A Transboundary Approach to Mitigating Total Dissolved Gas in the Columbia River Basin

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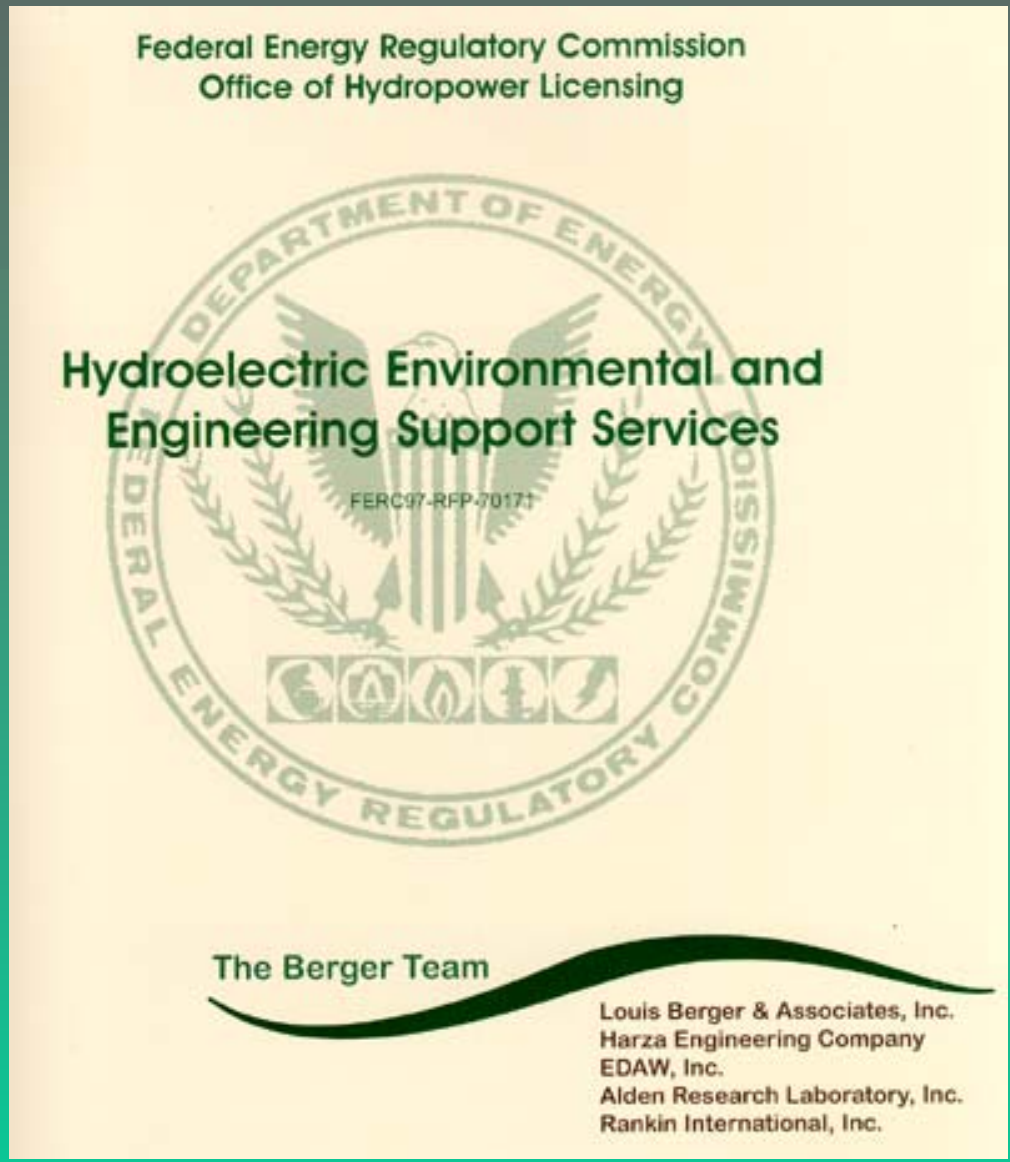
The Louis Berger Group, Inc.

Monitoring TDG Trends via Nationwide Contract



Presentation Objective

- Summarize what TGD is and how it affects fish
- How can two countries cooperate on this issue
- Compare how 2 jurisdictions deal with TDG

What is total dissolved gas?

- Partial pressures of atmospheric gases in solution exceed their respective partial pressures in the atmosphere.
- TDG varies with water temperature
- Common below spillways
- Can increase with increasing plunge depth
- Can diminish via turbulent action downstream
- Reported in mm Hg or % atm. pressure

Sub-dermal Emphysema on the Head of a Rainbow Trout.

source: BC Ministry of Environment

Severe Exopthalmia in a Juvenile Rainbow Trout

source: BC Ministry of Environment

Intra-corporeal Bubbles in the Lamella of a Rainbow Trout

source: BC Ministry of Environment

TDG Standards in Washington State - USA

- TDG shall not exceed 110 percent of saturation
- TDG cannot exceed 115% in forebays and 120% in tailraces when spilling to benefit fish
- A one hour maximum of 125 percent applies

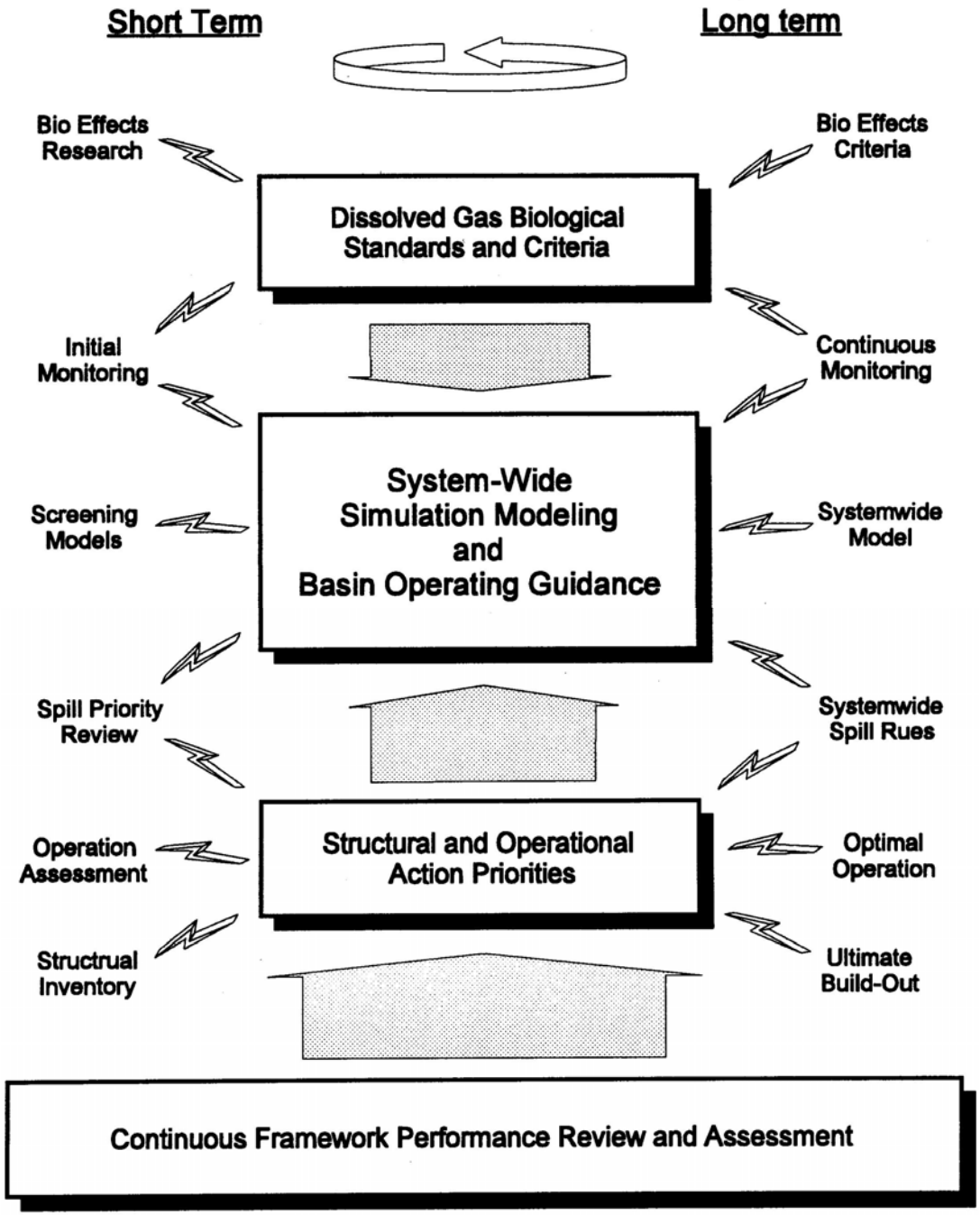
TDG Objectives in BC Canada

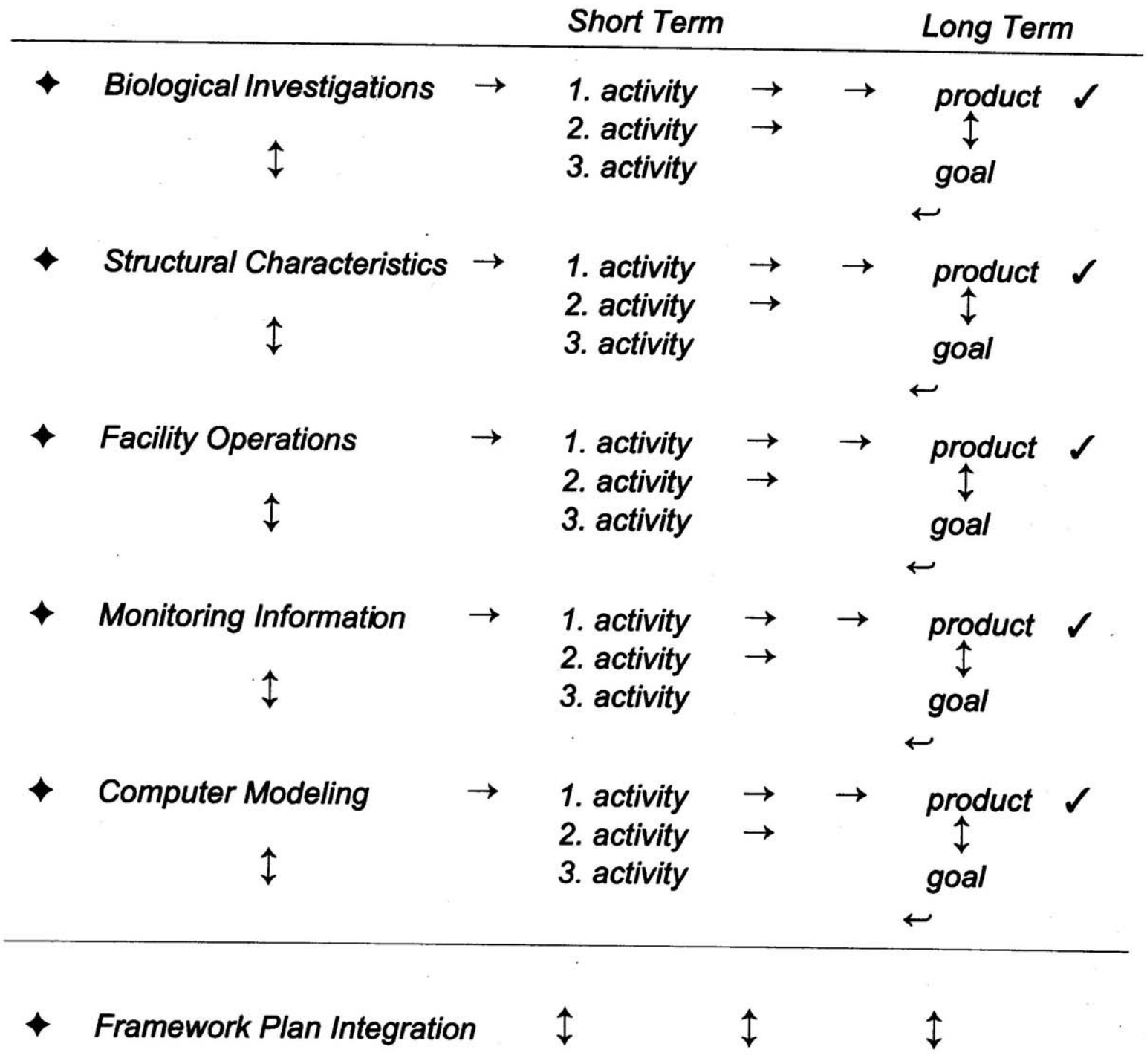
- The objective for TDG is a level less than 110 percent of saturation
- The Province is also addressing TDG via Water Use Plans

Milestones

- 1909 International Joint Commission formed
- 1961 Columbia River Treaty signed - 4 new dams to be built (1 in USA)
- 1998 System Configuration Team and Dissolved Gas Team formed in US
- 1998 binational Transboundary Gas Group formed
- 2002 - April latest meeting (meets twice per year)


Mica
Revelstoke
Arrow Lakes
Duncan
Keenleyside
Kootenay Lake
Canada
U.S.
Grand Coulee
Chief Joseph
Wells
Rocky Reach
Rock Island
Wanapum
Priest Rapids
Columbia R.
Albeni Falls
Libby
Hungry Horse
Noxon
Pend Oreille Lake
Flathead Lake
Kerr
Little Goose
Lower Monumental
Lower Granite
Dworshak
Montana
Seattle
Washington
The Dalles
Ice Harbor
Portland
Bonneville
McNary
John Day
Hells Canyon
Oxbow
Brownlee
Idaho
Willamette R.
Oregon
Boise Projects
Jackson Lake
Snake R.
Corps of Engineers Dams
Dams owned by Others


Short Term
Long term
Bio Effects Research
Bio Effects Criteria
Dissolved Gas Biological Standards and Criteria
Initial Monitoring
Continuous Monitoring
System-Wide Simulation Modeling and Basin Operating Guidance
Screening Models
Systemwide Model
Spill Priority Review
Systemwide Spill Rues
Operation Assessment
Structural and Operational Action Priorities
Optimal Operation
Structrual Inventory
Ultimate Build-Out
Continuous Framework Performance Review and Assessment


Short Term
Long Term
Biological Investigations
1. activity
2. activity
3. activity
product
goal
Structural Characteristics
1. activity
2. activity
3. activity
product
goal
Facility Operations
1. activity
2. activity
3. activity
product
goal
Monitoring Information
1. activity
2. activity
3. activity
product
goal
Computer Modeling
1. activity
2. activity
3. activity
product
goal
Framework Plan Integration

Framework Plan Integration

- *Facilitate Technical Group Activity Interactions*
- *Transboundary Gas Management Status Report*
- *Coordinate with Lower Columbia River Planning*

Treaty Implications of Dissolved Gas Management in the Columbia River Basin

Robert M. Goldschmid

for

The British Columbia Ministry of Water, Land and Air Protection

and

The Columbia River Transboundary Gas Group

June 27, 2001

Review Draft – 2-13-02

Total Maximum Daily Load (TMDL) for Lower Columbia River Total Dissolved Gas

February 2002

Prepared jointly by the
Oregon Department of Environmental Quality
and the
Washington State Department of Ecology

Washington State Department of Ecology

Working Groups

•Sytemwide Dissolved Gas Abatement Steering Committee

•four additional work groups:

- Biological Effects and Research;
- Monitoring and Information Sharing;
- Modeling;
- Operational and Structural Abatement.

Overall Goal:

"Reduce systemwide TDG to levels safe for all aquatic life in the most cost-effective manner possible."

Objectives

- Define the geographic scope of the effort;

- Identify the status of current TDG biological and physical studies, additional TDG monitoring needs, and data management and availability;

- Identify physical and biological models that can be used to analyze systemwide TDG operational and structural alternatives;

- Identify and analyze potential operational and structural options to abate TDG in a systemwide context;

Objectives (cont.)

- Identify additional research needs related to biological and physical effects of operational and/or structural alternatives;

- Develop and recommend an action plan for systemwide TDG abatement;

- Define major elements of the Systemwide Dissolved Gas Abatement Study Plan

Seven Mile Dam in BC Actually strips TDG

Waneta Dam in BC receives waters from WA State & discharge to WA State


Mica
Revelstoke
Arrow Lakes
Duncan
Keenleyside
Kootenay Lake
Canada
U.S.
Grand Coulee
Chief Joseph
Wells
Rocky Reach
Rock Island
Wanapum
Priest Rapids
Columbia R.
Albeni Falls
Libby
Hungry Horse
Noxon
Pend Oreille Lake
Flathead Lake
Kerr
Little Goose
Lower Monumental
Lower Granite
Dworshak
Montana
Seattle
Washington
The Dalles
Ice Harbor
Portland
Bonneville
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Oregon
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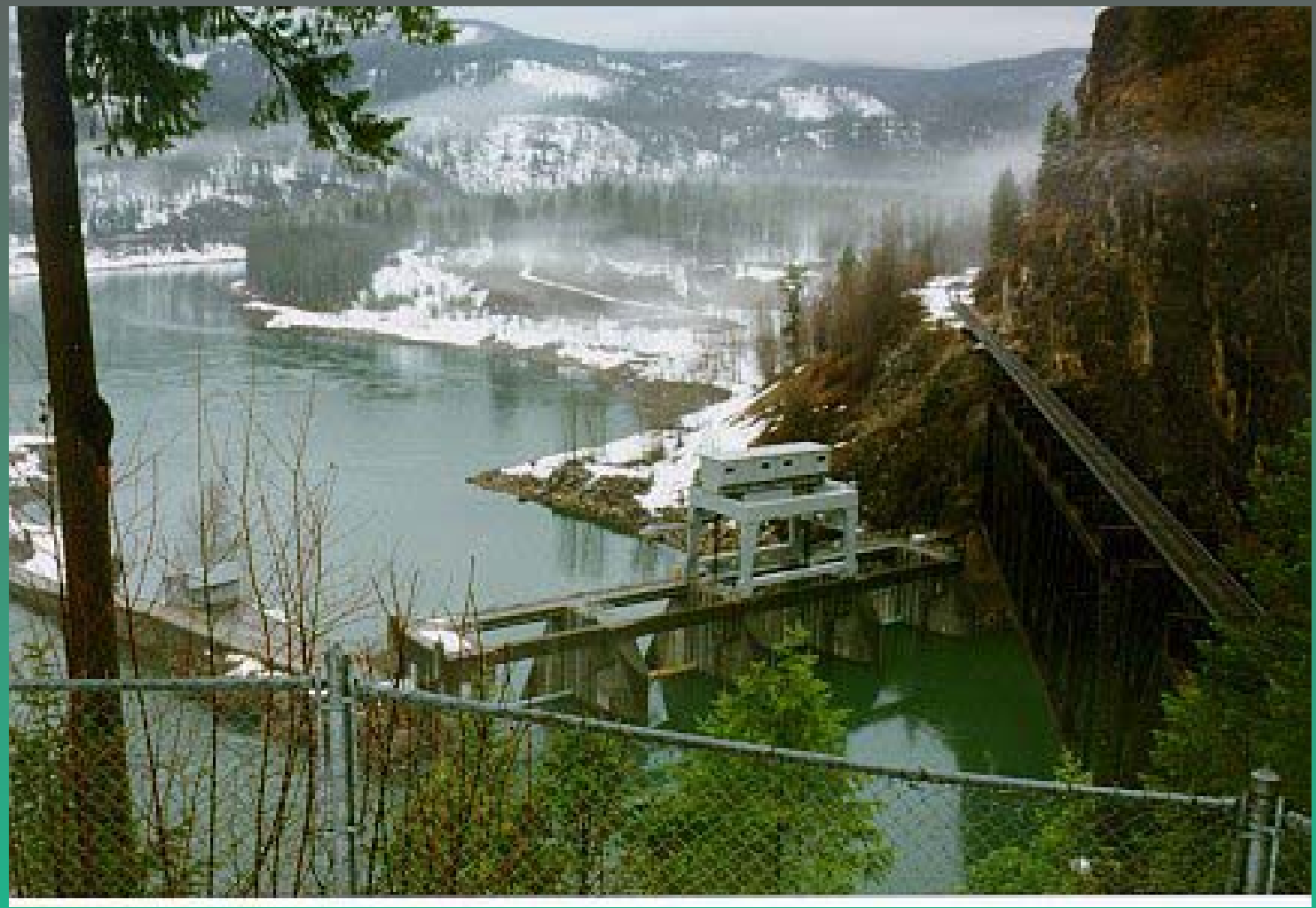
Snake R.
Corps of Engineers Dams
Dams owned by Others



Box Canyon Dam - NE Washington State: Water flows downstream to one more project and on to Canada (source Pend Oreille PUD)

Hells Canyon Hydroelectric Complex
Laboratory Studies on TDG and mitigation

Natural Sources of TDG include waterfalls

The Columbia River in BC, Canada

Economic Consequences

Expensive Solutions - $50 million at one small dam

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onomic Benefits - part of overall solution to restore salmon to recovery levels

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- Strong Cultural Link for Indigenous People - goal restore salmon to harvestable level

restore salmon to harvestable level

Recent Trends

- Trading Credits
- TMDLS for TDG
- Increased Spills for fish - more TDG
- More Collaboration
- More Regulatory Uncertainty

More info: google search
transboundary gas group

Will the Total Dissolved Gas Problem be solved in the Pacific Northwest? A combination of regulatory actions and transboundary management actions combined with creative approaches such as a TDG credit trading trading program bode well for the future.