WEATHER
STATION
SITE

SEC. 26

③

②

⑤

LAMPY ROAD

BULK SAMPLE
SITE

①

SPRUCE ROAD

④

SEC. 30
SITE

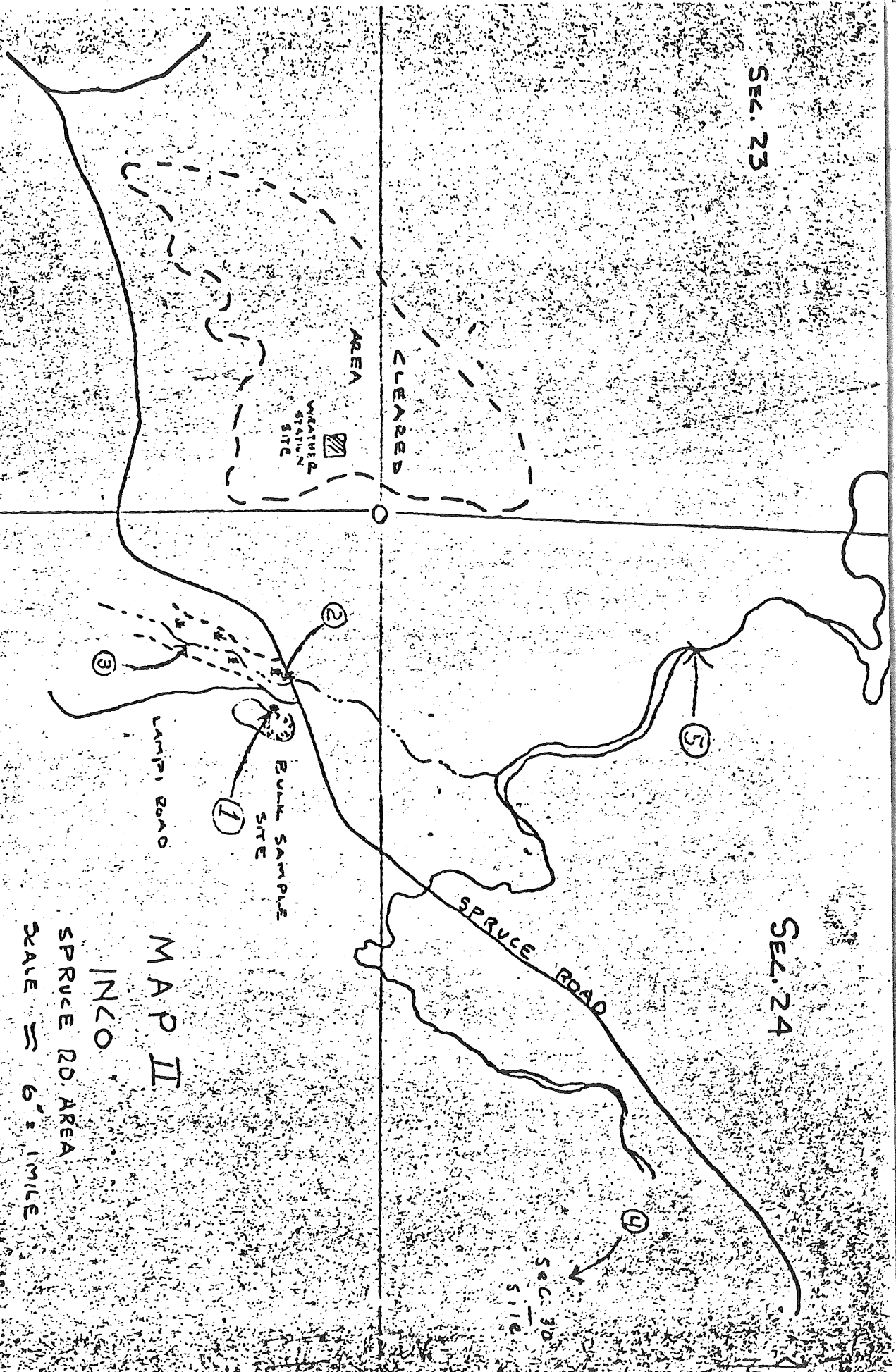
MAP II

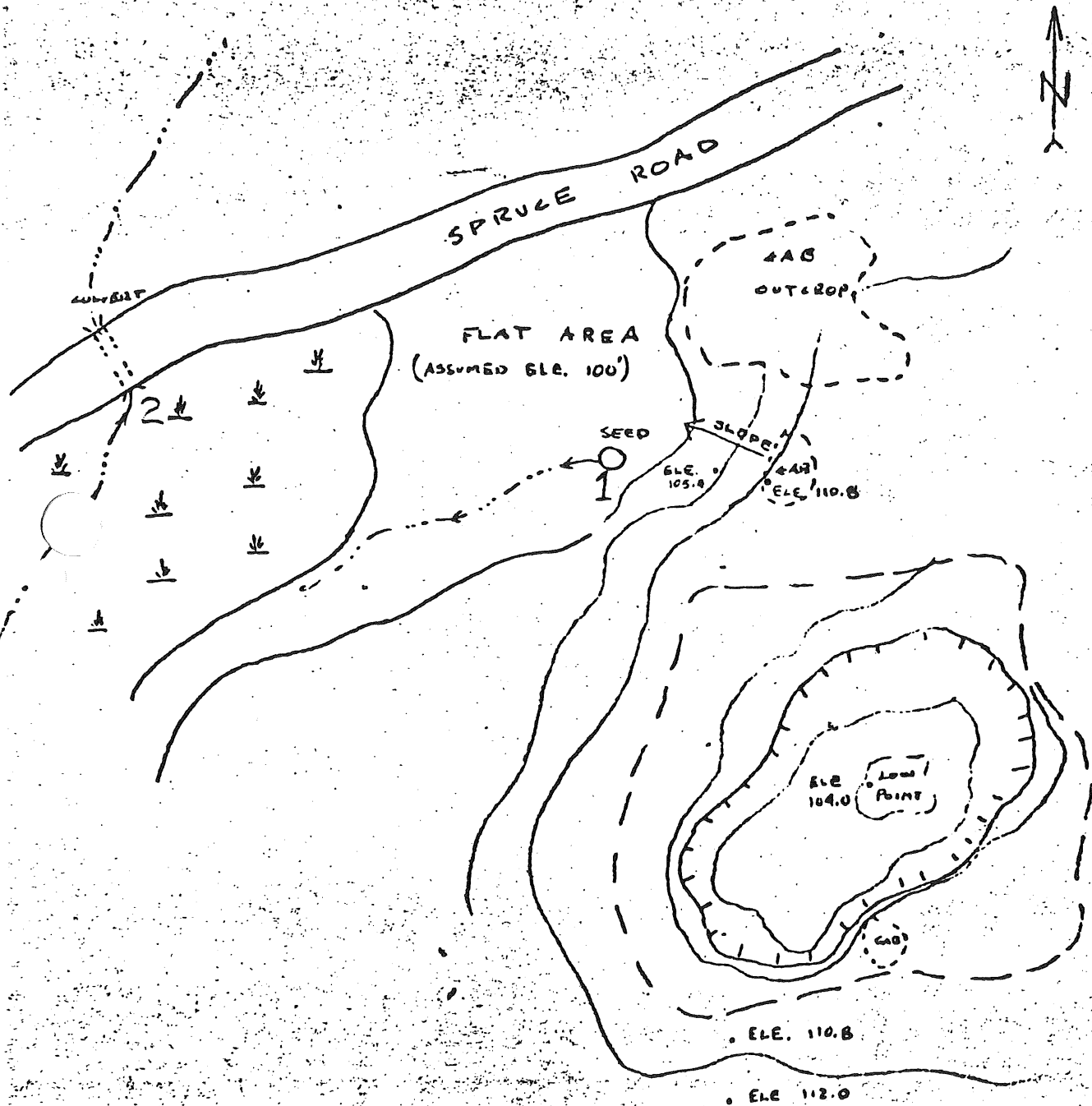
INCO

SPRUCE RD. AREA

SCALE = 6" = 1 MILE

SEC. 25





BULK SAMPLE SITE
HAND LEVEL SKETCH
SCALE 1" = 50'
SEC. 35, T62, R11

Results

1. Flow

The tributary flow data is presented on Table I. All of the flow information is on the tributary next to the bulk sample site. It was not possible to obtain flow values for the seep. Flow was measured during sample collection immediately below the culvert on the Spruce Road with a pygmy meter.

The flow ratios between Filson and its tributary are demonstrated on Table II. The ratio is approximately 40-50 to 1. Watershed ratio is about 35 to 1.

Total rainfall for the period was about 9 inches, most of which occurred in June. Only 1.4 inches fell between April 1 and May 3 and none fell between May 3 and June 6. The water equivalent in the snowpack was about 4 inches.

2. Bulk sample site chemistry

Surface flow from the bulk sample site lasted for only a very short time. The chemical levels are demonstrated on Table III. The values are little different from those reported by INCO with the exception of heavy metals, particularly nickel and copper. This could be due to differences in sampling methods. INCO built a small catchment basin to collect the seepage for the purposes of sampling and measuring flow. No doubt, considerable amounts of suspended particulates settled in this pool and are not reflected in the analyses. No attempt was made to build a pool for the Forest Service sampling and much higher levels are found. It is also possible that the higher levels found are the result of the reclamation work done the previous fall, (i.e., exposure of fresh soil to weathering and erosion).

3. Tributary; chemistry

The results of the chemical analysis are shown on Table IV. All samples are surface grab samples. The upstream site is about 100 yards south of the culvert on the Spruce Road and is located in a dense alder swamp. This sampling point is above any discharge originating from the bulk sample site. The sampling site located at the culvert on the Spruce Road is immediately below the bulk sample site. Because of the surrounding topography and the elevated, compacted Spruce Road, most, if not all, of the discharge from the bulk sample site will pass through the culvert.

TABLE I

Flow data from tributary next to bulk sample site

<u>Date</u>	<u>CFS</u>	<u>Liters/Sec</u>
4/13/76 ^{1/}	1.76	49.84
5/5/76	.34	9.63
5/20/76	.09	2.55
6/22/76 ^{2/}	.35	9.91
7/7/76	.03	.85
7/20/76	.02	.57
8/5/76 ^{3/}	0.00	0.00

1/ Estimated flow from bulk sample site was .008 CFS.

2/ Surface discharge from the bulk sample site ceased.

3/ Surface flow in tributary ceased.

TABLE II

Flow Ratios: Filson/Tributary

<u>Date</u>	<u>Filson CFS</u>	<u>Tributary CFS</u>	<u>Ratio</u>
4/13/76	74	1.76	42
5/5/76	17	.34	50
5/20/76	3.3	.09	37
6/22/76	14	.35	40
7/7/76	2.8	.03	93
7/20/76	.94	.02	47
8/5/76	.18	--	--

TABLE III

Seep: Bulk Sample Site

Date	pH	Sp. Cond.	Temp. °C	Alk mg/l	SO ₄ mg/l	Fe ug/l
4/13/76	6.8	628	6.0	118	--	4600
5/5/76	7.0	711	6.0	107	250	4200
5/20/76	7.0	655	13.0	110	270	1500

Date	Ca mg/l	Mg mg/l	K mg/l	Na mg/l	Turb. JTU	Color PT/co
4/13/76	84	48	7.3	2.6	26	60
5/5/76	72	43	7.0	10	30	25
5/20/76	70	45	6.8	9.3	6	22

Date	Ni ug/l	Cu ug/l	Cd ug/l	Pb ug/l	Zn ug/l	Si mg/l
4/13/76	13000	360	2.4	1.0	190	--
5/5/76	10000	970	2.0	.3	210	24
5/20/76	11000	1000	2.4	1.2	5300	24

TABLE IV

Tributary Upstream of Bulk Sample Site

Date	pH	Sp. Cond.	Temp. °C	Alk mg/l	Fe ug/l	Ni ug/l	Cu ug/l	Cd ug/l	Pb ug/l	Zn ug/l
4/13/76	5.6	30	1.0	11	450	9	11	.04	.5	4.2
5/5/76	5.4	29	5.5	16	470	9	16	.02	<.2	3.9
5/20/76	5.8	19	10.0	10	440	12	19	.02	.5	6.9
6/22/76	6.0	26	16.5	35	--	19	35	<.01	.4	3.6
7/7/76	6.4	30	14.0	18	--	21	18	.01	.2	2.9
7/20/76	5.5	31	18.0	11	1600	26	19	<.01	.5	6.4
\bar{x} =	5.8	27.5				16	20	.02	.4	4.7

Tributary Downstream of Bulk Sample Site

	pH	Sp. Cond.	Temp. °C	Alk mg/l	Fe ug/l	Ni ug/l	Cu ug/l	Cd ug/l	Pb ug/l	Zn ug/l
4/13/76	5.7	36	1.0	10	510	25	19	.08	1.1	3.0
5/5/76	5.7	34	5.0	8	460	15	22	.02	<.2	3.1
5/20/76	5.7	36	10.0	7	490	19	28	.02	.7	6.2
6/22/76	5.7	29	17.0	--	--	33	34	<.01	.2	3.1
7/7/76	6.1	36	16.0	--	--	24	22	<.01	.3	2.4
7/20/76	5.5	37	19.0	16	3100	27	25	<.01	.4	2.2
\bar{x} =	5.7	34.8				24.0	25	.03	.5	3.3

An increase in copper and nickel concentrations as the tributary flows past the bulk sample site is apparent. A paired t test performed on the data demonstrated that the difference in the data sets (upstream vs. downstream) was significant at the .05 probability level for both copper and nickel. The average increase in nickel and copper concentrations is about 9 ug/l and 5 ug/l, respectively.

Instantaneous loadings from the bulk sample site to the tributary are shown on Table V. Instantaneous loading and load ratios for Filson Creek are shown on Table VI.

Using the Filson Creek hydrograph and the measured values obtained on the tributary, a hydrograph was developed for the sampling period which is demonstrated on Graph I. Using this hydrograph and changes in copper and nickel concentrations between the upstream and downstream site, a loading of .5 Kg of copper and 1.0 Kg of nickel occurred over the sampling period (April - July) from the bulk sample site.

Paired t Test

Upstream vs. Downstream Sampling Stations

Pair	Copper ug/l						Sum	\bar{X}
	1	2	3	4	5	6		
Downstream (D)	19	22	28	34	22	25	150	25.00
Upstream (U)	11	16	19	35	18	19	118	19.67
$d_i = D_i - U_i$	8	6	9	-1	4	6	32	5.33

$$S_d^2 = \frac{\sum d_i^2 - \frac{(\sum d_i)^2}{n}}{n-1} = 12.66$$

$$t = \frac{\bar{X}_A - \bar{X}_B}{\sqrt{\frac{S_d^2}{n}}} = 3.68$$

The difference is significant at the .02 probability level

Paired t Test

Upstream vs. Downstream Sampling Stations

Pair	Nickel ug/l						Sum	\bar{X}
	1	2	3	4	5	6		
Downstream (D)	25	15	19	33	24	27	143	23.8
Upstream (U)	9	9	12	19	21	26	96	16.0
$d_i = D_i - U_i$	16	6	7	14	3	1	47	7.8

$$S_d^2 = \frac{\sum d_i^2 - \frac{(\sum d_i)^2}{n}}{n-1} = 35.77$$

$$t = \frac{\bar{X}_A - \bar{X}_B}{\sqrt{\frac{S_d^2}{n}}} = 3.20$$

The difference is significant at the .05 probability level

TABLE V

a

Copper Loading From Bulk Sample

Site on Tributary System

Date	Cu ug/s Upstream	Cu ug/s Downstream	Difference Cu ug/s
4/13/76	548	947	399
5/5/76	154	212	58
5/20/76	48	71	23
6/22/76	347	337	0
7/7/76	15	19	4
7/20/76	11	14	3

b

Nickel Loading From Bulk Sample

Site on Tributary Stream

Date	Ni ug/s Upstream	Ni ug/s Downstream	Difference Ni ug/s
4/13/76	449	1246	797
5/5/76	87	144	57
5/20/76	31	48	17
6/22/76	188	327	139
7/7/76	18	20	2
7/20/76	15	15	0

TABLE VI

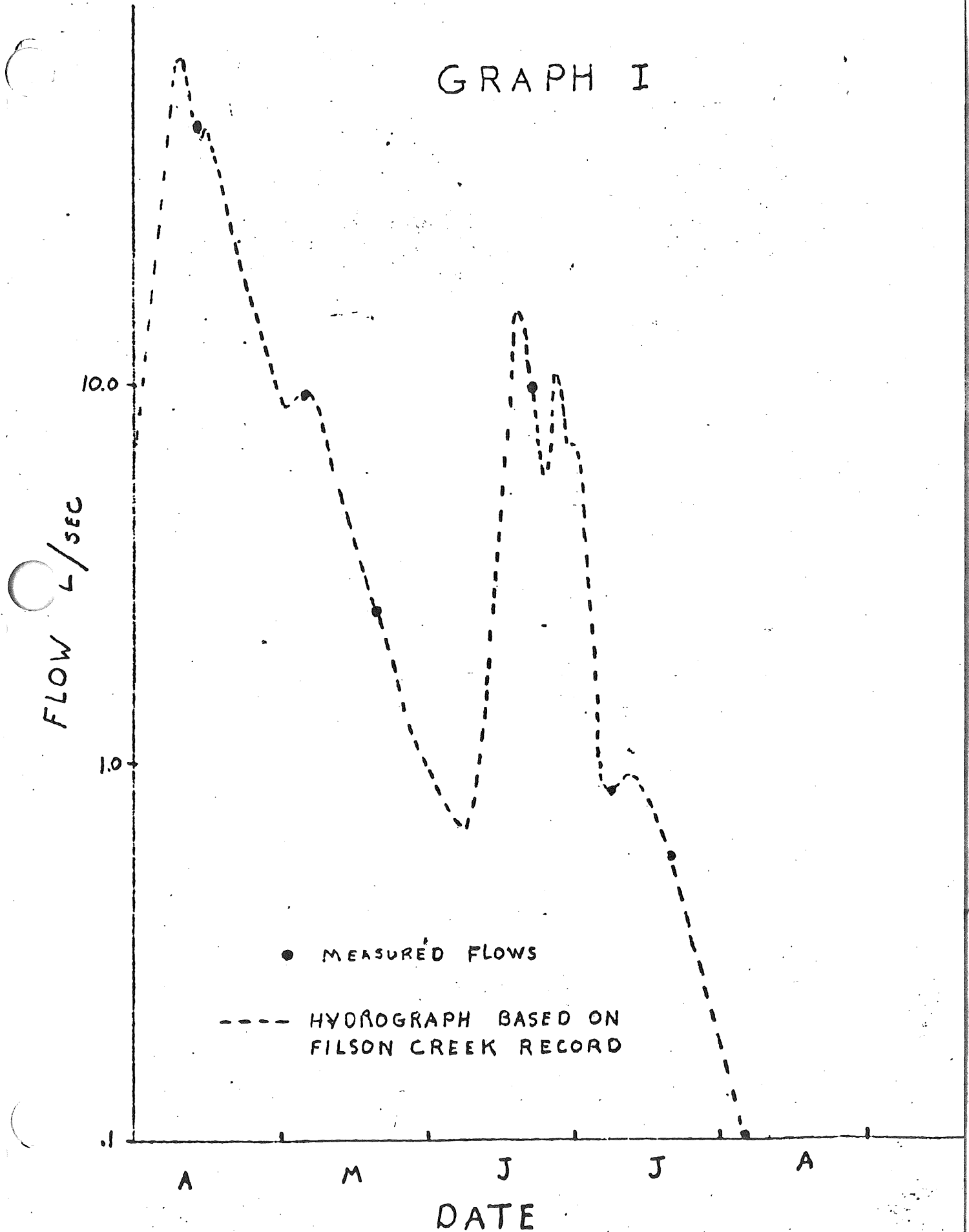
Bulk Sample Site Loading
on Filson Creek at Mouth

Date	Filson Cu & Ni Conc. ug/l	ug/sec Filson	ug/sec Seepage	Ratio Seep/Filson
4/13/76	Cu 5.5	11526	399	.035
	Ni 6.0	12570	797	.063
5/5/76	Cu 8.7	4184	58	.014
	Ni 5.0	2405	57	.024
5/20/76	Cu 12.0	1121	23	.021
	Ni 7.0	654	17	.026
6/22/76	Cu 10	3960	0	0
	Ni 7	2775	139	.050
7/7/76	Cu 9.5	753	4	.005
	Ni 7.0	555	2	.004
7/20/76	Cu 7.4	197	3	.015
	Ni 5	133	0	0

Discussion

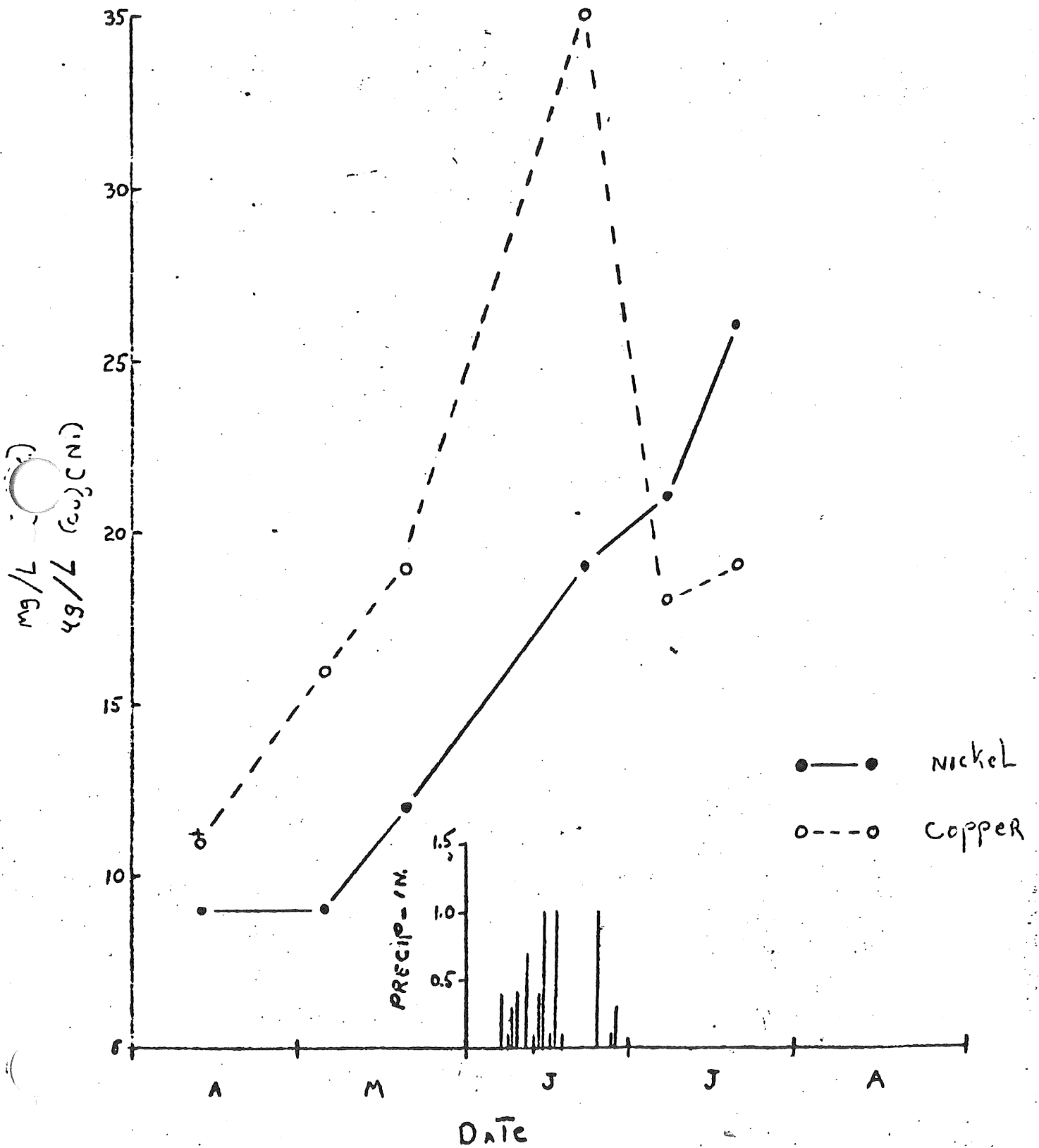
1. It is impossible to determine if the additional reclamation work done during the fall of 1975 had any effect on reducing the amount of water emanating from the bulk sample site. Although the seep ceased after a short period of time, it could be due to the extremely dry conditions that occurred last spring and summer.
2. The chemical composition of the seep water has changed little from INCO's initial tests: The seep has a neutral pH, high conductivity, high alkalinity, high sulfate, and high iron concentrations. All of the major cations (Ca, Mg, Na, K) are elevated. With the exception of lead, all of the heavy metals that were measured are 2-3 orders of magnitude higher than the surrounding surface water. Although far less nickel occurs in the ore (~3:1), nickel concentrations are ten times higher than the copper levels.
3. The influence of the seep on Filson Creek would not be measurable. The loading ratios are too small and concentration changes would be less than .5 ug/l.
4. The chemical composition of the tributary upstream of the bulk sample site demonstrates an acid pH and low conductivity, alkalinity. Cadmium, lead, and zinc levels are not much different from other surface waters in the area. Copper and nickel levels are twice as high as those found in Filson Creek and almost 10 times higher than those found in the South Kawishiwi River. There is slightly more copper than nickel in this runoff water and in this respect is similar to Filson Creek. A plot of concentration vs. time is presented on Graph II for the upstream sampling station. It is interesting to note the increase in nickel concentration over time. Copper concentrations also appear to rise early in the spring. A large flush of copper seems to occur with the June rains; however, the steady climb of nickel concentration seems to be unaffected by the rain and subsequent increase in runoff.
5. The tributary immediately below the bulk sample site exhibits increases in specific conductivity, nickel, copper, and probably iron. Cadmium, lead and zinc levels are not measurably changed. The increase is roughly 10 ug/l for nickel and about 5 ug/l for copper. It appeared that the changes in nickel concentration at the downstream site were very dependent on water movement from the bulk sample site. As flow from the bulk sample site could not be measured, tributary flow was used as an indicator of water movement. Therefore, tributary flow was regressed against the change in concentration between the upstream and downstream site and the results are shown on Graph III. Increased copper concentration is not related to water movement from the bulk sample site while nickel increases appear to be very dependent on water movement.

GRAPH I

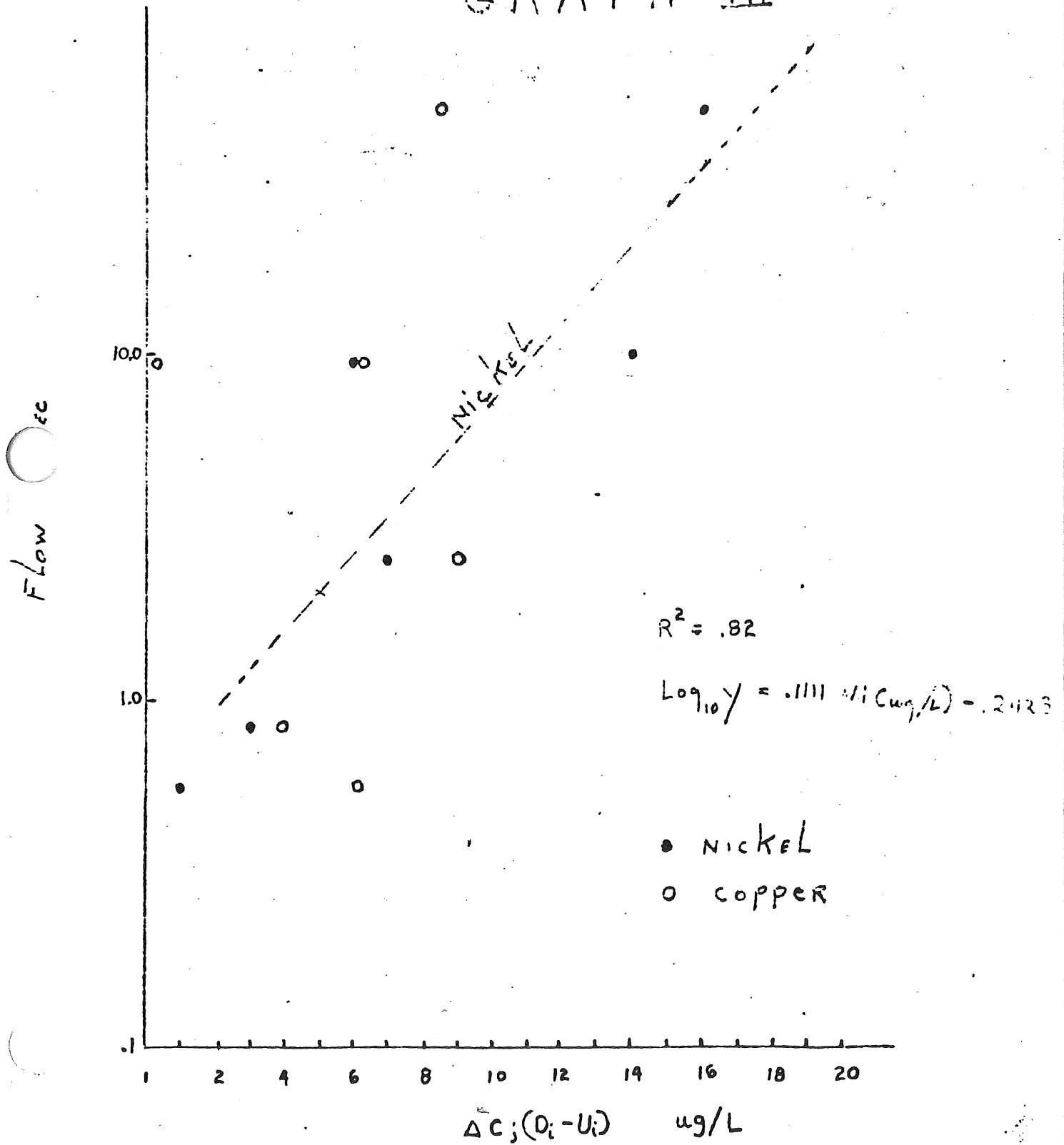


GRAPH II

UPSTREAM Cu, Ni CONCENTRATIONS



GRAPH III



Update on Spruce and Bulk Sample Site

The summer and fall of 1976 and the winter of 1977 were very dry. Filson Creek ceased to flow in late December and did not resume flowing until March of 1976. The total water content of the snowpack over the winter was less than two inches and the peak flow for Filson Creek at snowmelt was only 4 cfs. It is, therefore, not surprising that the seep ceased to flow during the summer of 1976 and did not resume flow during the spring of 1977. However, the seep did begin to flow in early June and has continued to flow to date. Samples have been taken of the discharge. Although chemical data is not available at this time for the summer of 1977, field measurements of specific conductivity and pH indicate little if any change from previous measurements and it is unlikely that any changes in the chemistry of the discharge has occurred.

Information is very limited at this time, but it appears that the surface reclamation procedures accomplished little relative to the quantity and quality of the water being discharged from the bulk sample site.

APPENDIX

Kangaroo



Minnesota Pollution Control Agency

September 10, 1975

FOREST SERVICE
SEP 15 1975

Mr. William Mounce
Resident Manager
International Nickel Company, Inc.
7600 Parklawn Ave.
Minneapolis, MN 55435

Dear Mr. Mounce:

On January 7, 1974, International Nickel Company requested from the Supervisor of the Superior National Forest permission to remove a 10,000 ton sample for milling and metallurgical tests. The sample was taken and the site was covered and seeded.

It has come to the attention of the Minnesota Pollution Control Agency that subsidence of the site has occurred and that waters from the site, which have come into contact with mineralized Duluth Gabbro, are draining to waters of the State. We believe there exists a potential for leached heavy metals entering and polluting waters of the State.

At this time, we request that you begin sampling runoff from the bulk sample site and supply the Agency with a report discussing any adverse effects resulting from the runoff.

The report should include a site description; source, quantity and quality of waters leaving the site; the analytical results of the sampling; a description of the drainage course; and possible mitigative procedures to eliminate contaminated runoff.

As you know, Minn. Statutes 115 and 116 defines the Agency's duty to enforce all laws relating to pollution of any waters of the State. The Agency under its power and duties must take action on this potential violation of laws and regulations under its charge.

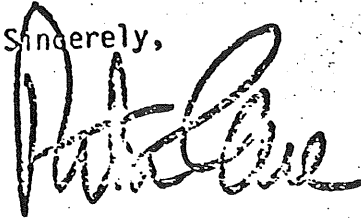
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CU-NI PROJECT		
SEP 11 '75		
Superior Natl. Forest	Info	Event
	In Proc.	

We ask that you respond to this request by September 19, 1975.

If you have any questions, please contact me or Mr. Curtis Sparks of my staff at (612) 296-7229.

Sincerely,

A handwritten signature in black ink, appearing to read "Peter L. Gove". The signature is written in a cursive style with a large, prominent initial "P".

Peter L. Gove
Executive Director

cc: U.S. FS, Attn: Ed Vandermilen
John Pegors
Robert Poppe, EQC

D R A F T

September 11, 1975

Mr. Peter Gove
Executive Director
Minnesota Pollution Control Agency
1935 West County Road B2
Roseville, MN 55113

Dear Mr. Gove:

This is to reply to your letter of September 10 concerning a small amount of seepage occurring at the site on our Federal lease 01353 from which a 10,000-ton bulk sample of copper-nickel ore was removed during January, 1974.

As indicated in your letter, after removal of the sample the site was reclaimed by back-filling and restoring the excavated area to approximately the original contours using locally available materials. The area was reseeded, and upon completion the restoration was judged acceptable by the USFS District Ranger.

In the Spring of this year it was apparent that the top area of the site had experienced some subsidence to the extent of creating a saucer shaped depression approximately 20 yards in diameter by 10 feet deep. During the early summer two small seeps were noted issuing from the foot of the face slope nearest Spruce Road, these occurred, evidently, as a result of precipitation that gathered in the area of subsidence and percolated down through the backfill. It has not been determined how much water may have accumulated

in the interior of the backfilled area, nor how long nor to what degree the in-seepage may have been exposed to mineralized rock.

One estimate could be based on assuming that all of the precipitation falling on the subsided area became involved in the process. No inflow of ground water was noted during the removal of the bulk sample. Calculating the surface area and total precipitation indicates that a maximum of _____ cubic feet of water could have been available from October to August.

The volume of seepage has been too small to make any sort of rate measurements. We estimate, however, that the total seepage does not exceed one half gallon per minute, and we have observed that the volume has not varied greatly through the past several months. (check)

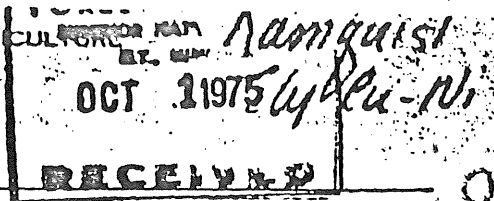
In June we started attempts to sample the seepage for chemical composition. The results can be considered as giving no more than general indications of the nature of the water because only small amounts of seepage could be accumulated in shallow puddles, and sampling necessarily risked entrainment of sediment and other local contaminants.

The analyses were performed on samples both as-gathered and after filtering through a micropore filter. Three separate samplings between June and September gave the following results: shown in Table I (check)

The occurrence of the seepage was discussed at various times during the summer with representatives of the USFS and the Minnesota Department of Natural Resources. The results of our first sampling were made available to both organizations, and were confirmed, in part, by a sample gathered by DNR. It was felt that by observing the seepage for a limited period of time, very useful information could be gained on the leaching characteristics of the local geological structures in the actual environment that would exist if mining were to be established.

In mid-August it was decided, with the agreement of the USFS, that the bulk sample site should be regraded and re-vegetated to eliminate the negative contour. Plans have been drawn up as indicated in the attachments and regrading should be completed by October.

We have set up a controlled program to use various local materials and vegetating schemes on the site to determine their effectiveness in reducing infiltration of surface water and consequent accumulation in the back fill. This information should help considerably to develop methods for treating lean ore and waste rock piles should mining be initiated. The appended report provides the information on site description; source, quantity and quality of the waters leaving the site; the analytical results of sampling to date; a description of the drainage course; and the plans for regrading, sealing and revegetating the site. I hope that it will be considered a satisfactory response to your letter of September 10.



REPLY TO: B410 Forest Service Environmental Impact Statements September 26, 1975

SUBJECT: Proposed Reclamation of INCO Spruce Road Bulk Sample Site

TO: File

In January, 1974, INCO removed a bulk sample of mineral bearing rock for milling and metallurgical tests adjacent to the Spruce Road, in the NW $\frac{1}{4}$ of the NW $\frac{1}{4}$ of Section 25, T62N, R11W. Removal was under terms of a Federal Lease held by INCO and the sample was the basis of INCO's request to the Supervisor, Superior National Forest, to construct an open pit mine.

The bulk sample site was regraded and seeded by INCO in the Spring of 1974 with approval by the Forest Service. Subsequent to that time a subsidence of the surface has occurred and a seepage from the base of the sample site nearest the road was noticed in the summer of 1975.

In August, 1975, I visited the bulk sample site with Bill Mounce of INCO and we discussed the seepage problem. I requested that the problem be corrected and asked that they contact the Kawishiwi District Ranger submitting a plan for restoration.

INCO complied with the request and the restoration plan was approved by the District Ranger acting on technical advice of soil scientist Don Prettyman and watershed scientist Herb Garn.

Recent evidence indicates that a seepage existed in the area before bulk sampling began and that present plans to reclaim the area may not be able to stop the seepage.

It now appears that it would be advisable to delay attempting reclamation until Spring in order to test the seepage thoroughly. On the basis of geologic observation and preliminary water quality samples a delay in reclamation does not appear to endanger the water quality of the river. It is my opinion that delaying the reclamation will allow time to gather useful information on leaching of rainwater through the mineral area. Facts gathered from these observations could be valuable in the development of EIS data collection.

2.

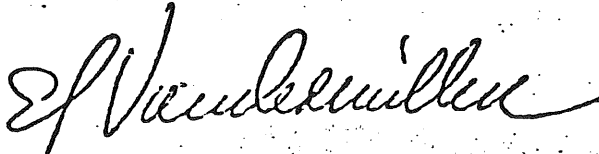
John Ramquist, water quality specialist, informs me that the amount of nickel released into the Kawishiwi River from the seepage is inconsequential and amounts to parts per trillion. Other metals released would be correspondingly less.

Stuart Behling's opinion is that the small amount of rock exposed by the bulk sample removal is inconsequential in comparison to other large quantities of exposed mineral in the area and that delay in reclamation in favor of further testing would be desirable.

I have informed Don Church, Kawishiwi District, of my recommendation. The District is in favor of delaying reclamation until Spring. Don Prettyman and John Ramquist are also in agreement with the recommendation.

On September 10, INCO was requested by MPCA Director, Peter Gove, to sample the seepage and report to the State.

I informed Connie Ennega of MPCA today that we were planning to delay until Spring in favor of further testing and explained reasons for doing so. She stated that MPCA did not feel that the seepage was a major problem but that their request to secure samples was a precaution measure.



E. J. VANDERMILLEN
Copper- Nickel Project Leader

Enclosure

cc: Kawishiwi District

J. Ramquist
J. Torrence
D. Prettyman
Herb Garn
S. Behling

UNITED STATES DEPARTMENT OF AGRICULTURE
FOREST SERVICE

S.O.

SW

REPLY TO: 8410 Forest Service Environmental Statements
(2580)

September 25, 1975

SUBJECT: Inco Project - Inco test pit

TO: E. J. Vandermillen



This is in reply to your request for geologic input regarding the question of whether Inco should do additional reclamation on the Spruce Road bulk sample site or establish a monitoring program for leaching of heavy metals. Due to the equivocal nature of the detailed information available from the site, this question will be approached in a general way.

As pointed out in numerous geologic publications, the Duluth Gabbro contains extensive zones of Cu-Ni mineralization along its basal contact. By nature, much of this mineralization has been exposed to subaerial weathering and leaching, not only in extensive outcrop areas, but also as abundant rock fragments in the glacial drift. By man, in addition to the subject site, exposures have been created in numerous borrow pits and road-cuts excavated in weathered mineralized outcrop and in glacial drift containing mineralized rock fragments, many of which are located along Spruce Road. The condition of the material in the man made excavations differ from that in the natural exposures in that it contains abundant freshly exposed mineralized surfaces from which readily available heavy metals are leached. This accelerated leaching continues until the exposed surfaces are covered with weathering products. Because of the comparably insignificant surface area involved, even though chemically more active, it is doubtful whether seepage from Inco's test pit or from the excavation related to road construction contribute significantly to the heavy metals being leached from natural exposures.

In reference to future Cu-Ni mining, it would be very useful to determine which metals are most active when freshly exposed, the duration of their accelerated activity, and their mobility in the natural environment. A well conducted monitoring program of the seepage from the bulk sample site could contribute significantly toward this insight. It would also provide control data to determine the effectiveness of the final reclamation. Therefore, I would support this alternative rather than immediate reclamation.

Stuart J. Behling
STUART J. BEHLING
Geologist

Cu-Ni Project

8410 Forest Service E.I.S.

October 3, 1975

Bulk Sample Site Leaching

Files

On September 30, 1975, flow measurements were taken in and around the spruce road bulk sample site in an attempt to determine probable levels of heavy metals in water downstream of the site.

Flow from the bulk sample site was determined volumetrically, the small tributary to Filson was metered and flows in Filson and the South Kawishiwi River were determined from rating curves. In addition, nickel concentrations from the leach at the bulk sample site were provided by INCO.

Following is a table summarizing the data and results. (Refer to attached map for site locations).

<u>Location</u>	<u>Flow</u>	<u>Ni - Concentrations</u>
Bulk Sample (Site A)	.0005 cfs	2300 ppb
Tributary (Site B)	.05 cfs	(Calc.) 25 ppb
Filson Cr. (Site D)	1.72 cfs	(Calc.) .75 ppb
South Kawishiwi	247 cfs	(Calc.) .005 ppb

The data indicates that nickel concentrations in Filson and in the South Kawishiwi will not be measurably effected by leaching from the bulk sample site and should pose no threat to aquatic life in these two streams. In addition, all other heavy metals are of far less concentration in the bulk sample site leachate.

Although there are no significant hazards associated with this leachate, it should be followed closely as long as it exists.

JOHN A. RAMQVIST
Water Quality Specialist

CC: Ed Vanderrillen



Attn: John Ramquist

Minnesota Pollution Control Agency

CU NI PROJECT	
Agency	
NOV 3 '75	
October 28, 1975	
Superior Natl. Forest	
Info	Act
No. Rec.	
Supervisor	
Dep. Super.	
Adm. Mat.	
Ely CU-NI	

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

Mr. William Mounce
Resident Manager
International Nickel Company, Inc.
7600 Parklawn Avenue
Minneapolis, Minnesota 55435

Dear Mr. Mounce:

I have reviewed your September 19, 1975 letter regarding seepage and runoff from the Spruce Road bulk sample site.

It is apparent from your letter that there has been a misinterpretation of my letter to you of September 10, 1975.

In a letter to Ms. Connie Hennega from Mr. R. E. Wager, dated October 6, 1975, an outline of the proposed report requested by the Agency was provided. The plan is acceptable to the Agency. However, the MPCA requests that INCO correct the seepage problem as expeditiously as possible. If regrading the site as proposed does not abate the flow of polluted water, grouting may be necessary. Extending the length of time in which pollutants are being discharged is not acceptable to the Agency.

As a result, I request that you abate the seepage problem as soon as possible. Any monitoring information gathered should be restricted to the shortest length of time necessary to end the seepage. I would appreciate your providing the information to the MPCA but request that you do not prolong the seepage problem merely to collect the information.

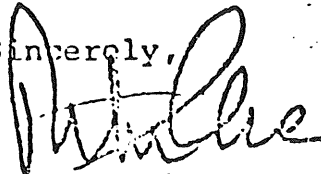
At this time the Agency cannot accept any preoperational monitoring results obtained to establish a baseline on the streams impacted by this project until such time as this discharge is corrected.

The information requested by the Agency in its September 10, 1975 letter, including any monitoring data obtained prior to the proposed reclamation of the site, will be useful in assessing any unusually high levels of heavy metals in natural streams located in the area and for defining any specific leaching problems associated with the Spruce Road site.

Mr. William Mounce
Page 2

I ask that the information previously requested be provided as soon as it becomes available. If you have any questions, please contact me or Curtis J. Sparks of my staff.

Sincerely,



Peter L. Gove
Executive Director

PLG:ss

cc: ✓ Ed Vandermillen, U.S. Forest Service
Robert Poppe, Environmental Quality Council
Robert Herbst, Department of Natural Resources
John Pegors, MPCA Regional Office

John Kamaus

NOV 14 1975

CU-NI PROJECT		
NOV 7 75		
Special Mail Form		
Info		Acc
	No Rec.	
	Super User	
	Dep. Super	
	Adm. Mail	
	Ely CU-NI	

November 4, 1975

Mr. Peter Gove
Executive Director
Minnesota Pollution Control Agency
1935 W. Co. Rd. B2
St. Paul, MN 55113

Dear Mr. Gove:

This is to provide an interim reply to your letter of October 28 concerning the seepage occurring at the Spruce Road site from which we removed a bulk sample of copper nickel ore in early 1974.

1. We are proceeding to develop information required to prepare the report requested in your letter of September 19. We are following the outline forwarded to MPCA on October 6, and appreciate being notified that the plan is acceptable to the Agency.
2. To date 13 water samples have been taken from the seep itself and in addition 7 sets of samples from 2 ground water observation points above the bulk sample site, and from 3 points between the site and the lower end of Filson Creek.
3. Flow has been monitored regularly and recently showed a rate less than 1 pint per minute.
4. Our plan for regrading the site was outlined to the USFS in the attached proposal on September 2. Regrading according to these procedures started on November 3 and should be completed early next week.
5. The effect of the regrading on the seep will be carefully observed.

Mr. Peter Gove
November 4, 1975
Page 2

6. We hope to have the requested report completed by
December 1.

Very truly yours,

W. S. Mounce

WSM:msh
Att.

cc: E. Vandermillen ✓

September 2, 1975

Ray Chase
District Ranger
Department of Agriculture
United States Forest Service
Postoffice Building
Ely, Minnesota 55731

Dear Ray,

It is our intention to undertake additional reclamation procedures on the Spruce Rd. bulk sample site, located in the NW $\frac{1}{4}$, NW $\frac{1}{4}$, Sec. 25, T62, R11.

Discussions with other Forest Service personnel has defined the following general procedure to be followed in this program.

- (1) The depression caused by settling of the original fill will be eliminated by raising to a condition of positive relief. It is estimated that this will require approximately 2,000 cubic yards of material.
- (2) The initial 8" - 10" layer will be compacted by the operating equipment and an attempt will be made to utilize largely impervious material.
- (3) Final elevation will be contoured to blend with existing topography.
- (4) Reseeding of the site will follow the attached suggested seed analysis and fertilizing schedule.
- (5) A 6" - 8" lift of gravel will be spread on the adjacent "Lampi Rd", in order to eliminate the natural boggy condition which has existed.

We hope to start the project in early September and will have it completed before the end of the month. We may wish to carry out additional experimental planting on the site and will confer with you prior to undertaking this work.

Please call if you should have any additional advice or comments on this program.

Sincerely,

R. E. Wager
Project Geologist

Suggested Seed Analysis and Fertilizing Schedule

Annual Rye) Either or both in combo
Agriculture Rye) Not more than 10% by weight

Laderno or alsac clover - either or both in combo with white
clover to make up 70% by weight

Brome grass 20% by weight

Fertilizer	10/10/10	300#/acre
Best	20/15/30	200#/acre

Lime 2½ ton per Acre of Agriculture lime.

SUMMARY OF CHEMICAL ANALYSIS

SEEP

<u>Date</u> 1975	<u>Copper</u> ug/l	<u>Nickel</u> ug/l	<u>Hardness</u> mg/l	<u>Sulfate</u> mg/l	<u>Zinc</u> ug/l	<u>Manganese</u> ug/l
5-16	380	2300	-	-	15.0	2800
7-9	78	37	-	-	14.0	3500
7-23	34	200	-	-	<10.0	4100
8-13	100	200	-	-	9.0	4500
8-25	? 1800	2900?	-	-	17.0	4800
9-15	120	1700	-	-	10.0	4600
9-29	-	3000	180	304	6.1	4500
10-4	170	3100	-	-	7.8	4300
10-7	160	3100	942	304	7.5	4200
10-10	130	2800	1217	281	6.8	4100
10-15	100	2100	1211	271	5.4	4100
10-20	78	2600	514	289	7.5	5300
10-23	190	3100	1107	286	3.0	4800
11-4	100	3100	1579	323	8.8	4500

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SUMMARY OF COPPER-NICKEL ANALYSIS
ALL IN ug/l

<u>DATE</u>	<u>SEEP</u>	<u>MARSH</u>	<u>CREEK</u>	<u>FILSON</u>	<u>LOCATION II</u>
9-29	-/3000	21/13	30/30	11 /6.6	1.5/1
10-4	170/3100	40/13	40/19	30 /6	.
10-7	160/3100	40/11	40/15	40 /5	2 /2.9
10-10	130/2800	27/17	31/25	11 /6.6	
10-15	100/2100	22/16	30/28	11 /6.1	
10-20	78/2600	20/18	32/26	11.2/6	2.1/2
10-23	90/2400	25/28	36/28	10 /8	1.0/2
11-3	100/3100	25/20	---	---	---

Copper/Nickel

Generally levels have dropped in the marsh and tend to increase in creek and drop again in Filson.

CU 118.3 \bar{x}	27.5	34	17.7
6 35.7	8.1	4.5	12.1
Ni 2770	17.0	24.4	6.3
3770	6.3	5.4	.9

TR. 3 ABOVE SEEP

4-13-76

UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
CENTRAL LABORATORY, DENVER, COLORADO

WATER QUALITY ANALYSIS
LAB ID # 107003 RECORD # 8357

SAMPLE LOCATION: STATION NUMBER 3 BULK SAMPLE SITE
STATION ID: 470956091403903 LAT, LONG, SEQ.: 470956 0914039 03
DATE OF COLLECTION: BEGIN--760413 END-- TIME--1000
STATE CODE: 27 COUNTY CODE: 075 PROJECT IDENTIFICATION: 442704100
DATA TYPE: 2 SOURCE: SURFACE WATER GEOLOGIC UNIT:
COMMENTS:
COLL BY J RAMQUIST, S LUNDEEN, R BERRISFORD 200 YDS UPSTREAM OF
SAMPLE SEQUENCE NO 2 ON TRIBUTARY

MAIL TO ST PAUL MINN
SCHEDULES USED: 271 0 0 0
NUMBER OF DETERMINATIONS: 20 HCODE = 16
COST OF ANALYSIS \$ 107.80 BILLING CODE: 27
SUBMIT CORRECTIONS TO THE DENVER CENTRAL LAB
WITHIN 15 DAYS FROM 09/04/76. INDICATE THE
CENTRAL LAB ID # AND RECORD # WITH RESPONSE.
WRD-Q* FILE STORAGE WAS REQUESTED AND THE
STATION HEADING INFORMATION IN THE WRD STATION
HEADER FILE WAS SUBSTITUTED HERE, PLEASE CHECK.

AIR TEMP (DEG C)		18.0	MAGNESIUM TOTAL USGS MG/L	2.8
ALK, TOT (AS CaCO3)	MG/L	7	NICKEL TOTAL AAGF UG/L	9
BICARBONATE	MG/L	8	PH FIELD	5.6
CADMIUM TOTAL AAGF	UG/L	0.04	POTASSIUM TOTAL USGS MG/L	0.4
CALCIUM TOTAL USGS	MG/L	2.3	RESIDUE SUSPEN 110C MG/L	1
CARBON DIOXIDE	MG/L	32	SODIUM TOTAL USGS MG/L	0.2
CARBONATE	MG/L	0	SP. CONDUCTANCE FLD	30
COLOR		110	SULFIDE TOTAL MG/L	0.8
COPPER TOTAL AAGF	UG/L	11	TURBIDITY (JTU)	1
IRON TOTAL	UG/L	450	WATER TEMP (DEG C)	1.0
LEAD TOTAL AAGF	UG/L	0.5	ZINC TOTAL AAGF UG/L	4.2

CATIONS

(MG/L)

(MEQ/L)

BICARBONATE
CARBONATE

TOTAL

ANIONS

(MG/L)

(MEQ/L)

8
0

TOTAL

0.132
0.000
0.131

TRIB ABOVE SEEP
 UNITED STATES DEPARTMENT OF THE INTERIOR
 GEOLOGICAL SURVEY
 CENTRAL LABORATORY, DENVER, COLORADO

FS
 5-5-

WATER QUALITY ANALYSIS
 LAB ID # 129026 RECORD # 13332

SAMPLE LOCATION: FILSON CR TRIBUTARY ABOVE MOUTH ABOVE SEEP DISC
 STATION ID: 05124992 LAT, LONG, SECT: 474957 0914030 00
 DATE OF COLLECTION: BEGIN==760505 END== TIME==1000
 STATE CODE: 27 COUNTY CODE: 075 PROJECT IDENTIFICATION: 442704100
 DATA TYPE: 2 SOURCE: SURFACE WATER GEOLOGIC UNIT:

COMMENTS:
 CALL BY J RAMQUIST, S LUNDEEN, R BERRISFORD FROM TRIBUTARY ABOVE
 POINT WHERE SEEP DISCHARGES INTO TRIBUTARY

MAIL TO ST PAUL MINN
 SCHEDULES USED: 271 0 0 0
 NUMBER OF DETERMINATIONS: 20 HCODE = 0
 COST OF ANALYSIS \$ 107.80 BILLING CODE: 27
 SUBMIT CORRECTIONS TO THE DENVER CENTRAL LAB
 WITHIN 15 DAYS FROM 12/24/76. INDICATE THE
 CENTRAL LAB ID # AND RECORD # WITH RESPONSE.
 WRD-9* FILE STORAGE WAS NOT REQUESTED FOR
 THIS ANALYSIS. THE ANALYSIS WILL REMAIN
 IN THE CENTRAL LAB FILE ONLY.

AIR TEMP (DEG C)		2.0	MAGNESIUM TOTAL USGS MG/L	2.5
ALK, TOT (AS CaCO3)	MG/L	26	NICKEL TOTAL AAGF UG/L	9
BICARBONATE	MG/L	32	PH FIELD	5.4
CADMIUM TOTAL AAGF	UG/L	0.02	POTASSIUM TOTAL USGS MG/L	0.3
CALCIUM TOTAL USGS	MG/L	2.5	RESIDUE SUSPEN 110C MG/L	6
CARRON DIOXIDE	MG/L	204	SODIUM TOTAL USGS MG/L	1.1
CARRONATE	MG/L	0	SP. CONDUCTANCE FLD	29
COLOR		150	SULFIDE TOTAL MG/L	1.8
COPPER TOTAL AAGF	UG/L	16	TURBIDITY (JTU)	1
IRON TOTAL	UG/L	470	WATER TEMP (DEG C)	5.5
LEAD TOTAL AAGF	UG/L	0.2	ZINC TOTAL AAGF UG/L	3.9

CATIONS

(MG/L) (MEQ/L)

BICARBONATE
 CARBONATE

TOTAL

ANIONS

(MG/L) (MEQ/L)

0.525
 0.000

TOTAL 0.524

trib. above site
 Julk S
 5-2-76

UNITED STATES DEPARTMENT OF THE INTERIOR
 GEOLOGICAL SURVEY
 CENTRAL LABORATORY, ALBANY, NEW YORK

JUN 23 1978

WATER QUALITY ANALYSIS
 LAB ID # 143159 RECORD # 46342

SAMPLE LOCATION: FILSON CR TRIBUTARY ABOVE MOUTH ABOVE SFP DISC
 STATION ID: 05124992 LAT.LONG.SFO.: 474957 0914030 00
 DATE OF COLLECTION: BEGIN--760520 END-- TIME--1100
 COUNTY CODE: 075 PROJECT IDENTIFICATION: 442704100
 DATA TYPE: 2 SOURCE: SURFACE WATER GEOLOGIC UNIT:

COMMENTS:

COLLECTED BY R HERRISFORD & S LUNDEEN
 FROM TRIBUTARY ABOVE POINT WHERE
 SEEP DISCHARGES INTO TRIBUTARY CS=9

MAIL TO MINN
 SCHEDULES USED: 271 0 0 0
 NUMBER OF DETERMINATIONS: 14 HCODE = 0
 COST OF ANALYSIS \$ 37.80 DOP--740622
 SURMIT CORRECTIONS TO CENTRAL LAB WITHIN
 15 DAYS FROM RFLOW STAMPED DATE. INDICATE
 CENTRAL LAB ID # AND RECORD # WITH RESPONSE.
 WRD-0# FILE STOPAGE WAS NOT REQUESTED FOR
 THIS ANALYSIS. THE ANALYSIS WILL REMAIN
 IN THE CENTRAL LAB FILE ONLY.

AIR TEMP (DEG C)		12.0	MAGNESIUM TOTAL USGS MG/L	1.9
ALK.TOT (AS CaCO3)	MG/L	10	PH FIELD	5.8
BICARBONATE	MG/L	12	POTASSIUM TOTAL USGS MG/L	0.1
CALCIUM TOTAL USGS	MG/L	2.6	RESIDUE SUSPEN 110C MG/L	3
CARBON DIOXIDE	MG/L	30	SODIUM TOTAL USGS MG/L	1.1
CARBONATE	MG/L	0	SULFIDE TOTAL MG/L	1.2
COLOR		160	TURBIDITY (JTU)	1
IRON TOTAL	UG/L	440	WATER TEMP (DEG C)	10.0

CATIONS

(MG/L) (MEQ/L)

BICARBONATE
 CARBONATE

TOTAL

ANIONS

(MG/L) (MEQ/L)

12 0.197
 0 0.000

TOTAL 0.197

TRIB ABOVE SEEP

UNITED STATES DEPARTMENT OF THE INTERIOR
 GEOLOGICAL SURVEY
 CENTRAL LABORATORY, DENVER, COLORADO

5-20-77

WATER QUALITY ANALYSIS
 LAB ID # 148417 RECORD # 16367

SAMPLE LOCATION: FILSON CR TRIBUTARY ABOVE MOUTH ABOVE SEEP DISC
 STATION ID: 05124992 LAT. LONG. SEQ. 474957 0914030 00
 DATE OF COLLECTION: BEGIN--760520 END-- TIME--1100
 STATE CODE: 27 COUNTY CODE: 075 PROJECT IDENTIFICATION: 442704100
 DATA TYPE: 2 SOURCE: SURFACE WATER GEOLOGIC UNIT:
 COMMENTS:

COLL BY R HERRISFORD AND S LUNDEEN FROM TRIBUTARY ABOVE POINT WHEN
 SEED DISCHARGES INTO TRIBUTARY

AIR TEMP (DEG C)		18.0	NICKEL TOTAL AAGF	UG/L	12
CADMIUM TOTAL AAGF	UG/L	0.02	PH FIELD		5.8
COPPER TOTAL AAGF	UG/L	19	SP. CONDUCTANCE FLD		31
LEAD TOTAL AAGF	UG/L	0.5	WATER TEMP (DEG C)		10.0
			ZINC TOTAL AAGF	UG/L	6.9

MAIL TO ST PAUL MINN
 SCHEDULES USED: 457 0 0 0
 NUMBER OF DETERMINATIONS: 9 HCODE = 0
 COST OF ANALYSIS \$ 70.00 BILLING CODE: 27
 SUBMIT CORRECTIONS TO THE DENVER CENTRAL LAB
 WITHIN 15 DAYS FROM 01/08/77. INDICATE THE
 CENTRAL LAB ID # AND RECORD # WITH RESPONSE.
 HARD-DISK FILE STORAGE WAS NOT REQUESTED FOR
 THIS ANALYSIS. THE ANALYSIS WILL REMAIN
 IN THE CENTRAL LAB FILE ONLY.

~~AT CONVENT~~ TRIB ABOVE SEEF

5-20-76 UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
CENTRAL LABORATORY, DENVER, COLORADO

WATER QUALITY ANALYSIS
LAB ID # 148417 RECORD # 16367

SAMPLE LOCATION: FOLSON CR TRIBUTARY ABOVE MOUTH ABOVE SEEF DISC
STATION ID: 05124992 LAT, LONG, SECT: 474957 0914030 00
DATE OF COLLECTION: RGIN--760520 END-- TIME--1100
STATE CODE: 27 COUNTY CODE: 075 PROJECT IDENTIFICATION: 402704100
DATA TYPE: 2 SOURCE: SURFACE WATER GEOLOGIC UNIT:
COMMENTS:

COLL BY P REPRISFORD AND S LUNDEEN FROM TRIBUTARY ABOVE POINT WHEN
SEEF DISCHARGES INTO TRIBUTARY

AIR TEMP (DEG C)		18.0	NICKEL TOTAL AAGF	UG/L	12
CADMIUM TOTAL AAGF	UG/L	0.02	PH FIELD		5.8
COPPER TOTAL AAGF	UG/L	19	SP. CONDUCTANCE FLD		31
LEAD TOTAL AAGF	UG/L	0.5	WATER TEMP (DEG C)		10.0
			ZINC TOTAL AAGF	UG/L	6.9

MAIL TO ST PAUL MINN
SCHEDULES USED: 457 0 0 0
NUMBER OF DETERMINATIONS: 9 HCODE # 0
COST OF ANALYSIS \$ 70.00 BILLING CODE: 27
SUBMIT CORRECTIONS TO THE DENVER CENTRAL LAB
WITHIN 15 DAYS FROM 01/15/77. INDICATE THE
CENTRAL LAB ID # AND RECORD # WITH RESPONSE.
NO-64 FILE STORAGE HAS NOT REQUESTED FOR
THIS ANALYSIS. THE ANALYSIS WILL REMAIN
IN THE CENTRAL LAB FILE ONLY.

TRIP ABOVE SEEP

FS
6-22

UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
CENTRAL LABORATORY, ALBANY, NEW YORK

WATER QUALITY ANALYSIS
LAB ID # 182027 RECORD # 61321

SAMPLE LOCATION: FILSON CR TRIBUTARY ABOVE MOUTH ABOVE SEEP DISC
STATION ID: 05124992 LAT.LONG.SEQ.: 474957 0914030 00
DATE OF COLLECTION: BEGIN--760622 END-- TIME--1040
COUNTY CODE: 075 PROJECT IDENTIFICATION: 442704100
DATA TYPE: 2 SOURCE: SURFACE WATER GEOLOGIC UNIT:

COMMENTS:
COLL BY R BERRISFORD & S LUNDEEN FROM TRIBUTARY ABOVE POINT
WHERE SEEP DISCHARGES INTO TRIBUTARY

AIR TEMP (DEG C)		24.0	MAGNESIUM TOTAL USGS MG/L	2.5
ALK.TOT (AS CaCO3)	MG/L	13	PH FIELD	6.0
BICARBONATE	MG/L	16	POTASSIUM TOTAL USGS MG/L	0.1
CALCIUM TOTAL USGS	MG/L	4.0	RESIDUE SUSPEN 110C MG/L	1
CARBON DIOXIDE	MG/L	26	SODIUM TOTAL USGS MG/L	1.3
CARBONATE	MG/L	0	SP. CONDUCTANCE FLD	26
COLOR		240	SULFIDE TOTAL MG/L	1.3
IRON TOTAL	UG/L	860	TURBIDITY (JTU)	1
			WATER TEMP (DEG C)	16.5

MAIL TO MINN SCODE: 27
SCHEDULES USED: 271 0 0 0
TOTAL PARAMETERS: 19 HCODE = 0
COST OF ANALYSIS \$ 37.80 DOP--770516
SUBMIT CORRECTIONS TO CENTRAL LAB WITHIN
15 DAYS FROM BELOW STAMPED DATE. INDICATE
CENTRAL LAB ID # AND RECORD # WITH RESPONSE.
WRD-Q# FILE STORAGE WAS NOT REQUESTED FOR
THIS ANALYSIS. THE ANALYSIS WILL REMAIN
IN THE CENTRAL LAB FILE ONLY.

CATIONS

(MG/L) (MEQ/L)

BICARBONATE
CARBONATE

TOTAL

ANIONS

(MG/L) (MEQ/L)

16 0.263
0 0.000

TOTAL 0.262

TRIB ABOVE SEEP

FS 6-22-

UNITED STATES DEPARTMENT OF THE INTERIOR
 GEOLOGICAL SURVEY
 CENTRAL LABORATORY, DENVER, COLORADO

WATER QUALITY ANALYSIS
 LAB ID # 185406 RECORD # 20614

SAMPLE LOCATION: FILLSON CR. TRIBUTARY ABOVE MOUTH ABOVE SEEP DISC
 STATION ID: 05124902 LAT. LONG. SEQ. 1 474957 0914030 00
 DATE OF COLLECTION: BEGIN--760622 END-- TIME--1040
 STATE CODE: 27 COUNTY CODE: 075 PROJECT IDENTIFICATION: 442704100
 DATA TYPE: 2 SOURCE: SURFACE WATER GEOLOGIC UNIT:

COMMENTS:
 COIL BY R. HERRISFORD AND S. LUNDEEN FROM TRIBUTARY ABOVE POINT WHERE
 SEEP DISCHARGES INTO TRIBUTARY

AIR TEMP (DEG C)		24.0	NICKEL TOTAL AAGF	UG/L	19
CADMIUM TOTAL AAGF	UG/L	0.01	PH FIELD		6.0
COPPER TOTAL AAGF	UG/L	35	SP. CONDUCTANCE FLD		26
LEAD TOTAL AAGF	UG/L	0.4	WATER TEMP (DEG C)		16.5
			ZINC TOTAL AAGF	UG/L	3.6

MAIL TO ST PAUL MN
 SCHEDULES USED: 437 0 0 0
 NUMBER OF DETERMINATIONS: 9 HCODE = 0
 COST OF ANALYSIS \$ 76.99 BILLING CODE: 27
 SURMIT CORRECTIONS TO THE DENVER CENTRAL LAB
 WITHIN 15 DAYS FROM 01/08/77. INDICATE THE
 CENTRAL LAB ID # AND RECORD # WITH RESPONSE.
 WHEN FILE STORAGE WAS NOT REQUESTED FOR
 THIS ANALYSIS, THE ANALYSIS WILL REMAIN
 IN THE CENTRAL LAB FILE ONLY.

*** THIS ANALYSIS HAS PREVIOUSLY BEEN APPROVED AND TRANSMITTED BUT THESE PARAMETERS HAVE BEEN UPDATED SINCE THAT TRANSMITTAL ***
LAB ID # 182027 RECORD # 61321 (ASSOCIATED CALCULATIONS HAVE ALSO BEEN UPDATED)

CODE	PARAMETER NAME	CODE	PARAMETER NAME	CODE	PARAMETER NAME
8	BICARBONATE				

TRIB ABOVE SEEP

FS

7-7-74

UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
CENTRAL LABORATORY, ALBANY, NEW YORK

WATER QUALITY ANALYSIS
LAR ID # 197039 RECORD # 66073

SAMPLE LOCATION: FILSON CR TRIBUTARY ABOVE MOUTH ABOVE SEEP DISC
STATION ID: 05124992 LAT.LONG.SEQ.: 474957 0914030 00
DATE OF COLLECTION: BEGIN--760707 END-- TIME--1025
COUNTY CODE: 075 PROJECT IDENTIFICATION: 442704100
DATA TYPE: 2 SOURCE: SURFACE WATER GEOLOGIC UNIT:

COMMENTS:
COLL BY R BERRISFORD & S LUNDEEN FROM TRIBUTARY ABOVE POINT
WHERE SEEP DISCHARGES INTO TRIBUTARY CS@25

MAIL TO MN RCODE: 27
SCHEDULES USED: 271 0 0 0
TOTAL PARAMETERS: 19 HCODE = 0
COST OF ANALYSIS \$ 37.80 DOP--770516
SURMIT CORRECTIONS TO CENTRAL LAB WITHIN
15 DAYS FROM BELOW STAMPED DATE. INDICATE
CENTRAL LAB ID # AND RECORD # WITH RESPONSE.
WRD-QW FILE STORAGE WAS NOT REQUESTED FOR
THIS ANALYSIS. THE ANALYSIS WILL REMAIN
IN THE CENTRAL LAB FILE ONLY.

AIR TEMP (DEG C)		20.0	MAGNESIUM TOTAL USGS MG/L	2.5
ALK.TOT (AS CaCO3)	MG/L	13	PH FIELD	6.4
BICARBONATE	MG/L	16	POTASSIUM TOTAL USGS MG/L	0.1
CALCIUM TOTAL USGS	MG/L	7.3	RESIDUE SUSPEN 110C MG/L	9
CARBON DIOXIDE	MG/L	10	SODIUM TOTAL USGS MG/L	1.3
CARBONATE	MG/L	0	SP. CONDUCTANCE FLD	30
COLOR		280	SULFIDE TOTAL MG/L	3.8
IRON TOTAL	UG/L	920	TURBIDITY (JTU)	1
			WATER TEMP (DEG C)	14.0

CATIONS

(MG/L) (MEQ/L)

BICARBONATE
CARBONATE

TOTAL

ANIONS

(MG/L) (MEQ/L)

16 0.263
0 0.000

TOTAL 0.262

*** THIS ANALYSIS HAS PREVIOUSLY BEEN APPROVED AND TRANSMITTED BUT THESE PARAMETERS HAVE BEEN UPDATED SINCE THAT TRANSMITTAL ***
LAB ID # 197039 RECORD # 66073 (ASSOCIATED CALCULATIONS HAVE ALSO BEEN UPDATED)

CODE	PARAMETER NAME	CODE	PARAMETER NAME	CODE	PARAMETER NAME	CODE	PARAMETER NAME
8	BICARBONATE						

TRIB ABOVE SEEP

7-7-76

UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
CENTRAL LABORATORY, DENVER, COLORADO

WATER QUALITY ANALYSIS
LAB ID # 199407 RECORD # 4562A

SAMPLE LOCATION: FILON CR, TRIBUTARY ABOVE MOUTH ABOVE SEEP DISC
STATION ID: 05120992 LAT, LONG, SEQ.: 474957 0914030 00
DATE OF COLLECTION: BEGIN--760707 END-- TIME--1025
STATE CODE: 27 COUNTY CODE: 075 PROJECT IDENTIFICATION: 402704100
DATA TYPE: 2 SOURCE: SURFACE WATER GEOLOGIC UNIT:

COMMENTS:
COLL BY R BERRISFORD AND S LUNDEEN FROM TRIBUTARY ABOVE POINT WHERE
SEEP DISCHARGES INTO TRIBUTARY

AIR TEMP (DEG C)		20.0	NICKEL TOTAL AAGF	UG/L	21
CADMIUM TOTAL AAGF	UG/L	0.01	PH FIELD		6.4
COPPER TOTAL AAGF	UG/L	18	SP. CONDUCTANCE FLD		30
LEAD TOTAL AAGF	UG/L	0.2	WATER TEMP (DEG C)		14.0
			ZINC TOTAL AAGF	UG/L	2.9

MAIL TO ST PAUL MINN
SCHEDULES USED: 0 0 0 0
NUMBER OF DETERMINATIONS: 9 MCODE = 0
COST OF ANALYSIS \$ 0.25 BILLING CODE: 27
SUBMIT CORRECTIONS TO THE DENVER CENTRAL LAB
WITHIN 15 DAYS FROM 02/04/77. INDICATE THE
CENTRAL LAB ID # AND RECORD # WITH RESPONSE.
RD-Q FILE STORAGE WAS NOT REQUESTED FOR.
THIS ANALYSIS, THE ANALYSIS WILL REMAIN
IN THE CENTRAL LAB FILE ONLY.

TRIB ABOVE SEEP

7-20-

UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
CENTRAL LABORATORY, DENVER, COLORADO

WATER QUALITY ANALYSIS
LAB ID # 205003 RECORD # 22707

SAMPLE LOCATION: PILSON CR, TRIBUTARY ABOVE MOUTH ABOVE SEEP DISC
STATION ID: 05124992 LAT, LONG, SEQ, 474957 0914030 00
DATE OF COLLECTION: BEGIN--760720 END-- TIME--1000
STATE CODE: 27 COUNTY CODE: 075 PROJECT IDENTIFICATION: 402704100
DATA TYPE: 2 SOURCE: SURFACE WATER GEOLOGIC UNIT:
COMMENTS:

COLL BY R. RERRISFORD AND S. LUNDBEN FROM TRIBUTARY ABOVE POINT WHERE
SEEP DISCHARGES INTO TRIBUTARY. SHALLOW WATER MADE SAMPLING DIFFIC.

MAIL TO ST PAUL MN
SCHEDULES USED: 271 0 0 0
NUMBER OF DETERMINATIONS: 15 HCODE = 0
COST OF ANALYSIS \$ 37.80 BILLING CODE: 27
SURMIT CORRECTIONS TO THE DENVER CENTRAL LAB
WITHIN 15 DAYS FROM 08/25/76. INDICATE THE
CENTRAL LAB ID # AND RECORD # WITH RESPONSE.
WRD-GW FILE STORAGE WAS NOT REQUESTED FOR
THIS ANALYSIS. THE ANALYSIS WILL REMAIN
IN THE CENTRAL LAB FILE ONLY.

AIR TEMP (DFG C)		22.0	MAGNESIUM TOTAL USGS MG/L	28
ALK, TOT (AS CaCO3)	MG/L	11	PH FIELD	5.5
BICARBONATE	MG/L	13	POTASSIUM TOTAL USGS MG/L	0.2
CALCIUM TOTAL USGS	MG/L	4.2	RESIDUE SUSPEN 110C MG/L	1
CARBON DIOXIDE	MG/L	66	SODIUM TOTAL USGS MG/L	1.1
CARBONATE	MG/L	0	SP. CONDUCTANCE FLD	31
COLOR		360	SULFIDE TOTAL MG/L	1.1
IRON TOTAL	UG/L	1600	TURBIDITY (JTU)	1
			WATER TEMP (DEG C)	10.0

CATIONS

(MG/L) (MEQ/L)

BICARBONATE
CARBONATE

TOTAL

ANIONS

(MG/L) (MEQ/L)

13 0.214
0 0.000

TOTAL 0.213

b. above Bulk Sample
fe

7-20-76

UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
CENTRAL LABORATORY, DENVER, COLORADO

WATER QUALITY ANALYSIS
LAB ID # 205003 RECORD # 22707

SAMPLE LOCATION: FILSON CR, TRIBUTARY ABOVE MOUTH ABOVE SEEP DISC
STATION ID: 05124992 LAT, LONG, SEQ. 474957 0914030 00
DATE OF COLLECTION: BEGIN--760720 END-- TIME--1000
STATE CODE: 27 COUNTY CODE: 075 PROJECT IDENTIFICATION: 442704100
DATA TYPE: 2 SOURCE: SURFACE WATER GEOLOGIC UNIT:
COMMENTS:

COLL BY R. HERRISFORD AND S. LUNDEEN FROM TRIBUTARY ABOVE POINT WHERE
SEEP DISCHARGES INTO TRIBUTARY, SHALLOW WATER MADE SAMPLING DIFFIC.

AIR TEMP (DFG C)		22.0	MAGNESIUM TOTAL USGS MG/L	28
ALK, TOT (AS CaCO3)	MG/L	11	PH FIELD	5.5
BICARBONATE	MG/L	13	POTASSIUM TOTAL USGS MG/L	0.2
CALCIUM TOTAL USGS	MG/L	4.2	RESIDUE SUSPEN 110C MG/L	1
CARBON DIOXIDE	MG/L	66	SODIUM TOTAL USGS MG/L	1.1
CARBONATE	MG/L	0	SP. CONDUCTANCE FLD	31
COLOR		360	SULFIDE TOTAL MG/L	1.1
IRON TOTAL	UG/L	1600	TURBIDITY (JTU)	1
			WATER TEMP (DEG C)	18.0

CATIONS

(MG/L) (MEQ/L)

BICARBONATE
CARBONATE

TOTAL

ANIONS

(MG/L) (MEQ/L)

13 0.214
0 0.000

TOTAL

0.213

MAIL TO ST PAUL MN
SCHEDULES USED: 271 0 0 0
NUMBER OF DETERMINATIONS: 15 HCODE = 0
COST OF ANALYSIS \$ 37.80 BILLING CODE: 27
SURMIT CORRECTIONS TO THE DENVER CENTRAL LAB
WITHIN 15 DAYS FROM 08/25/76, INDICATE THE
CENTRAL LAB ID # AND RECORD # WITH RESPONSE.
WRD-QW FILE STORAGE WAS NOT REQUESTED FOR
THIS ANALYSIS, THE ANALYSIS WILL REMAIN
IN THE CENTRAL LAB FILE ONLY.

COVE CULVERT
7-4 76

UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
CENTRAL LABORATORY, DENVER, COLORADO

WATER QUALITY ANALYSIS
LAB ID # 213404 RECORD # 25127

SAMPLE LOCATION: FILSON CR, TRIBUTARY AT MOUTH ABOVE CULVERT
STATION ID: 05124993 LAT, LONG, SEQ.: 474957 0914030 00
DATE OF COLLECTION: BEGIN--760720 END-- TIME--0015
STATE CODE: 27 COUNTY CODE: 075 PROJECT IDENTIFICATION: 442704100
DATA TYPE: 2 SOURCE: SURFACE WATER GEOLOGIC UNIT:
COMMENTS:

COLL BY S. LUNDEEN AND R. BERRISFORD IMMED. ABOVE CULVERT ON SPRUCE
RD. MINIMAL FLOW. HARD TO SAMPLE WITHOUT STIRRING UP BOTTOM SEDIMENT

AIR TEMP (DEG C)		22.0	NICKEL TOTAL AAGF	UG/L	27
CADMIUM TOTAL AAGF	UG/L	0.01	PH FIELD		5.5
COPPER TOTAL AAGF	UG/L	25	SP. CONDUCTANCE FLD		37
LEAD TOTAL AAGF	UG/L	0.4	WATER TEMP (DEG C)		19.0
			ZINC TOTAL AAGF	UG/L	2.2

No WRD
requested

MAIL TO ST PAUL MN
SCHEDULES USED: 437 0 0 0
NUMBER OF DETERMINATIONS: 9 MCODE = 0
COST OF ANALYSIS \$ 76.99 BILLING CODE: 27
SUBMIT CORRECTIONS TO THE DENVER CENTRAL LAB
WITHIN 15 DAYS FROM 02/26/77. INDICATE THE
CENTRAL LAB ID # AND RECORD # WITH RESPONSE.
WRD-QW FILE STORAGE WAS NOT REQUESTED FOR
THIS ANALYSIS, THE ANALYSIS WILL REMAIN
IN THE CENTRAL LAB FILE ONLY.

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 7-20-76

UNITED STATES DEPARTMENT OF THE INTERIOR
 GEOLOGICAL SURVEY
 CENTRAL LABORATORY, DENVER, COLORADO

WATER QUALITY ANALYSIS
 LAB ID # 205002 RECORD # 22705

SAMPLE LOCATION: FILSON CR, TRIBUTARY AT MOUTH ABOVE CULVERT
 STATION ID: 05124993 LAT, LONG, SEQ.: 474957 0914030 00
 DATE OF COLLECTION: BEGIN--760720 END-- TIME--0915
 STATE CODE: 27 COUNTY CODE: 075 PROJECT IDENTIFICATION: 442704100
 DATA TYPE: 2 SOURCE: SURFACE WATER GEOLOGIC UNIT:

COMMENTS:
 COLL BY S. LUNDEEN AND R. HERRISFORD IMMED. ABOVE CULVERT ON SPRUCE
 RD. MINIMAL FLOW. HARD TO SAMPLE WITHOUT STIRRING UP BOTTOM SEDIMENT.

AIR TEMP (DEG C)		22.0	MAGNESIUM TOTAL USGS MG/L	34
ALK. TOT (AS CaCO3)	MG/L	18	PH FIELD	5.5
BICARBONATE	MG/L	19	POTASSIUM TOTAL USGS MG/L	0.1
CALCIUM TOTAL USGS	MG/L	5.0	RESIDUE SUSPEN 110C MG/L	12
CARBON DIOXIDE	MG/L	96	SODIUM TOTAL USGS MG/L	1.3
CARBONATE	MG/L	0	SP. CONDUCTANCE FLD	37
COLOR		420	SULFIDE TOTAL MG/L	1.2
IRON TOTAL	UG/L	3100	TURBIDITY (JTU)	2
			WATER TEMP (DEG C)	19.0

MAIL TO ST PAUL MN
 SCHEDULES USED: 271 0 0
 NUMBER OF DETERMINATIONS: 15 MCODE = 0
 COST OF ANALYSIS \$ 37.80 BILLING CODE: 27
 SUBMIT CORRECTIONS TO THE DENVER CENTRAL LAB
 WITHIN 15 DAYS FROM 08/25/76. INDICATE THE
 CENTRAL LAB ID # AND RECORD # WITH RESPONSE.
 WRD=GW FILE STORAGE WAS NOT REQUESTED FOR
 THIS ANALYSIS. THE ANALYSIS WILL REMAIN
 IN THE CENTRAL LAB FILE ONLY.

CATIONS

(MG/L)

(MEQ/L)

BICARBONATE
 CARBONATE

TOTAL

ANIONS

(MG/L)

(MEQ/L)

19
 0

TOTAL

0.312
 0.000
 0.311

TRIB AT CULVERT

25

7-20-76

UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
CENTRAL LABORATORY, DENVER, COLORADO

WATER QUALITY ANALYSIS
LAB ID # 205002 RECORD # 22705

SAMPLE LOCATION: FILSON CR, TRIBUTARY AT MOUTH ABOVE CULVERT
STATION ID: 05124993 LAT, LONG, SEQ.: 474957 0914030 00
DATE OF COLLECTION: BEGIN==760720 END== TIME==0915
STATE CODE: 27 COUNTY CODE: 075 PROJECT IDENTIFICATION: 442700100
DATA TYPE: 2 SOURCE: SURFACE WATER GEOLOGIC UNIT:
COMMENTS:

COLL BY S. LUNDEEN AND R. BERRISFORD IMMED. ABOVE CULVERT ON SPRUCE
RD. MINIMAL FLOW. HARD TO SAMPLE WITHOUT STIRRING UP BOTTOM SEDIMENT.

MAIL TO ST PAUL MN
SCHEDULES USED: 271 0 0 0
NUMBER OF DETERMINATIONS: 15 HCODE = 0
COST OF ANALYSIS \$ 37.80 BILLING CODE: 27
SUBMIT CORRECTIONS TO THE DENVER CENTRAL LAB
WITHIN 15 DAYS FROM 08/25/76. INDICATE THE
CENTRAL LAB ID # AND RECORD # WITH RESPONSE.
WRD-QM FILE STORAGE WAS NOT REQUESTED FOR
THIS ANALYSIS. THE ANALYSIS WILL REMAIN
IN THE CENTRAL LAB FILE ONLY.

AIR TEMP (DEG C)		22.0	MAGNESIUM TOTAL USGS MG/L	34
ALK, TOT (AS CaCO3)	MG/L	16	PH FIELD	5.5
BICARBONATE	MG/L	19	POTASSIUM TOTAL USGS MG/L	0.1
CALCIUM TOTAL USGS	MG/L	5.0	RESIDUE SUSPEN 110C MG/L	12
CARBON DIOXIDE	MG/L	96	SODIUM TOTAL USGS MG/L	1.3
CARBONATE	MG/L	0	SP. CONDUCTANCE FLD	37
COLOR		420	SULFIDE TOTAL MG/L	1.2
IRON TOTAL	UG/L	3100	TURBIDITY (JTU)	2
			WATER TEMP (DEG C)	19.0

CATIONS

(MG/L)

(MEQ/L)

BICARBONATE
CARBONATE

TOTAL

ANIONS

(MG/L)

(MEQ/L)

19
0

0.312
0.000

TOTAL

0.311

TRIB AT CULVERT

UNITED STATES DEPARTMENT OF THE INTERIOR
 GEOLOGICAL SURVEY
 CENTRAL LABORATORY, DENVER, COLORADO

8-1-76

WATER QUALITY ANALYSIS
 LAB ID # 199408 RECORD # 05630

SAMPLE LOCATION: PILSON CR. TRIBUTARY AT MOUTH ABOVE CULVERT
 STATION ID: 05124993 LAT. LONG. SEQ. # 474957 0914030 00
 DATE OF COLLECTION: BEGIN--760707 END-- TIME--1000
 STATE CODE: 27 COUNTY CODE: 075 PROJECT IDENTIFICATION: 042704100
 DATA TYPE: 2 SOURCE: SURFACE WATER GEOLOGIC UNIT:

COMMENTS:
 COLL BY R BERNISFORD AND S LUNDEEN IMMED ABOVE CULVERT ON SPRUCE RD

MAIL TO ST PAUL MINN
 SCHEDULES USED: 0 0 0 0
 NUMBER OF DETERMINATIONS: 9 HCODE = 0
 COST OF ANALYSIS \$ 0.25 BILLING CODE: 27
 SUBMIT CORRECTIONS TO THE DENVER CENTRAL LAB
 WITHIN 15 DAYS FROM 02/04/77. INDICATE THE
 CENTRAL LAB ID # AND RECORD # WITH RESPONSE.
 NO FILE STORAGE WAS NOT REQUESTED FOR
 THIS ANALYSIS. THE ANALYSIS WILL REMAIN
 IN THE CENTRAL LAB FILE ONLY.

AIR TEMP (DEG C)		20.0	NICKEL TOTAL AAGF	UG/L	24
CADMIUM TOTAL AAGF	UG/L <	0.01	PH FIELD		6.1
COPPER TOTAL AAGF	UG/L	22	SP. CONDUCTANCE FLD		36
LEAD TOTAL AAGF	UG/L	0.3	WATER TEMP (DEG C)		16.0
			ZINC TOTAL AAGF	UG/L	2.4

*** THIS ANALYSIS HAS PREVIOUSLY BEEN APPROVED AND TRANSMITTED BUT THESE PARAMETERS HAVE BEEN UPDATED SINCE THAT TRANSMITTAL ***
LAB ID # 197037 RECORD # 66069 (ASSOCIATED CALCULATIONS HAVE ALSO BEEN UPDATED)

CODE	PARAMETER NAME	CODE	PARAMETER NAME	CODE	PARAMETER NAME	CODE	PARAMETER NAME
8	BICARBONATE						

4 TRIB. AT CULVERT

ES

7-7-

UNITED STATES DEPARTMENT OF THE INTERIOR
 GEOLOGICAL SURVEY
 CENTRAL LABORATORY, ALBANY, NEW YORK

WATER QUALITY ANALYSIS
 LAB ID # 197037 RECORD # 66069

SAMPLE LOCATION: FILSON CR TRIBUTARY AT MOUTH ABOVE CULVERT
 STATION ID: 05124993 LAT.LONG.SEQ.: 474957 0914030 00
 DATE OF COLLECTION: BEGIN--760707 END-- TIME--1000
 COUNTY CODE: 075 PROJECT IDENTIFICATION: 442704100
 DATA TYPE: 2 SOURCE: SURFACE WATER GEOLOGIC UNIT:
 COMMENTS:
 COLL BY R BERRISFORD & S LUNDEEN IMMED.
 ABOVE CULVERT ON SPRUCE RD CS#25

MAIL TO MN BCODE: 27
 SCHEDULES USED: 271 0 0 0
 TOTAL PARAMETERS: 19 HCODE = 0
 COST OF ANALYSIS \$ 37.80 DOP--770516
 SUBMIT CORRECTIONS TO CENTRAL LAB WITHIN
 15 DAYS FROM BELOW STAMPED DATE. INDICATE
 CENTRAL LAB ID # AND RECORD # WITH RESPONSE.
 WRD-Q# FILE STORAGE WAS NOT REQUESTED FOR
 THIS ANALYSIS. THE ANALYSIS WILL REMAIN
 IN THE CENTRAL LAB FILE ONLY.

AIR TEMP (DEG C)		20.0	MAGNESIUM TOTAL USGS MG/L	2.9
ALK.TOT (AS CaCO3)	MG/L	13	PH FIELD	6.1
BICARBONATE	MG/L	16	POTASSIUM TOTAL USGS MG/L	0.1
CALCIUM TOTAL USGS	MG/L	6.7	RESIDUE SUSPEN 110C MG/L	8
CARBON DIOXIDE	MG/L	20	SODIUM TOTAL USGS MG/L	1.4
CARBONATE	MG/L	0	SP. CONDUCTANCE FLD	36
COLOR		220	SULFIDE TOTAL MG/L	3.8
IRON TOTAL	UG/L	1300	TURBIDITY (JTU)	1
			WATER TEMP (DEG C)	16.0

CATIONS

(MG/L) (MEQ/L)

BICARBONATE
 CARBONATE

TOTAL

ANIONS

(MG/L) (MEQ/L)

16 0.263
 0 0.000

TOTAL 0.262

ES
Trib at Culvert
6-22-

UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
CENTRAL LABORATORY, DENVER, COLORADO

WATER QUALITY ANALYSIS
LAB ID # 145402 RECORD # 2060A

SAMPLE LOCATION: PILSON CR, TRIBUTARY AT MOUTH ABOVE CULVERT
STATION ID: 05124993 LAT, LONG, SEQ.: 474957 0914030 00
DATE OF COLLECTION: BEGIN==760622 END== TIME==1015
STATE CODE: 27 COUNTY CODE: 075 PROJECT IDENTIFICATION: 442704100
DATA TYPE: 2 SOURCE: SURFACE WATER GEOLOGIC UNIT:
COMMENTS:

COLL BY R. HERRISFORD AND S. LUNDEEN IMMED. ABOVE CULVERT ON SPRUCE RD

MAIL TO ST PAUL MN
SCHEDULES USED: 437 0 0 0
NUMBER OF DETERMINATIONS: 4 HCODE = 0
COST OF ANALYSIS \$ 76.99 BILLING CODE: 27
SUBMIT CORRECTIONS TO THE DENVER CENTRAL LAB
WITHIN 15 DAYS FROM 01/08/77. INDICATE THE
CENTRAL LAB ID # AND RECORD # WITH RESPONSE.
WRC-04 FILE STORAGE WAS NOT REQUESTED FOR
THIS ANALYSIS. THE ANALYSIS WILL REMAIN
IN THE CENTRAL LAB FILE ONLY.

AIR TEMP (DEG C)		24.0	NICKEL TOTAL AAGF	UG/L	53
CADMIUM TOTAL AAGF	UG/L	0.01	PH FIELD		5.7
COPPER TOTAL AAGF	UG/L	34	SP. CONDUCTANCE FLD		29
LEAD TOTAL AAGF	UG/L	0.2	WATER TEMP (DEG C)		17.0
			ZINC TOTAL AAGF	UG/L	3.1

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RIB AT CULVERT

UNITED STATES DEPARTMENT OF THE INTERIOR
 GEOLOGICAL SURVEY
 CENTRAL LABORATORY, DENVER, COLORADO

PS
 5-20-

WATER QUALITY ANALYSIS
 LAB ID # 149416 RECORD # 16365

SAMPLE LOCATION: FILSON CR TRIBUTARY AT MOUTH ABOVE CULVERT
 STATION ID: 05124993 LAT, LONG, SECT: 474957 0914030 00
 DATE OF COLLECTION: BEGIN--760520 END-- TIME--1030
 STATE CODE: 27 COUNTY CODE: 075 PROJECT IDENTIFICATION: 442704100
 DATA TYPE: 2 SOURCE: SURFACE WATER GEOLOGIC UNIT:
 COMMENTS:

COLL BY R BERRISFORD AND S LUNDEEN IMMED. ABOVE CULVERT ON SPRUCE RD

MAIL TO ST PAUL MINN
 SCHEDULES USED: 437 0 0 0
 NUMBER OF DETERMINATIONS: 9 HCODE = 0
 COST OF ANALYSIS \$ 70.00 BILLING CODE: 27
 SUBMIT CORRECTIONS TO THE DENVER CENTRAL LAB
 WITHIN 15 DAYS FROM 01/08/77. INDICATE THE
 CENTRAL LAB ID # AND RECORD # WITH RESPONSE.
 RD-Q FILE STORAGE WAS NOT REQUESTED FOR
 THIS ANALYSIS, THE ANALYSIS WILL REMAIN
 IN THE CENTRAL LAB FILE ONLY.

AIR TEMP (DEG C)		18.0	NICKEL TOTAL AAGF	UG/L	19
CADMIUM TOTAL AAGF	UG/L	0.02	PH FIELD		5.7
COPPER TOTAL AAGF	UG/L	28	SP. CONDUCTANCE FLD		36
LEAD TOTAL AAGF	UG/L	0.7	WATER TEMP (DEG C)		10.0
			ZINC TOTAL AAGF	UG/L	6.2

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 5-20-76

UNITED STATES DEPARTMENT OF THE INTERIOR
 GEOLOGICAL SURVEY
 CENTRAL LABORATORY, ALBANY, NEW YORK

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WATER QUALITY ANALYSIS
 LAB ID # 143158 RECORD # 46320

SAMPLE LOCATION: FTLSON CP TRIBUTARY AT MOUTH ABOVE CULVERT
 STATION ID: 05124993 LAT. LONG. SFO.: 474957 0914030 00
 DATE OF COLLECTION: BEGIN--760520 END-- TIME--1030
 COUNTY CODE: 075 PROJECT IDENTIFICATION: 442704100
 DATA TYPE: 2 SOURCE: SURFACE WATER GEOLOGIC UNIT:

COMMENTS:
 COLLECTED BY P HERRISFORD & S LUNDEEN
 IMMED ABOVE CULVERT ON SPRUCE RD CS=9

MAIL TO MINN
 SCHEDULES USED: 271 0 0 0
 NUMBER OF DETERMINATIONS: 15 HCODE = 0
 COST OF ANALYSIS \$ 37.00 DUP--760622
 SUBMIT CORRECTIONS TO CENTRAL LAB WITHIN
 15 DAYS FROM BELOW STAMPED DATE. INDICATE
 CENTRAL LAB ID # AND RECORD # WITH RESPONSE.
 WRD-QW FILE STORAGE WAS NOT REQUESTED FOR
 THIS ANALYSIS. THE ANALYSIS WILL REMAIN
 IN THE CENTRAL LAB FILE ONLY.

AIR TEMP (DEG C)		14.0	MAGNESIUM TOTAL USGS MG/L	2.1
ALK. TOT (AS CaCO3)	MG/L	7	PH FIELD	5.7
BICARBONATE	MG/L	9	POTASSIUM TOTAL USGS MG/L	0.1
CALCIUM TOTAL USGS	MG/L	3.0	RESIDUE SUSPEN 110C MG/L	3
CARBON DIOXIDE	MG/L	26	SODIUM TOTAL USGS MG/L	1.1
CARBONATE	MG/L	0	SP. CONDUCTANCE FLD	36
COLOR		150	SULFIDE TOTAL MG/L	2.5
IRON TOTAL	UG/L	490	TURBIDITY (JTU)	0
			WATER TEMP (DEG C)	10.0

CATIONS

(MG/L)	(MEQ/L)	
		BICARBONATE
		CARBONATE

TOTAL

ANIONS

(MG/L)	(MEQ/L)
0	0.132
0	0.000

TOTAL 0.131

18 AT CULVERT

5-5-76

UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
CENTRAL LABORATORY, DENVER, COLORADO

WATER QUALITY ANALYSIS
LAB ID # 129025 RECORD # 13330

SAMPLE LOCATION: FILSON CR TRIBUTARY AT MOUTH ABOVE CULVERT
STATION ID: 05124993 LAT, LONG, SEQ.: 474957 0914030 00
DATE OF COLLECTION: REGIN--760505 END-- TIME--0915
STATE CODE: 27 COUNTY CODE: 075 PROJECT IDENTIFICATION: 442704100
DATA TYPE: 2 SOURCE: SURFACE WATER GEOLOGIC UNIT:
COMMENTS:

COLL BY J RANQUIST, S LUNDEEN, R BERRISFORD IMMEDIATELY ABOVE
CULVERT ON SPRUCE RD

MAIL TO ST PAUL MINN
SCHEDULES USED: 271 0 0 0
NUMBER OF DETERMINATIONS: 20 HCODE = 0
COST OF ANALYSIS \$ 107.80 BILLING CODE: 27
SUBMIT CORRECTIONS TO THE DENVER CENTRAL LAB
WITHIN 15 DAYS FROM 12/16/76. INDICATE THE
CENTRAL LAB ID # AND RECORD # WITH RESPONSE.
WARD-OW FILE STORAGE WAS NOT REQUESTED FOR
THIS ANALYSIS. THE ANALYSIS WILL REMAIN
IN THE CENTRAL LAB FILE ONLY.

AI= TEMP (DEG C)		2.0	MAGNESIUM TOTAL USGS	MG/L	3.0
ALC, TOT (AS CaCO3)	MG/L	8	NICKEL TOTAL AAGF	UG/L	15
BICARBONATE	MG/L	10	PH FIELD		5.7
CADMIUM TOTAL AAGF	UG/L	0.02	POTASSIUM TOTAL USGS	MG/L	0.3
CALCIUM TOTAL USGS	MG/L	3.4	RESIDUE SUSPEN 110C	MG/L	12
CARRON DIOXIDE	MG/L	32	SODIUM TOTAL USGS	MG/L	1.6
CARRONATE	MG/L	0	SP. CONDUCTANCE FLD		34
CCLOR		130	SULFIDE TOTAL	MG/L	2.4
COPPER TOTAL AAGF	UG/L	22	TURBIDITY (JTU)		1
IRON TOTAL	UG/L	460	WATER TEMP (DEG C)		5.0
LEAD TOTAL AAGF	UG/L <	0.2	ZINC TOTAL AAGF	UG/L	3.1

CATIONS

(MG/L) (MEQ/L)

BICARBONATE 10
CARBONATE 0

TOTAL

ANIONS

(MG/L) (MEQ/L)

10 0.164
0 0.000

TOTAL 0.164

ABOVE SEEP
7-26

UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
CENTRAL LABORATORY, DENVER, COLORADO

WATER QUALITY ANALYSIS
LAB ID # 213405 RECORD # 25129

SAMPLE LOCATION: FILSON CR, TRIBUTARY ABOVE MOUTH ABOVE SEEP DISC
STATION ID: 05124992 LAT, LONG, SEQ.: 474957 0914030 00
DATE OF COLLECTION: BEGIN--760720 END-- TIME--1000
STATE CODE: 27 COUNTY CODE: 075 PROJECT IDENTIFICATION: 442704100
DATA TYPE: 2 SOURCE: SURFACE WATER GEOLOGIC UNIT:

COMMENTS:

CULL BY P. BERRISFORD AND S. LUNDEEN FROM TRIBUTARY ABOVE POINT WHERE
SEEP DISCHARGES INTO TRIBUTARY. SHALLOW WATER MADE SAMPLING DIFFIC.

WTR TEMP (DEG C)		22.0	NICKEL TOTAL AAGF	UG/L	26
CADMIUM TOTAL AAGF	UG/L	0.01	PH FIELD		5.5
COPPER TOTAL AAGF	UG/L	19	SP. CONDUCTANCE FLD		31
LEAD TOTAL AAGF	UG/L	0.5	WATER TEMP (DEG C)		18.0
			ZINC TOTAL AAGF	UG/L	6.4

No WED
reported

MAIL TO ST PAUL MN
SCHEDULES USED: 437 0 0
NUMBER OF DETERMINATIONS: 9 HCODE = 0
COST OF ANALYSIS \$ 76.99 BILLING CODE: 27
SUBMIT CORRECTIONS TO THE DENVER CENTRAL LAB
WITHIN 15 DAYS FROM 02/26/77. INDICATE THE
CENTRAL LAB ID # AND RECORD # WITH RESPONSE.
WRD-OW FILE STORAGE WAS NOT REQUESTED FOR
THIS ANALYSIS. THE ANALYSIS WILL REMAIN
IN THE CENTRAL LAB FILE ONLY.

7 ? AT CULVERT

UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
4-13-76 CENTRAL LABORATORY, DENVER, COLORADO

WATER QUALITY ANALYSIS
LAB ID # 107001 RECORD # 8353

SAMPLE LOCATION: STATION NUMBER 2 BULK SAMPLE SITE
STATION ID: 474956091403902 LAT. LONG. SEQ. 1 474956 0914039 02
DATE OF COLLECTION: BEGIN--760413 END-- TIME--0945
STATE CODE: 27 COUNTY CODE: 075 PROJECT IDENTIFICATION: 442704100
DATA TYPE: 2 SOURCE: SURFACE WATER GEOLOGIC UNIT:

COMMENTS:
COLL BY J RAMQUIST AS A SURFACE GRAB SAMPLE IMMEDIATELY ABOVE
CULVERT ON SPRUCE ROAD

AIR TEMP (DEG C)		18.0	MAGNESIUM TOTAL USGS	MG/L	2.8
ALK, TOT (AS CaCO3)	MG/L	10	NICKEL TOTAL AAGF	UG/L	25
BICARBONATE	MG/L	12	PH FIELD		5.7
CADMIUM TOTAL AAGF	UG/L	0.08	POTASSIUM TOTAL USGS	MG/L	0.5
CALCIUM TOTAL USGS	MG/L	3.5	RESIDUE SUSPEN 110C	MG/L	73
CARBON DIOXIDE	MG/L	38	SODIUM TOTAL USGS	MG/L	0.3
CARBONATE	MG/L	0	SP. CONDUCTANCE FLD		36
COLOR		100	SULFIDE TOTAL	MG/L	0.8
COPPER TOTAL AAGF	UG/L	19	TURBIDITY (JTU)		1
IRON TOTAL	UG/L	510	WATER TEMP (DEG C)		1.0
LEAD TOTAL AAGF	UG/L	1.1	ZINC TOTAL AAGF	UG/L	3.0

CATIONS

(MG/L)

(MEQ/L)

BICARBONATE
CARBONATE

TOTAL

ANIONS

(MG/L)

(MEQ/L)

12
0

TOTAL

0.197

MAIL TO ST PAUL MINN
SCHEDULES USED: 271 0 0 0
NUMBER OF DETERMINATIONS: 20 HCODE = 16
COST OF ANALYSIS \$ 107.80 BILLING CODE: 27
SUBMIT CORRECTIONS TO THE DENVER CENTRAL LAB
WITHIN 15 DAYS FROM 09/04/76. INDICATE THE
CENTRAL LAB ID # AND RECORD # WITH RESPONSE.
WRD=QW FILE STORAGE WAS REQUESTED AND THE
STATION HEADING INFORMATION IN THE WRD STATION
HEADER FILE WAS SUBSTITUTED HERE, PLEASE CHECK.

SEFP

4-13-76

UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
CENTRAL LABORATORY, DENVER, COLORADO

WATER QUALITY ANALYSIS
LAB ID # 107002 RECORD # 8355

SAMPLE LOCATION: STATION NUMBER 1 BULK SAMPLE SITE
STATION ID: 874956091403901 LAT, LONG, SEQ: 474956 0914039 01
DATE OF COLLECTION: BEGIN--760413 END-- TIME--1025
STATE CODE: 27 COUNTY CODE: 075 PROJECT IDENTIFICATION: 442704100
DATA TYPE: 2 SOURCE: SURFACE WATER GEOLOGIC UNIT:

COMMENTS:

COLL BY J RAMQUIST, S LUNDEEN, AND R BERRISFORD FROM DUG SUMP HOLE
ABOUT 100 FT BELOW BOTTOM OF SLOPE AT BULK SAMPLE SITE

MAIL TO ST PAUL MINN
SCHEDULES USED: 271 0 0 0
NUMBER OF DETERMINATIONS: 20 HCODE # 16
COST OF ANALYSIS \$ 107.80 BILLING CODE: 27
SUBMIT CORRECTIONS TO THE DENVER CENTRAL LAB
WITHIN 15 DAYS FROM 09/04/76, INDICATE THE
CENTRAL LAB ID # AND RECORD # WITH RESPONSE.
WRD=QW FILE STORAGE WAS REQUESTED AND THE
STATION HEADING INFORMATION IN THE WRD STATION
HEADER FILE WAS SUBSTITUTED HERE, PLEASE CHECK.

AIR TEMP (DEG C)		16.0	MAGNESIUM TOTAL USGS	MG/L	48
ALK, TOT (AS CaCO3)	MG/L	118	NICKEL TOTAL AAGF	UG/L	13000
BICARBONATE	MG/L	144	PH FIELD		6.8
CADMIUM TOTAL AAGF	UG/L	2.4	POTASSIUM TOTAL USGS	MG/L	7.3
CALCIUM TOTAL USGS	MG/L	84	RESIDUE SUSPEN 110C	MG/L	0
CARBON DIOXIDE	MG/L	37	SODIUM TOTAL USGS	MG/L	2.6
CARBONATE	MG/L	0	SP. CONDUCTANCE FLD		628
COLOR		60	SULFIDE TOTAL	MG/L	0.5
COPPER TOTAL AAGF	UG/L	360	TURBIDITY (JTU)		26
IRON TOTAL	UG/L	4600	WATER TEMP (DEG C)		6.0
LEAD TOTAL AAGF	UG/L	1.0	ZINC TOTAL AAGF	UG/L	190

CATIONS

(MG/L) (MEG/L)

BICARBONATE
CARBONATE

TOTAL

ANIONS

(MG/L) (MEG/L)

144 2.361
0 0.000

TOTAL 2.360

SEEP

 UNITED STATES DEPARTMENT OF THE INTERIOR
 GEOLOGICAL SURVEY
 CENTRAL LABORATORY, DENVER, COLORADO

 FS-
 5-5-76

 WATER QUALITY ANALYSIS
 LAB ID # 129027 RECORD # 13334

 SAMPLE LOCATION: SEEP ORIGINATING FROM BULK SAMPLE SITE
 STATION ID: 474957091403003 LAT, LONG, SEQ.: 474957 0914030 03
 DATE OF COLLECTION: BEGIN=760505 END= TIME=1030
 STATE CODE: 27 COUNTY CODE: 075 PROJECT IDENTIFICATION: 442704100
 DATA TYPE: 2 SOURCE: GROUND WATER GEOLOGIC UNIT:

COMMENTS:

 COLL BY R HERRISFORD, J RAMQUIST, S LUNDEEN FROM DUG SUMP HOLE AT
 BASE OF SLOPE, NO RUSS COLLECTED

 MAIL TO ST PAUL MINN
 SCHEDULES USED: 271 0 0 0
 NUMBER OF DETERMINATIONS: 31 HCODE = 0
 COST OF ANALYSIS \$ 121.75 BILLING CODE: 27
 SURMIT CORRECTIONS TO THE DENVER CENTRAL LAB
 WITHIN 15 DAYS FROM 12/24/76. INDICATE THE
 CENTRAL LAB ID # AND RECORD # WITH RESPONSE.
 WHO=QW FILE STORAGE WAS NOT REQUESTED FOR
 THIS ANALYSIS, THE ANALYSIS WILL REMAIN
 IN THE CENTRAL LAB FILE ONLY.

ATR TEMP (DEG C)		2.0	MAGNESIUM DISS	MG/L	42
ALK, TOT (AS CaCO3)	MG/L	107	MAGNESIUM TOTAL USGS	MG/L	43
BICARBONATE	MG/L	130	NICKEL DISS AAGF	DETR. DELETED	
CADMIUM DISS AAGF	DETR. DELETED		NICKEL TOTAL AAGF	UG/L	10000
CADMIUM TOTAL AAGF	UG/L	2.0	PH FIELD		7.0
CALCIUM DISS	MG/L	66	POTASSIUM DISS	MG/L	7.0
CALCIUM TOTAL USGS	MG/L	72	POTASSIUM TOTAL USGS	MG/L	7.0
CARBON DIOXIDE	MG/L	21	SAR		0.2
CARBONATE	MG/L	0	SILICA DISSOLVED	MG/L	24
CHLORIDE DISS	MG/L	5.5	SODIUM DISS	MG/L	9.4
COLOR		25	SODIUM TOTAL USGS	MG/L	10
COPPER DISS AAGF	DETR. DELETED		SP. CONDUCTANCE FLD		711
COPPER TOTAL AAGF	UG/L	970	SP. CONDUCTANCE LAB		711
HARDNESS NONCARB	MG/L	230	SULFATE DISS	MG/L	250
HARDNESS TOTAL	MG/L	340	SULFIDE TOTAL	MG/L	0.0
IRON TOTAL	UG/L	4200	TURBIDITY (JTU)		30
LEAD DISS AAGF	DETR. DELETED		WATER TEMP (DEG C)		6.0
LEAD TOTAL AAGF	UG/L	0.3	ZINC DISS AAGF	DETR. DELETED	
			ZINC TOTAL AAGF	UG/L	210

CATIONS

	(MG/L)	(MEQ/L)
CALCIUM DISS	66	3.294
MAGNESIUM DISS	42	3.455
POTASSIUM DISS	7.0	0.179
SODIUM DISS	9.4	0.409
TOTAL		7.336

ANIONS

	(MG/L)	(MEQ/L)
BICARBONATE	130	2.131
CARBONATE	0	0.000
CHLORIDE DISS	5.5	0.156
SULFATE DISS	250	5.205
TOTAL		7.491

PERCENT DIFFERENCE = -1.04

QUALITY CONTROL INFORMATION FOR LAB ID # 129027 RECORD # 13334

***RDTM FLD
NICKEL DISS
CADMIUM DISS
COPPER DISS AAGF
LEAD DISS AAGF
ZINC DISS AAGF

CONDUCTANCES SUBMITTED - ONLY FIELD VALUE IS STORED IN GW FILE
WAS DELETED BECAUSE: DELETION REQUESTED BY DISTRICT,
WAS DELETED BECAUSE: DELETION REQUESTED BY DISTRICT,
WAS DELETED BECAUSE: DELETION REQUESTED BY DISTRICT,
WAS DELETED BECAUSE: DELETION REQUESTED BY DISTRICT,
WAS DELETED BECAUSE: DELETION REQUESTED BY DISTRICT,

UP # 711,000

SEEP

UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
CENTRAL LABORATORY, DENVER, COLORADO

FS
5-20-

WATER QUALITY ANALYSIS
LAB ID # 148410 RECORD # 16353

SAMPLE LOCATION: SEEP ORIGINATING FROM BULK SAMPLE SITE
STATION ID: 474957091403003 LAT, LONG, SECT: 474957 0914030 00
DATE OF COLLECTION: BEGIN--760520 END-- TIME--1130
STATE CODE: 27 COUNTY CODE: 075 PROJECT IDENTIFICATION: 402704100
DATA TYPE: 2 SOURCE: GROUND WATER GEOLOGIC UNIT:

COMMENTS:
COLL BY R HERRISFORD AND S LUNDEEN FROM DUG SUMP HOLE AT BASE OF
SLOPE

MAIL TO ST PAUL MINN
SCHEDULES USED: 437 0 0 0
NUMBER OF DETERMINATIONS: 14 HCODE = 0
COST OF ANALYSIS \$ 69.99 BILLING CODE: 27
SUBMIT CORRECTIONS TO THE DENVER CENTRAL LAB
WITHIN 15 DAYS FROM 01/08/77. INDICATE THE
CENTRAL LAB ID # AND RECORD # WITH RESPONSE.
WRD=0* FILE STORAGE WAS NOT REQUESTED FOR
THIS ANALYSIS. THE ANALYSIS WILL REMAIN
IN THE CENTRAL LAB FILE ONLY.

AIR TEMP (DEG C)	18.0	NICKEL DISS AAGF	DETR. DELETED
CADMIUM DISS AAGF	DETR. DELETED	NICKEL TOTAL AAGF	UG/L 11000
CADMIUM TOTAL AAGF	UG/L 2.0	PH FIELD	7.0
COPPER DISS AAGF	DETR. DELETED	SP. CONDUCTANCE FLD	655
COPPER TOTAL AAGF	UG/L 1000	WATER TEMP (DEG C)	13.0
LEAD DISS AAGF	DETR. DELETED	ZINC DISS AAGF	DETR. DELETED
LEAD TOTAL AAGF	UG/L 1.2	ZINC TOTAL AAGF	UG/L 5300

No WRD printout

~~at H Summit A and~~

No header file

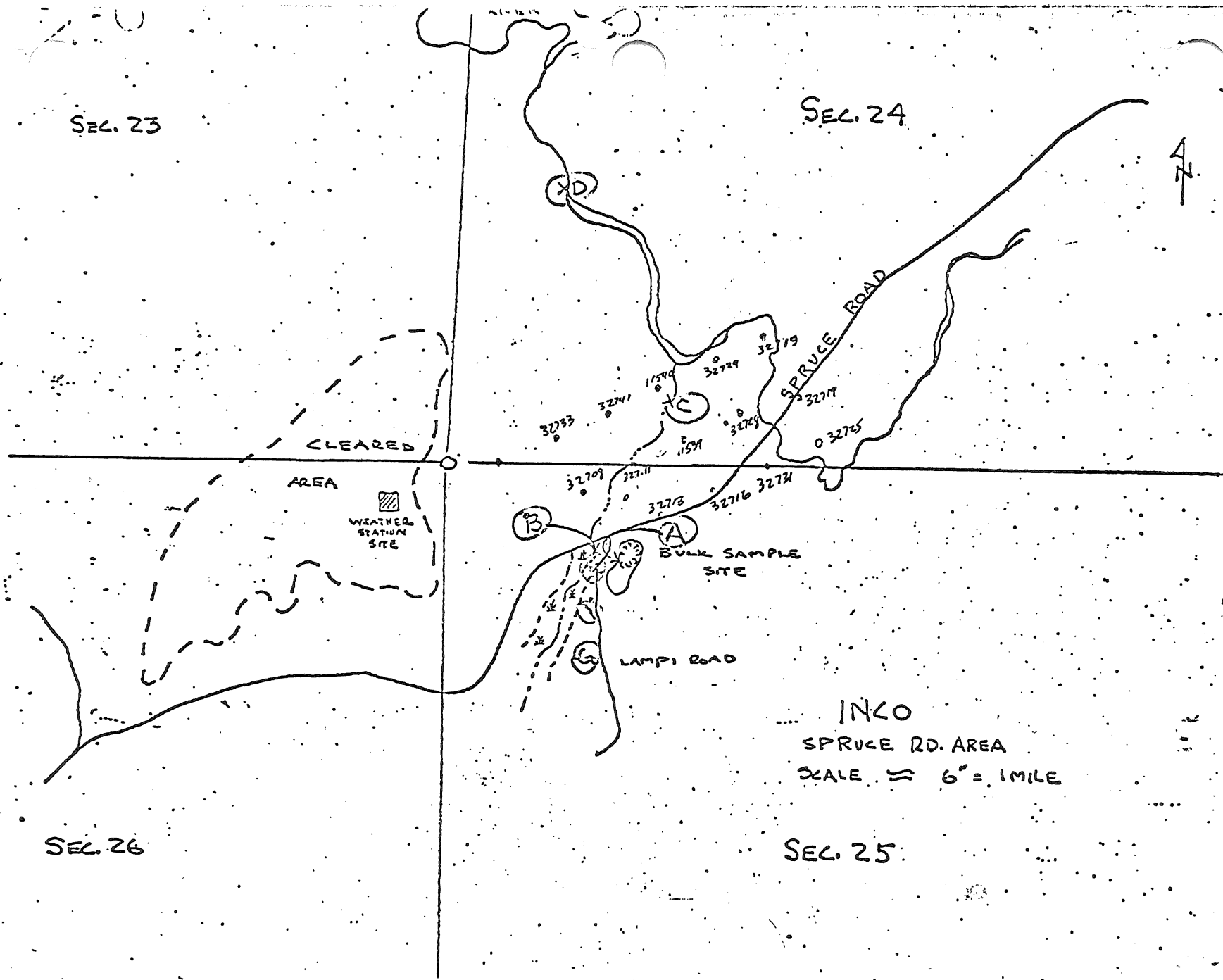
Was WRD storage requested? no

CONTROL INFORMATION FOR LAB ID # 148410 RECORD # 16353

ICKEL DISS AA	WAS DELETED BECAUSE; DELETION REQUESTED BY DISTRICT.
IODIUM DISS AAL	WAS DELETED BECAUSE; DELETION REQUESTED BY DISTRICT.
UPPER DISS AAGF	WAS DELETED BECAUSE; DELETION REQUESTED BY DISTRICT.
AD DISS AAGF	WAS DELETED BECAUSE; DELETION REQUESTED BY DISTRICT.
AC DISS AAGF	WAS DELETED BECAUSE; DELETION REQUESTED BY DISTRICT.

SEC. 23

SEC. 24

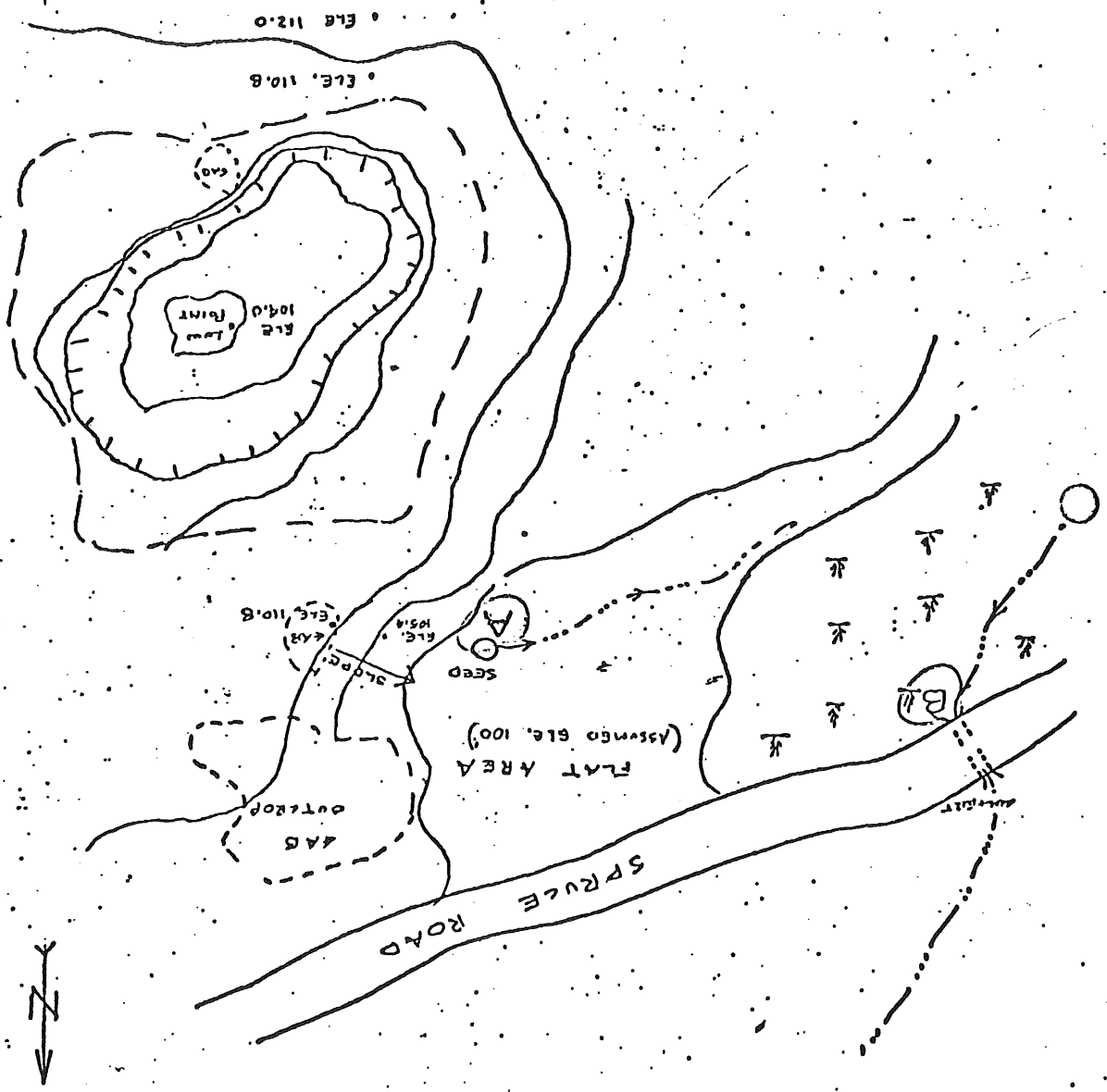


INCO
SPRUCE RD. AREA
SCALE = 6" = 1 MILE

SEC. 26

SEC. 25

BULK SAMPLE SITE
HAND LEVEL SKETCH
SCALE 1" = 50'
SECT. 25, T22, R11



PREOPERATIONAL MONITORING

SAMPLE REPORT FORM

E. A. HICKOK & ASSOCIATES

Received 10-8-75

Samples Collected by A. Hickok & Assoc.

Analyzed By E.A. Hickok & Assoc. 1a

Field Number Sampling Point and Source of Sample Date Collected Time Collected

Site A	a	Seep	10-7-75	
Site B	b	Culvert	10-7-75	
Site C	c	Tributary	10-7-75	
Site D	d	Filson	10-7-75	
Sump F	e	Sump F	10-7-75	

Sample Number	Temp. °C	Dissolved Oxygen mg/l	Total Coliform col/100ml	Fecal Coliform col/100ml	Fecal Strep. col/ml	Total Solids mg/l	Suspended Solids mg/l	Dissolved Solids mg/l	Turbidity JTU
a Site A									
b Site B									
c Site C									
d Site D									
e Sump F									
Color plat. unit	Total Hardness mg/l	Total Alkalinity mg/l	pH	Ortho-phosphorus mg/l	Total Phosphorus mg/l	Nitrite Nitrogen mg/l	Nitrate Nitrogen mg/l	Ammonia Nitrogen mg/l	Organic Nitrogen mg/l
a	942	120	6.8						
b	171	12	6.7						
c	154	0	6.7						
d	121	12	6.6						
e	-	-	6.6						
COD mg/l	Chloride mg/l	Sulfate mg/l	Iron mg/l	Copper ug/l	Lead ug/l	Zinc ug/l	Manganese ug/l	Cadmium ug/l	Cobalt ug/l
a	7	304	1.24/.10	160/30	<.2/<.2	7.5/4.4	4200/4000	.18/.16	280/250
b	5	17	.35/.32	40/30	.3/<.2	3.4/3.5	17/12	<.02/<.02	.85/<.2
c	7	10	.17/.17	40/30	<.2/<.2	2.3/5.4	3/3	<.02/<.02	<.2/<.2
d	6	4	.75/.68	40/30	.2/.6	2.3/8.4	45/17	.08/<.02	1.0/.5
e	-	-	.05/.05	750/380	1.0/<.2	8.4/8.2	32/23	.35/.28	21.5/18.6
Nickel ug/l	Mercury ug/l	Sodium mg/l	Potassium mg/l	Calcium mg/l	Magnesium mg/l	Silicate mg/l	Chlorophyll ug/l	TOC mg/l	Secchi Disc feet
a 3100/2900	.12	13/13	5.2/5.0	68/71	18/18				
b 11/14	<.1	1.5/1.5	.06/.05	3.1/3.8	3.0/3.1				
c 15/14	.18	1.7/1.7	.13/1.2	3.7/4.3	3.7/3.7				
d 5/5	<.1	1.4/1.3	.25/.24	3.7/3.3	2.5/2.4				
e 500/400	<.1	3.2/3.0	1.4/1.4	6.8/5.4	6.4/6.0				

Received 10-8-75

Samples Collect

E. A. Hickok & Assoc.

Analyzed By E. A. Hickok &

1a

Well Number	Sampling Point and Source of Sample	Date Collected	Time Collected
Sump G a	Sump G	10-7-75	
b			
c			
d			
e			

Sample Number	Temp. °C	Dissolved Oxygen mg/l	Total Coliform col/100ml	Fecal Coliform col/100ml	Fecal Strep. col/ml	Total Solids mg/l	Suspended Solids mg/l	Dissolved Solids mg/l	Turbidity JTU
a Sump G									
b									
c									
d									
e									
Color plat. unit	Total Hardness mg/l	Total Alkalinity mg/l	pH	Ortho-phosphorus mg/l	Total Phosphorus mg/l	Nitrite Nitrogen mg/l	Nitrate Nitrogen mg/l	Ammonia Nitrogen mg/l	Organic Nitrogen mg/l
a			6.3						
b									
c									
d									
e									
COD mg/l	Chloride mg/l	Sulfate mg/l	Iron mg/l	Copper ug/l	Lead ug/l	Zinc ug/l	Manganese ug/l	Cadmium ug/l	Cobalt ug/l
a			4.4/.12	240/50	1.7/<.2	8.4/4.0	230/160	.16/.09	7.1/3.1
b									
c									
d									
e									
Nickel ug/l	Mercury ug/l	Sodium mg/l	Potassium mg/l	Calcium mg/l	Magnesium mg/l	Silicate mg/l	Chloro-phyll ug/l	TOC mg/l	Secchi Disc feet
a 150/100	.1	4/4	2.2/1.7	9.4/9	7.7/6.5				
b									
c									
d									
e									

unfiltered/filtered

Received 10-14-75 Samples Collected By A. Hickok & Assoc. Analyzed By E. A. Hickok & Assoc. at

Field Number	Sampling Point and Source of Sample	Date Collected	Time Collected
Site A a	Seep	10-10-75	9:25 am
Site B b	Culvert	10-10-75	9:20 am
Site C c	Tributary	10-10-75	9:55 am
Site D d	Filson	10-10-75	10:30 am
Sump E e	Sump E	10-10-75	9:30 am

Sample Number	Temp. °C	Dissolved Oxygen mg/l	Total Coliform col/100ml	Fecal Coliform col/100ml	Fecal Strep. col/ml	Total Solids mg/l	Suspended Solids mg/l	Dissolved Solids mg/l	Turbidity JTU
a Site A									
b Site B									
c Site C									
d Site D									
e Sump E									
Color plat. unit	Total Hardness mg/l	Total Alkalinity mg/l	pH	Ortho-phosphorus mg/l	Total Phosphorus mg/l	Nitrite Nitrogen mg/l	Nitrate Nitrogen mg/l	Ammonia Nitrogen mg/l	Organic Nitrogen mg/l
a	1217	132	6.7						
b	83	16	6.2						
c	65	12	6.3						
d	52	16	6.5						
e	1435	44	6.4						
COD mg/l	Chloride mg/l	Sulfate mg/l	Iron mg/l	Copper ug/l	Lead ug/l	Zinc ug/l	Manganese ug/l	Cadmium ug/l	Cobalt ug/l
a	8	281	5.0/.2	130/30	<.2/<.2	6.8/5.9	4100/4000	.24/.15	270/270
b	6	18	.6/.4	27/27	<.2/<.2	2.8/2.1	22/14	<.02/<.02	1.0/1.0
c	6	18	.3/.2	31/28	<.2/<.2	2.1/-	3/2	<.02/<.02	.5/.5
d	6	<1	1.0/.6	11/8	1.5/.5	1.7/1.7	29/12	<.02/<.02	.5/.5
e	7	200	.3/.1	720/400	<.2/<.2	9.6/9.3	680/650	.53/.53	100/100
Nickel ug/l	Mercury ug/l	Sodium mg/l	Potassium mg/l	Calcium mg/l	Magnesium mg/l	Silicate mg/l	Chloro-phyll ug/l	TOC mg/l	Secchi Disc feet
a 2800/2200	.1	13	5.3	82	50				
b 17/17	.2	1.6	.48	3.9	3.7				
c 25/25	.6	1.7	.13	4.2	4.2				
d 6.6/6.6	.2	1.4	.26	3.1	2.7				
e 1200/1000	.2	11.5	3.3	37	33				

Date Received 10-17-75 Samples Collected by E.A. Hickok & Assoc. Analyzed By E.A. Hickok & Assoc. c-1

File Number	Sampling Point and Source of Sample	Date Collected	Time Collected
Site A a	Seep	10-15-75	
Site B b	Culvert	10-15-75	
Site C c	Tributary	10-15-75	
Site D d	Filson	10-15-75	
Sump E e	Sump E	10-15-75	

Sample Number	Temp. °C	Dissolved Oxygen mg/l	Total Coliform col/100ml	Fecal Coliform col/100ml	Fecal Strep. col/ml	Total Solids mg/l	Suspended Solids mg/l	Dissolved Solids mg/l	Turbidity JTU
a Site A									
b Site B									
c Site C									
d Site D									
e Sump E									
Color plat. unit	Total Hardness mg/l	Total Alkalinity mg/l	pH	Ortho-phosphorus mg/l	Total Phosphorus mg/l	Nitrite Nitrogen mg/l	Nitrate Nitrogen mg/l	Ammonia Nitrogen mg/l	Organic Nitrogen mg/l
a	1211	42	6.7						
b	113	8	6.0						
c	43	10	6.2						
d	39	12	6.5						
e	836	22	6.7						
COD mg/l	Chloride mg/l	Sulfate mg/l	Iron mg/l	Copper ug/l	Lead ug/l	Zinc ug/l	Manganese ug/l	Cadmium ug/l	Cobalt ug/l
a	8	271	4.4/<.1	100/30	<.2/<.2	5.4/5.4	4100/4000	.29/.13	270/250
b	7	15	.5/.4	22/22	.3/<.2	2.1/2.1	13/9	<.02/<.02	.6/.5
c	5	17	.3/.3	30/27	.3/<.2	6.8/2.3	2/2	<.02/<.02	.5/.4
d	7	0	1.1/.8	11/10	.5/.5	1.8/1.8	39/27	<.02/<.02	.5/.5
e	7	228	.2/<.1	500/390	<.2/<.2	8.0/7.5	960/950	.51/.51	120/120
Nickel ug/l	Mercury ug/l	Sodium mg/l	Potassium mg/l	Calcium mg/l	Magnesium mg/l	Silicate mg/l	Chlorophyll ug/l	TOC mg/l	Secchi Disc feet
a 2100/2000	.4	13	5.0	80	48				
b 16/16	.6	1.6	.19	2.7	3.4				
c 28/24	.6	1.7	.13	3.0	3.8				
d 6.1/5	.2	1.4	.33	2.4	2.5				
e 1200/1200	.8	13	3.2	26	39				

unfiltered/filtered

Date Received 10-22-75 Samples Collected E.A. Hickok & Assoc. Analyzed By E.A. Hickok & Assoc. 12

Point Number	Sampling Point and Source of Sample	Date Collected	Time Collected
Site A a	Seep	10-20-75	
Site B b	Culvert	10-20-75	
Site C c	Tributary	10-20-75	
Site D d	Filson	10-20-75	
Sump F e	Sump F	10-20-75	

Sample Number	Temp. °C	Dissolved Oxygen mg/l	Total Coliform col/100ml	Fecal Coliform col/100ml	Fecal Strep. col/ml	Total Solids mg/l	Suspended Solids mg/l	Dissolved Solids mg/l	Turbidity JTU
a Site A									
b Site B									
c Site C									
d Site D									
e Sump F									
Color plat. unit	Total Hardness mg/l	Total Alkalinity mg/l	pH	Ortho-phosphorus mg/l	Total Phosphorus mg/l	Nitrite Nitrogen mg/l	Nitrate Nitrogen mg/l	Ammonia Nitrogen mg/l	Organic Nitrogen mg/l
a	514	128	6.8						
b	81	12	6.0						
c	50	12	6.3						
d	34	12	6.5						
e	516	19	6.6						
COD mg/l	Chloride mg/l	Sulfate mg/l	Iron mg/l	Copper ug/l	Lead ug/l	Zinc ug/l	Manganese ug/l	Cadmium ug/l	Cobalt ug/l
a	6	289	3.50/.07	78/13	<.2/<.2	7.5	5300/5000	.12/.08	250/240
b	5	17	.39/.38	20/20	.3/<.2	1.9	9/9	.08/<.01	<.2/<.2
c	5	19	.20/.19	32/31	<.2/<.2	2.6	2/2	<.01/<.01	<.2/<.2
d	5	<1	1.20/.97	11/11	.5/.4	2.2	26/23	<.01/<.01	.7/.5
e	3	32	.05/.02	500/340	<.2/<.2	5.4	25/20	.20/.18	22/21
Nickel ug/l	Mercury ug/l	Sodium mg/l	Potassium mg/l	Calcium mg/l	Magnesium mg/l	Silicate mg/l	Chlorophyll ug/l	TOC mg/l	Secchi Disc feet
a 2600/2600	.4	14	5.0	80	51				
b 18/18	.1	1.5	.10	3.7	3.5				
c 26/24	.1	1.6	.14	4.2	3.9				
d 6/6	.1	1.2	.30	3.2	2.7				
e 370/350	.1	3.2	.95	7.3	7.4				

unfiltered/filtered