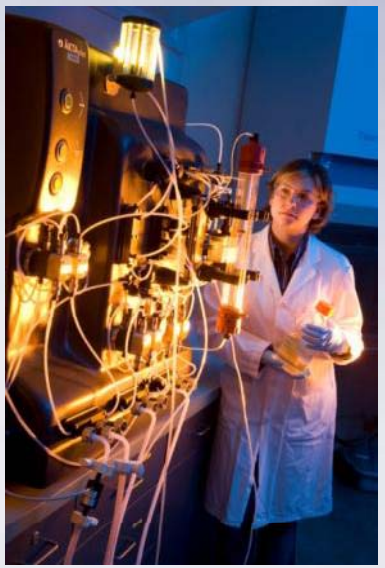
Gunnar Uranium Mine Remediation

November, 2009
Fond du Lac, SK
Saskatchewan Research Council

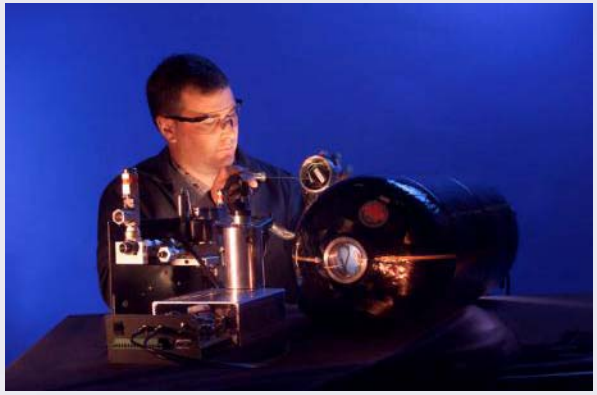
Agriculture, Biotechnology & Food



Mining & Minerals

Environment & Forestry

Alternative Energy & Manufacturing



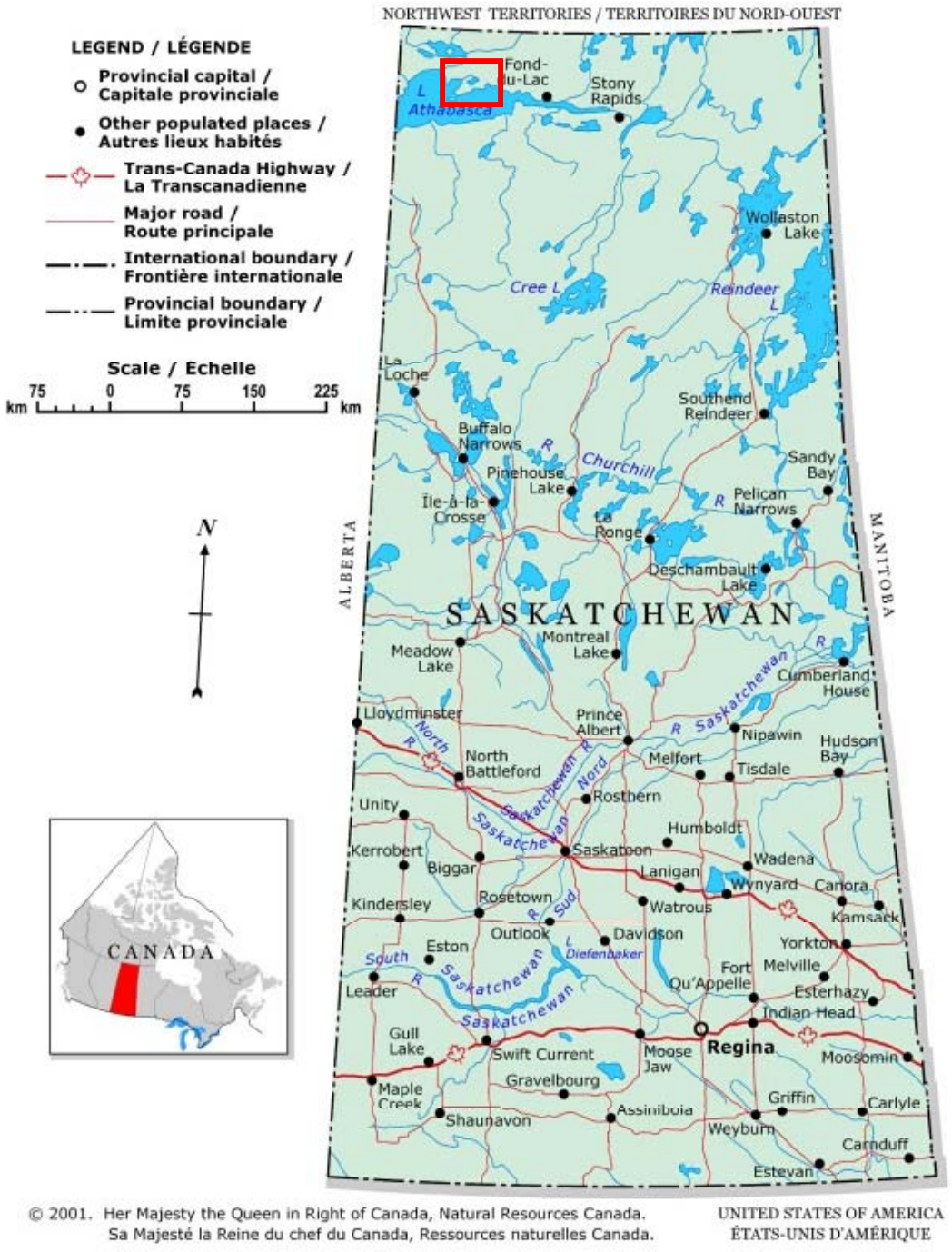
Energy

Presentation Outline

1. Gunnar Site Overview
2. Site Characterization
3. Contaminant Pathway Studies
4. Other Baseline Studies
5. Traditional Knowledge
6. Community Involvement
7. Questions/Discussions

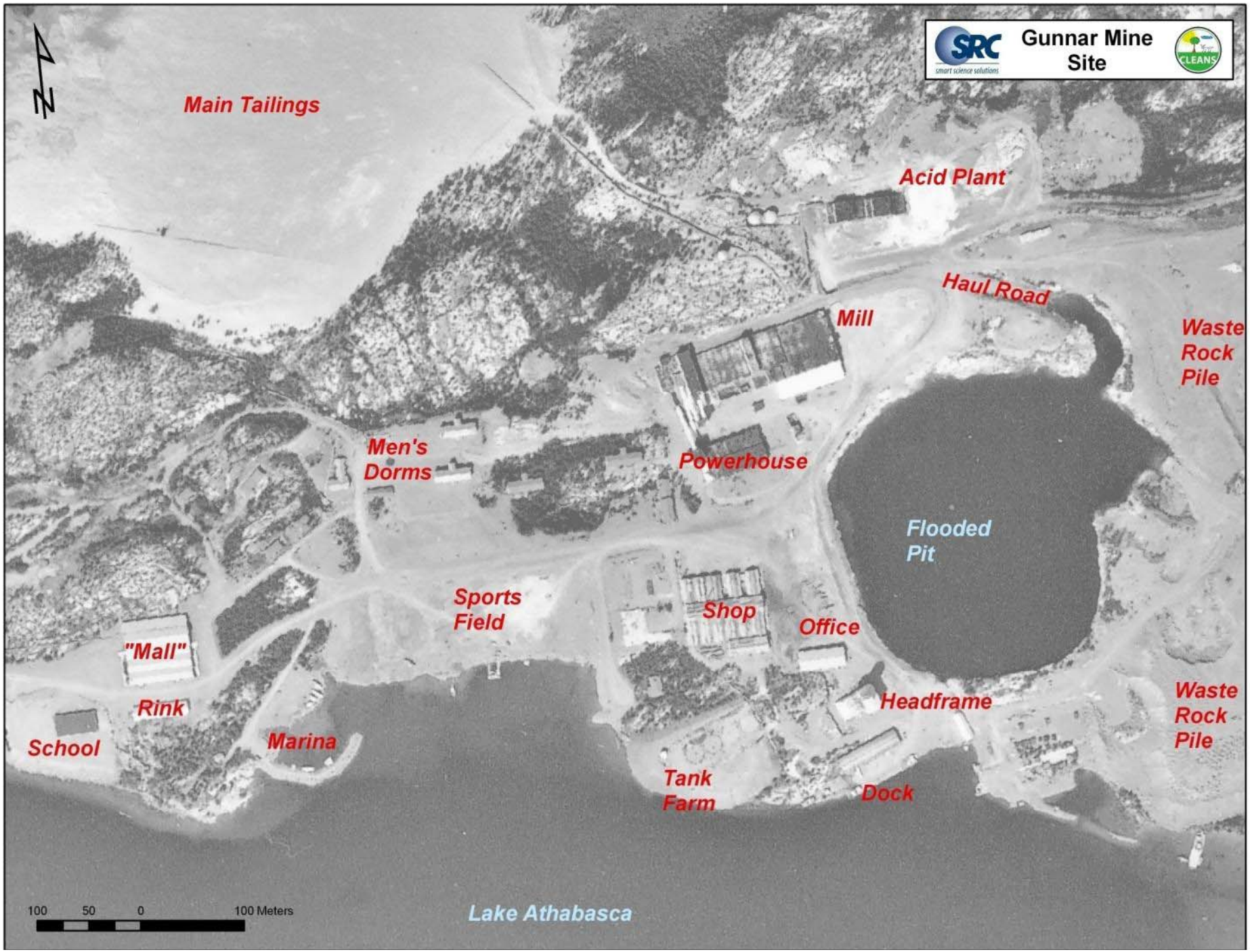
Gunnar History

- mine operated from 1953-1964
- a total of 8.3 million tons of rock mined
- average grade of deposit was 0.18% U_3O_8
- initially started as open pit
- a 600 metre deep vertical shaft was sunk
- underground mining started in1957
- mining ceased in 1964
- pit was flooded, shaft covered with concrete cap, and mine site abandoned



Gunnar Site

- Northwestern Saskatchewan on the Crackingstone peninsula

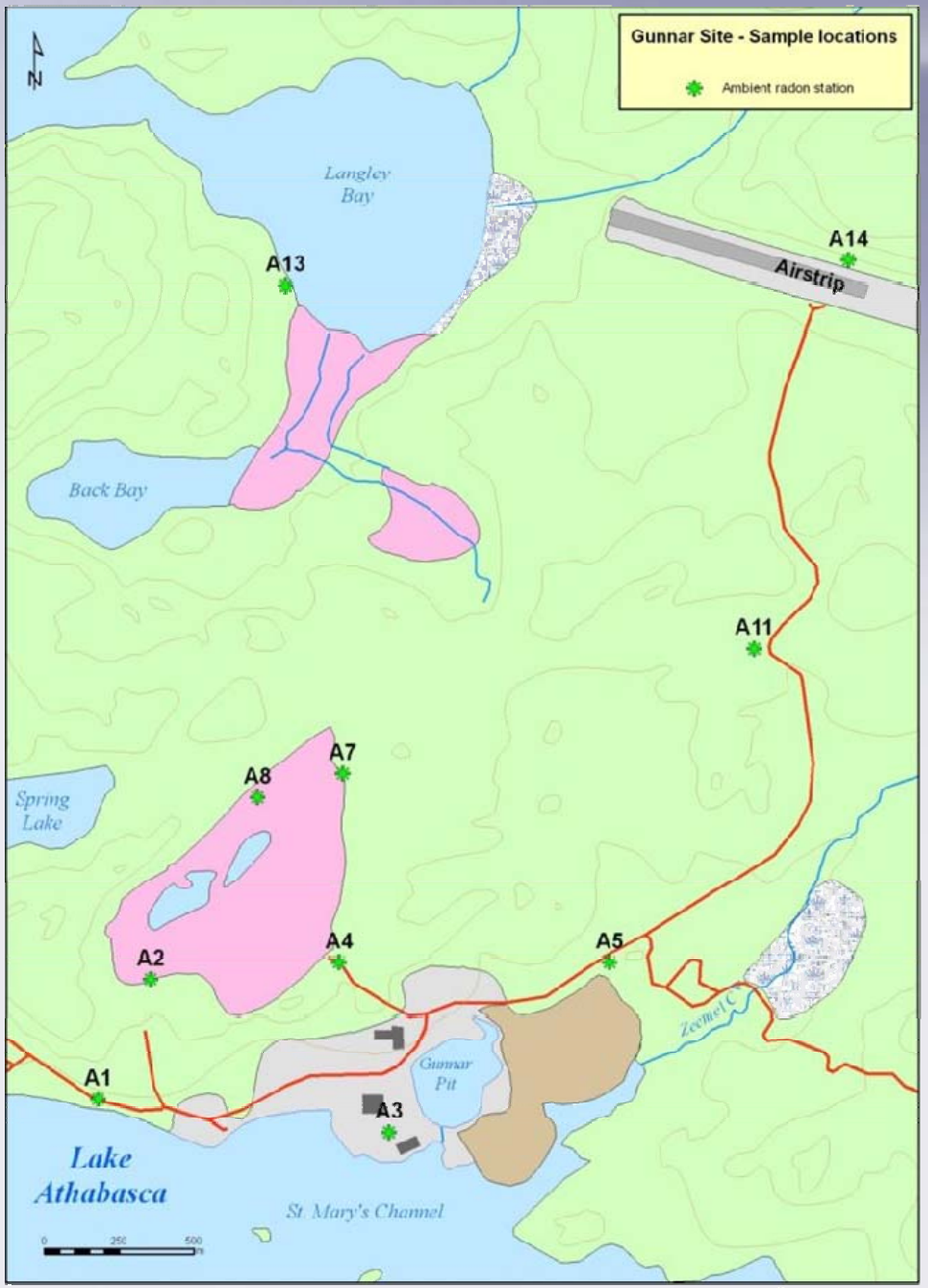

Gunnar Mine Site
N
Main Tailings
Acid Plant
Haul Road
Mill
Waste Rock Pile
Men's Dorms
Powerhouse
Flooded Pit
Sports Field
Shop
Office
"Mall"
Rink
School
Marina
Headframe
Waste Rock Pile
Tank Farm
Dock
100 50 0 100 Meters
Lake Athabasca

Gunnar 1955 (open pit no head frame)

Gunnar 2009 (45 years after closure)

Hazards/Site Characterization

- Radon
- Gamma Radiation
- Buildings and Structures
- Tailings Areas (3)
- Waste Rock (2)
- Gunnar Pit
- Historical Surface Water Quality

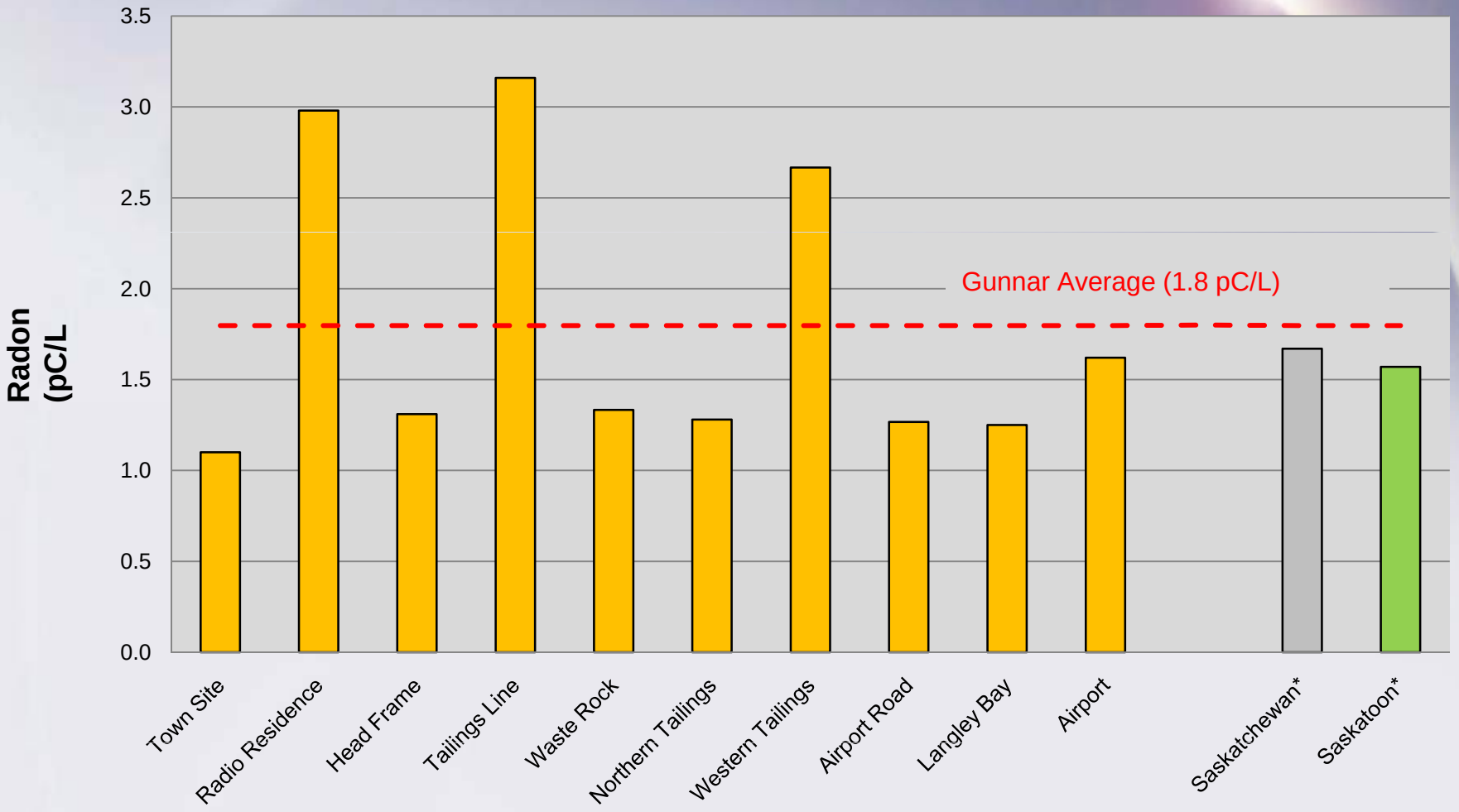


Radon monitoring stations at the Gunnar site

Radon gas monitoring

10 radon gas stations are located on the Gunnar site Detectors are collected and analyzed twice a year

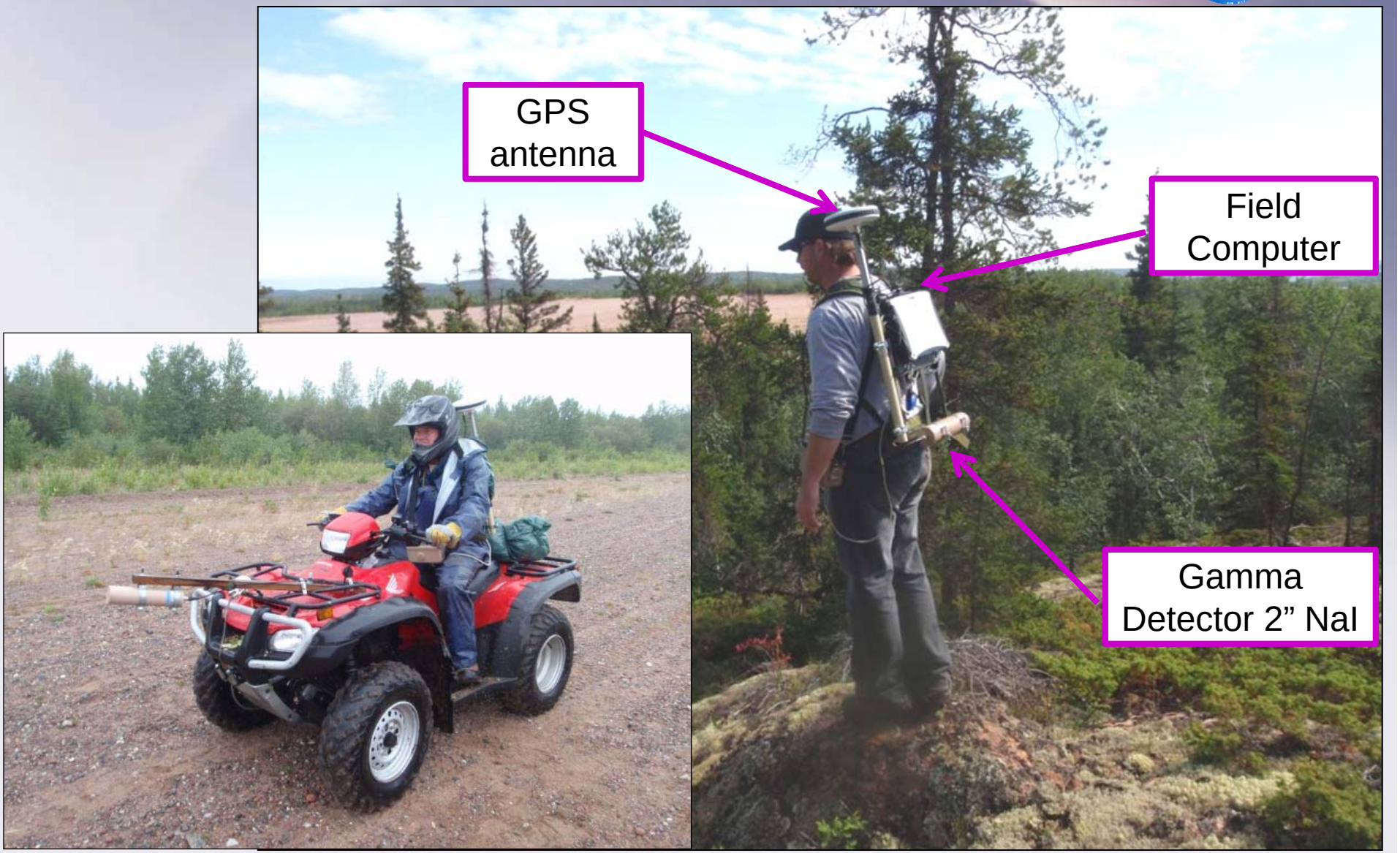
Average Radon levels Gunnar site 2004-2009

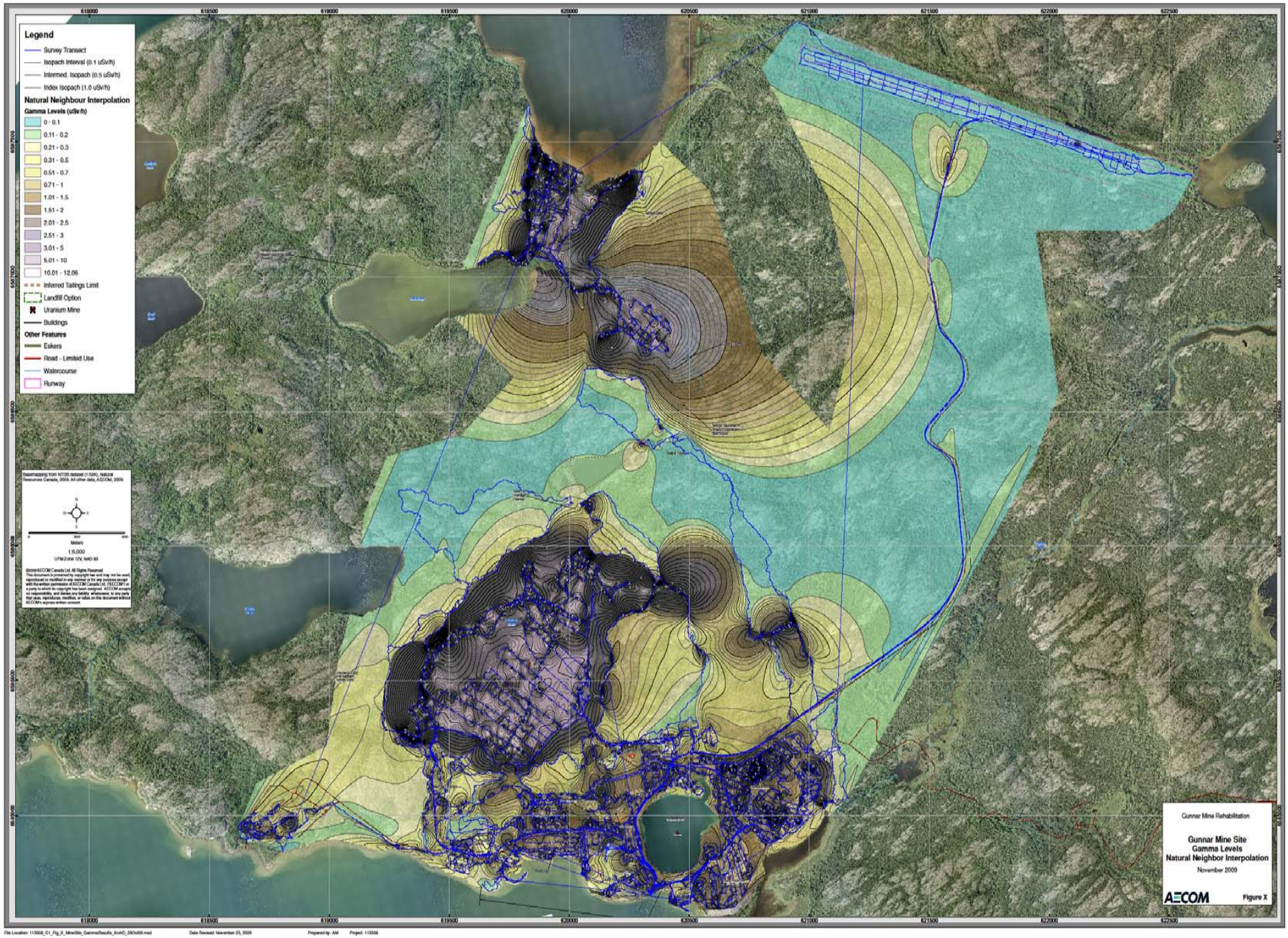


*Saskatchewan & Saskatoon levels from Health Physics, 1994

Gamma radiation survey

(reading taken every 2 seconds, over 40,000 gamma measurements collected)



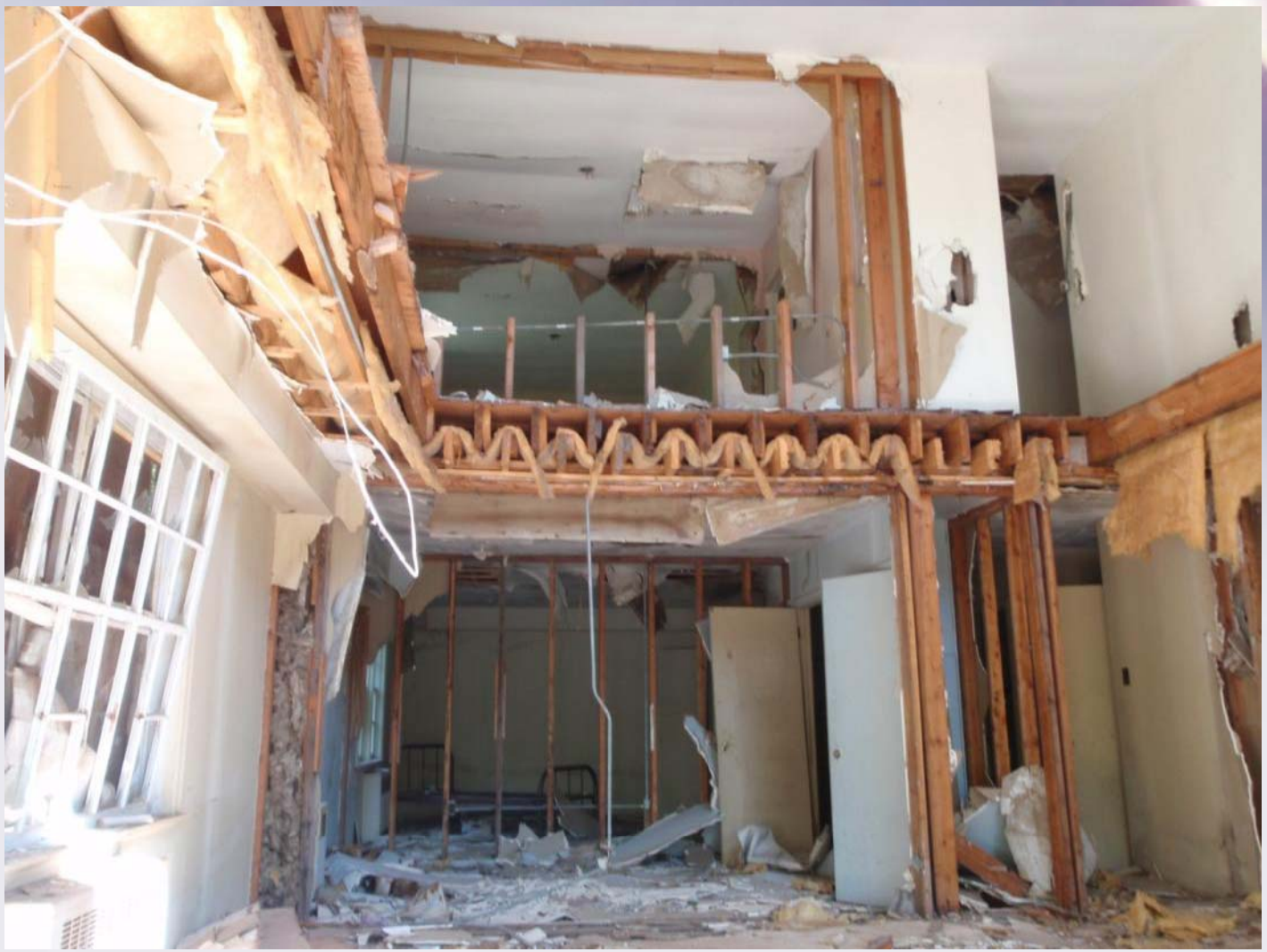

Legend
Survey Transect
Isopach Interval (0.1 uSv/h)
Intermed. Isopach (0.5 uSv/h)
Index Isopach (1.0 uSv/h)
Natural Neighbour Interpolation
Gamma Levels (uSv/h)
0 - 0.1
0.11 - 0.2
0.21 - 0.3
0.31 - 0.5
0.51 - 0.7
0.71 - 1
1.01 - 1.5
1.51 - 2
2.01 - 2.5
2.51 - 3
3.01 - 5
5.01 - 10
10.01 - 12.06
Inferred Tailings Limit
Landfill Option
Uranium Mine
Buildings
Other Features
Eskers
Road - Limited Use
Watercourse
Runway
Meters
1:15,000
UTM Zone 15V, NAD 83
Gunnar Mine Rehabilitation
Gunnar Mine Site
Gamma Levels
Natural Neighbor Interpolation
November 2009
AECOM
Figure X

Buildings and Structures

Married Persons Quarters

Single Workers Residence

Unauthorized salvage



Buildings structurally unsound

Many of the residence buildings are in very poor condition

Buildings and Structures

Head Frame

Crusher, Mill, Acid Plant

Mill Building

Ore Storage Bins

Product Packaging Area

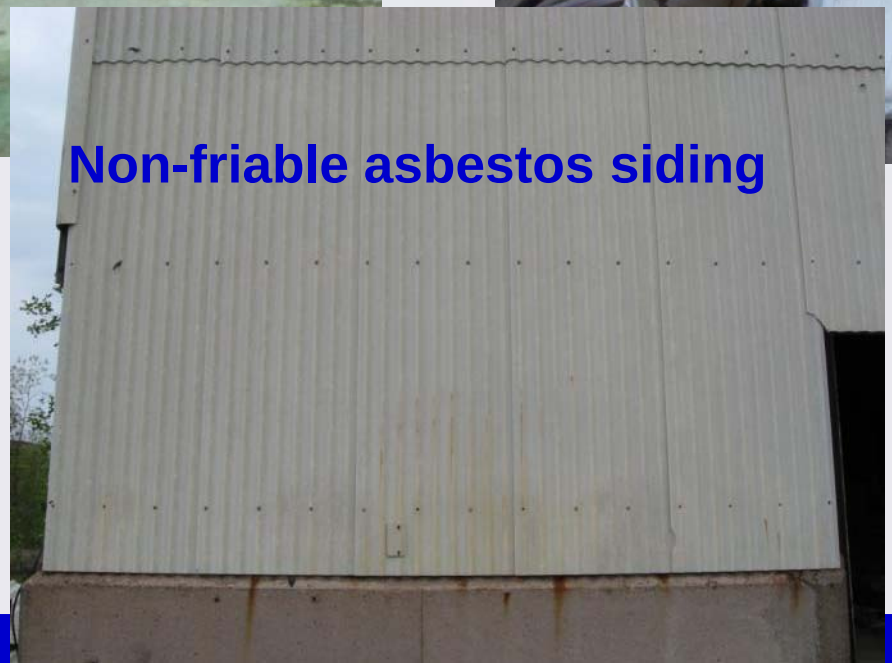
Acid Plant corroded and structurally unsound

Hazardous Materials

- Asbestos
- PCB- containing electrical devices
- Sulphur
- Blasting materials
- Miscellaneous chemicals

Asbestos

Friable -spray on asbestos insulation & pipe insulation



Non-friable asbestos siding

Asbestos requires specialized handling and disposal techniques

Sulphur, barged in from Alberta, was used to make sulphuric acid required in the refining process. Several cubic metres of sulphur still remain on site

Tailings Areas

A total of 4.4 million tonnes of tailings were discharged from the mill This material is located in 3 main tailings deposits on the Gunnar site:

- **Gunnar Main**
- **Gunnar Central**
- **Langley Bay**

Gunnar Tailings Areas

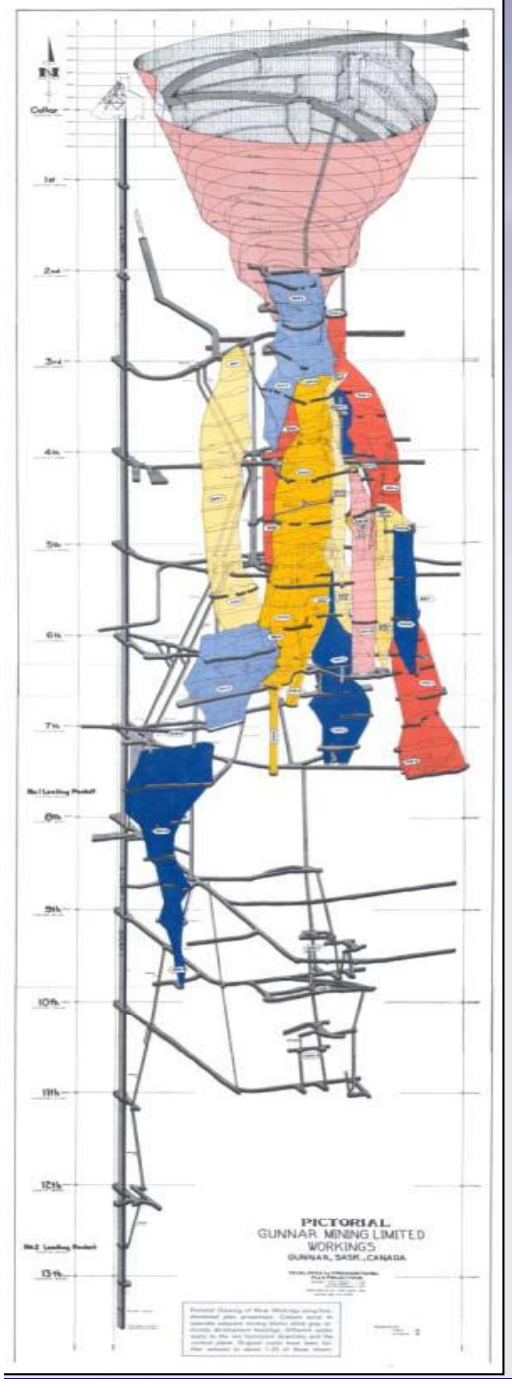
Gunnar Main Tailings Area

Gunnar Main looking south towards Lake Athabasca

Water ponded on Gunnar Main (note wind blown dust)

Waste Rock

2.7 million m^3 of waste rock located adjacent to the shore of Zeemel Creek and Lake Athabasca



Gunnar Pit (1963-1964)

Gunnar Pit

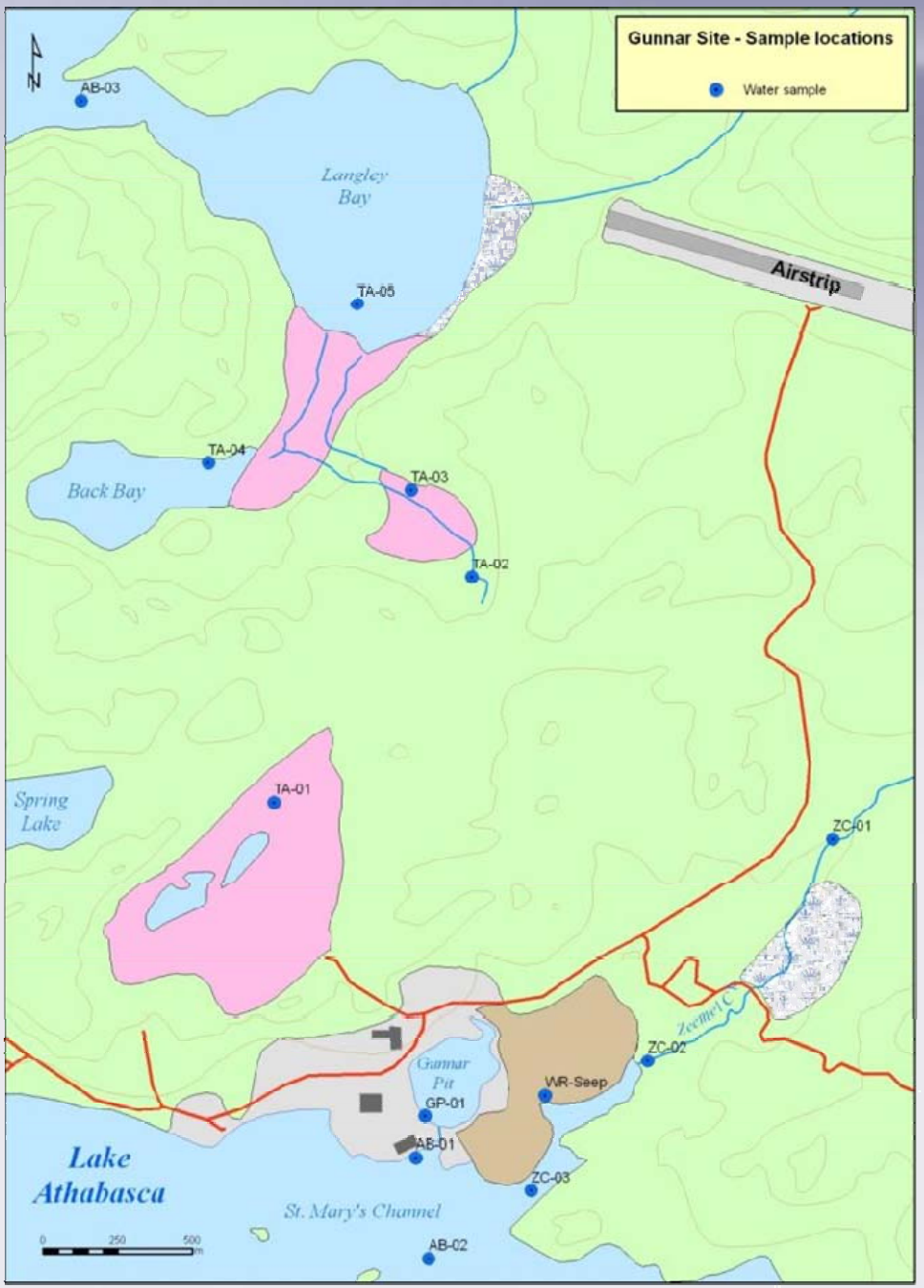
Gunnar Pit - 1964

116m deep, and approx. 300m dia.

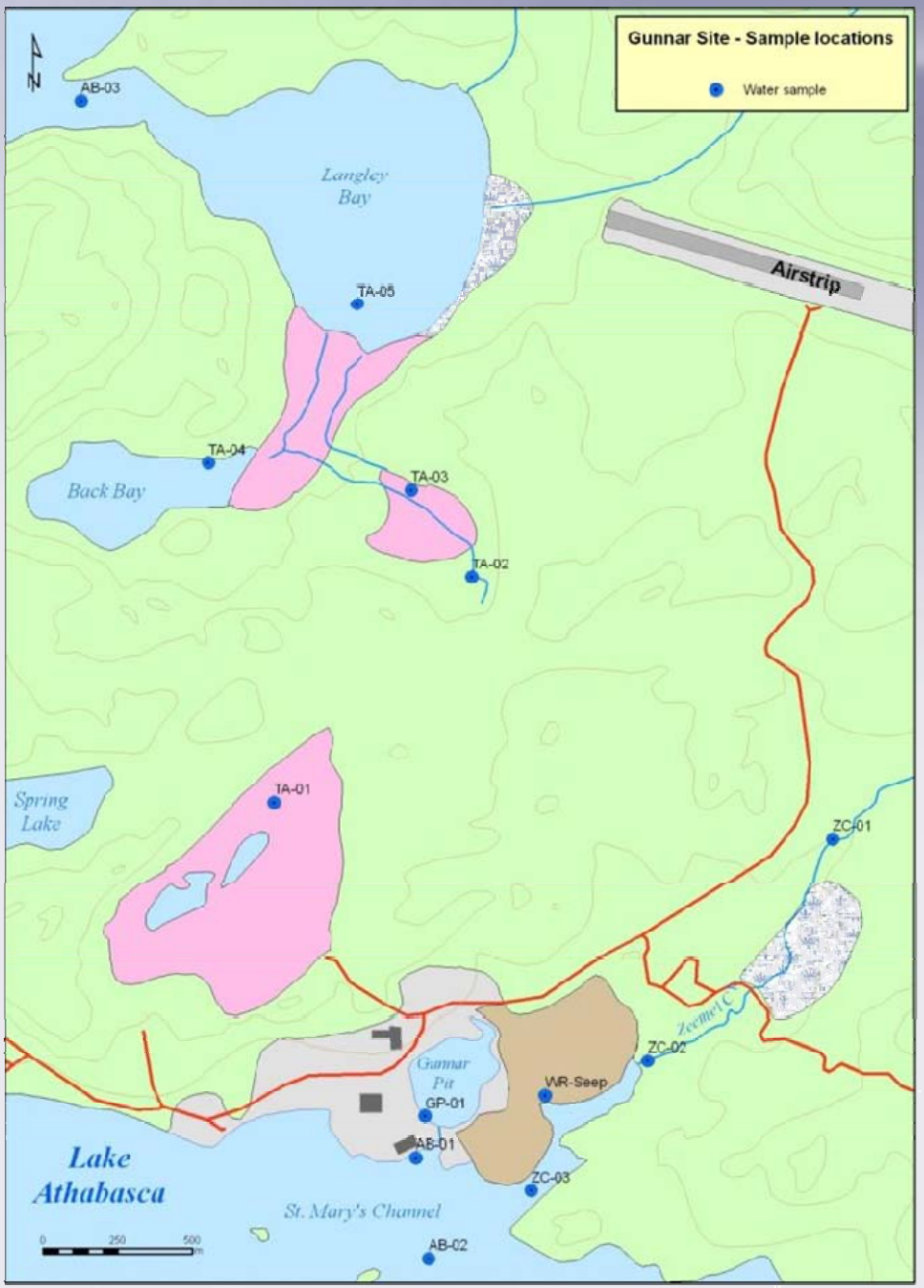
50 m from shore of Lake Athabasca

Gunnar Pit today

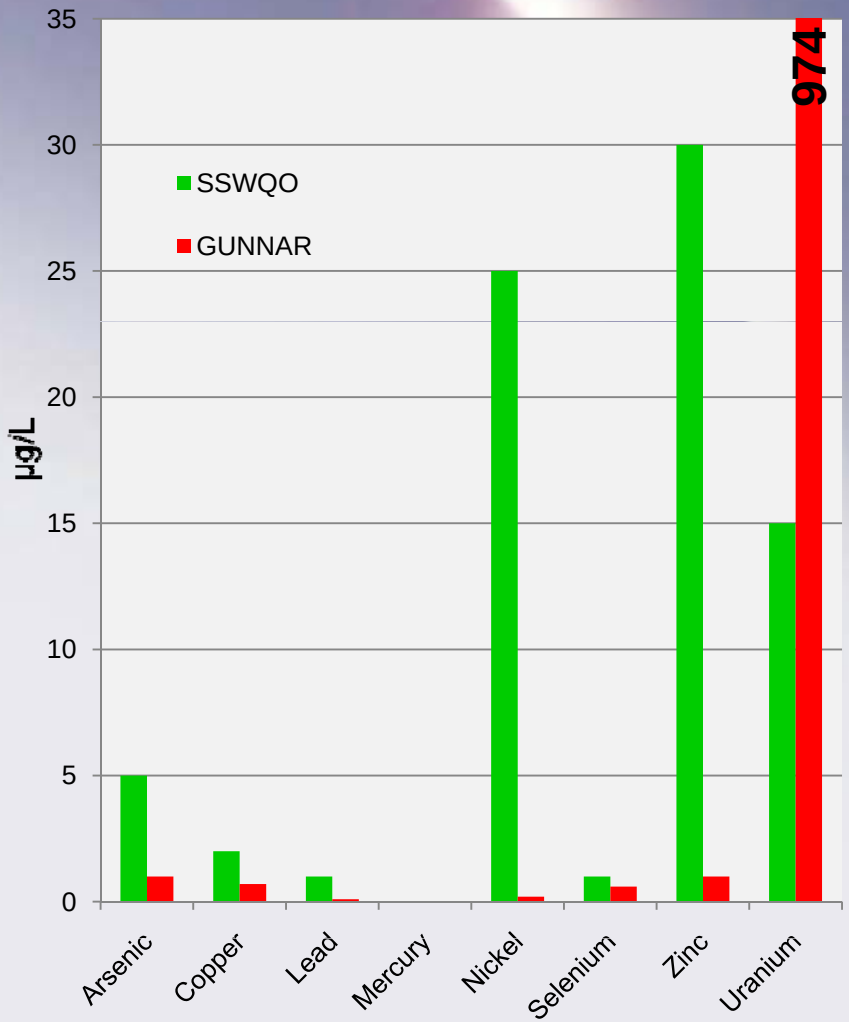
Flooded and supporting a population of northern pike

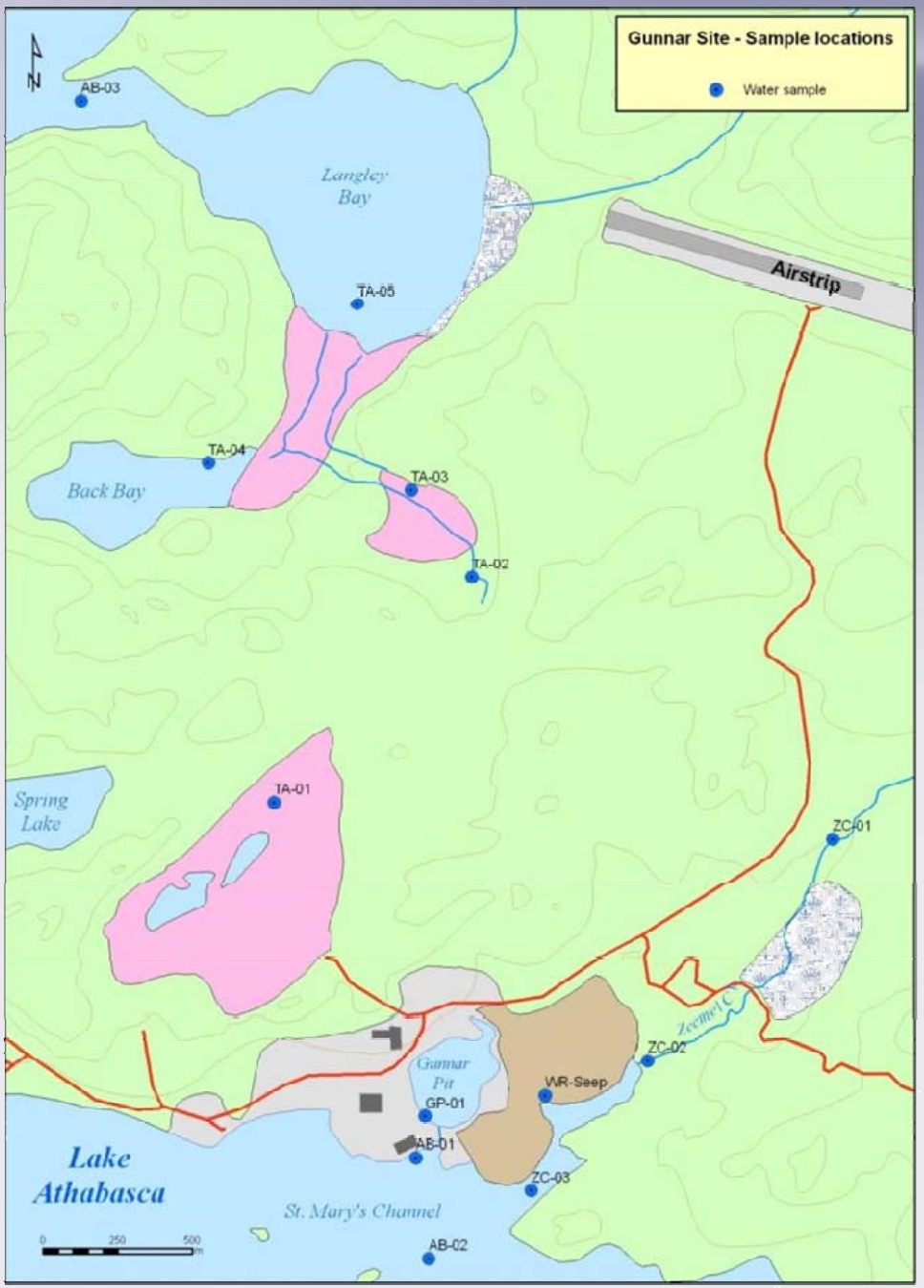


Surface water sample sites at the Gunnar mine site

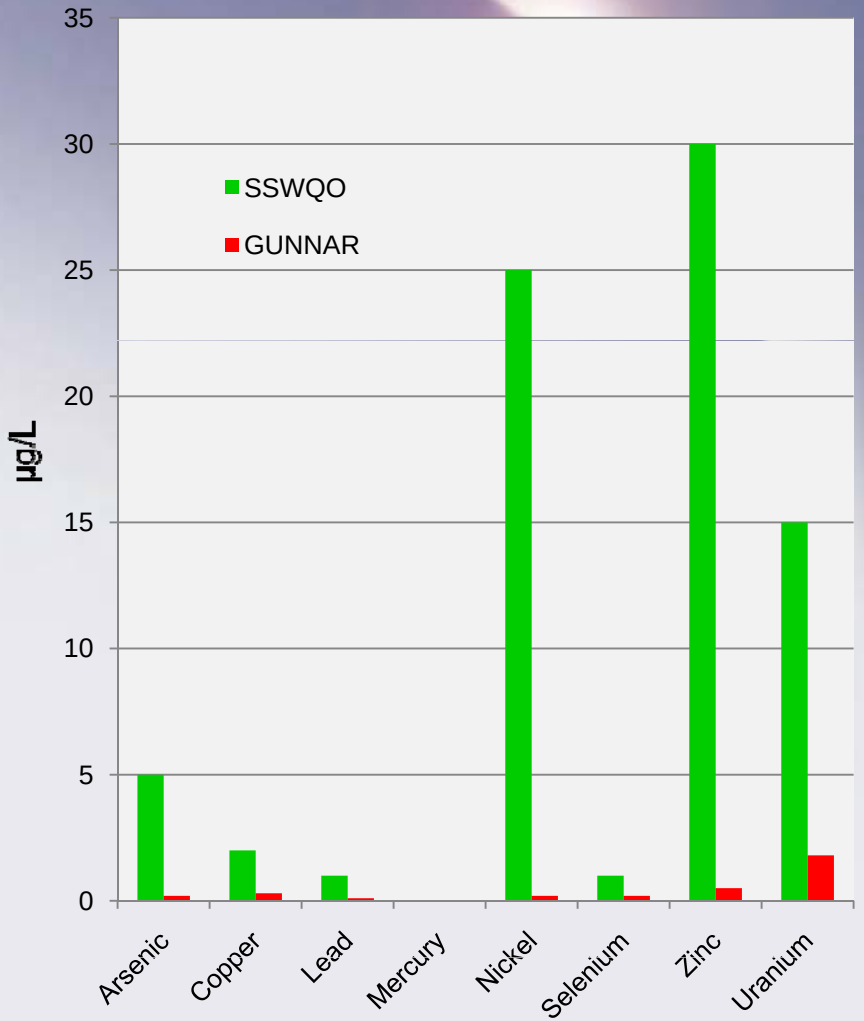


Gunnar Pit Water Quality GP-01

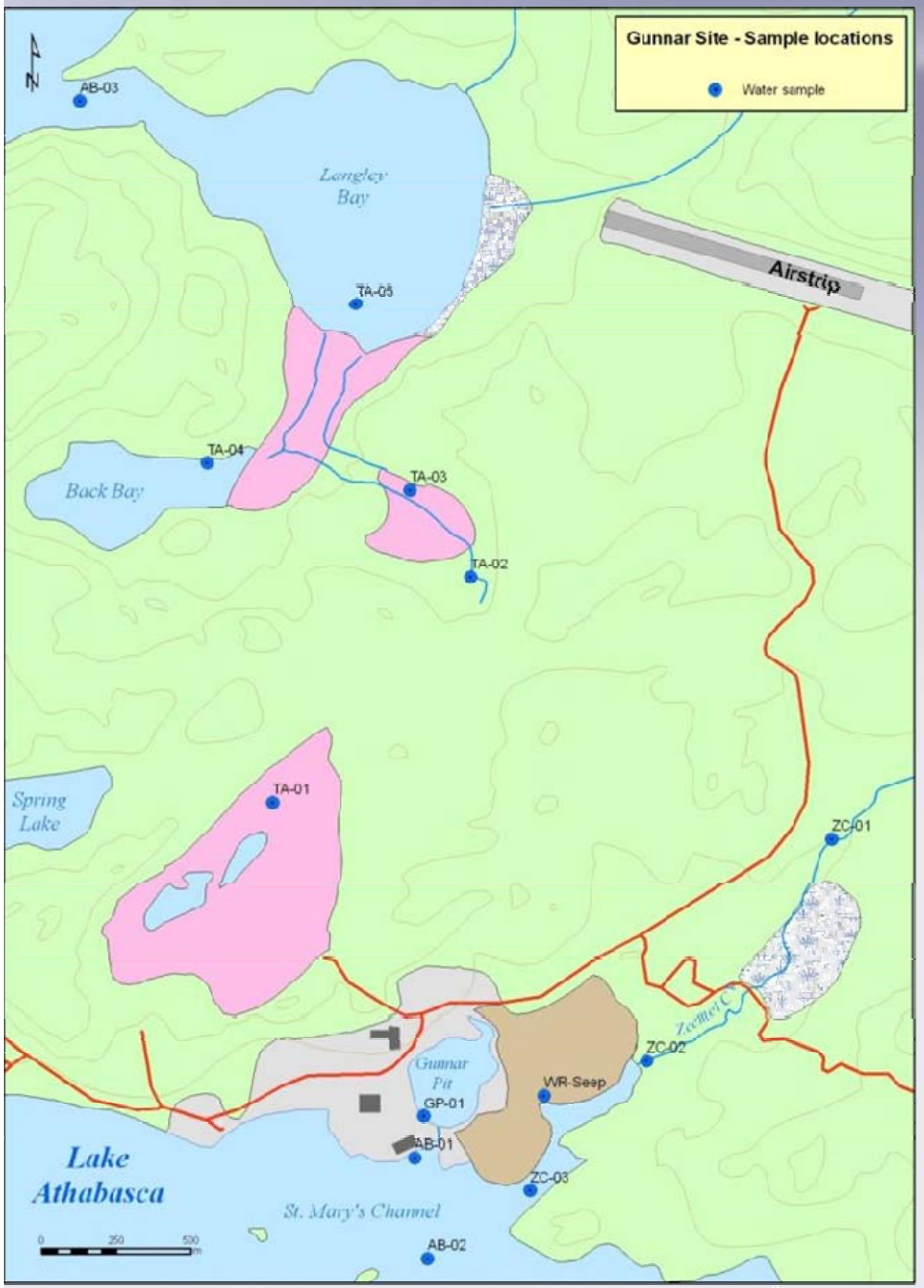


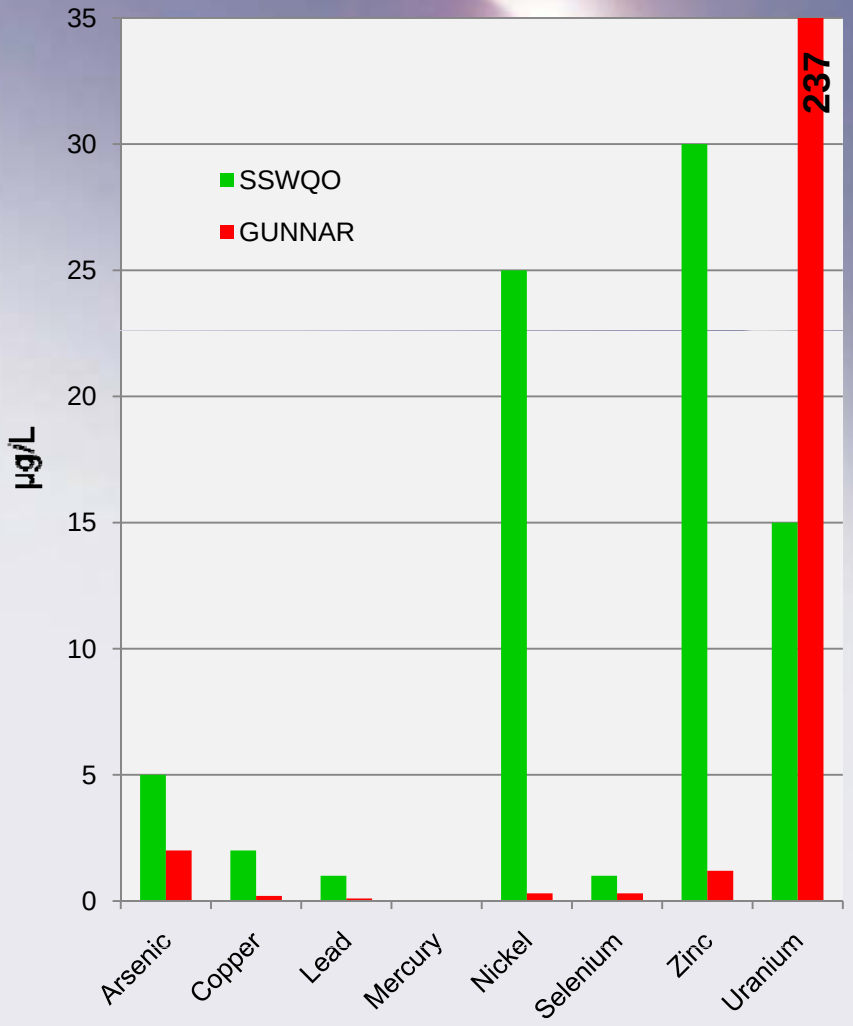


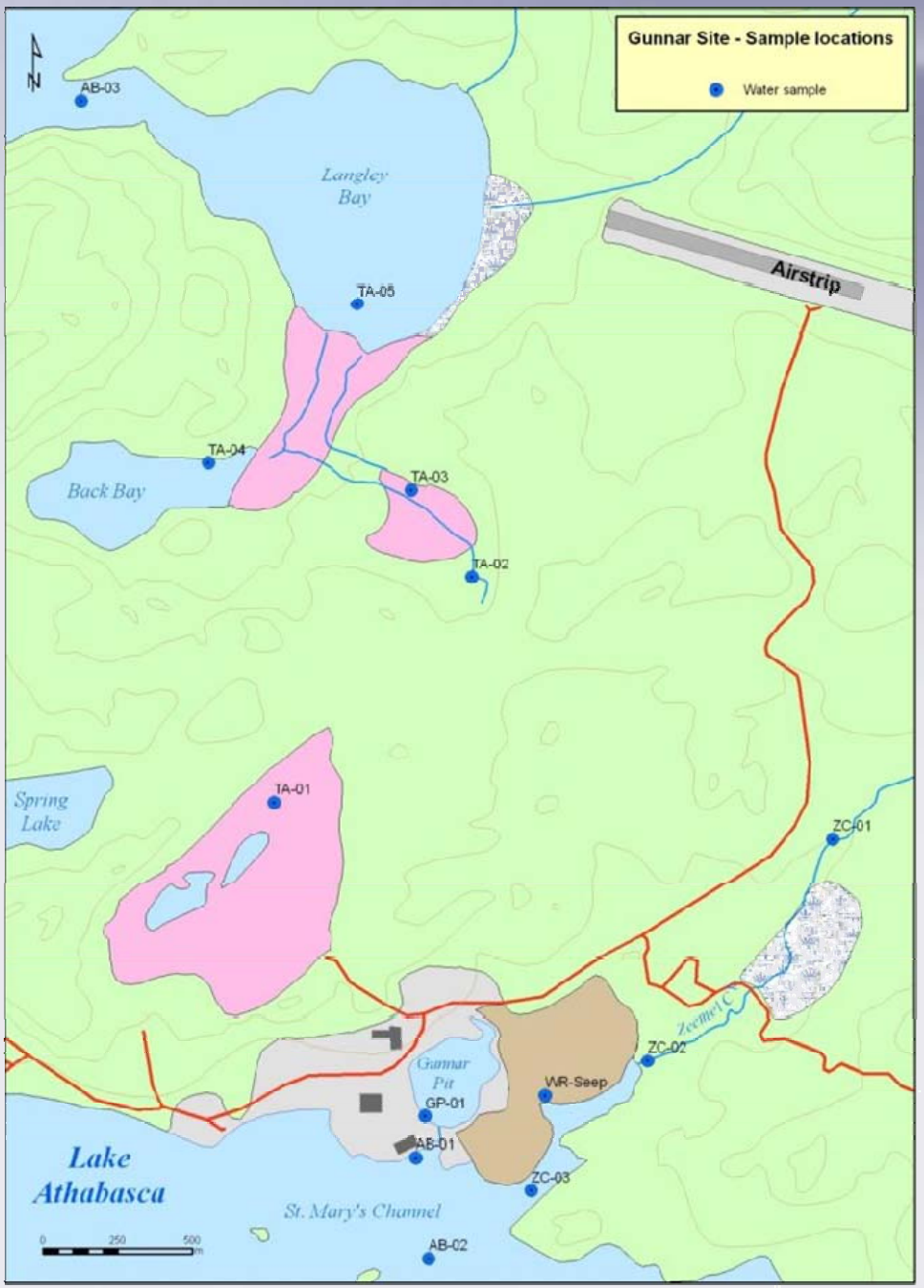
St. Mary's Channel Lake Athabasca AB-01



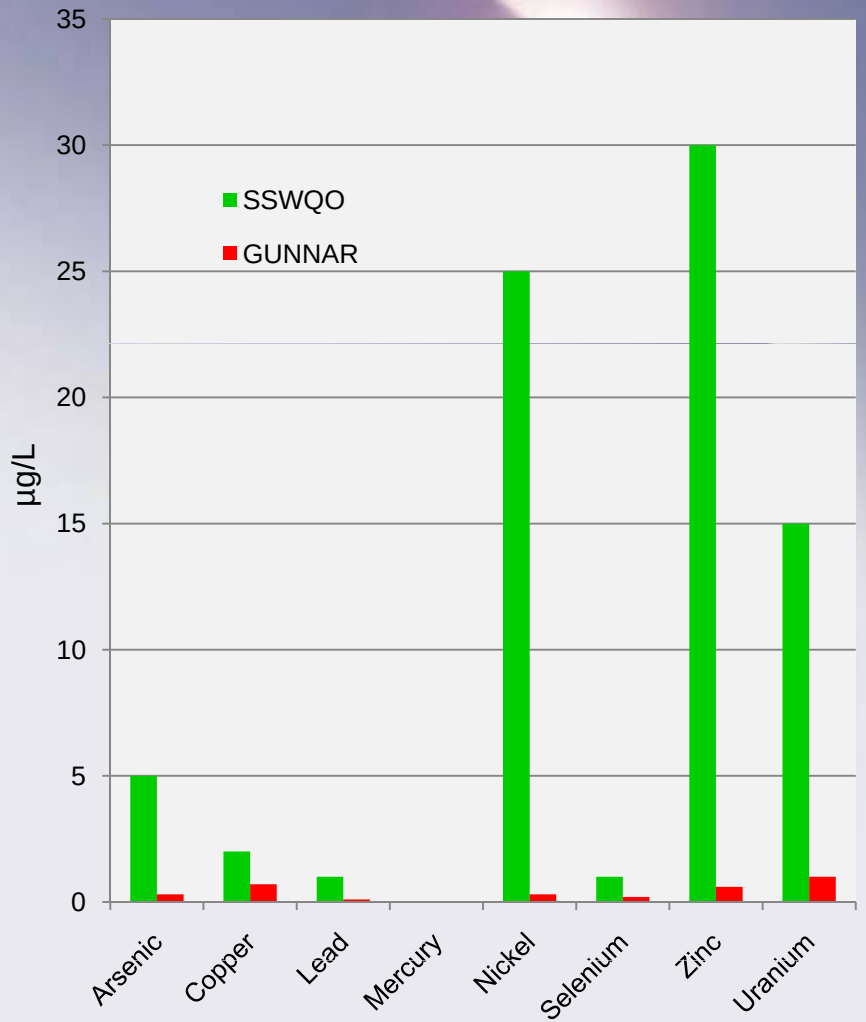
Gunnar
Main Tailings
TA-01





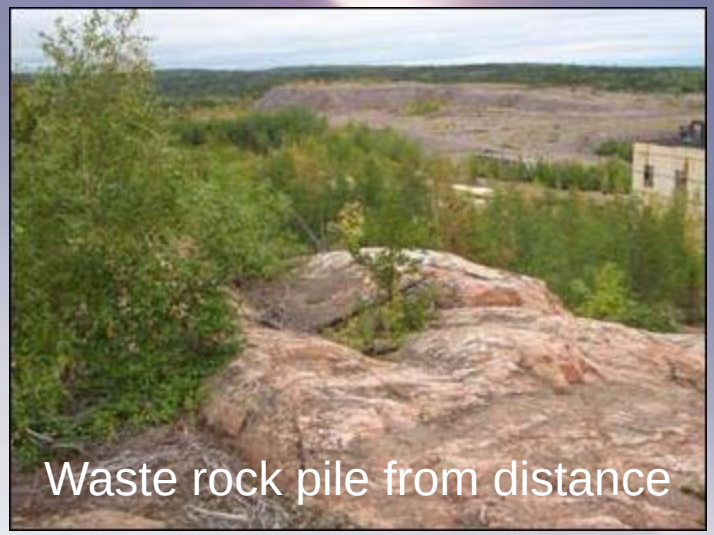


Langley Bay
Lake Athabasca
TA-05



Contaminant Pathway Studies

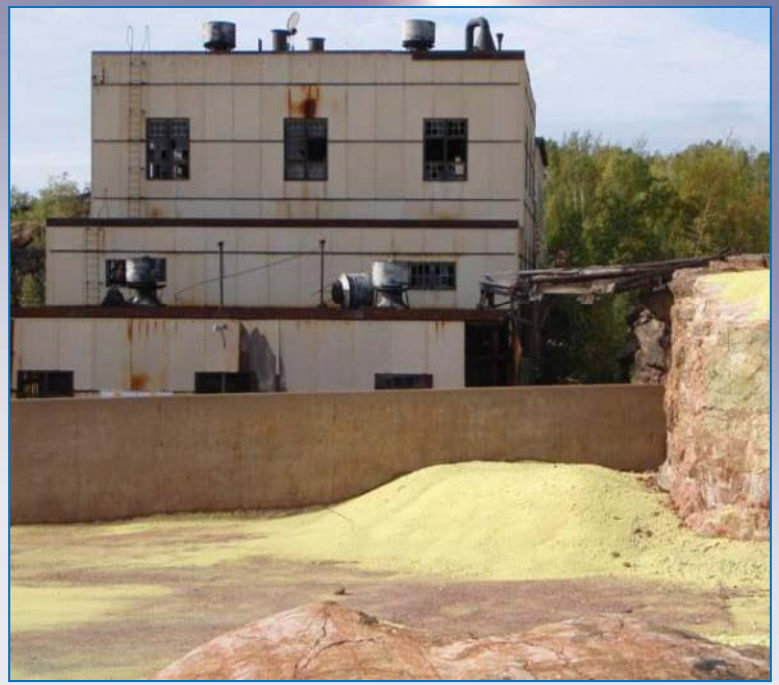
- **Risk-based decisions** for site remediation will be based on an appreciation of important –
  - *Sources of Contaminant Release to the Environment*
  - *Exposure Pathways Once Released*
  - *Parts of the Biosphere, Including Humans, That Might be Exposed*


Waste rock pile from distance


Gunnar Central

Major Sources to be Assessed

- Tailings (and contaminated water on and in tailings)
- Waste rock (including parts used in road beds and elsewhere)
- Water in Gunnar pit
- Secondary contaminants such as petroleum products released around mill site, or process chemicals



Risks to What?
(VECs listed in EIS Guideline)

- **Terrestrial Receptors:**
  - **Birds** – Mallard, Eagle, Merganser, Ptarmigan/Grouse, Scaup
  - **Terrestrial Mammals** – Bear, Woodland Caribou, Barren Ground Caribou, Snowshoe Hare, Moose, Wolf, Lynx
  - **Terrestrial Vegetation** – Blueberries, Labrador Tea, Lichen, Cranberries, Browse, Rosehips
  - **Humans**
- **Aquatic Receptors**
  - **Aquatic Vegetation** – Algae, Pond Lily, Pondweed
  - **Consumers of Primary Producers** – Zooplankton, Chironomids, Sphaerids
  - **Fish** – Northern Pike, Lake Whitefish, Lake Trout, White Sucker
  - **Aquatic Mammals** – Beaver, Muskrat, Otter, Mink

Four Generally Important Pathways:

1. **Direct radiation exposures** for humans, wildlife, or other living things near uranium mine wastes:

- *Gamma radiation levels:* a form of electromagnetic radiation produced by radioactive decay of uranium and 'daughter' radionuclides such as radium, thorium and polonium
- Extensive new survey data on site gamma levels

2. Airborne Exposures – Humans and Wildlife:

- Radon gas

- Inhaling dust that contains contaminated particles

3. Via Soils and Uptake into/onto Terrestrial Biota

Soils ⟶ *Plants*

Blue berries, labrador tea, rosehips, grasses, sedges, …

Soils ⟶ *Air* ⟶ *Plant and Lichen Surfaces*

Plants & Lichens ⟶ ***Herbivores***

Small mammals (mice, voles, …), hare, ptarmigan/grouse, caribou, moose, others

Herbivores → carnivores

Wolves, lynx, coyotes, raptors

Omnivores

for example, black bears

ALL VECs will be assessed, including humans

New (2009) field data will help us refine our estimates of contaminant transfer factors between the environment and living organisms.

4. Entry into Surface Water and Groundwater and then into Areas with Aquatic Life

- Fish (pike, whitefish, trout, other)
- Aquatic plants (macrophytes)
- Bottom-dwelling insect larvae and other animals

Other Baseline Studies

Heritage

- Compiled existing information from historic reports
- Conducted site visit in September 2009 to confirm extant historic structures and remains of historic buildings: mine site, former town site, fish plant

Other Baseline Studies

Vegetation, Soils and Wildlife

- Wildlife surveys to document how species (e.g., waterfowl, beaver, muskrat, moose) are using the area, and habitat assessments
- Air photos and 2009 field information are being used to prepare vegetation, soils and wildlife habitat maps
- Studies will be used to assist with rehabilitation options work:
  - Develop soil salvage recommendations
  - Assist in developing site-specific reclamation measures
  - Identify significant features (e.g., wetlands) that could be disturbed during reclamation activities

Traditional Knowledge and Traditional Land Use

Kuni Albert

Albert & Associates Ltd.

Traditional Knowledge

- Aboriginal people have lived and survived on the land for centuries.
- Through their accumulation of environmental, cultural and spiritual knowledge, they have developed rich and diverse cultures.

Traditional Knowledge

Traditional Knowledge is a cumulative body of knowledge, practice and belief, evolving by adaptive processes and handed down through generations by cultural transmission, about the relationship of living beings (including humans) with one another and with their environment (Berkes,1999).

Berkes, Fiknet. 1999. Sacred Ecology:
Traditional Ecological Knowledge and Resource Management. Taylor & Francis.

Traditional Knowledge

- Traditional Knowledge is inseparable from the people who hold it, the land they live on, and the relationship they have developed with the land, waters and all creatures found within these elements.

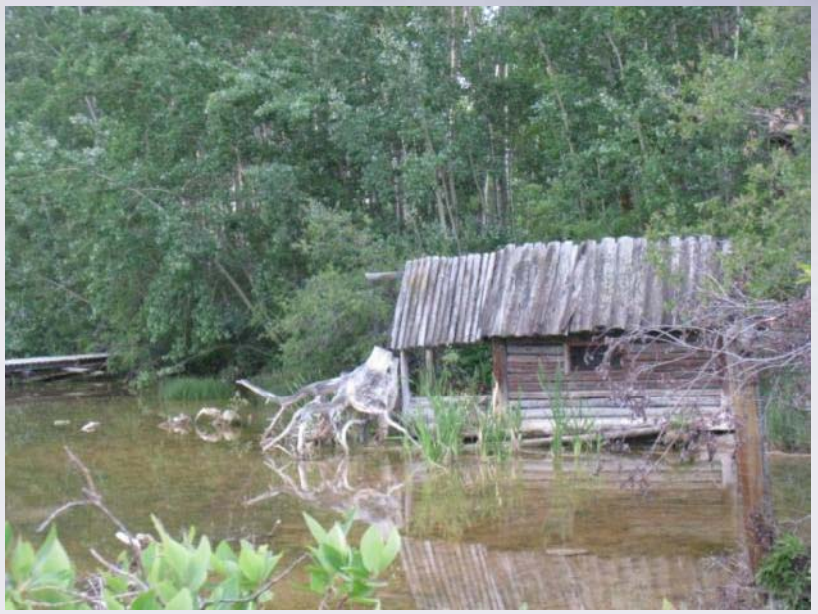
Traditional Land Use (TLU)

Is how people rely on the land for hunting, fishing, gathering edible and medicinal plants, trapping, and generally living and traveling in the bush.

Why Should TK/TLU be Documented?

- Intergenerational transfer of knowledge
- Preserve sites of cultural importance
- Create options for the future
- TLE Selection
- Environmental Impact Assessments
- Conservation and Land Use Planning

Access to Traditional Knowledge



- TK and TLU are important to shaping and refining the rehabilitation options of the Gunner Mine site.
- Some communities may not be willing to release TK/TLU unconditionally, therefore the highly sensitive information is protected by Intellectual Property Rights and Confidentiality Agreements.

TK/TLU Collection & Sharing

- Recognize the importance of protecting TK/TLU through Agreements.
- Confidentiality Agreements (CA) are to protect each participant interviewed and the researcher.
- If CA documents are available and shared by the community participating the researcher will abide by the procedures outlined within the documents.

TK and TLU: Relationship to Rehabilitation Options

EIS Guidelines requirements:

- EIS to include specific section on incorporation of TK
- Assessment of impacts is to include TK
- Elements of the engagement plan are to involve contribution of TK to the development of the rehabilitation plan and the identification of Valued Ecosystem Components (VECs) and any current and traditional uses of the Gunnar site and area

Methodology

- Research Method: Interviews/Workshops.
- Interviews will be conducted according to the community's protocols and procedures with recommended participants.
- During interview sessions:
  - Conducted in English and Traditional Language
  - Map showing the Gunner Mine site (LSA) and surrounding areas (RSA)
  - Focus will be on the site and what existed prior to exploration and development
  - Using Ecosite phase indexes map the area with recommendations from the interview participant
  - List flora and fauna and traditional uses including corridors and migration routes (past and present)

Integration of Traditional Knowledge into Western Science

- The researcher will work with discipline leads to create a map and rehabilitation strategy that incorporates the collected TK and TLU data .
- List flora and fauna and traditional uses – focus on Valued Ecosystem Components.
- Share relevant information with EA team to assist in understanding baseline conditions and assessing potential effects / benefits.
- Final TK & TLU Report

Traditional Knowledge

“We were born there and raised there and we understand the area”

Stanly Sam
Nuu-Chan Elder
Ahousaht, BC

Community Involvement

- SRC wants to understand the concerns and ideas about the rehabilitation of the Gunnar mine site
  - First, we would like to meet with leadership to develop an approach to community engagement and TK engagement
  - Second, develop detailed community engagement plan and implement and adjust as needed

Community Involvement

Project Review Committee

Representation for each of the following communities:

- Uranium City
- Camsell Portage
- Fond du Lac
- Stony Rapids
- Black Lake
- Hatchet Lake
- Prince Albert Grand Council, Athabasca Vice Chief

Community Involvement

- We envision that input will be gathered through rehabilitation options workshops, meetings, and open houses
- To date a number of meetings have been held in Athabasca communities regarding the CLEANS program and SRC co-hosted an open house in early October specifically on the Gunnar site in Uranium City

Gunnar Proposed Activity

- 4th quarter 2009
  - Internal preliminary options review
  - Initiate a detailed engagement plan
- 1st quarter 2010
  - Options workshop 1
  - Traditional Knowledge (TK) Study
  - Public Meetings
  - Regulatory Engagement
  - Begin preparation of the EIS
- 2nd quarter 2010
  - Options workshop 2
  - Continued aboriginal, stakeholder and regulatory engagement
  - Continued TK study

Gunnar Proposed Activity

- 3rd quarter 2010
  - Collect additional data if needed
  - Continue aboriginal, stakeholder and regulatory engagement
- 4th quarter 2010
  - Peer review of draft EIS
  - Submit EIS to regulators December 2010
  - Await decision

Thank You…

Concept by a student from the school here in Fond du Lac

www.saskcleans.ca