

**GEOLOGICAL SURVEY OF CANADA OPEN FILE 2174
(105K EAST)
CANADA – YUKON ECONOMIC DEVELOPMENT PROGRAM (1989–1990)**

**REGIONAL STREAM SEDIMENT AND WATER GEOCHEMICAL DATA,
CENTRAL YUKON**



INDEX MAP

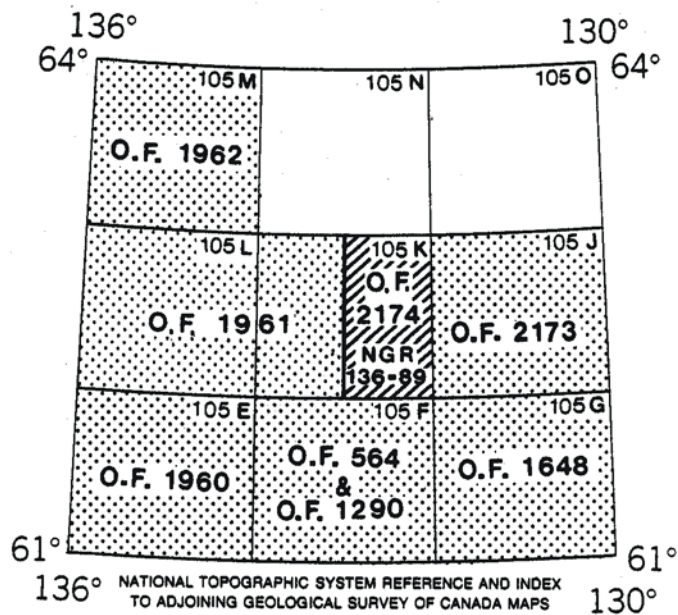
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July, 1990

NATIONAL GEOCHEMICAL RECONNAISSANCE
 STREAM SEDIMENT AND WATER GEOCHEMICAL DATA
 YUKON 1990
 GEOLOGICAL SURVEY OF CANADA OPEN FILE 2174, NGR 136-1989
 NTS 105K EAST



Open File 2174 represents a contribution to the Canada – Yukon Economic Development Program (1989-1990). This project was managed by the Geological Survey of Canada.

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REGIONAL STREAM SEDIMENT AND WATER GEOCHEMICAL DATA, YUKON 1990, GSC OPEN FILE 2174, NGR 136-1990; NTS 105K (EAST HALF)

INTRODUCTION

Open File 2174 is one of four open files released in 1990 covering areas in the Yukon. National Topographic System mapsheet 105K (East) was sampled in 1989 as part of the Canada-Yukon Economic Development Program (1989-1990). Open File 1961, released in 1989, includes the west half of NTS 105K. Open File 2174 contains the results of analyses of stream sediments and waters from the eastern half of 105K for 43 elements plus loss-on-ignition. Corresponding waters were analysed for uranium, fluoride and pH.

The reconnaissance survey was undertaken by the Geological Survey of Canada in conjunction with the Department of Indian Affairs and Northern Development.

Analytical results and field observations are used to build a national geochemical data base for resource assessment, mineral exploration, geological mapping and environmental studies. Sample collection and preparation procedures and analytical methods are strictly specified and carefully monitored to ensure consistent and reliable results regardless of the area, the year or the analytical laboratory.

CREDITS

E.H.W. Hornbrook directed the survey.

P.W.B. Friske coordinated the operational activities of contract and Geological Survey of Canada staff.

Contracts were let to the following companies for sample preparation and analysis and were managed by the following staff of the Regional Geochemical Studies section:

Collection: Northway Map Technology
Don Mills, Ontario
E.H.W. Hornbrook
P.W.B. Friske

Preparation: Golder Associates
Ottawa, Ontario
J.J. Lynch

Analysis: Bondar-Clegg and Company
Ottawa, Ontario
Chemex Labs
North Vancouver, British Columbia
J.J. Lynch

M. McCurdy edited open files and coordinated production.

A.C. Galletta managed the digital geochemical data and provided computer processing support.

H. Gross developed microcomputer software to produce data listings and summary statistics.

Sample location and gold value maps were plotted by Canada Lands Data Systems staff at Environment Canada, Hull, Quebec. Symbol-trend maps were prepared by GSC staff.

Pat Doyle, C.C. Durham and Rob Phillips provided technical assistance.

DESCRIPTION OF SURVEY AND SAMPLE MANAGEMENT

Helicopter-supported sample collection was carried out during the summer of 1989. Stream sediment and water samples were collected at an average density of one sample per 13 square kilometres throughout the 5,800 square kilometres of the central Yukon survey.

Sample site duplicate samples were routinely collected in each analytical block of twenty samples.

Field observations were recorded on standard forms used by the Geological Survey of Canada (Garrett, 1974).

The sample site positions were marked on appropriate 1:250 000 scale NTS maps in the field. These maps were digitized at the Geological Survey in Ottawa to obtain the sample site UTM coordinates.

In Ottawa, field dried samples were air-dried and sieved through a minus 80 mesh (177 micron) screen, and ball-milled before analyses. At this time, control reference and blind duplicate samples were inserted into each block of twenty sediment samples. For the water samples, only control reference samples were inserted into the block. There were no blind duplicate water samples.

The sample site coordinates were checked as follows: a sample location map was produced on a Calcomp 1051 drum plotter using the digitized coordinates; the original sample location map produced in the field was then overlain on the Calcomp map; the two sets of points were checked for coincidence. The dominant rock types in the stream catchment basins were identified on appropriate geological maps used as the bedrock geological base on NGR maps.

Thorough inspections of the field and analytical data were made to check for any missing information and/or gross errors.

Quality control and monitoring of the geochemical data was undertaken by a standard method used by the Exploration Geochemistry Subdivision at the Geological Survey of Canada.

ANALYTICAL PROCEDURES

Instrumental Neutron Activation Analysis (INAA)

The weighed sample (generally 10 to 40 g) is irradiated epithermally for 20 minutes in a neutron flux with an approximate density of 1×10^{11} neutrons/cm²/second. Counting begins seven days after irradiation. The counting time is somewhat variable (6 to 11 minutes) and is matrix dependent. Counting is done on a germanium-lithium co-axial counter. The counting data is accumulated on a VAX computer and is subsequently converted to concentrations. Numerous international reference samples are irradiated with each batch of routine samples. Elements determined by INA analyses

include: Na, Sc, Cr, Fe, Co, Ni, Zn, As, Se, Br, Rb, Zr, Mo, Ag, Cd, Sn, Sb, Te, Cs, Ba, La, Ce, Sm, Eu, Tb, Yb, Lu, Hf, Ta, W, Ir, Au, Th, and U. The sample weight is also reported. Data for Zn, Se, Zr, Ag, Cd, Sn, Te, and Ir are not published because of inadequate detection limits and/or precision.

Atomic Absorption Spectroscopy (AAS) and Other Analyses

For the determination of Zn, Cu, Pb, Ni, Co, Ag, Mn, Fe, Cd and As a 1 gram sample was reacted with 3 mL concentrated HNO_3 in a test-tube overnight at room temperature. After digestion, the test-tube is immersed in a hot water bath at room temperature and brought up to 90°C and held at this temperature for 30 minutes with periodic shaking. One mL of concentrated HCl is added and heating continues for another 90 minutes. The sample solution is then diluted to 20 mL with metal-free water and mixed. Zn, Cu, Pb, Ni, Co, Ag, Mn, Fe and Cd are determined by atomic absorption spectroscopy using an air-acetylene flame. Background corrections are made for Pb, Ni, Co, Ag, and Cd.

Arsenic is determined by atomic absorption using a hydride evolution method wherein the hydride (AsH_3) is evolved and passed through a heated quartz tube in the light path of an atomic absorption spectrophotometer. The method is described by Aslin (1976).

Molybdenum and vanadium are determined by atomic absorption spectroscopy using a nitrous oxide acetylene flame. A 0.5 gram sample is reacted with 1.5 mL concentrated HNO_3 at 90°C for 30 minutes. At this point, 0.5 mL concentrated HCl is added and the digestion continued at 90°C for an additional 90 minutes. After cooling, 8 mL of 1250 ppm Al solution are added and the sample solution diluted to 10 mL before aspiration.

Mercury is determined by the Hatch and Ott procedure with some modifications. The method is described by Jonasson *et al.* (1973). A 0.5 gram sample is reacted with 20 mL concentrated HNO_3 and 1 mL concentrated HCl in a test-tube for 10 minutes at room temperature prior to two hours of digestion with mixing at 90°C in a hot water bath. After digestion, the sample solutions are cooled and diluted to 100 mL with metal-free water. The Hg present is reduced to the elemental state by the addition of 10 mL 10% w/v SnSO_4 in M H_2SO_4 . The Hg vapour is then flushed by a stream of air into an absorption cell mounted in the light path of an atomic absorption spectrophotometer. Absorption measurements were made at 253.7 nm.

Loss-on-ignition is determined using a 500 mg sample. The sample, weighed into 30 mL beaker, is placed in a cold muffle furnace and brought up to 500°C over a period of two to three hours. The sample is held at this temperature for four hours, then allowed to cool to room temperature for weighing.

Uranium is determined using a neutron activation method with delayed neutron counting. A detailed description of the method is provided by Boulanger *et al.* (1975). In brief, a 1 gram sample is weighed in a 7 dram polyethylene vial, capped and sealed. The irradiation is provided by the Slowpoke reactor with an operating flux of 10^{12} neutrons/cm²/second. The samples are pneumatically transferred from an automatic loader to the

reactor, where each sample is irradiated for 60 seconds. After irradiation, the sample is again transferred pneumatically to the counting facility where after a 10 second delay the sample is counted for 60 seconds with six BF_3 detector tubes embedded in paraffin. Following counting, the samples are automatically ejected into a shielded storage container. Calibration is carried out twice a day as a minimum, using natural materials of known uranium concentration.

Antimony is determined as described by Aslin (1976). A 500 mg sample is placed in a test tube; 3 mL concentrated HNO_3 and 9 mL concentrated HCl are added and the mixture is allowed to stand overnight at room temperature. The mixture is heated slowly to 90°C and maintained at this temperature for at least 90 minutes. The solution is cooled and diluted to 10 mL. A one mL aliquot of this solution is diluted to 10 mL with 1.8 mL HCl. The antimony in an aliquot of this dilute solution is then determined by hydride evolution- atomic absorption spectrometry.

Fluorine is determined as described by Ficklin (1970). A 250 mg sample is sintered with 1 gram of a flux consisting of two parts by weight sodium carbonate and one part by weight potassium nitrate. The residue is then leached with water. The sodium carbonate is neutralized with 10 mL 10% (w/v) citric acid and the resulting solution is diluted to 100 mL with water. The pH of the solution should range from 5.5 to 6.5. The fluoride content of the test solution is measured using a fluoride ion electrode. Standard solutions contain sodium carbonate and citric acid in the same quantities as the sample solution.

Tin in stream sediments is determined by heating a 200 mg sample with NH_4I : the sublimed SnI_4 is dissolved in acid and the tin determined by atomic absorption spectrometry after solvent extraction of the tin into methyl isobutyl ketone containing trioctylphosphine oxide (TOPO). The method is described by E.P. Welsch and T.T. Chao.

Water Analyses

Fluoride in water samples is determined using a fluoride electrode. Prior to measurement an aliquot of the sample is mixed with an equal volume of TISAB II buffer solution (total ionic strength adjustment buffer). The TISAB II buffer solution is prepared as follows: to 50 mL metal-free water add 57 mL glacial acetic acid, 58 gm NaCl and 4 g CDTA (cyclohexylene dinitrilo tetraacetic acid). Stir to dissolve and cool to room temperature. Using a pH meter, adjust the pH between 5.0 and 5.5 by slowly adding 5 M NaOH solution. Cool and dilute to one liter in a volumetric flask. Detection limit = 20 ppb.

Hydrogen ion activity (pH) is measured with a combination glass-calomel electrode and a pH meter.

Uranium in waters is determined by a laser-induced fluorometric method using a Scintrex UA-3 uranium analyser. A complexing agent, known commercially as Fluran and composed of sodium pyrophosphate and sodium monophosphate (Hall, 1979) is added to produce the uranyl pyrophosphate species which fluoresces when exposed to the laser. Since organic matter in the sample can cause unpredictable behaviour, a standard addition method is used. Further, the reaction of uranium with

Fluran can be delayed or sluggish; for this reason an arbitrary 24 hour time delay between the addition of the Fluran and the actual reading was incorporated into this method. In practice, 500 µL of Fluran solution are added to a 5 mL sample and allowed to stand for 24 hours. At the end of this period fluorescence readings are made with the addition of 0.0, 0.2 and 0.4 ppb U. For high samples the additions are 0.0, 2.0 and 4.0 (20 µL aliquots of either 55 or 550 ppb U are used). All readings are taken against a sample blank.

A summary of analytical methods and detection limits is provided in Table 1.

PRESENTATION AND INTERPRETATION OF GOLD DATA

The following discussion reviews the format used to present the Au geochemical data and outlines some important points to consider when interpreting this data. This discussion is included in recognition of the special geochemical behaviour and mode of occurrence of Au in nature and the resultant difficulties in obtaining and analyzing samples which reflect the actual concentration level at a given site.

To correctly interpret Au geochemical data from regional stream sediment or lake sediment surveys requires an appreciation of the unique chemical and physical characteristics of Au and its mobility in the surficial environment. Key properties of Au that distinguish its geochemical behaviour from most other elements include (Harris, 1982):

- (1) Gold occurs most commonly in the native form which is chemically and physically resistant. A significant proportion of the metal is dispersed in micron-sized particulate form, and the high specific gravity of gold results in heterogeneous distribution, especially in stream sediment and clastic-rich (low LOI) lake sediment environments. Gold distribution appears to be more homogeneous in organic-rich fluvial and lake sediments.
- (2) Gold typically occurs at low concentrations in the ppb range. Whereas gold concentrations of only a few ppm may represent economic deposits, background levels encountered from stream and centre-lake sediments seldom exceed 10 ppb, and commonly are near the detection limit of 2 ppb.

These factors result in a particle sparsity effect wherein very low concentrations of gold are heterogeneously enriched in the surficial environment. Hence, a major problem facing the geochemist is to obtain a representative sample. In general, areas where concentrations of gold in sediments are low, and/or grain sizes of the gold present relatively high require proportionally larger samples to reduce the uncertainty between subsample analytical values and actual values. Conversely, as actual gold concentrations increase or grain size decreases, the number of gold particles to be shared in random subsamples increases and variability of results decreases (Clifton *et al.*, 1969; Harris, 1982). The limited amount of material collected during the rapid, reconnaissance-style regional surveys and the need to analyze for a broad spectrum of elements,

precludes the use of a significantly large sample weight for the gold analyses. Therefore, to obtain representative samples, grain size is reduced by sieving and ball milling of the dried samples.

The following control methods are currently employed to evaluate and monitor the sampling and analytical variability which are inherent in the analysis of gold in geochemical media:

- (1) For each block of 20 samples:
 - (a) random insertion of a standard reference sample to control analytical accuracy and long-term precision;
 - (b) collection of a field duplicate (two samples from one site) to measure sampling variance;
 - (c) analysis of a second subsample (blind duplicate) from one sample to measure and control short-term precision.
- (2) For both stream and lake sediments, routine repeat analyses on a second subsample are performed for all samples having values that are statistically above approximately the 90th percentile of total data set.
- (3) For lake sediments only, a routine repeat analysis on a second subsample is performed on those samples with LOI values below 10%, indicating a large clastic component. Ongoing studies suggest that the gold distribution in these samples is more likely to be variable than in samples with a higher LOI content.

The presentation of gold data, statistical treatment and the value map format are different than for other elements. Gold data listed in the open file may include initial analytical results, values determined from repeat analyses, together with sample weights and corresponding detection limits for all analyzed samples. The gold, statistical parameters and regional symbol-trend plots are determined using only the first analytical value. Gold values less than the detection limit are set to half that limit. On the value map, initial values are followed by a comma and a value obtained by a second analysis, where determined. Samples weights used can be found in the text. Following are possible variations in data presentation on a value map.

+ *	No data
+27	Single analysis
+27,14	Repeat analysis
+ <1	Single analysis, less than detection limit

TABLE 1. Summary of Analytical Data and Methods

ELEMENT	DETECTION LEVEL		METHOD
<u>SEDIMENTS:</u>			
Zn Zinc	2	ppm	AAS
Cu Copper	2	ppm	AAS
Pb Lead	2	ppm	AAS
Ni Nickel	2	ppm	AAS
Co Cobalt	2	ppm	AAS
Ag Silver	0.2	ppm	AAS
Mn Manganese	5	ppm	AAS
As Arsenic	1	ppm	HY-AAS
Mo Molybdenum	2	ppm	AAS
Fe Iron	0.02	pct	AAS
U Uranium	0.5	ppm	NADNC
Hg Mercury	10	ppb	CV-AAS
F Fluorine	20	ppm	AAS
V Vanadium	5	ppm	AAS
Cd Cadmium	0.2	ppm	AAS
Sb Antimony	0.2	ppm	HY-AAS
LOI Loss-on-ignition	1	pct	GRAV
Sn Tin	1	ppm	AAS
Na Sodium	0.02	pct	INAA
Sc Scandium	0.2	ppm	INAA
Cr Chromium	20	ppm	INAA
Fe Iron	0.2	pct	INAA
Co Cobalt	5	ppm	INAA
Ni Nickel	10	ppm	INAA
As Arsenic	0.5	ppm	INAA
Br Bromine	0.5	ppm	INAA
Rb Rubidium	5	ppm	INAA
Mo Molybdenum	1	ppm	INAA
Sb Antimony	0.1	ppm	INAA
Cs Cesium	0.5	ppm	INAA
Cs Barium	50	ppm	INAA
La Lanthanum	2	ppm	INAA
Ce Cerium	5	ppm	INAA
Sm Samarium	0.10	ppm	INAA
Eu Europium	1	ppm	INAA
Tb Terbium	0.5	ppm	INAA
Yb Ytterbium	2	ppm	INAA
Lu Lutetium	0.2	ppm	INAA
Hf Hafnium	1	ppm	INAA
Ta Tantalum	0.5	ppm	INAA
W Tungsten	1	ppm	INAA
Th Thorium	0.2	ppm	INAA
U Uranium	0.2	ppm	INAA
Wt Weight	0.01	g	-
Au Gold	2	ppb	INAA
<u>WATERS:</u>			
F Fluoride	20	ppb	ISE
pH Hydrogen ion activity	-	-	GCM
U Uranium	0.05	ppb	LIF

- AAS - atomic absorption spectrometry
 CV-AAS - cold vapour (flameless) atomic absorption
 GCM - glass Calomel electrode and pH meter
 GRAV - gravimetry
 HY-AAS - atomic absorption using hydride evolution
 INAA - Instrumental Neutron Activation Analysis
 ISE - ion selective electrode
 LIF - laser-induced fluorescence
 NADNC - neutron activation, delayed neutron counting

In summary, geochemical follow-up investigations for gold should be based on a careful consideration of all geological and geochemical information, and especially a careful appraisal of gold geochemical data and its variability. In some instances, prospective follow-up areas may be indirectly identified by pathfinder element associations in favourable geology, although a complementary gold response due to natural variability may be lacking. Once an anomalous area has been identified, field investigations should be designed to include detailed geochemical follow-up surveys and collection of large representative samples. Subsequent repeat subsample analyses will increase the reliability of results and permit a better understanding of natural variability which can then be used to improve sampling methods and interpretation.

12, Mercury in Ores, Rocks, Soils, Sediments and Water, Geol. Surv. Can. Paper 73-21.

Welsch, E.P. and Chao, T.T. (1976) Determination of trace amounts of tin in geological materials by atomic absorption spectrometry; *Anal. Chim. Acta.*, Vol. 82, pp. 337-342.

FIELD DATA LEGEND

Table 2 describes the field and map information appearing on the following pages preceding the analytical data for each sample site.

REFERENCES

- Aslin, G.E.M.** (1976) The determination of arsenic and antimony in geological materials by flameless atomic absorption spectrophotometer; *Journal of Geochemical Exploration*, Vol. 6, pp. 321-330.
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- Ficklin, W.H.** (1970) A rapid method for the determination of fluoride in rocks and soils, using an ion selective electrode; *U.S. Geol. Surv. Paper 700C*, pp. C186-188.
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- Hall, G.E.M.** (1979) A study of the stability of uranium in waters collected from various geological environments in Canada; in *Current Research, Part A*, *Geol. Surv. Can. Paper 79-1A*, pp. 361-365.
- Harris, J.F.** (1982) Sampling and analytical requirements for effective use of geochemistry in exploration for gold; in Levinson, A.A., Editor, *Precious Metals in the Northern Cordillera*, proceedings of a symposium sponsored by the Association of Exploration Geochemists and the Cordilleran Section of the Geological Association of Canada, pp. 53-67.
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TABLE 2. Field Observations Legend

FIELD RECORD	DEFINITION	TEXT CODE
MAP SHEET	National topographic system (NTS); lettered quadrangle (1:250 000 scale or 1:50 000 scale).	105J or 105K
SAMPLE ID	Remainder of sample number: Year of collection Field crew Sample sequence number	89 1 or 3 001-999
REP STAT	Replicate status; relationship of the sample to others within the survey: Routine sample site First of a duplicate pair Second of a duplicate pair	00 10 20
UTM	Universal Transverse Mercator UTM co-ordinate system; digitized sample location coordinates.	
ZN	Zone (7 to 22)	
EASTING	UTM Easting in metres	
NORTHING	UTM Northing in metres	
ROCK UNIT	Major rock type of stream catchment area: CENOZOIC QUATERNARY glacial and surficial deposits..... TERTIARY basalt conglomerate, sandstone, shale feldspar porphyry dykes, flows MESOZOIC CRETACEOUS quartz monzonite, granodiorite; alaskite..... granodioritic and monzonitic porphyry..... South Fork; andesite, dacite, basalt TRIASSIC polymictic conglomerate sandstone, siltstone PALEOZOIC greenstone, amphibolite PENNSYLVANIAN AND PERMIAN limestone chert..... CARBONIFEROUS AND PERMIAN serpentinite, diorite, pyroxenite, peridotite Anvil Range Group: andesite, basalt, slate, chert limestone andesite, basalt, chert, tuff..... schist, gneiss, includes Big Salmon Metamorphic Complex..... DEVONIAN AND MISSISSIPPIAN Sylvester Group: shale, chert, arenite, conglomerate, basic volcanic rocks Earn Group: chert arenite, shale, conglomerate.... Crystal Peaks: chert pebble conglomerate	QS PV LTS TFP KQM KGDP KSF TRCG TRS PAV PPAC PPAT CPUB CPAV CPV CPSN DMS DME DMCP

FIELD RECORD	DEFINITION	TEXT CODE
ROCK UNIT (cont.)	DEVONIAN Earn Group (lower): slate, quartzite, limestone, shale, siltstone SILURIAN AND DEVONIAN dolomite, quartzite, artillite ORDOVICIAN, SILURIAN AND DEVONIAN Road River: black graphtolitic shale, chert ORDOVICIAN AND SILURIAN limestone, shale CAMBRIAN AND ORDOVICIAN Kechika Group: phyllite, limestone shale, limestone. shale, limestone CAMBRIAN AND HADRYNIAN schist, gneiss, quartzite PROTEROZOIC HADRYNIAN crystalline limestone gritty quartzite, argillite, shale, phyllite	DEI SDCQ OSDR OSC COK COP HCSN HC HQP
ROCK AGE	Stratigraphic age of dominant rock type in catchment basin: Quaternary Tertiary – Pliocene Tertiary – Eocene Cretaceous Triassic Paleozoic Pennsylvanian and Permian Carboniferous and Permian Devonian and Mississippian Devonian Silurian and Devonian Ordovician, Silurian and Devonian Ordovician and Silurian Cambrian-Ordovician Cambrian and Hadrynian Hadrynian	64 62 59 52 42 09 35 35 29 25 24 20 19 14 08 07
SAMPLE TYPE	Sample material collected: Stream bed sediment only Spring or sediment seep Heavy mineral concentrate Stream water only Natural groundwater, spring seep Simultaneous stream sediment and water Simultaneous spring or seep water and sediment	SedOnly SpgSedOnly HvMnCn Strm GrWat Sed/Water SpgSep/Sed
STREAM WIDTH	Stream width in decimetres	
STREAM DEPTH	Water depth in decimetres	
SAMPLE CONT.	Contamination; human or natural: None Possible Probable Definite Mining activity Industrial sources Agricultural Domestic or household Forestry activities Burned areas	- Possible Probable Definite Mining Industry Agricult Domestic Forestry Burn

FIELD RECORD	DEFINITION	TEXT CODE
BANK TYPE	Bank type; the general nature of the bank material adjacent to the sample site: Alluvial Colluvial (bare rock, residual or mountain soils)..... Glacial till..... Glacial outwash sediments Bare rock..... Talus scree Organic predominant (debris, peat, muskeg, swamp)	Alluv Colluv Till Outwash Bare Rk Tal/Scr Organic
WATER COLOUR	Water colour; the general colour and suspended load of the sampled water: Clear Brown transparent White cloudy Brown cloudy	Clear BnTrans WhCl'dy BnCl'dy
STREAM FLOW	Water flow rate: Stagnant Slow Moderate Fast Torrential.....	Stagnt Slow Modert Fast Torrnt
SAMPLE COLOUR	Predominant sediment colour: Red-brown White-buff Black..... Yellow Green..... Grey, blue grey Pink Buff to brown Brown	Rd-Bn Wh-Bf Black Yellow Green Gy-Blu Pink Bf-Bn Brown
SAMPLE COMP.	Sediment composition; description of the bulk mechanical composition of the collected sample on a scale of 1 to 3, the total of the column must add up to 3 or 4 or 5: Size fractions are divided as follows: Column 1 >0.125 mm (sand) Column 2 <0.125 mm (fines – organic silt, clay) Column 3 organic material Amount of size fraction: sum of amounts = 3 4 5 Absent 0 0 0 Minor <33% 25% 20% Medium 33-67% 50% 40% Major >67% 75% 60%	0 1 2 3
BOTTOM PCPT	Precipitate or stain; the presence of any coatings on pebbles, boulders or stream bottoms: None Red-brown White or buff Black..... Yellow Green..... Grey Pink Buff to brown	Rd-Bn Wh-Bf Black Yellow Green Grey Pink Bf-Bn

FIELD RECORD	DEFINITION	TEXT CODE
BANK PCPT	Distinctive precipitate, stains or weathering on rocks in immediate area of catchment basin or stream bank: None Red, brown (eg., Fe) White, buff (eg., Co ₃ , Zn) Black (e.g., Fe, Mn, sulphides) Yellow (e.g., Pb, U, Fe, Mo, REE)..... Green (Cu, Ni, U, Mo, As, Fe) Bluish (Zn, P) Pink (Co, As)	- Rd-Bn Wh-Bf Black Yellow Green Blue Pink
STREAM PHYSIOG	General physiography of the drainage basin: Plain Muskeg, swampland Peneplain, plateau Hilly, undulating Mountainous, mature Mountainous, youthful (precipitous)	Plain Swamp Penpln Hill Moun/M Moun/Y
STREAM DRAINAGE	Drainage pattern: Poorly defined, haphazard..... Dendritic..... Herringbone Rectangular Trellis..... Discontinuous shield type (chains of lakes) Basinal Others.....	Poor Dendrc Herrbn Rectln Trellis Discnt Closed Other
STREAM TYPE	Stream type: Undefined Permanent, continuous..... Intermittent, seasonal..... Re-emergent, discontinuous.....	Undfnd Permnt Intermit Re-emerg
STREAM CLASS	Classification based on proximity to source: Undefined Primary Secondary Tertiary Quaternary	Undfnd Pri'ary Sec'ary Ter'ary Qua'ary
STREAM SOURCE	Source of water: Unknown Groundwater Snow melt or spring run-off Recent precipitation Ice-cap or glacial meltwater	Unknown Ground Sp'gMelt RecRain Glacier
Miscellaneous	Missing data in any field.....	*