Environment Canada Environnement Canada

Canada

Assessment and Management of Sediment in Canadian Waters

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Outline

- Federal Regulatory Programs (2 examples)
  1. Disposal at Sea
  2. Chemicals Management Plan

- Non-regulatory Program (2 examples)
  A. Federal Contaminated Sites Action Plan
  B. Canadian Sediment Quality Guidelines

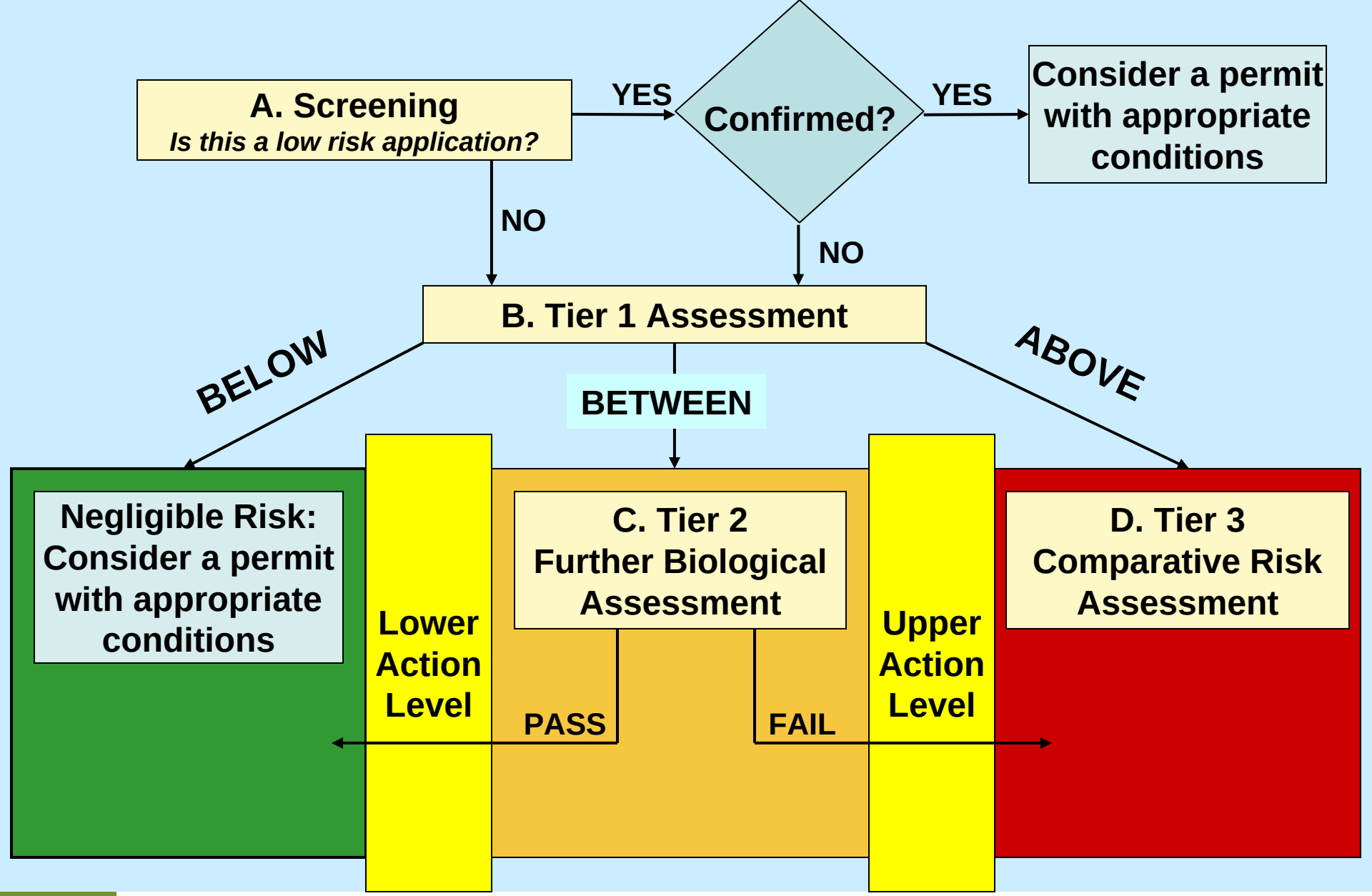
- Tools (3 examples)
  I. Sediment Quality Index
  II. Decision-making Framework for Contaminated Sediment
  III. Data Management Systems CABIN

Current Situation in Canada

- Federal government has full or shared responsibility for coastal & marine waters, boundary waters & north of 60º parallel.
- Sediment protection, dredging, disposal at sea & clean-up are assessed & managed separately
- Protection & remediation goals vary by program & site

1. Disposal at Sea

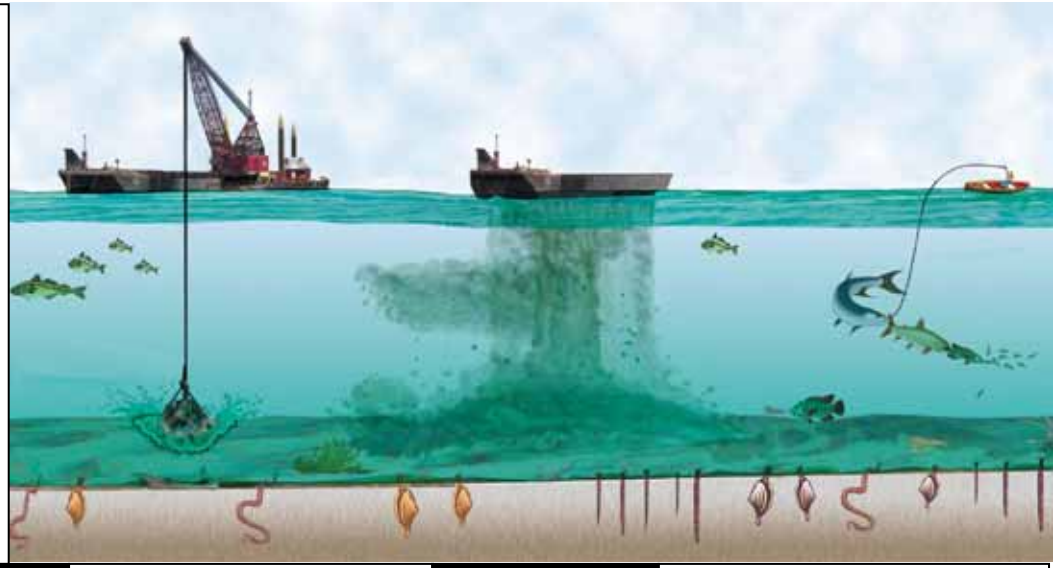
- Under the *Canadian Environmental Protection Act, 1999* (CEPA) “disposal at sea” is the deliberate disposal of approved substances at sea from ships, aircraft, platforms or other structures.
- a permit system controlling the disposal of waste and other matter at sea.
- permit is granted following a detailed assessment and sets conditions to protect the marine environment and human health.
- Each year in Canada, 2-3 million tonnes of material are disposed at sea, under this system, permits have been issued since 1975.
  - Mostly dredged material that must be moved to keep shipping channels and harbours clear for navigation and commerce
  - Also fisheries waste, ships, inert matter, uncontaminated organic matter and bulky substances.
  - discharges from land or from normal ship operations (such as bilge water) are not considered disposal at sea, but are subject to other controls


A. Screening
Is this a low risk application?
YES
Confirmed?
YES
Consider a permit with appropriate conditions
NO
NO
B. Tier 1 Assessment
BELOW
BETWEEN
ABOVE
Negligible Risk: Consider a permit with appropriate conditions
Lower Action Level
C. Tier 2 Further Biological Assessment
PASS
FAIL
Upper Action Level
D. Tier 3 Comparative Risk Assessment

Tier 3. COMPARATIVE RISK ASSESSMENT

LEGISLATIVE CRITERIA

CONCEPTUAL MODEL



HUMAN HEALTH	ECOLOGICAL HEALTH	FOOT PRINT	ENGINEERING ISSUES
40%	35%	15%	10%

RISK SCORE vs. COST

RECOMMENDATION

Social Responsibility

Aboriginal Considerations

DECISION

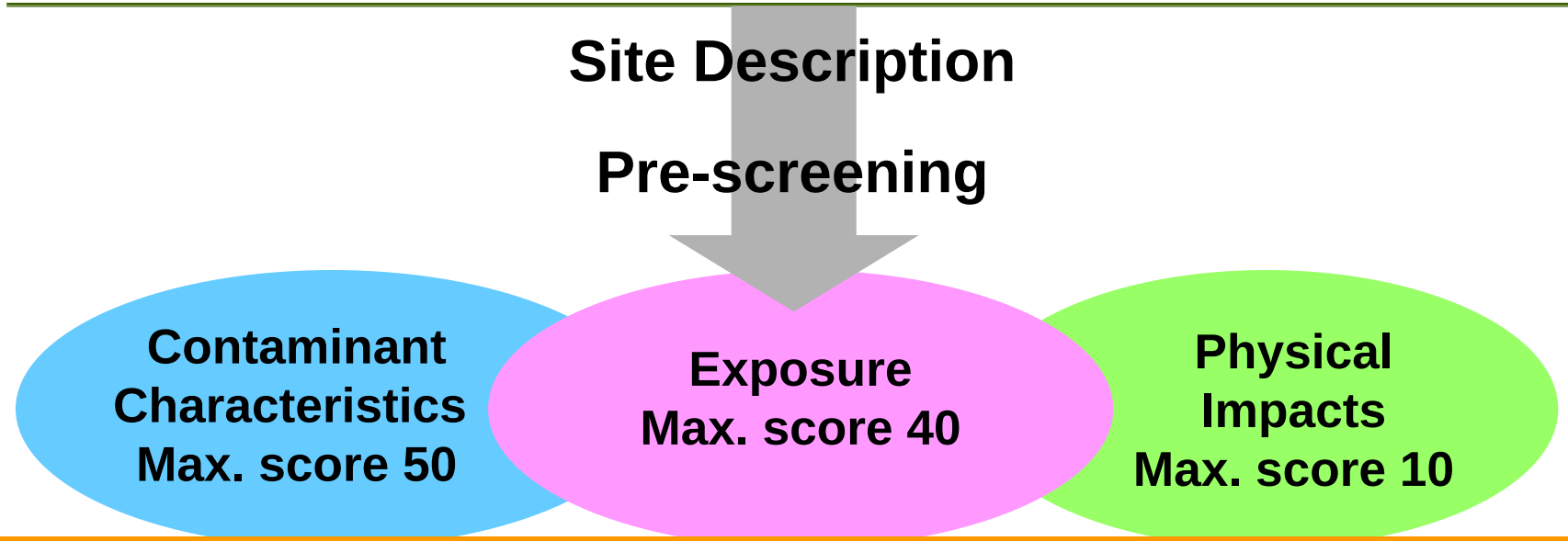
2. Chemicals Management Plan (CMP)

- Chemicals are “screened-in” via the categorisation of the CEPA Domestic Substances List (DSL)
  - 4,000 of 23,000 substances require further attention
  - 800 of these relevant to water
- Risk Assessment
  - Risk Quotient = Estimated Exposure ÷ Probable No-effect Concentration (PNEC)
- Risk Management
  - Variety of Management and Control Instruments
  - E.g., Pollution Prevention Plans, Performance Agreements
- Federal Environmental Quality Guidelines
  - Role in both RA (= PNEC) and RM (as performance benchmarks)

A. Federal Contaminated Sites Action Plan

- Aquatic Sites Classification System
  - to prioritize aquatic contaminated sites for action (immediate remediation, site-specific risk assessment, no action)
  - Customized tools in MS EXCEL
- Framework for Addressing Federal Aquatic Contaminated Sites (under development)

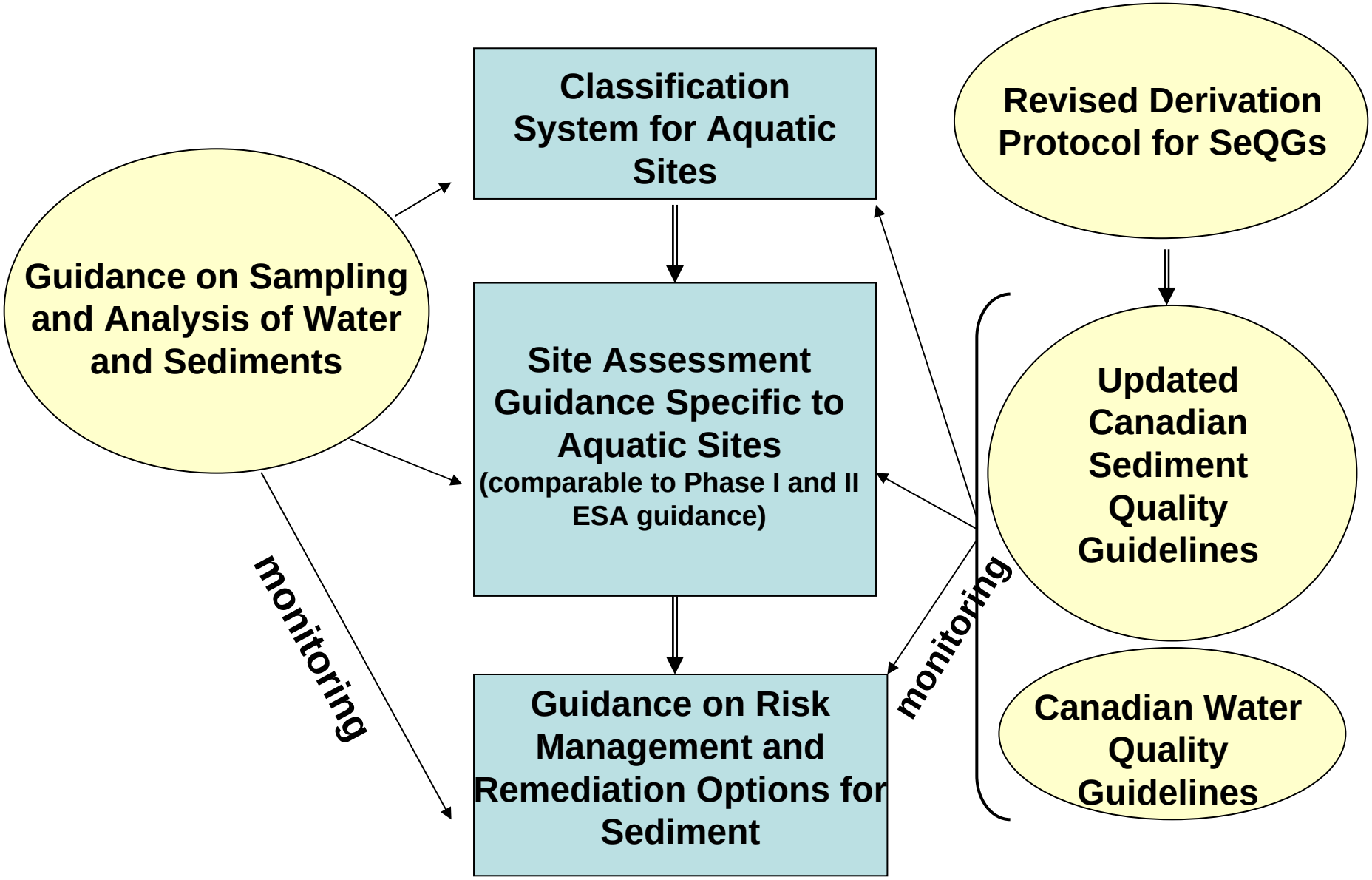
Aquatic Sites Classification System



Summary Score & Classification

Score >70	Score 50-69	Score 37-49	Score <37	>30% of responses are "do not know"
Class 1 High	**Class 2** Medium	**Class 3** Low	**Class N** Not a priority	**Class INS –** Insufficient information

FRAMEWORK FOR MANAGEMENT OF AQUATIC CONTAMINATED SITES



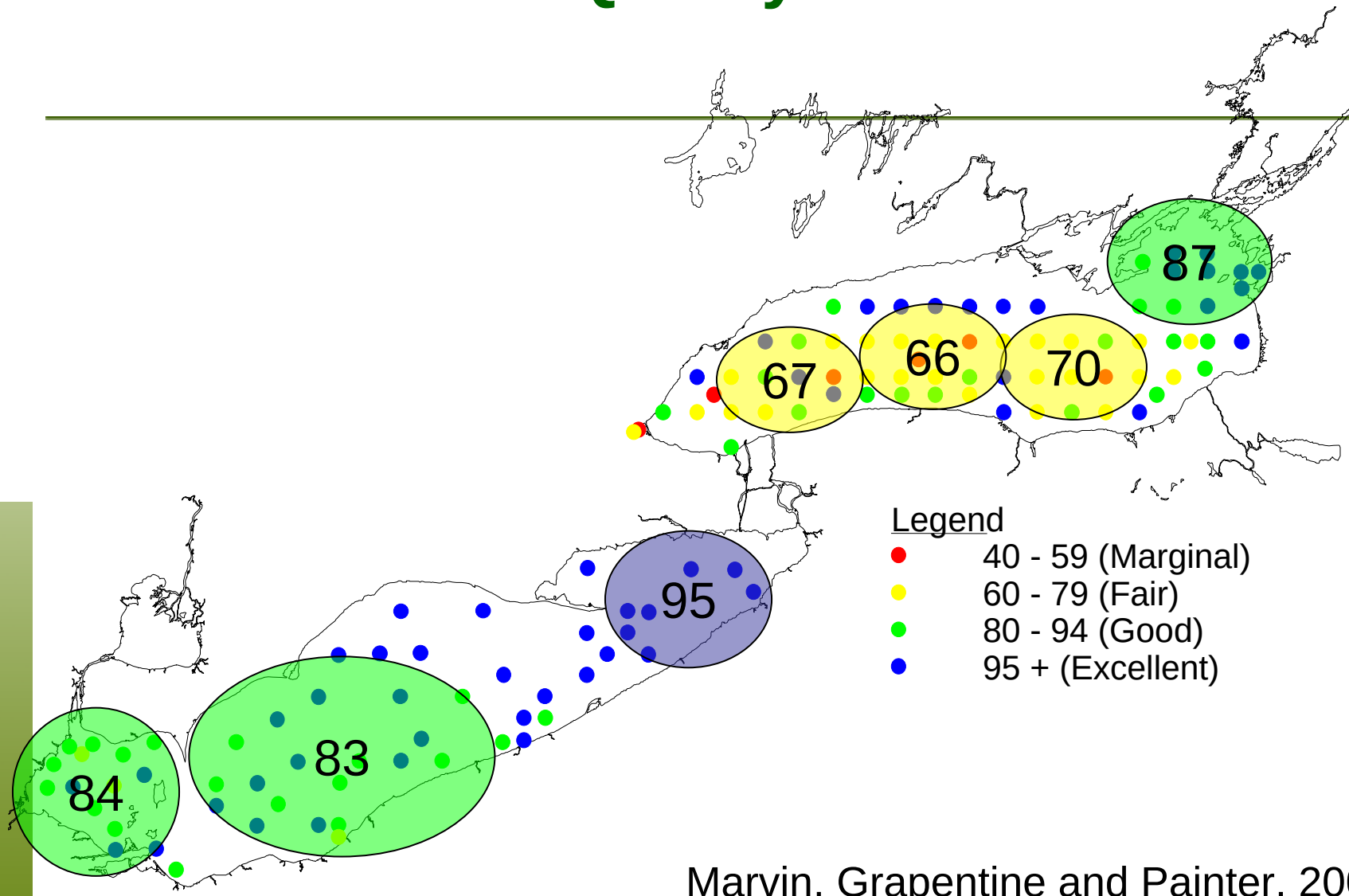
B. Canadian Sediment Quality Guidelines

- Developed by a national committee (federal, provincial, territorial)
- Protects all aquatic life and their life cycle during indefinite exposure to substances in bed sediments
- Protocol for derivation and most values published in 1995
- Undergoing re-assessment

I. Sediment Quality Index (SeQI)

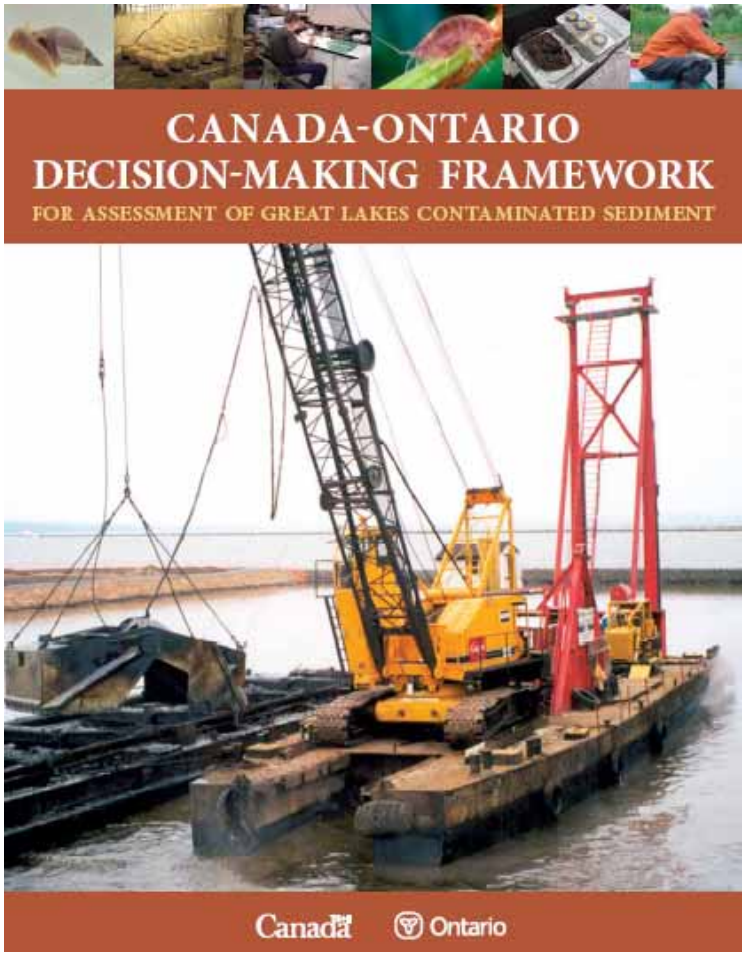
- Integrates sediment chemistry data into a single metric
- Scores levels of multiple sediment contaminants relative to guideline or target from 0 (low quality) to 100 (high quality)
  - Scope (# of contaminants)
  - Frequency (how often – either over time or area)
  - Amplitude (by how much)
  - It does NOT consider dose-response curves
- Based on CCME Water Quality Index
- First applied to Sediment by Grapentine, Marvin, and Painter, 2002

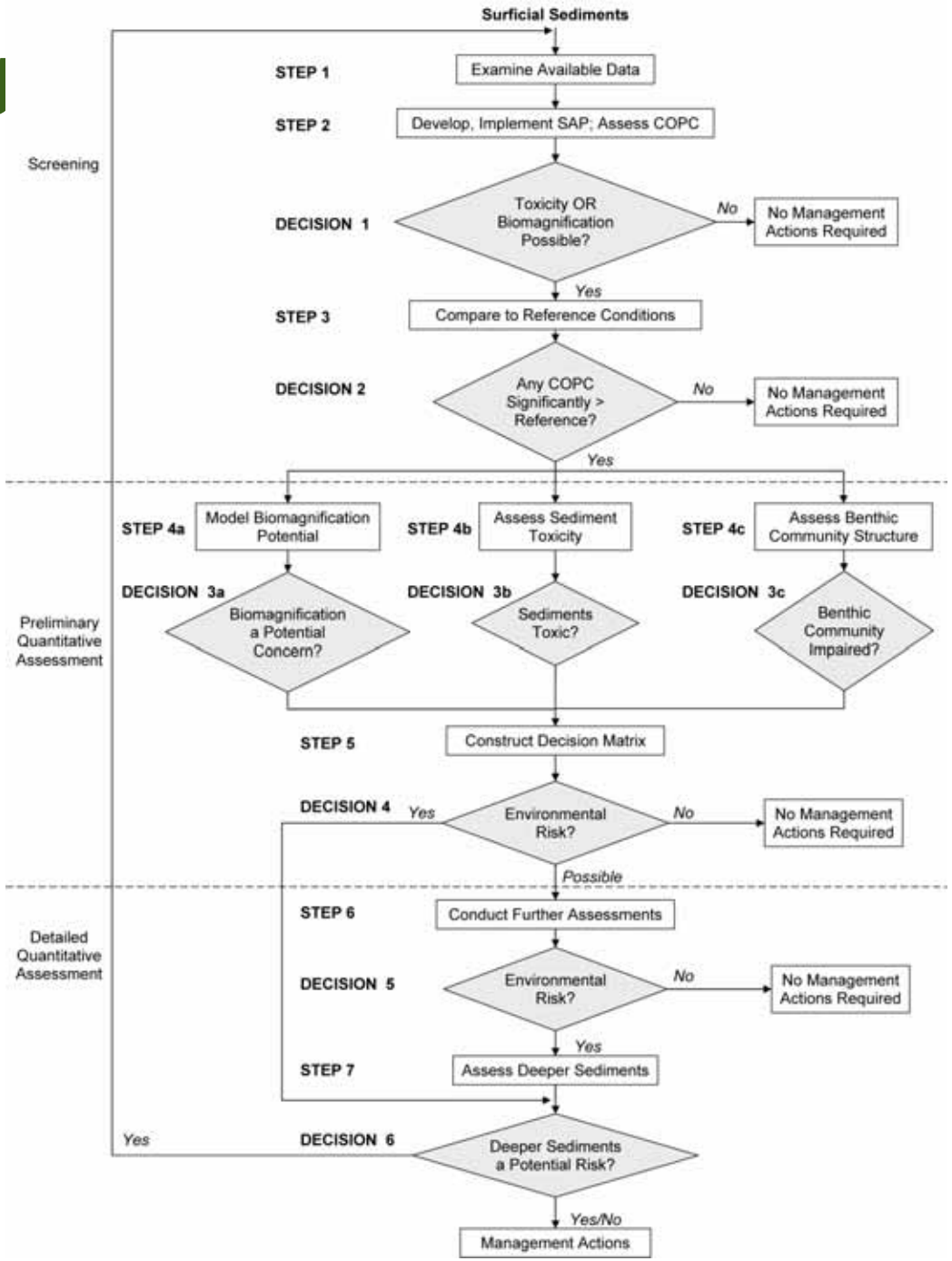
Sediment Quality Index



Marvin, Grapentine and Painter, 2004.

III. Decision-making Framework





Full Decision Matrix

- 16 possible overall outcome scenarios (■ & ◘ not distinct)
- guidance provided for further assessment to address uncertainty
- determination of significant potential for biomagnification (■) requires further assessment

Scenario	Bulk Sediment Chemistry	Overall Toxicity[1]	Benthos Alteration[2]	Biomagnification Potential[3]	Assessment
1	□	□	□	□	No further actions needed
2	■–◘	□	□	□	No further actions needed
3	○	□	■–◘	□	Determine reason(s) for benthos alteration (Section 5.3)
4	□	■–◘	□	□	Determine reason(s) for sediment toxicity (Section 5.3)
5	□	□	□	◘	Fully assess risk of biomagnification (Section 4.3)
6	■–◘	■–◘	□	□	Determine reason(s) for sediment toxicity (Section 5.3)
7	□	□	■–◘	◘	Determine reason(s) for benthos alteration (Section 5.3) **and** fully assess risk of biomagnification (Section 4.3)
8	■–◘	□	■–◘	□	Determine reason(s) for benthos alteration (Section 5.3)
9	■–◘	□	□	◘	Fully assess risk of biomagnification (Section 4.3)
10	■–◘	■–◘	□	◘	Determine reason(s)for sediment toxicity (Section 5.3) **and** fully assess risk of biomagnification (Section 4.3)
11	■–◘	□	■–◘	◘	Determine reason(s) for benthos alteration (Section 5.3) **and** fully assess risk of biomagnification (Section 4.3)
12	□	■–◘	□	◘	Determine reason(s) for sediment toxicity (Section 5.3) **and** fully assess risk of biomagnification (Section 4.3)
13	□	■–◘	■–◘	□	Determine reason(s) for sediment toxicity **and** benthos alteration[2] (Section 5.3)
14	□	■–◘	■–◘	◘	Determine reason(s) for sediment toxicity **and** benthos alteration (Section 5.3), **and** fully assess risk of biomagnification (Section 4.3)
15	■–◘	■–◘	■–◘	□	Management actions required[4]
16	■–◘	■–◘	■–◘	◘	Management actions required[4]

- Reference Condition Approach
- Reference sites: minimal impacts by human use
  - different geographic regions and stream sizes
  - Web accessible database
- sites suspected of being impaired are sampled and analysed
  - Training available
- Differences between organisms found at the reference and test sites quantify the degree of impairment at the test sites

Summary

- Interest in sediment quality issues is gaining momentum in Canada
  - New and revised programs
  - Chemical and biological components are recognised
- Need to better integrate programs
  - Define sediment quality goals
  - Provide consistent advice regarding sediment assessment tools
  - Provide common sampling guidance
  - Avoid duplicate research

Questions & Discussion

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