



# Case Study: Kemess South Mine Reclamation and Closure (Development of a Risk-Based Remediation Plan)

NORTHERN LATITUDES MINE RECLAMATION WORKSHOP

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Presented by:

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**Project Manager**

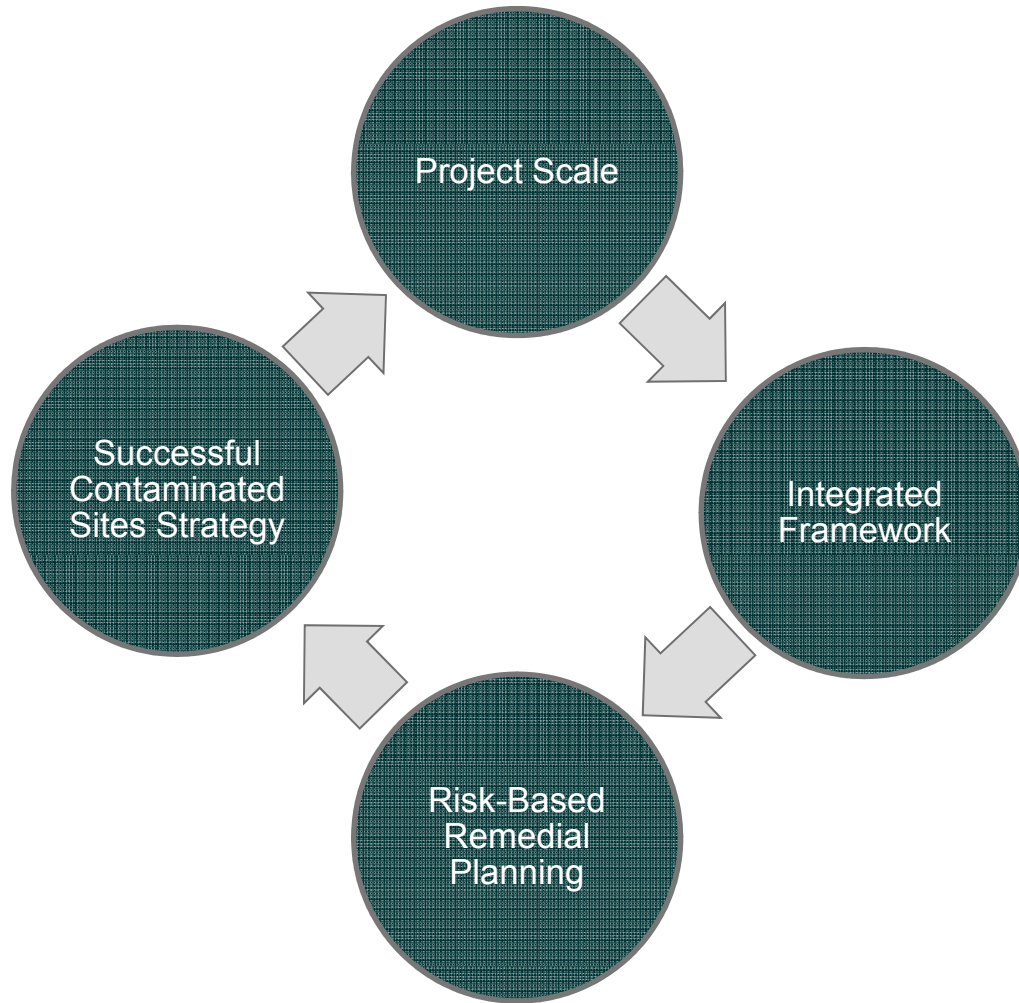


# Agenda

1. Project Overview and Site Description
2. Site Screening and Investigation Process
3. Risk Assessment and Remedial Action Plan
4. Outcomes and Project Summary



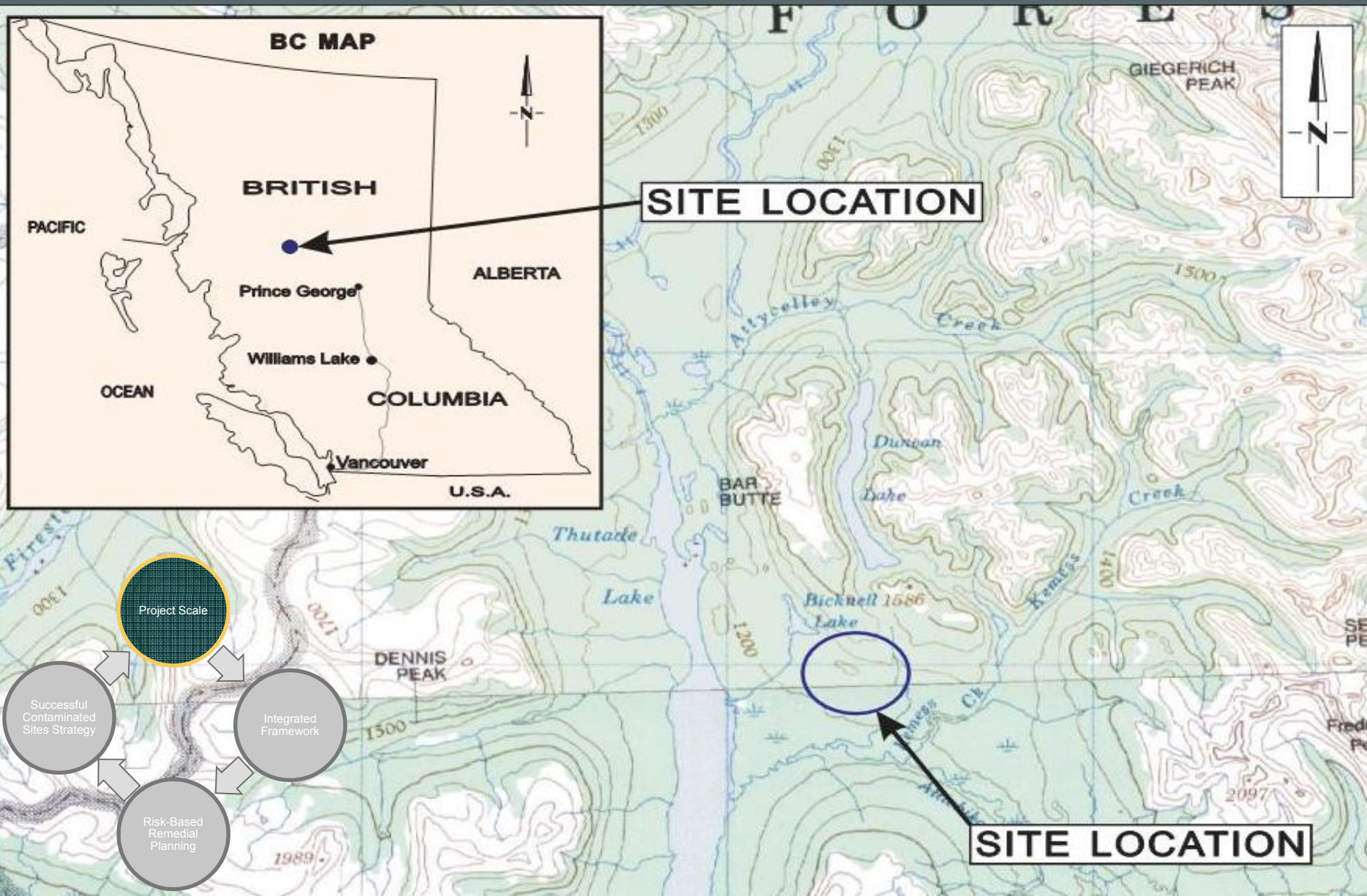
# Case Study – Essential Components



- **Project Scale**
  - Both the site itself and our overall scope
- **Integrated Framework**
  - Complex regulatory requirements and multi-phase approach
- **Risk-Based Remedial Plan**
  - Focused, site-specific
- **Successful Site Closure Strategy**



# Site Location – near Mackenzie, BC



# Site Setting – Core and Non-Core



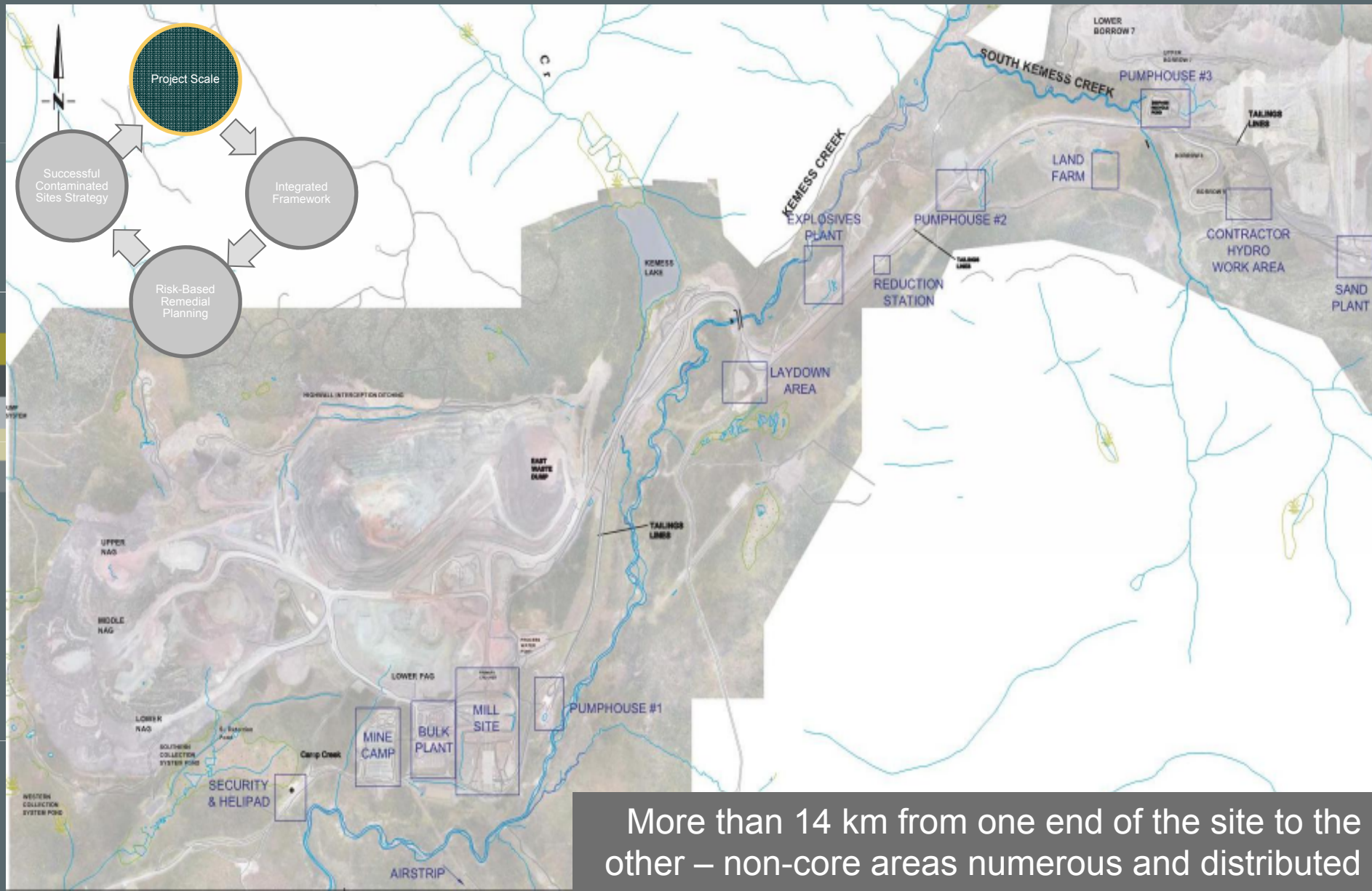
Project Scale

Successful Contaminated Sites Strategy

Integrated Framework

Risk-Based Remedial Planning

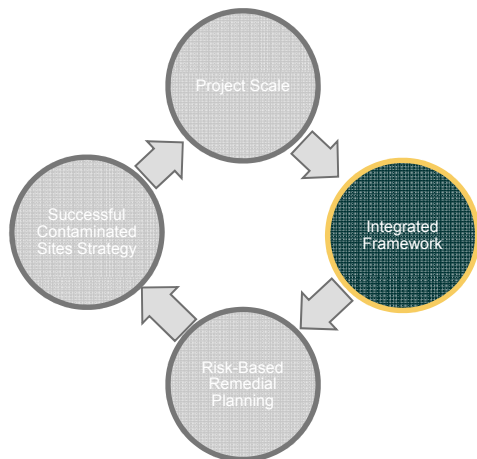
# Site Layout – Non-Core Areas



More than 14 km from one end of the site to the other – non-core areas numerous and distributed

# The Mine Site – Regulatory Drivers

- BC Requirements – Mine Sites
  - Past - Ministry of Energy, Mines, and Petroleum Resources (MEMPR)
  - Now – MEMPR Environmental Management Act – Ministry of Environment (MOE) and MEMPR
  - Complete closure plan – core **AND** non-core areas

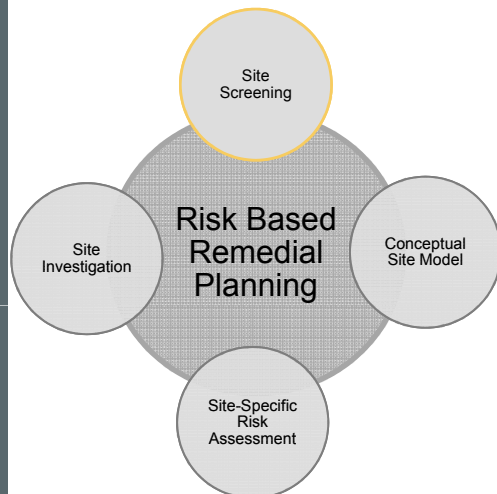


# Remedial Plan – Risk-Based Approach



# Site Screening

- Identify areas of environmental concern and associated contaminants of concern – screen all possible sources



# Jet Fuel Storage



Site  
Screening

Site  
Investigation

Risk Based  
Remedial  
Planning

Conceptual  
Site Model

Site-Specific  
Risk  
Assessment

# Warehouse Laydown and Storage Area



Site  
Screening

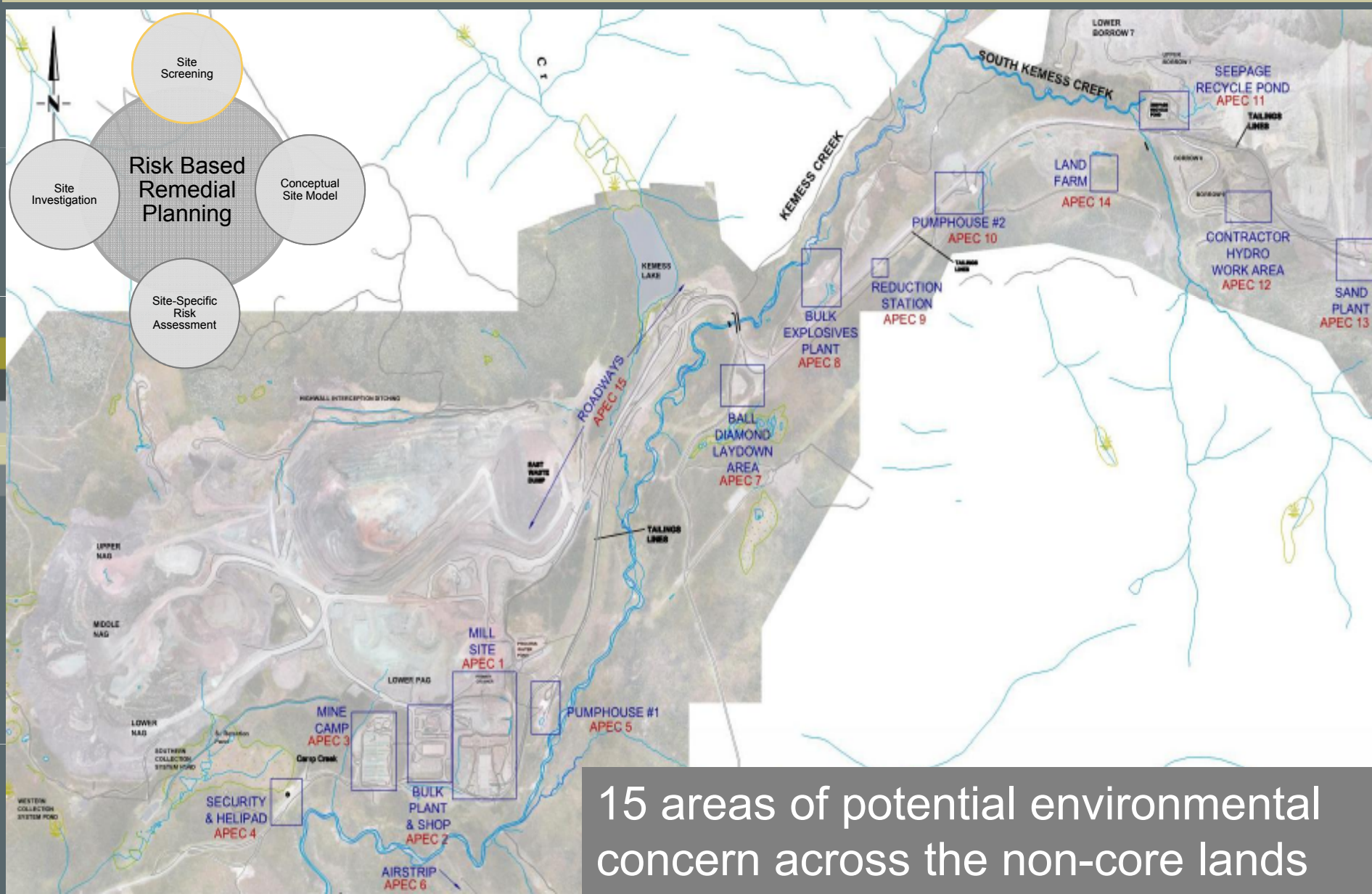
Site  
Investigation

Risk Based  
Remedial  
Planning

Conceptual  
Site Model

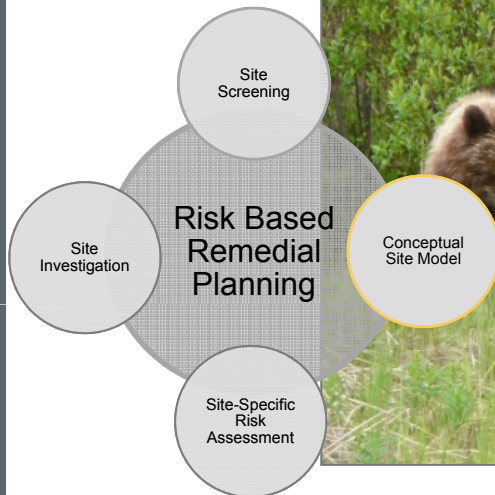
Site-Specific  
Risk  
Assessment

# Potential Source Areas



# Conceptual Site Model

- Identify potential receptors and exposure pathways—focus the investigation program



# Aquatic Receiving Environment

**Kemess Creek adjacent to pumphouse**

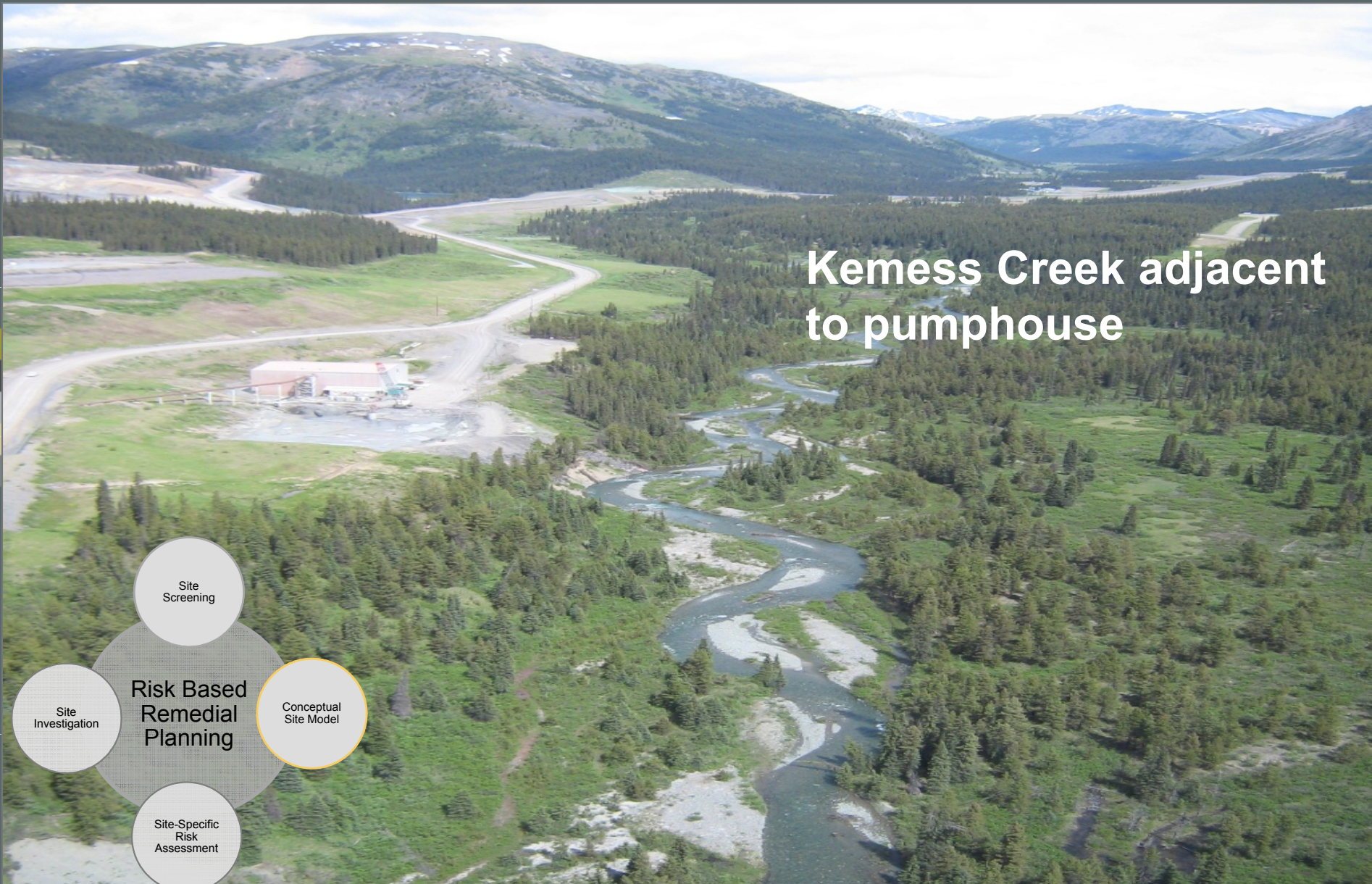
Site  
Screening

Site  
Investigation

**Risk Based  
Remedial  
Planning**

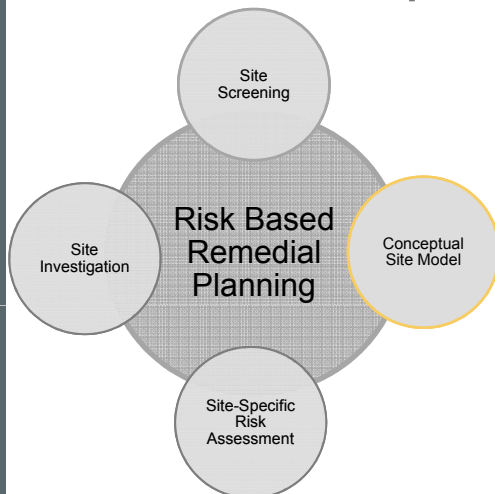
Conceptual  
Site Model

Site-Specific  
Risk  
Assessment

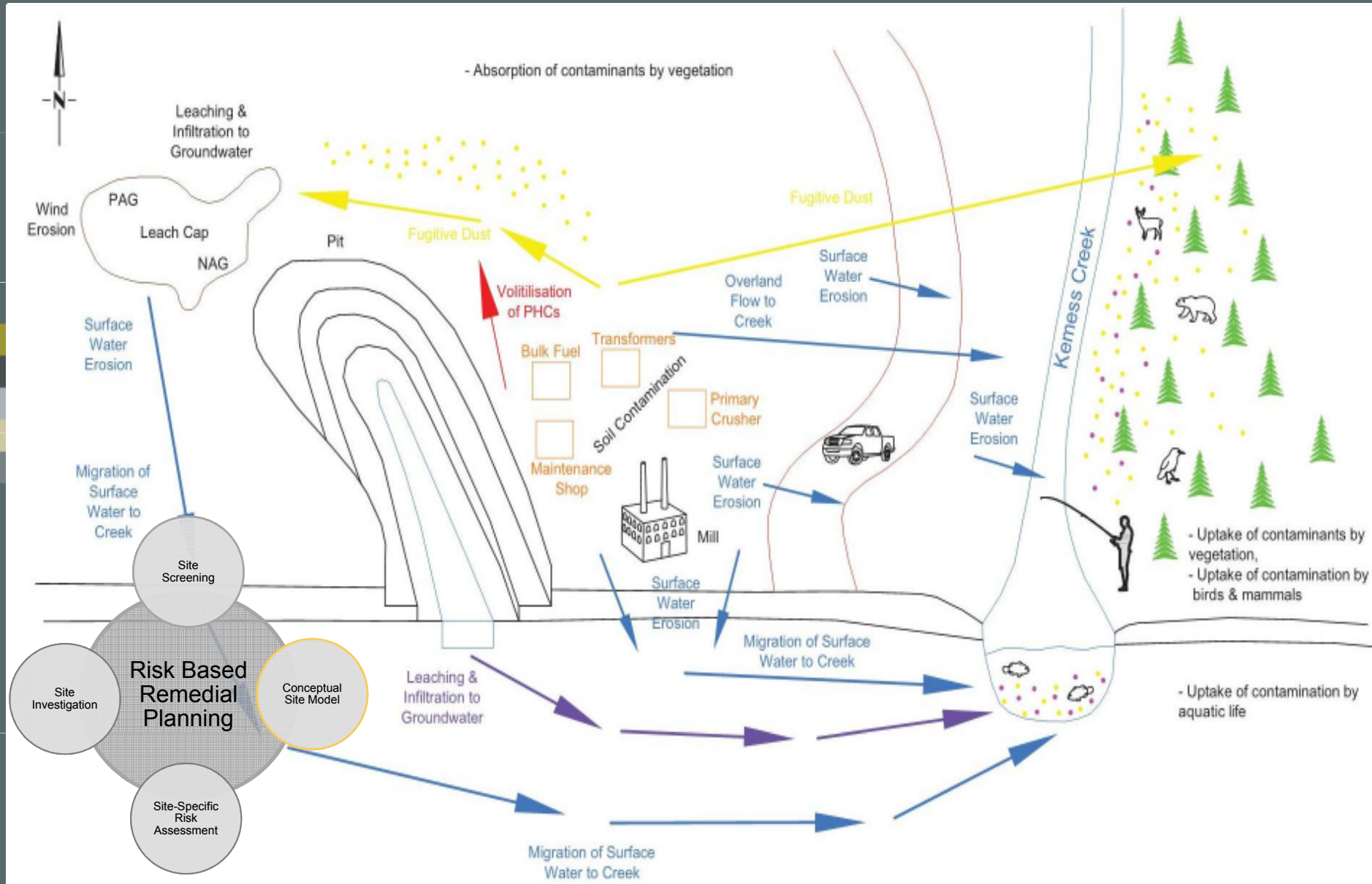


# Source, Pathways & Receptors

- Integrate potential contaminant sources, pathways, and receptors
  - Sources from Site Screening
  - Release Mechanisms
  - Transport Pathways
  - Exposure Routes
  - Receptors

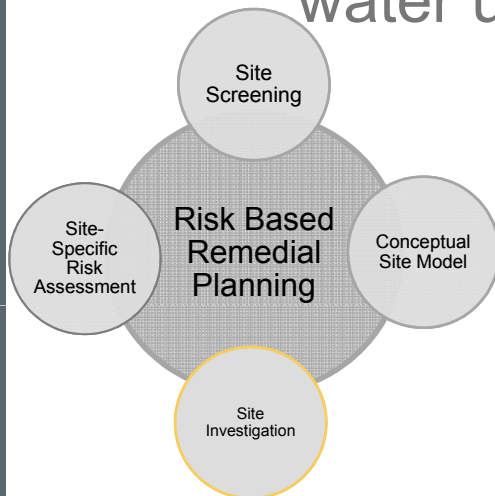


# Summary of Results



# Site Investigation Objectives

- Characterize potential sources and migration potential – key elements of Risk Assessment
- Three major sources and pathways:
  1. Surface soil – soil ingestion and eco
  2. Sub-soil – soil ingestion, eco, and shallow groundwater
  3. Deep groundwater – eco, aquatic, and drinking water users



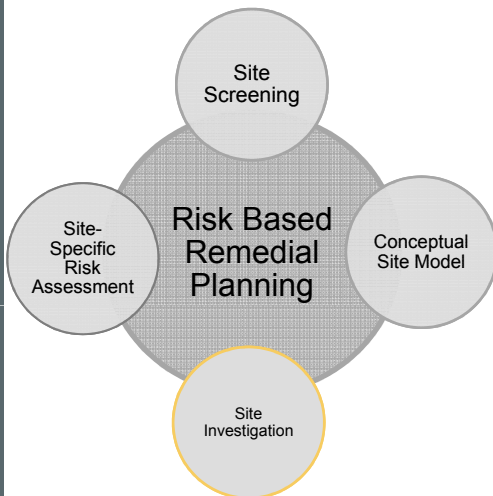
# Phase 1 - Surface Soil



# Phase 2 – Test Pits (Sub-Soil)

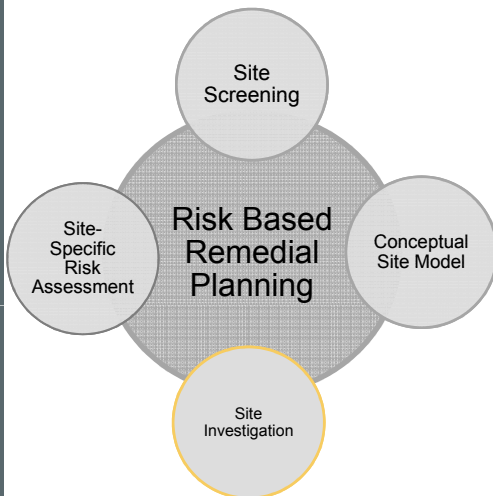


Note the staining in shallow soil



# Phase 3 - Groundwater

- Wells at worst-case locations – directly down-gradient of sources and/or adjacent to receptors
- Characterize flow, aquifer and identify contaminant migration potential



# Phase 3 - Groundwater



Site  
Screening

Site-  
Specific  
Risk  
Assessment

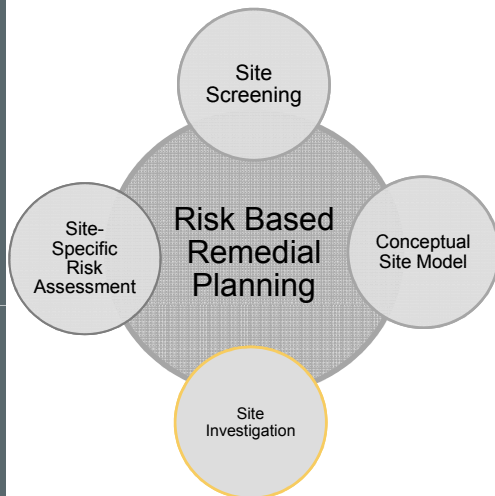
**Risk Based  
Remedial  
Planning**

Conceptual  
Site Model

Site  
Investigation

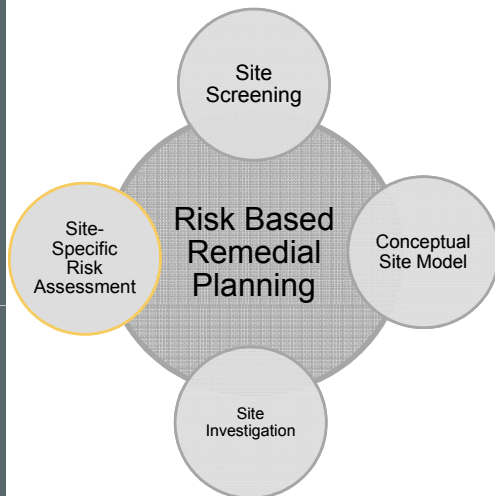
# Summary of Investigation Results

- 15 areas of potential environmental concern reduced to 10 actual areas of environmental concern
- Completed in short time (2 months)
- Limited resources required
- Met the objectives – data from targeted sources



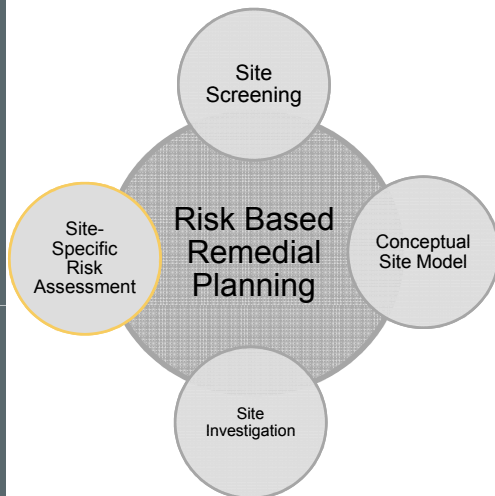
# Risk Assessment Strategy

- Identification of risk – incorporate Conceptual Site Model and investigation results
- Evaluate potential for adverse effects to human and ecological receptors – ten areas of concern
- Focus on future exposure during post-decommissioning activities



# Human Receptors

- Future human users of the site – main driver for Risk Assessment and Remedial Plan
  - Environmental sources - more sensitive receptors

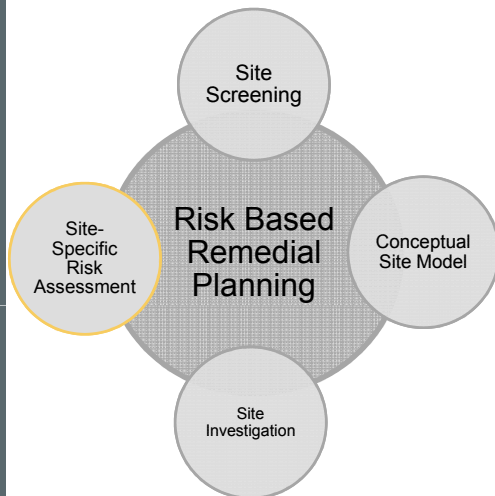


# Ecological Receptors

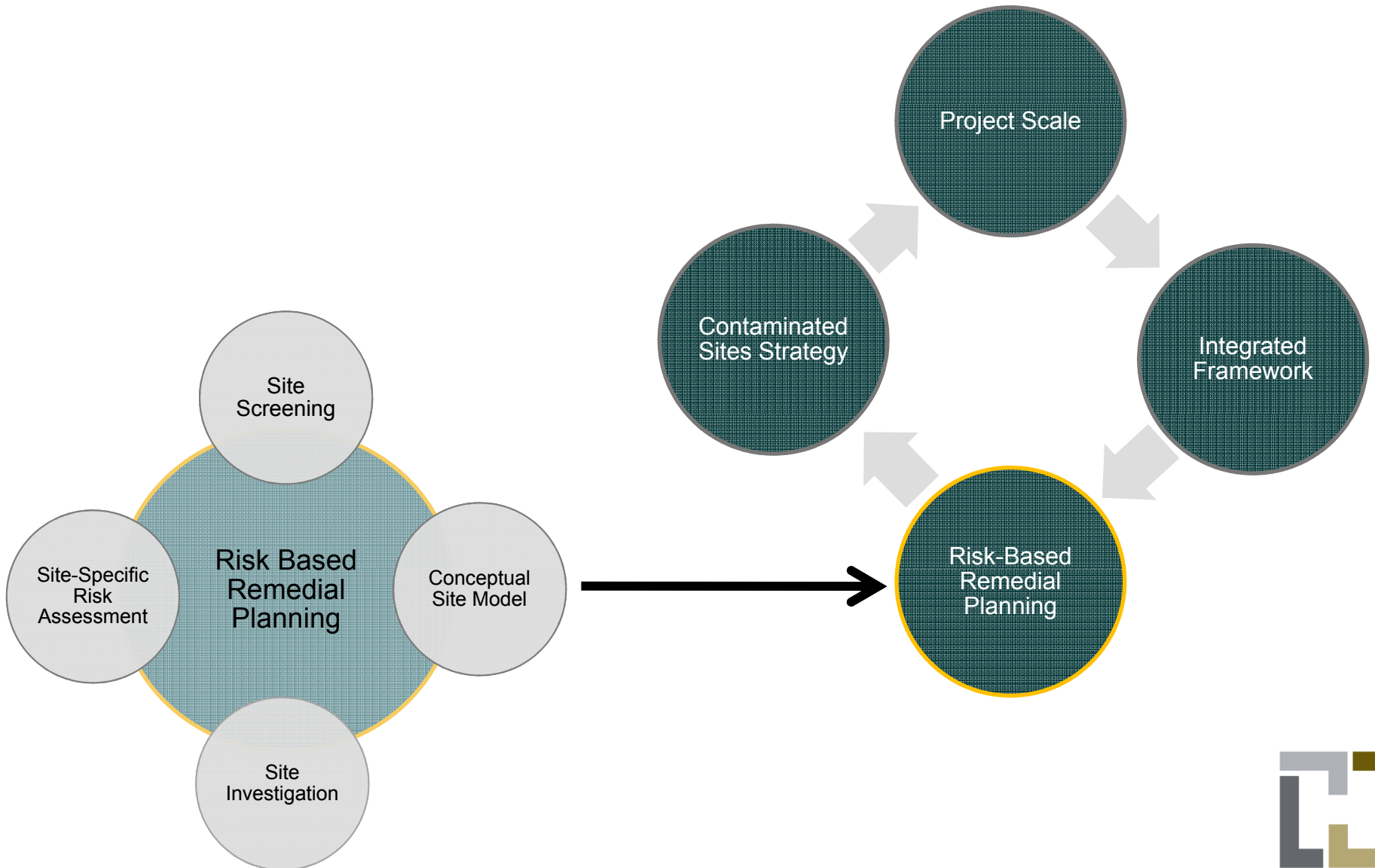


# Summary of Potential Risk

- Ten areas of environmental concern reduced to four with unacceptable risk
  - Unacceptable risk to ecological receptors in soil for metals; shallow impacts
  - Acceptable risk to human health
- Mine site contamination was not considered extensive

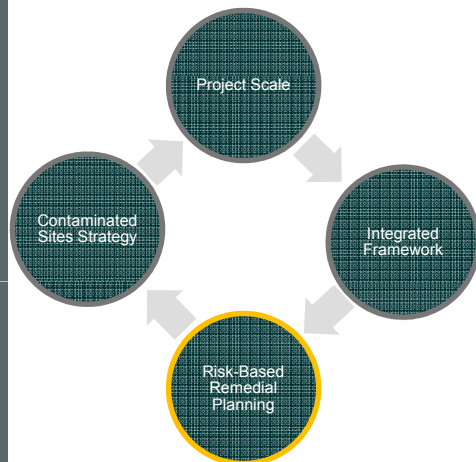


# Risk-Based Approach – Remedial Plan



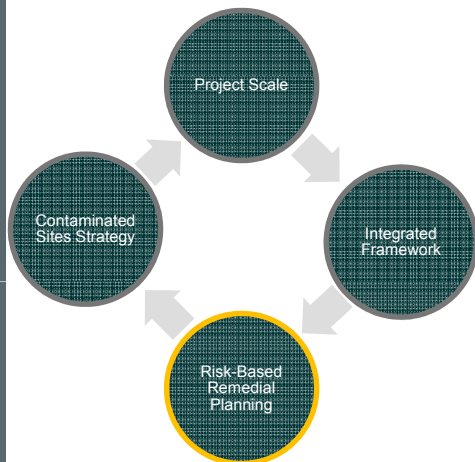
# Risk Based Remedial Plan

- Final step of the integrated strategy to address the non-core areas
- Targeted remedial strategies for each of the four areas of environmental concern with potential risk
- Based on future land use at the site



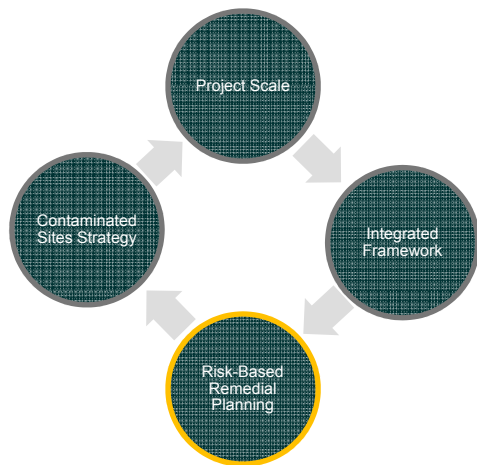
# Remediation Strategy

- Soil contamination – shallow excavations
  - onsite disposal
- Further investigation
  - Stained soil, surface impacts, inaccessible buildings



# Remediation Strategy

- Recommendations only at those areas with unacceptable risk to receptors
- Remediation methods tailored to site conditions and available resources
- Designed to meet MOE requirements for Non-Core areas



# Successes of Our Approach

- Short time frame
  - Site Screening to RAP in 8 months
- Reduced cost to complete entire program
  - Four major tasks – significantly less than full-scale remediation
- Site-specific remedial options
- Risk-based RAP successfully integrated into Mine Closure Plan for core and non-core areas
  - Innovative alternative to “traditional” reclamation

Successful  
Contaminated  
Sites Strategy



# Questions? Thank You!

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**Hemmera**

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