Drainage Basin Geochemistry In New Brunswick

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Project Overview

- **WHAT**
  - Collect stream sediment and stream water data from sites within the same <100km^2 drainage basin as the North American Soil Geochemical Landscapes Project (NASGLP) soil sample site.
- **WHY**
  - Generate systematic baseline coverage of geochemical data for drainage basins across Canada.
  - Provide data to study the relationship between the chemistry of the soils and that of stream sediment and stream water within the same drainage basin.
- **WHERE and WHEN**
  - The developmental phase of this add-on project took place throughout New Brunswick in the Fall of 2007.

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Site Selection

- **Criteria for selecting a stream site location**
  - Must be within the same drainage basin as a NASGLP soil site
  - Must be downstream of a NASGLP soil site
  - The drainage basin areal extent of the stream site location must be <100km^2, which are generally first or small second order streams

Typical First Order Stream

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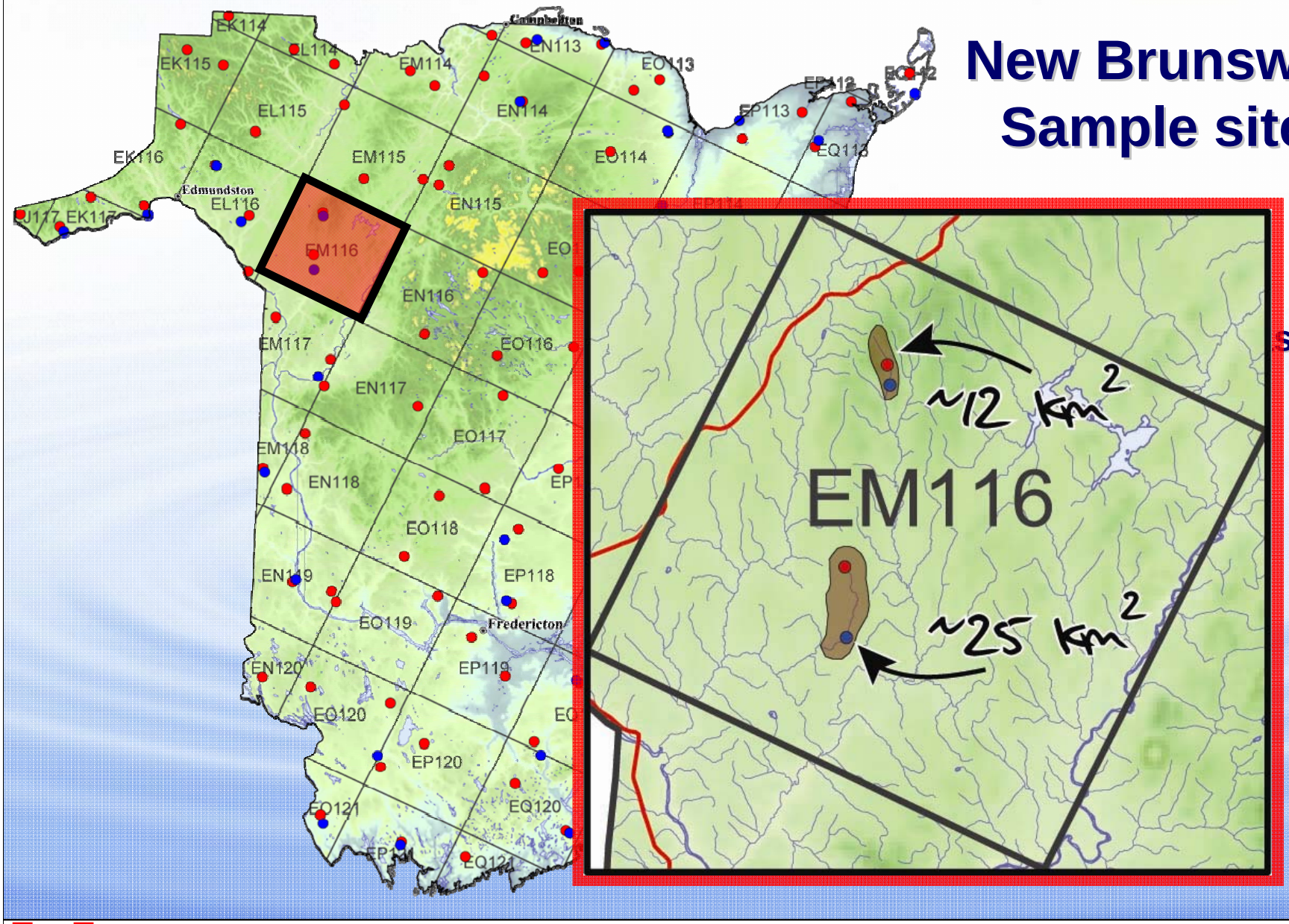
New Brunswick Sample sites



sin Sites

On-site

- **Collect water samples**
  - Three water samples are filtered and stored at 4°C

- **Collect stream sediment samples**
  - Two Kraft paper bags are filled with silt-sized stream sediment.

- **Collect and record in-situ measurements**
  - Multiple physical and chemical parameters are measured and recorded at each site

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Geochemical Data

Stream Water

Filtered and acidified (HNO_3)

ICP-MS → Trace elements
ICP-ES → Major elements

Filtered and unpreserved

Ion chromatography → Anions
Titration → Alkalinity
Combustion → Total dissolved Organic

Filtered and preserved (BrCl)

CV-AFS → Mercury

Stream Water

In-situ measurements

- pH
- Conductivity
- Temperature
- Dissolved Oxygen
- Colour
- Turbidity
- Discharge

Stream Sediment (<177µm)

- **ICP-MS**
- **INAA**
- **Fusion** → Tin & Fluorine
- **Loss on ignition**
- **Total carbon**

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Drainage Basin Geochemistry

Analysed Parameters in

Stream Water

Analytical Methods

- ICP-MS (Trace Elements)
- ICP-ES (Major Elements)
- Ion Chromatography (Anions)
- CV-AFS (Mercury)
- Titration (Alkalinity)
- Dissolved Organic

1 1.0079 H HYDROGEN																	2 4.0026 He HELIUM
3 6.941 Li LITHIUM	4 9.0122 Be BERYLLIUM											5 10.811 B BORON	6 12.011 C CARBON	7 14.007 N NITROGEN	8 15.999 O OXYGEN	9 18.998 F FLUORINE	10 20.180 Ne NEON
11 22.990 Na SODIUM	12 24.305 Mg MAGNESIUM											13 26.982 Al ALUMINIUM	14 28.086 Si SILICON	15 30.974 P PHOSPHORUS	16 32.065 S SULPHUR	17 35.453 Cl CHLORINE	18 39.948 Ar ARGON
19 39.098 K POTASSIUM	20 40.078 Ca CALCIUM	21 44.956 Sc SCANDIUM	22 47.867 Ti TITANIUM	23 50.942 V VANADIUM	24 51.996 Cr CHROMIUM	25 54.938 Mn MANGANESE	26 55.845 Fe IRON	27 58.933 Co COBALT	28 58.693 Ni NICKEL	29 63.546 Cu COPPER	30 65.39 Zn ZINC	31 69.723 Ga GALLIUM	32 72.64 Ge GERMANIUM	33 74.922 As ARSENIC	34 78.96 Se SELENIUM	35 79.904 Br BROMINE	36 83.80 Kr KRYPTON
37 85.468 Rb RUBIDIUM	38 87.62 Sr STRONTIUM	39 88.906 Y YTTRIUM	40 91.224 Zr ZIRCONIUM	41 92.906 Nb NIOBIUM	42 95.94 Mo MOLYBDENUM	43 (98) Tc TECHNETIUM	44 101.07 Ru RUTHENIUM	45 102.91 Rh RHODIUM	46 106.42 Pd PALLADIUM	47 107.87 Ag SILVER	48 112.41 Cd CADMIUM	49 114.82 In INDIUM	50 118.71 Sn TIN	51 121.76 Sb ANTIMONY	52 127.60 Te TELLURIUM	53 126.90 I IODINE	54 131.29 Xe XENON
55 132.91 Cs CAESIUM	56 137.33 Ba BARIUM	57-71 La-Lu Lanthanide	72 178.49 Hf HAFNIUM	73 180.95 Ta TANTALUM	74 183.84 W TUNGSTEN	75 186.21 Re RHENIUM	76 190.23 Os OSMIUM	77 192.22 Ir IRIDIUM	78 195.08 Pt PLATINUM	79 196.97 Au GOLD	80 200.59 Hg MERCURY	81 204.38 Tl THALLIUM	82 207.2 Pb LEAD	83 208.98 Bi BISMUTH	84 (209) Po POLONIUM	85 (210) At ASTATINE	86 (222) Rn RADON
87 (223) Fr FRANCIUM	88 (226) Ra RADIUM	89-103 Ac-Lr Actinide	104 (261) Rf RUTHERFORDIUM	105 (262) Db DUBNIUM	106 (266) Sg SEABORGIUM	107 (264) Bh BOHRIUM	108 (277) Hs HASSIUM	109 (268) Mt MEITNERIUM	110 (281) Uun UNUNNILIUM	111 (272) Uuu UNUNUNIUM	112 (285) Uub UNUNBIUM		114 (289) Uuq UNUNQUADIUM				

LANTHANIDE

57 138.91 La LANTHANUM	58 140.12 Ce CERIUM	59 140.91 Pr PRASEODYMIUM	60 144.24 Nd NEODYMIUM	61 (145) Pm PROMETHIUM	62 150.36 Sm SAMARIUM	63 151.96 Eu EUROPIUM	64 157.25 Gd GADOLINIUM	65 158.93 Tb TERBIUM	66 162.50 Dy DYSPROSIUM	67 164.93 Ho HOLMIUM	68 167.26 Er ERBIUM	69 168.93 Tm THULIUM	70 173.04 Yb YTTERBIUM	71 174.97 Lu LUTETIUM

ACTINIDE

89 (227) Ac ACTINIUM	90 232.04 Th THORIUM	91 231.04 Pa PROTACTINIUM	92 238.03 U URANIUM	93 (237) Np NEPTUNIUM	94 (244) Pu PLUTONIUM	95 (243) Am AMERICIUM	96 (247) Cm CURIUM	97 (247) Bk BERKELIUM	98 (251) Cf CALIFORNIUM	99 (252) Es EINSTEINIUM	100 (257) Fm FERMIUM	101 (258) Md MENDELEVIUM	102 (259) No NOBELIUM	103 (262) Lr LAWRENCIUM

Alkalinity | Nitrate

Dissolved Organic | Sulphate

In-Situ Measurements → Ph | Conductivity | Temperature | Turbidity | Colour | Discharge | Dissolved Oxygen

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NASGLP Workshop
Ottawa, February 27-28th, 2008

Drainage Basin Geochemistry

Analysed Parameters in

Stream Sediment

Analytical Methods

- ICP-MS
- INAA
- Fusion
- Loss on ignition
- Total carbon

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Loss on ignition | Total carbon

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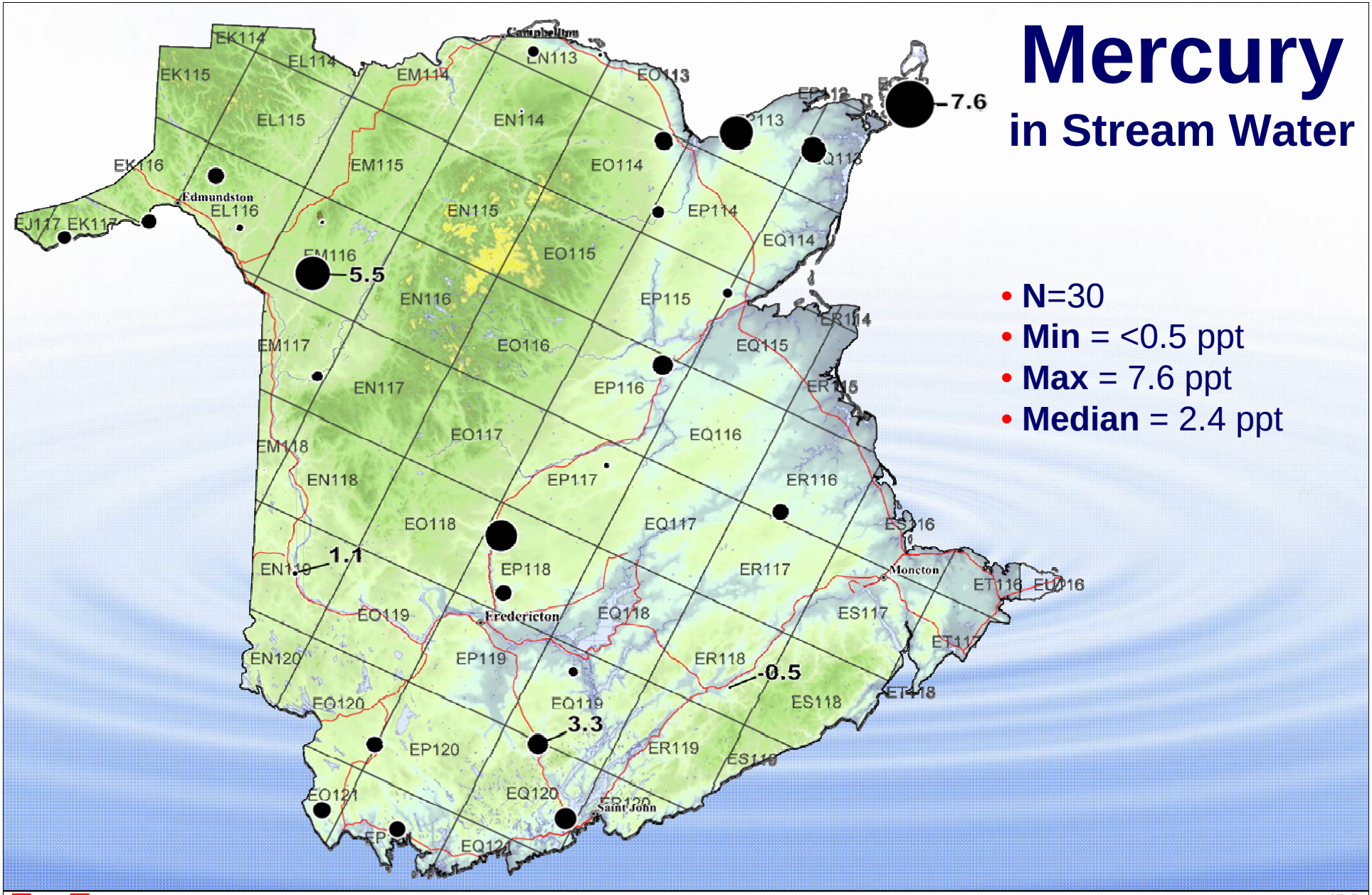
Mercury
in Stream Water



- **N**=30
- **Min** = <0.5 ppt
- **Max** = 7.6 ppt
- **Median** = 2.4 ppt

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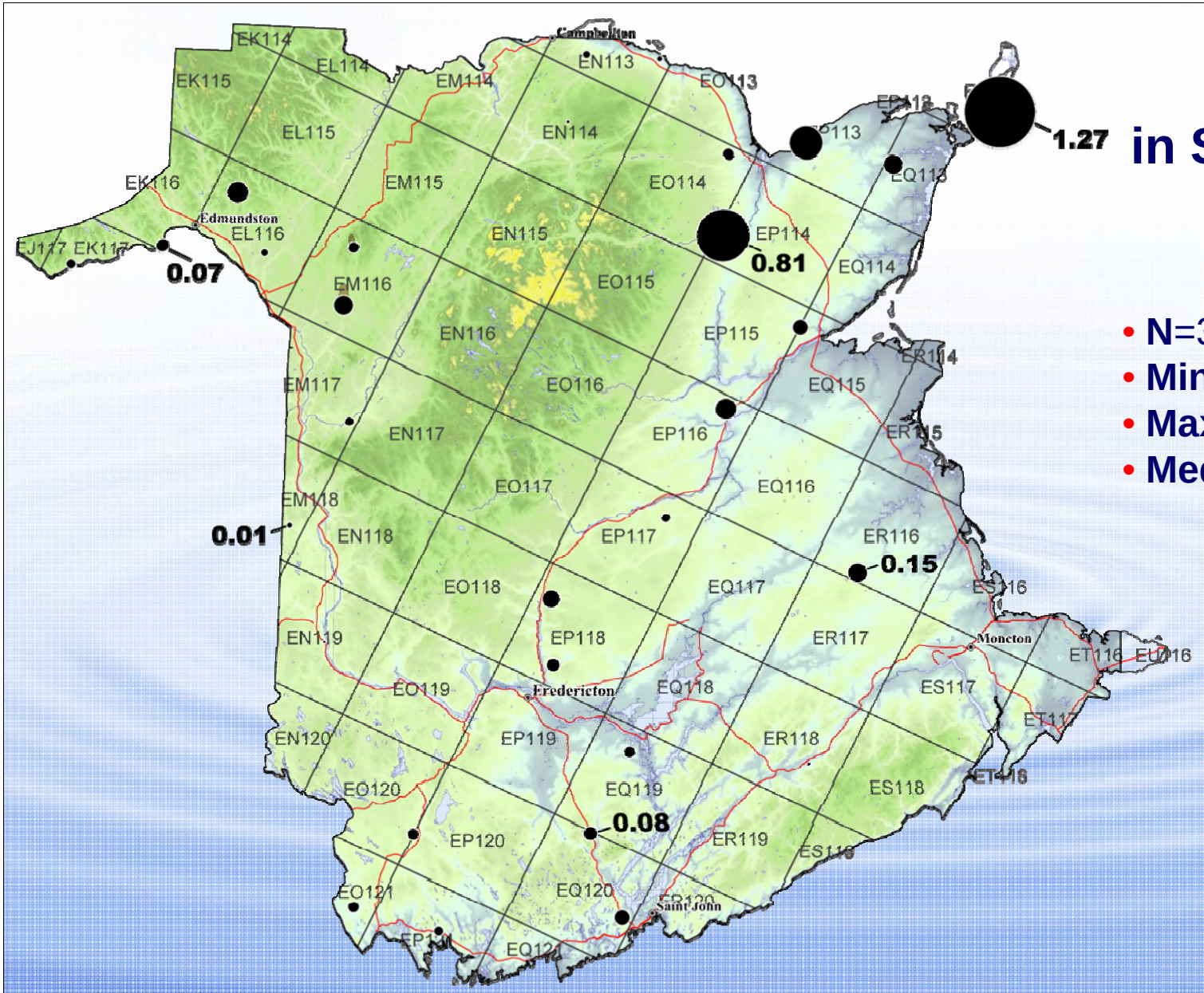
Lead
in Stream Water



- **N**=30
- **Min** = <0.01 ppb
- **Max** = 1.27 ppb
- **Median** = 0.06 ppb

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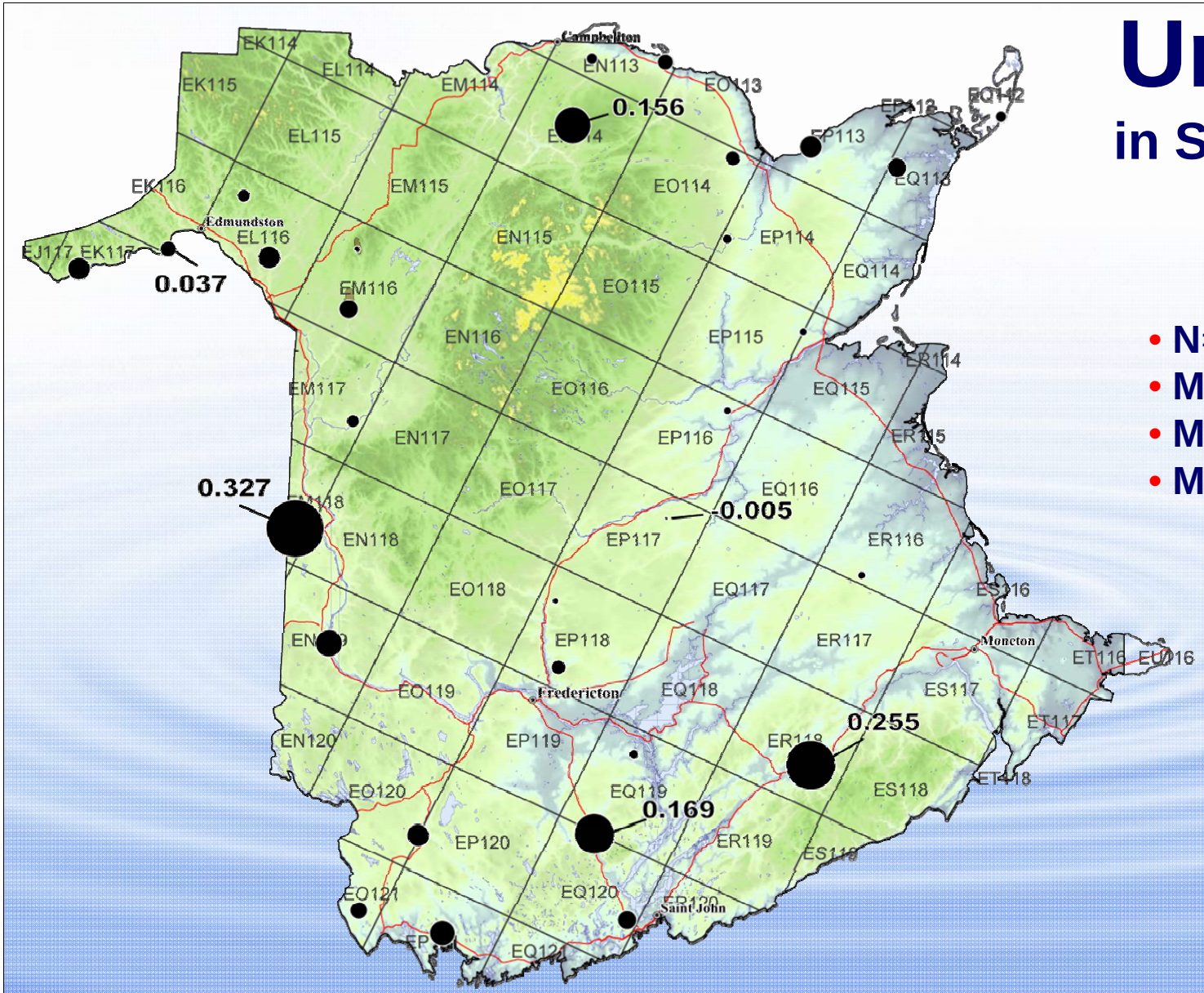
Uranium

in Stream Water



- **N**=30
- **Min** = <0.005 ppb
- **Max** = 0.327 ppb
- **Median** = 0.037 ppb

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What Next ?

- With continued funding from the GSC Environment & Health Program and with additional funding from Environment Canada's Clean Air Regulatory Agenda (CARA) the project will continue this Summer.

- Begin interpretation of the stream sediment and stream water data with the soil geochemical data.

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Abbreviations Used

CV-AFS - Cold vapour atomic fluorescence spectrophotometry

ICP-AES – Inductively coupled plasma atomic emission spectroscopy

ICP-MS - Inductively coupled plasma mass spectrometry

INAA – Instrumental neutron activation analysis

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