Indian and Northern Affairs Canada | Affaires indiennes et du Nord Canada

Giant Mine Remediation Project Risk Management

National Executive Symposium

May 30, 2013

Canada

Presentation Outline

- Site History
- Site Overview
- Project Objectives
- Remediation Approach
- Project Timelines
- Project Risks
- Risk Management
- Next Steps

Indian and Northern Affairs Canada
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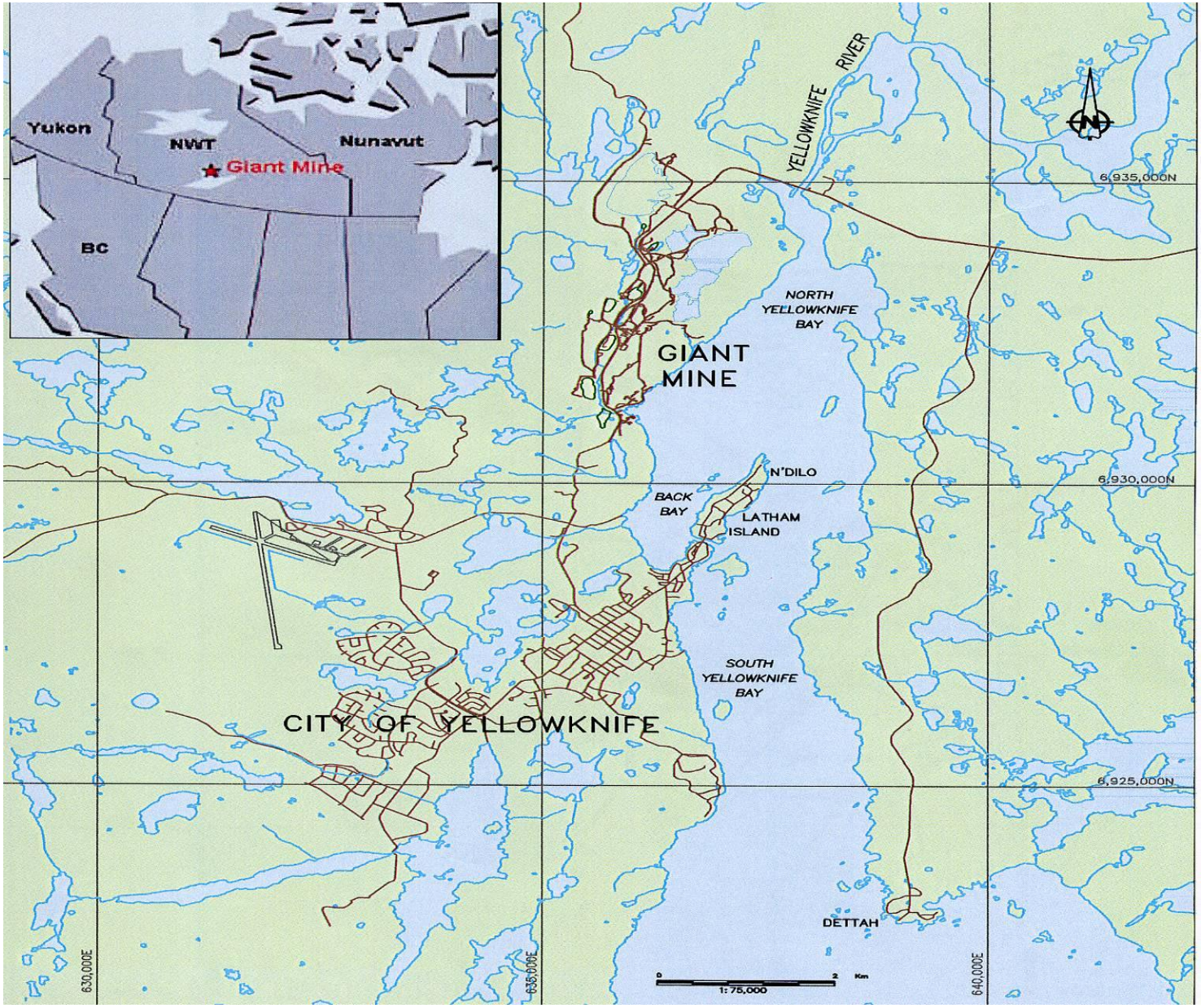
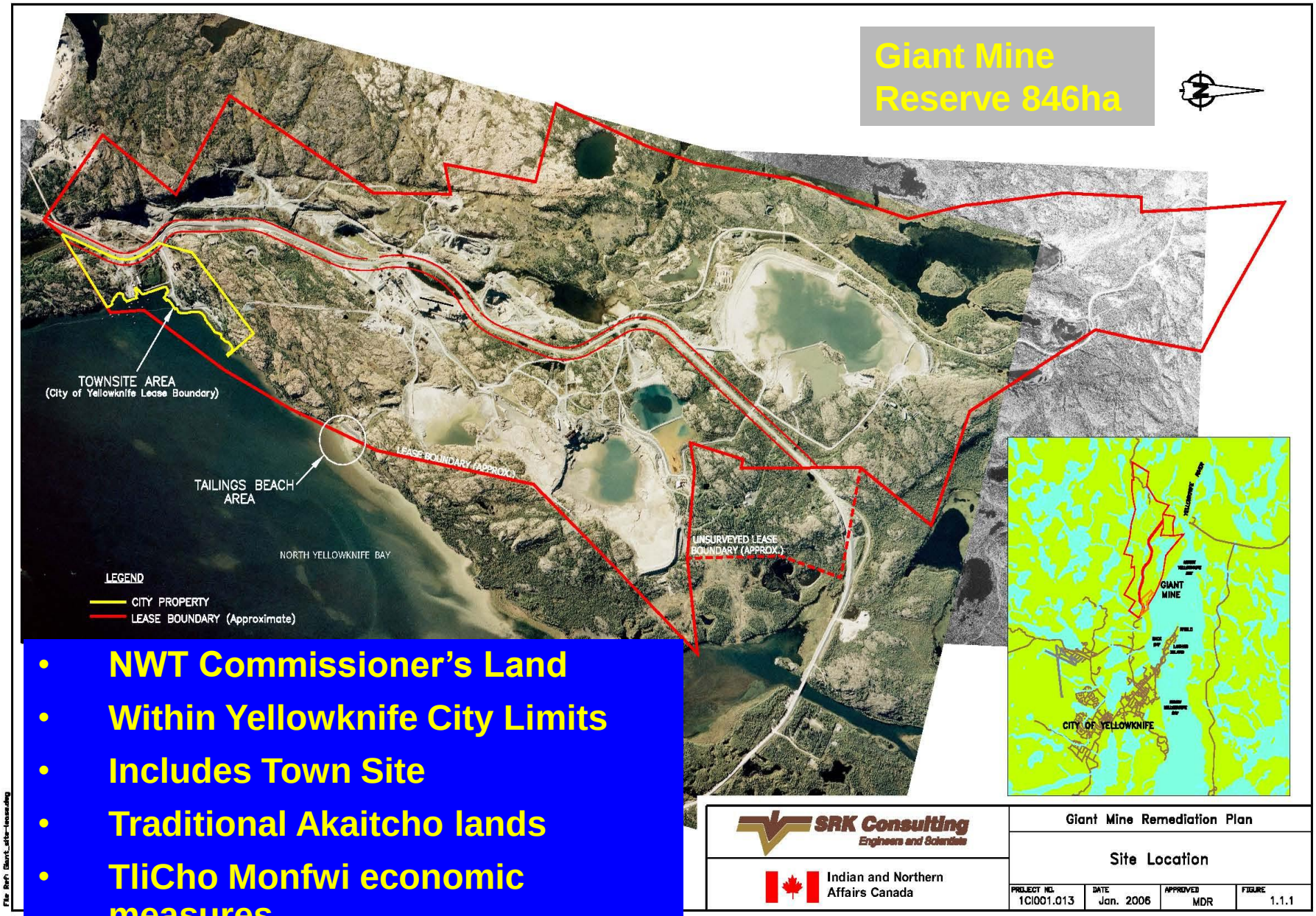


Canada

Site History

- Operated from 1948 through 2004
- In 1999 Royal Oak was assigned into Receivership
- Royal Oak Lease area is now under the care of Aboriginal Affairs and Northern Development Canada
- Site Characteristics:
  - Covers approximately 850 hectares;
  - Mining extracted over 7.6 million ounces of gold; and
  - Processing of gold ore by roasting resulted in the production of arsenic trioxide dust:
    - 237,000 tonnes stored underground; and
    - Various building and surface areas around the property are also contaminated with arsenic and asbestos.



- NWT Commissioner's Land
- Within Yellowknife City Limits
- Includes Town Site
- Traditional Akaitcho lands
- TliCho Monfwi economic measures

Canada

Giant Mine – Site Overview

Remediation Project Objectives

- **Minimize public and worker health and safety risks**
- **Implement an approach that is cost effective and robust over the long-term**
- **Minimize the release of contaminants from the site to the surrounding environment**
- **Remediate the site in a manner that instills public confidence**

Overview of Remediation Approach

Focus Area	Approach
Arsenic Trioxide Dust	Freeze the arsenic and the rock around each of the 15 underground chambers
Underground Stability	Support and stabilize the bulkheads, concrete plugs and other areas of the mine
Baker Creek	Reduce the risk of the mine flooding – diversion or control mechanisms (i.e., dam, channels)
Open Pits & Waste Rock	Backfill or surround pits by berms or fences to prevent access
Contaminated Soils	Soils and mine rock will be excavated and disposed or moved to tailings or sludge impoundments
Tailings and Sludge	Areas to be covered with two layers, graded with ditches and spillways – allowing for re-vegetation
Buildings and Waste Disposal	Over 100 buildings will be removed – arsenic and asbestos contaminated materials will be placed underground
Water Management	A new water treatment plant will be constructed to collect and treat contaminated surface and mine water

Project Timeline

Phase 1 – Project Assessment (1999 – 2006)

- **Site Assessment, Care and Maintenance**

Phase 2 – Project Definition (2006 – 2017)

- **Environmental Assessment – Remediation Plan Finalization**
- **Site Stabilization Plan - Advanced Remediation of High Risks**
- **Engineering Designs, Water Licence**

Phase 3 – Project Implementation (2017 - 2025)

- **Full Site Remediation**
- **Close-Out**

Phase 4 – Monitoring and Maintenance (2025 onward)

- **Post Remediation Adaptation**

Managing Risk

Objectives:

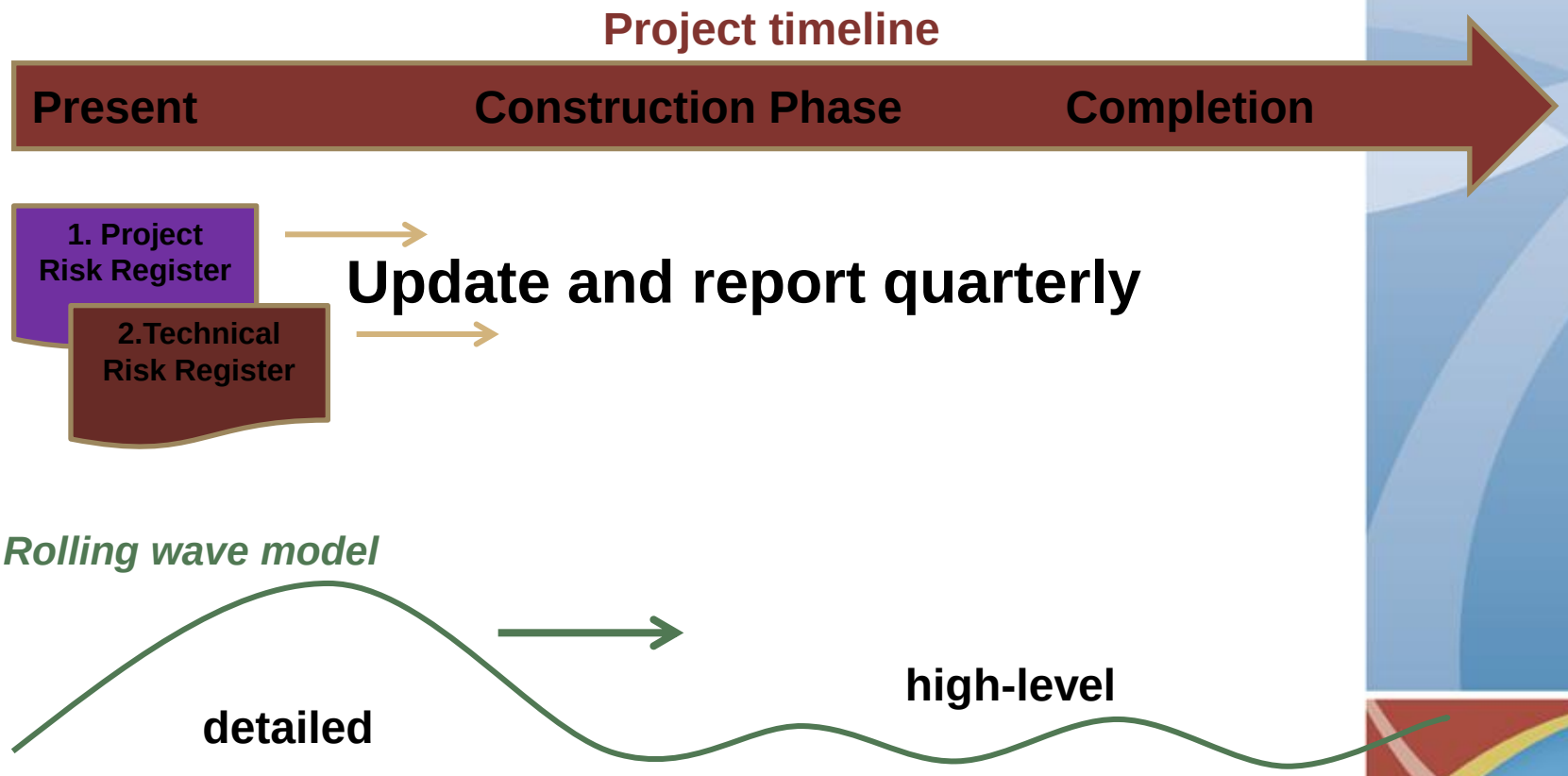
- To provide:
  - A consistent methodology for developing an inventory and evaluating the many different types of risk at contaminated sites;
  - A process to ensure that no high risk items “fall through the cracks”; and
  - A basis for prioritizing risk mitigation or control activities.

Giant Mine Remediation Project Risk Framework

1. **Project Risks** – Project management risks, planning and implementation risks, and financial, human resources, and stakeholder engagement risks. This includes near term and long term strategic risks.

2. **Technical Risks** – Risks associated with care and maintenance activities, legacy infrastructure, new infrastructure, and operations.

GMRP Risk Framework



Project Risks

- **Procurement** – appropriate processes and strategies to deliver the project and socio economic benefits
- **Human Resources** – acquiring and maintaining the necessary skills, experience and expertise
- **Governance** – complexity of operating within federal bureaucracy, developing appropriate decision making structure for complex / mega project
- **Planning and Controls** – ensuring processes in place to manage effectively scope, schedule and budget

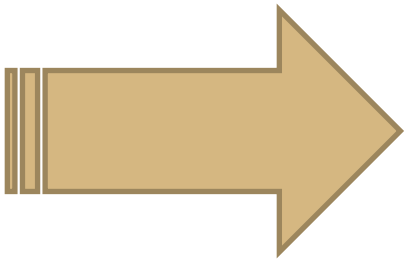
Project Risks

- **Community Engagement** – obtaining community trust and support
- **Duty to Consult** – fulfilling legal obligations under Section 35 of the constitution
- **Regulatory** – managing timelines and the complexity associated with delivering the project while obtaining approvals (including completing the environmental assessment)
- **Funding** – securing short, medium and long-term funding required to manage the project

Technical Risks

- This will evolve into risks related to remediation activities and associated remediation infrastructure
- Currently technical risks are focused on Care and Maintenance activities

A. Dams
B. Diversions
C. Tailings and sediments
D. Open Pits
E. Underground
F. Waste Rock Dumps
G. Water treatment
H. Infrastructure
I. Buildings, tanks, structures



A. Baker Creek
B. Tailings and sediments
C. Open Pits
D. Underground
E. Water treatment Plant
F. Freeze Plant
G. Chambers
H. …

Technical Risks

ELEMENT	SUB ELEMENTS	TYPES OF RISK EVENTS
1. Dams	multiple dams	breach, seepage, releases
2. Diversions	creek diversions, rock cuts	runoff, freezing
3. Tailings and sediments	ponds, piles, beaches	public access and safety, dusting
4. Open pits	multiple pits	public /worker access and safety
5. Underground	bulkheads, pillars, shafts	bulkhead failure, arsenic release
6. Waste rock	rock piles, debris	public access and safety
7. Water treatment	Treatment plants, feed lines	operational / mechanical failure
8. Infrastructure (roads, landfills)	Culverts, boneyards, power systems, dumps, etc.	public access, vandalism, safety
9. Buildings, tanks and structures	Boiler and roaster complexes, tanks, mills, etc.	fire, spills, public access, asbestos

Managing Risk - Project-Level Risk

Risk Matrix:

- Consider an Event
  - Example: public access to open pits leads to a fatality
- Risk = consequence severity times likelihood

Likelihood	Consequence Severity				
	Low	Minor	Moderate	Major	Critical
Almost Certain	Moderate	Moderately High	High	Very High	Very High
Likely	Moderate	Moderate	Moderately High	High	Very High
Possible	Low	Moderate	Moderately High	High	High
Unlikely	Low	Low	Moderate	Moderately High	Moderately High
Very Unlikely	Low	Low	Low	Moderate	Moderately High

Managing Risk - Project-Level Risk

Tolerance:

Likelihood	Consequence Severity				
	Low	Minor	Moderate	Major	Critical
Almost Certain	Moderate	Moderately High	High	Very High	Very High
Likely	Moderate	Moderate	Moderately High	High	Very High
Possible	Low	Moderate	Moderately High	High	High
Unlikely	Low	Low	Moderate	Moderately High	Moderately High
Very Unlikely	Low	Low	Low	Moderate	Moderately High

Intolerable Region

ALARP Region

Broadly Acceptable Region

Managing Risk - Project-Level Risk

Action Limits:

- Intolerable Region
  - Very High - priority to mitigate immediately
  - High - priority to mitigate within 2 years
- ALARP (As Low As Reasonably Practicable) Region
  - Moderately High Risk - mitigate within 2 years subject to priority
  - Moderate Risk - mitigate within 5 years subject to priority
- Broadly Acceptable Region
  - Low Risk - Monitor over 10 years

Managing On-Site Risks

- Every year the Giant Mine Remediation Project Team reviews the risk register to review the status of risks and the mitigation measures completed over the year. These meetings are attended by:
  - Program staff responsible for the day to day management of the Giant Mine Site remediation project;
  - Government experts on contaminated sites remediation;
  - Expert advisors contracted to provide ongoing advice to the Remediation Team and address specific risks at the Giant Mine site (eg. Design Team, Technical Advisors).

Updating the Risk Registry

- **Annual risk registry update meetings follow a standardized format**

Discuss Risk Element

↳

Discuss Risk Events

↳

Modify risk ratings and mitigation

↳

Identify follow up and Action Plan

1. How has it changed?
2. Are existing mitigation measure adequate?
3. Are there implications to schedule?
4. Are there implications to budget?

Example: Dams

DAMS 3C & 3D

1.3.1 Seepage from sump contained by Dam 3C leads to release of contaminated water to environment

2002

Consequence	Severity	Likelihood	Risk
Consequence costs	Low	Likely	Moderate
Environmental impact	Major	Likely	High
Human health & safety	Low	Likely	Moderate
Legal obligation	Moderate	Likely	Moderately High
Special consideration	Moderate	Likely	Moderately High

2011

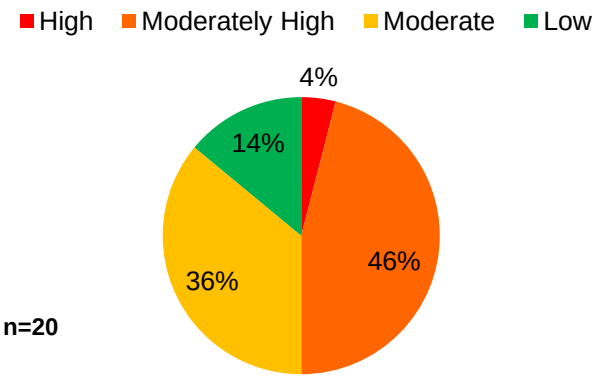
Consequence	Severity	Likelihood	Risk
Consequence costs	Low	Unlikely	Low
Environmental impact	Minor	Unlikely	Low
Human health & safety	Low	Unlikely	Low
Legal obligation	Moderate	Unlikely	Moderate
Special consideration	Minor	Unlikely	Low

Mitigation:

- **Since 2002 - maintained low water levels in sump**
- **May 2007 - Implementation of OMS manual**
- **Dec 2010 – Increased surface water management reporting requirements**

Comparison of the Dam Element Between 2002 and 2011

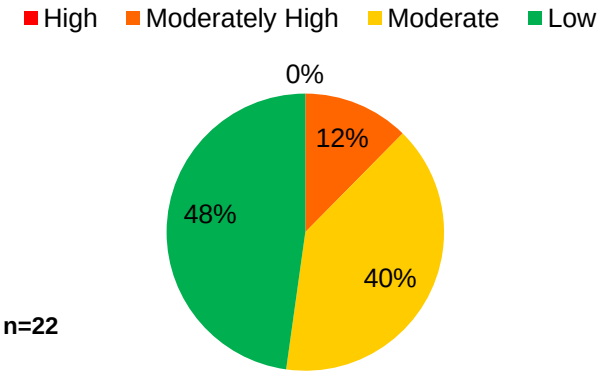
Dams 2002



Events: n=20

Consequences:

Dams 2011

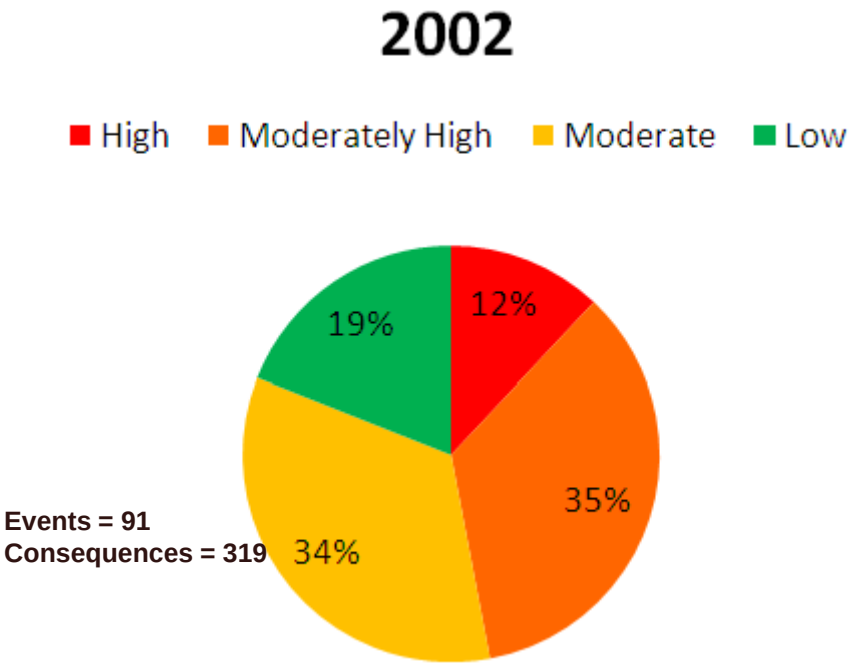


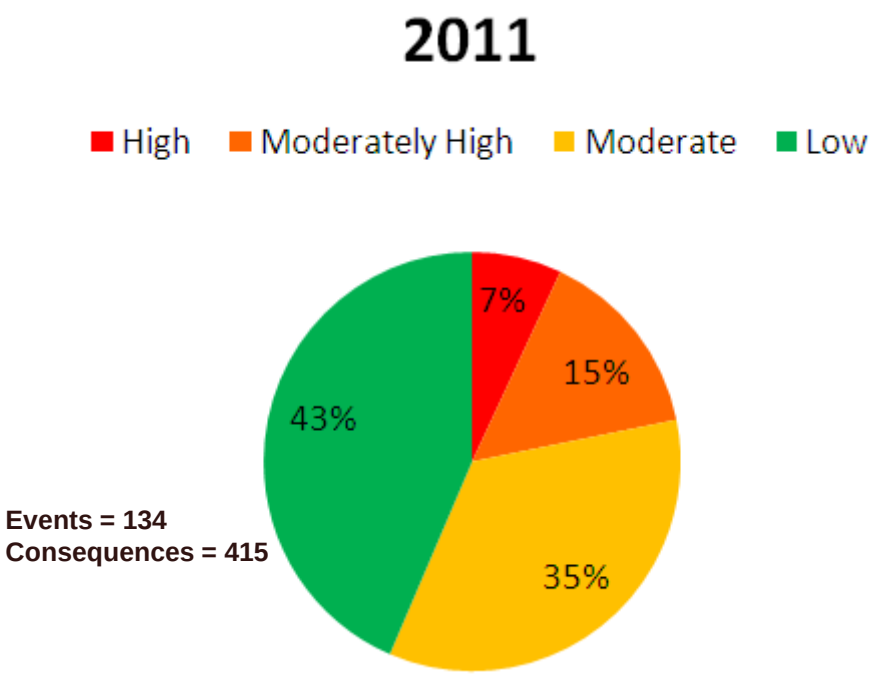
Events: n=22

Consequences: n=113

- **The number of events and related consequences has increased over time.**
- **Regular updates of the risk register have allowed AANDC to systematically monitor the status of risks and the effectiveness of mitigation measures.**

Comparing the Overall Level of Risk Between 2002 and 2011





- **Despite an increase in the number of events and consequences at the Giant Mine Site, AANDC has been able to effectively reduce or minimize the level of risk at the site**

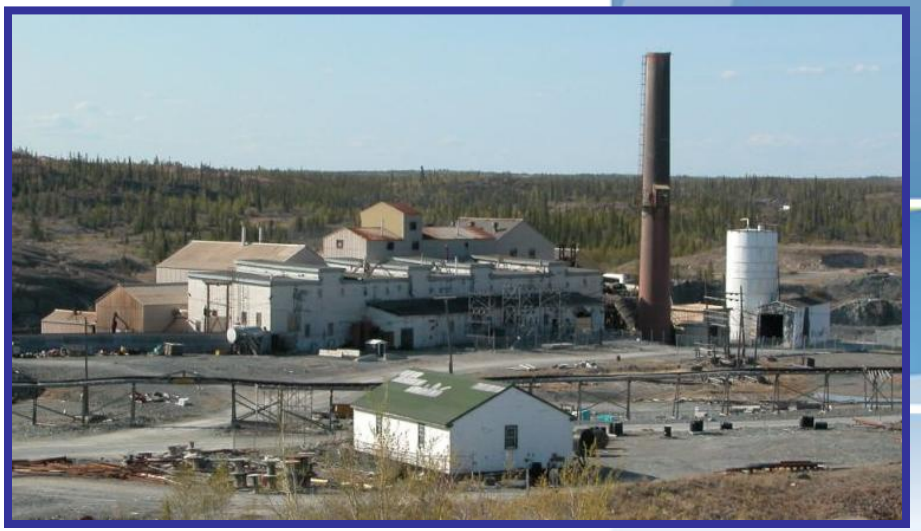
Current Project Status

AANDC is committed to risk management of the site and continual improvement of our risk management practices

Currently in process of addressing urgent on-site risks in order to protect human health and safety as well as the environment

Advanced Remediation of High Risks (2012 to 2016)

- Roaster Complex Deconstruction, Underground Stabilization

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