


WARDROP

Considerations for Environmental Permitting of Tailings Disposal in a Fish Bearing Lake

The Bucko Lake Experience

Doug Ramsey, M.Sc., R.P.Bio.
Wardrop Engineering Inc.
MEND Workshop
Winnipeg, June 5, 2008

People, Passion, Performance. Trusted Globally.




Why Tailings Disposal in a Lake?

- Sub-aqueous disposal of potentially acid generating tailings is a recognized best-management practice
- On-land disposal may be less suitable or impossible for engineering and/or environmental reasons
- Natural depressions provide potential for secure containment/minimize reliance on engineered structures
- Local topography may make use of a lake unavoidable – all the depressions may be full of water




But why a fish-bearing lake?

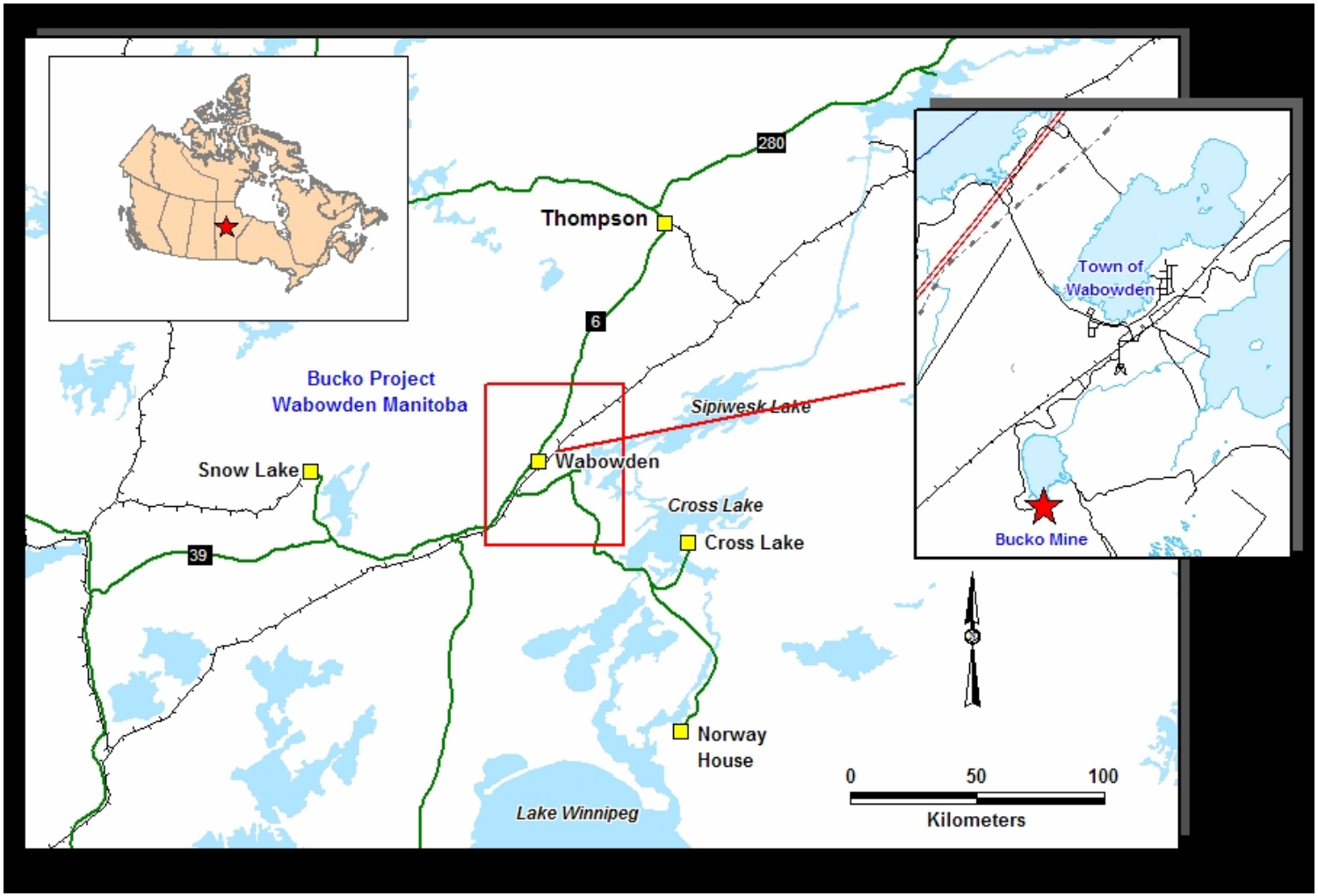
- Lakes with any capacity for tailings and without any fish are very difficult to find!




WARDROP

Bucko Lake Nickel Project

4 km from Wabowden on the South shore of Bucko Lake






Bucko Lake Nickel Project

Project Plan

- Underground nickel mine
- Mine at 1000 tonnes/day for 5 years
- 50% of tailings returned to mine as backfill
- 50% of tailings placed in Bucko Lake for long term secure disposal




WARDROP

Bucko Mine Tailings

Acid Generating

Parameter	Tailings sample	Duplicate
Paste pH	8.2	8.2
Carbon (Total %)	0.13	-
CO_2 (%)	0.32	-
$CaCO_3$ NP	7.3	-
S (Total, %)	1.45	-
S (SO_4, %)	0.08	-
S (S^{-2}, %)	1.37	-
AP	42.81	-
NP	38.5	38.4
Net NP	**-4.3**	-
Fizz Test	None	None

Sulphate-sulphur amalysed by sodium carbonate leach.

AP = Acid potential in tonnes $CaCO_3$ equivalent per 1000 tonnes of material. AP is determined from calculated sulphide sulphur content: S(total)-S(SO_4).

NP = Neutralization potential in tonnes $CaCO_3$ equivalent per 1000 tonnes of material.

NET NP = NP-AP

Carbonate NP is calculated from CO_2 originating from carbonates and is expressed in kg $CaCO_3$/tonne



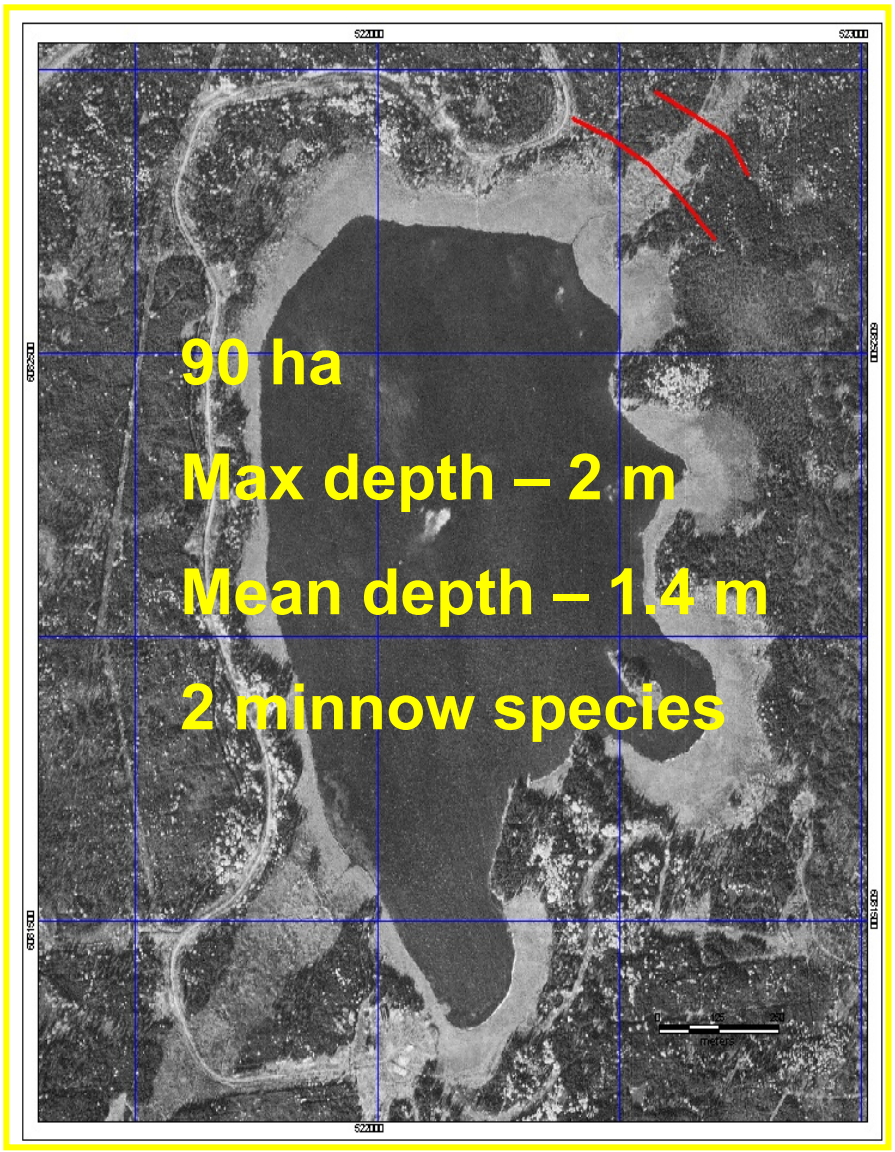

Bucko Mine Tailings

- But - low metal leaching potential if acid generation prevented
- Ideal candidate for lake-based disposal




WARDROP

Bucko Lake






The Regulatory Hoops

- Canada has about 55 operating metal mines (Stats Can 2005)
- Manitoba has about 100,000 lakes
- 7 lakes currently listed on Schedule 2 of MMER
- Approval for lake disposal of tailings is among the most involved of all environmental approvals




Key Regulatory Requirements

- Manitoba
  - Class 2 *Environment Act* Licence
- Canada
  - *Fisheries Act* - Section 36 – Metal Mining Effluent Regulations (MMER) – Order in Council (Cabinet) approval to amend Schedule 2 of the MMER
  - *Navigable Waters Protection Act* (NWPA) – Section 23 Exemption by Order in Council for Lake Infilling
  - NWPA – Section 5.1 Approval for Tailings Distribution System




Information Filing Requirements

- Manitoba Environment Act License Proposal
- Closure Plan
- CEAA – screening environmental assessment
- ***Robust Tailings Disposal Alternatives Analysis***
- ***Fish Habitat Compensation Plan***
- Engineered Risk Assessment for Containment/Control Structures
- NWPA Application




Consultation/Public Review Requirements

- *Constitution Act*, Section 35 Aboriginal Consultation (Canada and Manitoba)
- Public review of *Environment Act* License Proposal
- Public review of CEAA screening assessment
- Public review of MMER amendment (Canada Gazette I and II)
- Public review of draft *Environment Act* License




Tailings Disposal Alternatives Analysis

- Identify primary criteria for tailings disposal (e.g., acid generating tailings requiring secure permanent disposal)
- Examine all practical disposal alternatives
- Define the site specific design criteria for the alternatives and evaluate the potential to meet these criteria
- Objectively evaluate and compare the alternatives, with emphasis on their environmental attributes

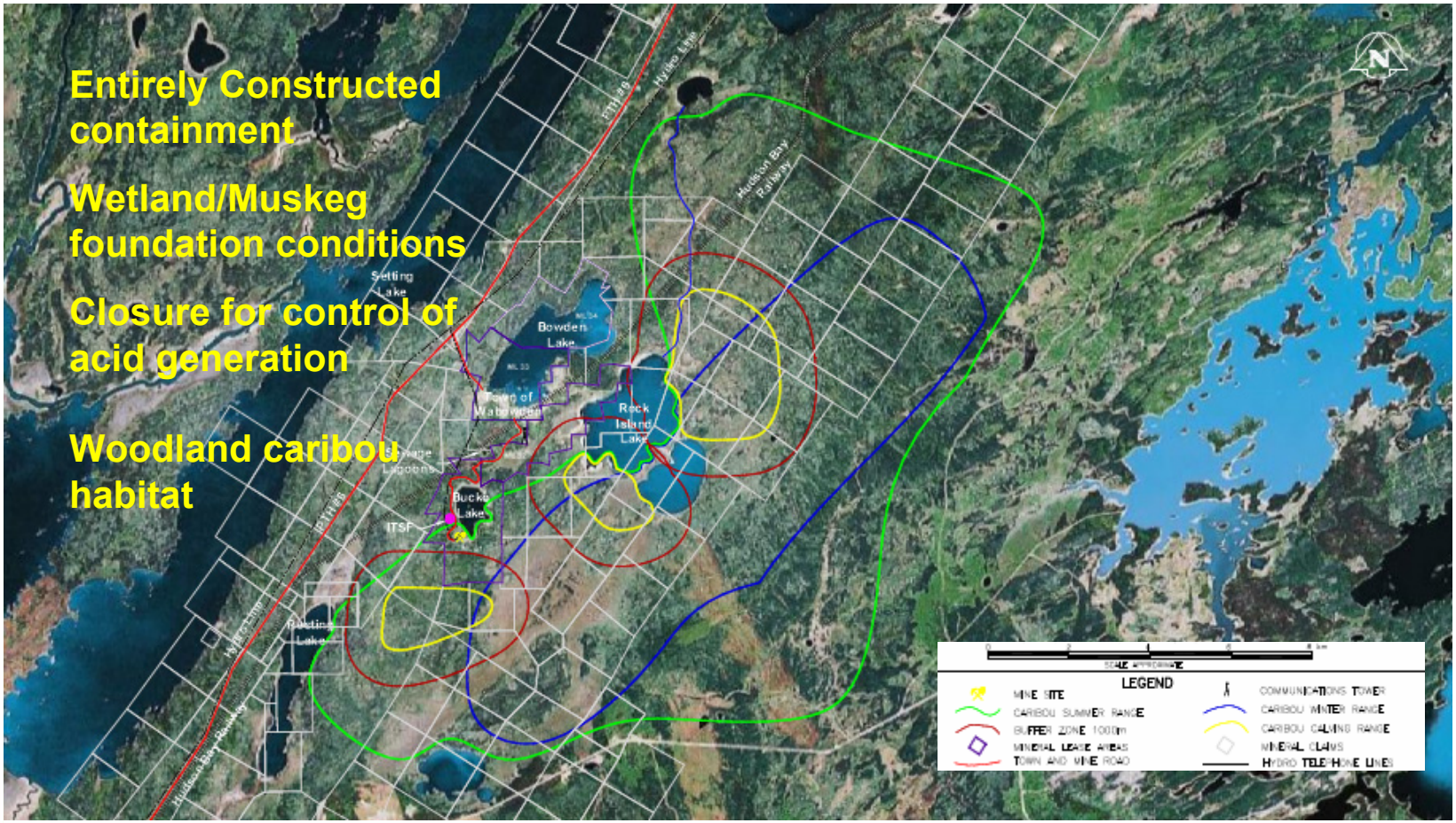



Bucko Lake – Alternatives Considered

- Land-based
  - conventional tailings
  - paste tailings (theoretical, tails have poor paste properties)
- Disposal in abandoned mines in region
  - None available
- Disposal in a lake



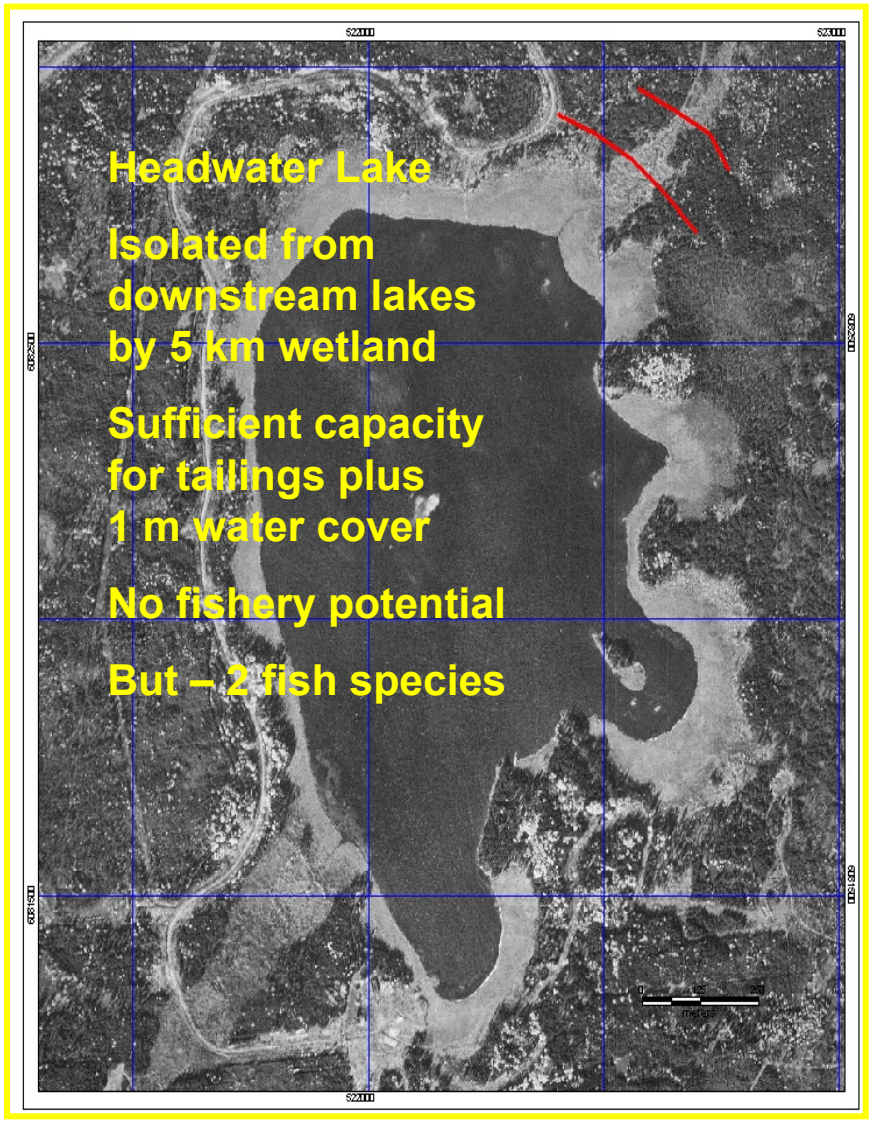

Land Based Disposal Considerations






WARDROP

Bucko Lake Disposal Considerations






Criteria	Rating		
	1	3	5
a) Societal value of the affected environmental components – includes nature and degree of protection provided	Not valuable (no designation)	Moderately valuable (designated or protected locally, regionally or provincially)	Highly valuable (designated or protected nationally or internationally)
b) Ecological value of receptors affected including rarity and uniqueness, fragility, importance within ecosystem, importance to scientific studies	Not valuable and	Moderately valuable	Highly valuable
c) Duration – length of time the project impact will last	Short-term (less than 1 year)	Moderate (between 1 and 25 years)	Long-term (more than 25 years)
d) Frequency – rate of reoccurrence of the project activity causing the effect	Rarely (less than once per year)	Sporadically (less than once per month)	Frequently (more than once per week)
e) Geographic extent – area over which the effect will occur	**Single point**	**Localized at project site**	**Extends beyond project site**
f) Magnitude – predicted disturbance compared to existing conditions	**No measurable disturbance**	**Measurable disturbance but no loss of function**	**Measurable disturbance with loss of function**
g) Mitigatable – ability to mitigate the environmental or ecological impact	**Between 1 and 25+ years**	**Between 25 and 50 years**	**Irreversible**
h) Constructability–complexity of construction	Straight forward construction as a result of design simplicity and few restrictions – no unique or difficult site characteristics (soils environmental receptors), site and materials easily accessible	Moderately complex construction arising from a design with challenging features and/or some restrictions – unique or difficult site characteristics (soils environmental receptors) site accessibility and material availability issues	Complex construction arising from complicated design features and/or multiple restrictions – unique or difficult site characteristics (soils environmental receptors) site inaccessibility, limited material availability issues
i) Closure stability– future risk of failure of environmental protection measures	Negligible when constructed to recognized standards and designed to conservative criteria	Low but measurable risk of failure after closure	Moderate to high risk of failure after closure




Environmental Ranking

TIA Alternative	Environmental Effects - Operations and Closure						*Environmental Effects Sub-total*
	A) Social value	B) Ecological value	C) Duration	D) Geographic Extent	E) Magnitude	F) Mitigatable or reversible impacts	
Conventional Wet Tailings	5	5	5*	5	5	5	*30*
Paste Tailings	5	5	5*	5	3	5	*27*
Bucko Lake	1	1	5*	3	3**	1	*14*




Conclusion

Tailings Disposal in Bucko Lake Has the Lowest Net Environmental Impact!

WARDROP

Questions?

People, Passion, Performance. Trusted Globally.