Columbia River Treaty 2014-2024 Review Update

March 2013
Canadian Technical Conferences

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Columbia River Treaty 2014 / 2024 Review

Purpose

Enable the U.S. Entity to make an informed recommendation, in collaboration with the regional sovereigns and stakeholders, to the U.S. Dept of State by Fall of 2013 as to whether or not it is in the best interest of the U.S. to continue, terminate, or seek to amend the Treaty.

Authorization

Columbia River Treaty executed between the U.S. and Canada in 1964 and Executive Order 11177 authorizes the U.S. Entity* to conduct studies necessary to implement the Treaty.

The U.S. Entity is conducting the Treaty Review in collaboration and consultation with the region, however, the ultimate decision on whether to terminate or seek to amend the Treaty rests with the Department of State and the President.

**The Administrator of the Bonneville Power Administrator (Chair) and the Northwestern Division Engineer of the U.S. Army Corps of Engineers (Member) comprise the U.S. Entity responsible for implementing the Treaty for the U.S.*

Columbia River Treaty 2014/2024 Review Program Scope

- Work Completed to Date
  - Phase 1: U.S./Canadian Entities Joint Technical Studies (released July 2010)
  - U.S. Entity Supplemental Studies (released Sept 2010)
  - Iteration 1 Studies complete (released June/July 2012)
  - Iteration 2 Studies: April 2013 release
- Work Currently Underway & Planned
  - Regional Engagement with Sovereign and Stakeholder Interests
  - Developing Elements of a Draft "Straw" recommendation
  - Coordination with U.S. Departments of State, Energy, and Defense
  - Iteration 3 Studies: Summer 2013 release planned
  - Additional technical analysis and evaluation of Treaty Alternatives
- Regional Recommendation
  - Expected to be issued by the U.S. Entity to Department of State, governments in the Fall of 2013. (Note: The B.C. Government has a parallel process and plans to provide a recommendation to Ottawa in Fall of 2013 as well).
- National Determination
  - State Department and federal interagency review of regional recommendation; procedural analysis and review of broad national interests

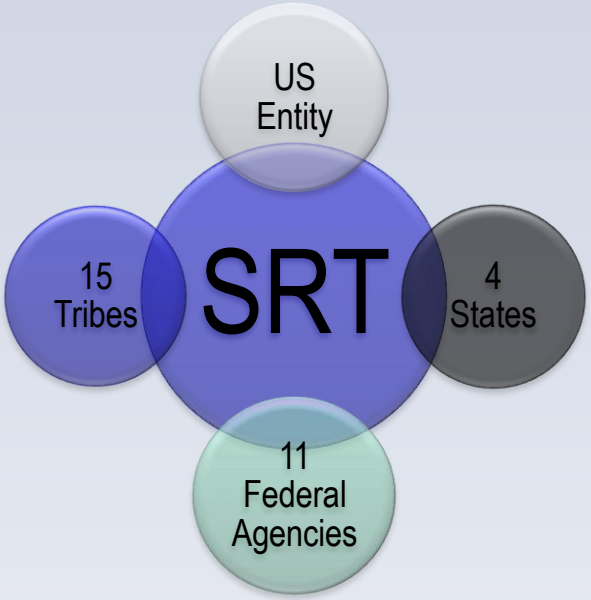
Regional Engagement

Sovereign Review Team

Sovereign Review Team (SRT):

- 4 States
- 15 Northwest Tribes: 5 representatives
- 11 Federal Agencies

The Sovereign Review Team has met monthly since October 2010



Sovereign Technical Team (STT):

- Technical experts representing each of the SRT members
- Responsible for designing alternatives and evaluating modeling results for conveyance to the Sovereign Review Team

The Sovereign Technical Team began meeting in February 2011 and meets at least twice a month in addition to topical workshops and workgroup meetings

Regional Engagement Stakeholders/Public

Achieved through a variety of forums and processes:

- Sovereign Review Team representatives
- Sovereign Technical Team representatives
- Tribal governments, councils and tribal groups
- Columbia River Power Group (utilities)
- Public Listening sessions
- Treaty 101 sessions
- Government to Government (Province of British Columbia)
- Regional Federal Columbia River Treaty Review Team
- Individual interest group meetings (e.g., irrigation and environmental interests, university-hosted forums, civic groups)
- Congressional, state, county/local government one-on-ones or briefings
- Project tours for interested stakeholders

Iteration 2 Alternatives and Components

- Alternatives:
  - A system of operational, structural and/or non-structural measures formulated to meet the identified study objectives subject to study constraints.
- Components:
  - A system of operational, structural and/or non-structural measures formulated to meet to meet only one of the primary driving purposes: Ecosystem-based function, Flood risk or Hydropower.
  - Not stand-alone alternatives to be implemented; rather, “bookends” meant to understand operation of the system for a single purpose
  - Components may be combined into alternatives in Iteration 3

Iteration 2 Alternatives

Alternatives:

4 alternatives carried forward from Iteration 1 for full impact assessment

- Current Condition (RC-CC)
- Treaty Continues with current and relaxed SRDs (1A-TC and 2B-TC)
- Treaty Terminates current SRDs (1A-TT)

4 Additional Treaty Terminates Canadian Operations scenarios

2 Climate Change scenarios incorporated into Treaty Continues alternatives

Iteration 2 "Components"

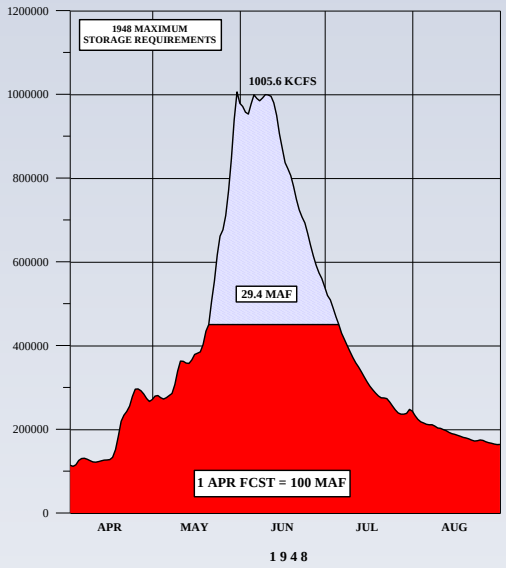
- **E1 – Natural Hydrograph**
  Store and release water from U.S. and Canadian reservoirs to meet a natural flow based on the type of water year, no system flood control, no operation specifically for power
- **E2 – Reservoirs as Natural Lakes**
  Generally hold reserves full and pass inflows through, no system flood control, no operation specifically for power
- **E3 – Summer Flows**
  Store water in Canadian projects during the fall and release to augment summer flows in U.S.
- **E4 – [reconnect flood plains]**
  (focuses on potential levee removal for purpose of ecosystem benefits)
- **E5 – Dry Year Strategy**
  Store water in Canadian projects during the winter/early spring to augment spring flows in lowest 20% of water years
- **H1 – Optimize Canadian and U.S. hydropower systems**
  Optimized the Canadian and U.S. hydropower systems using current system projects
- **H2 – Optimize the Canadian and U.S. power system with the BiOp operations included**
  Including fish operations, optimize the Canadian and U.S. hydropower system using current system projects
- **F1 – Full Use of Authorized Storage**
  Maximize use of authorized U.S. storage (full draft as needed)
- **F2 – No Called Upon Flood Storage**
  No use of Canadian storage for U.S. flood risk management
- **F3 – Modify U.S. Levees to perform to Authorized Level**
  Evaluate the ability to reduce U.S. flood risk if all levees in U.S. perform to authorized level

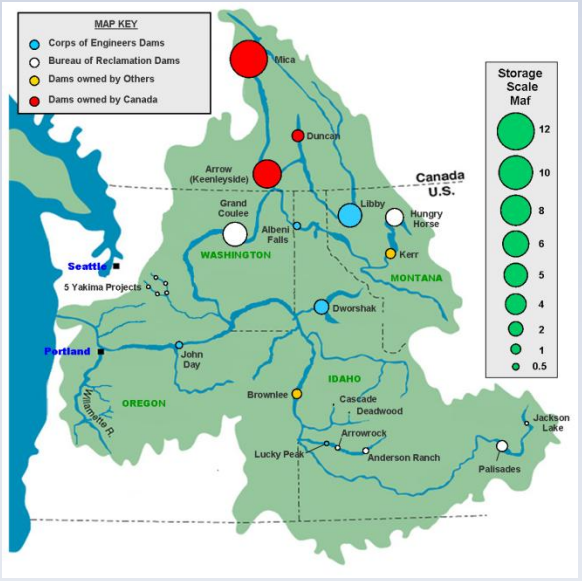
Other Impact Analyses

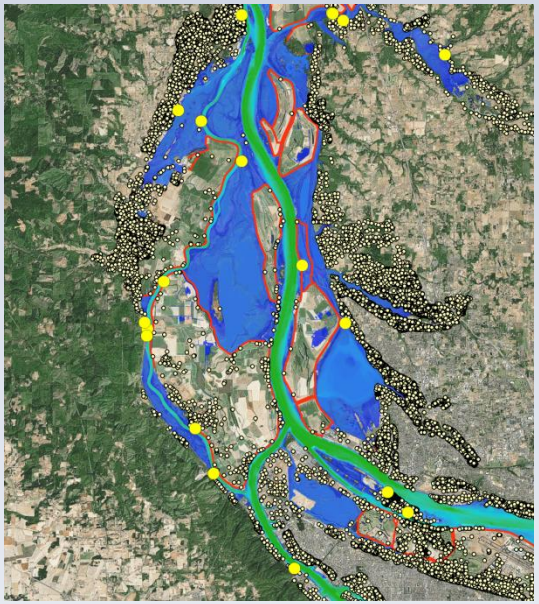
Intended to be comparative basic analyses. Some only on Iteration 2 or 3.

- Water supply (Irrigation)
- Navigation
- Recreation
- Cultural resources
- Water quality (temperature, total dissolved gas, sediment & toxics)
- Resident fish
- Wildlife
- Anadromous Fish (perhaps lamprey) (Compass/CSS)
- Estuary
- Climate change
- Hydropower
- Flood risk

Columbia Basin Flood Risk Management



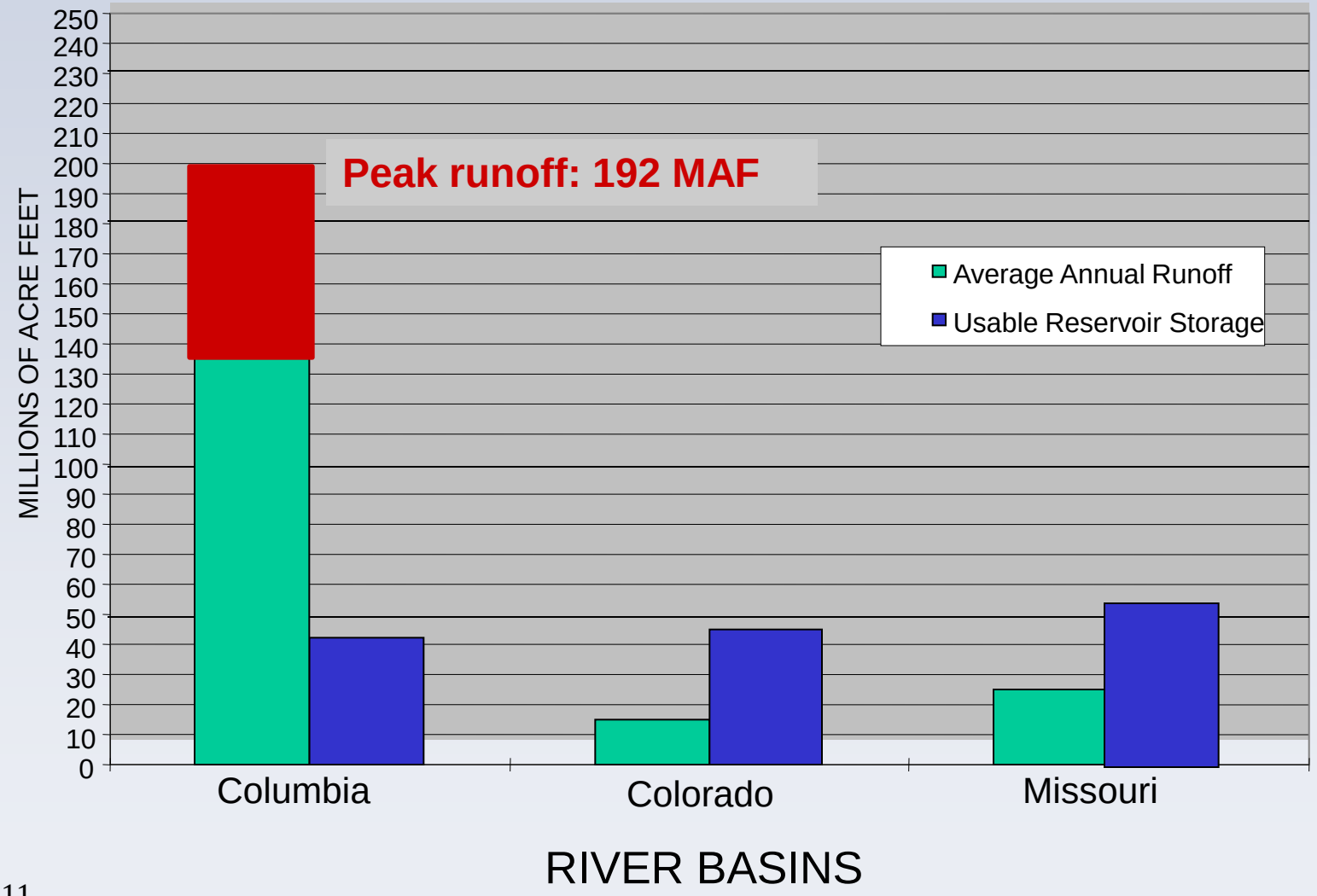




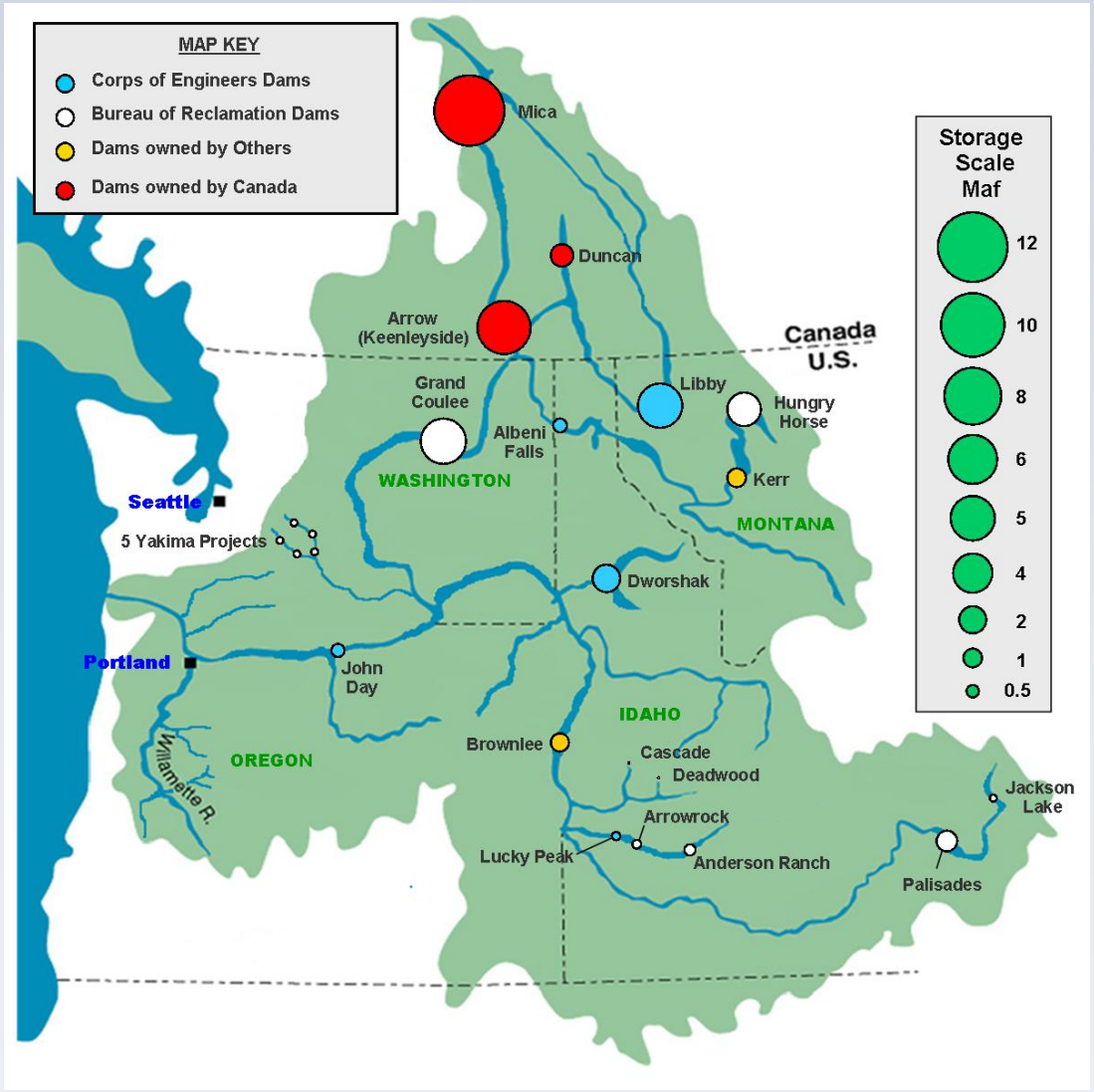
Runoff – Draft = Flood Risk

Flood Risk = Probability x Consequences

Storage vs. Runoff



Where is our reservoir storage?



What influences our current level of flood risk?

- Economic factors
  - **Homes**
  - **Businesses**
  - **Property**
  - Agriculture
  - Transportation
  - Emergency management
- Hydrologic factors
  - Infrequent-high damage events
  - More frequent-low damage events
  - Unforecastable events
  - Multiple contribution points
- Social/political factors
  - Safety
  - Cultural
  - Ethical
  - Communication
  - Ecosystem
  - Recreation
- Management
  - Infrastructure
  - Reservoir storage
  - Non-structural measures

▶ **Factored into Iteration 2 flood risk metrics**

Flood Risk Analysis Assumptions

- Canada is not obligated to provide any greater degree of flood risk management post-2024 than they do today
- Post-2024 flood risk management reverts to “Called Upon”
- Focus on seasonal flows influenced by snowmelt
- Called Upon storage in Canada is available when U.S. asks for it
- Called Upon includes reservoir storage drawdown and refill
- Authorized level of risk is Current Condition – no other level authorized

Iteration 2 Flood Risk Analysis

What it is:

- Process designed for multiple alternatives
- Designed for screening purposes
- Centered around current Treaty operations
- Opportunity to consider system flexibility

What it is not:

- Comprehensive flood risk analysis (Iteration 3)
- Process to change risk level
- Platform to optimize system flood risk management
- Final cost and benefit metrics

Iteration 2 – Flood Risk Analysis

- Alternatives Analysis
  - RC-CC: Current Conditions
  - 1A-TC: Post-2024 Treaty Continues operations
  - 2B-TC: Post-2024 reduced system flood risk management operations
  - F1: Authorized Storage
  - F2: 1A-TC No Called Upon (NCU)
  - F3: Levees at Authorized Levels (ran with 1A and 2B)
  - 1A-TT with sampled Canadian Operations
- Other Iteration 2 components have undergone mission-specific analysis (ecosystem or hydropower without flood risk)

Iteration 2 Flood Risk Metrics

Probability

- **Flow Frequency Curves (Hydrologic factors)**
  - Including hydrologic uncertainty, the curves show the likelihood that any given flow will occur in any given year
  - Demonstrates the relative flow frequency between alternatives (defines 1%, 0.2%, etc. flood events)
  - Developed using HEC-WAT FRA Monte Carlo model; 5000 events evaluated

Consequence

- **Preliminary Expected Annual Damage (EAD)**
  - Average monetary value of physical losses (structure and content) related to how each alternative manages an event

Columbia River Treaty 2014/2024 Review

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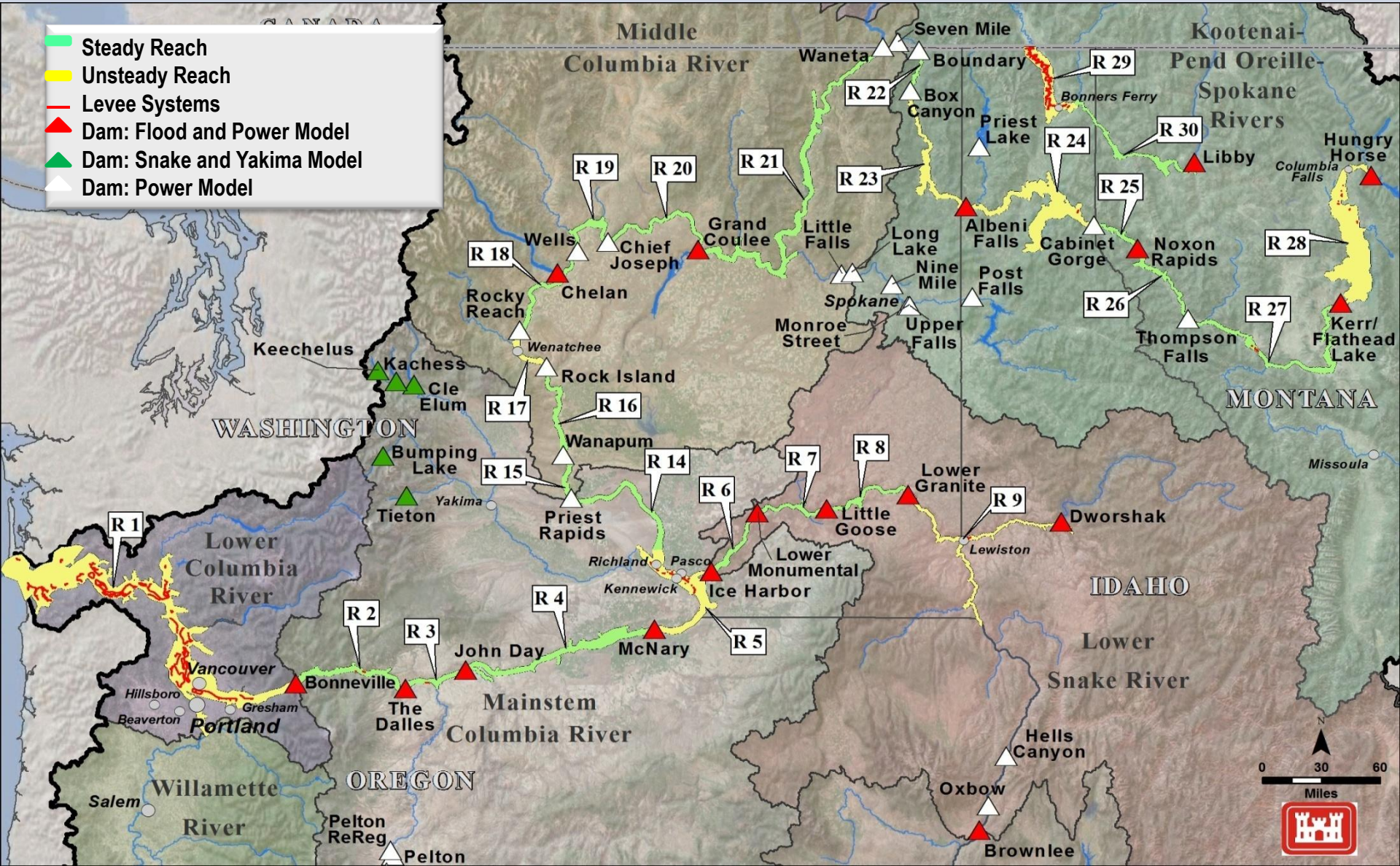
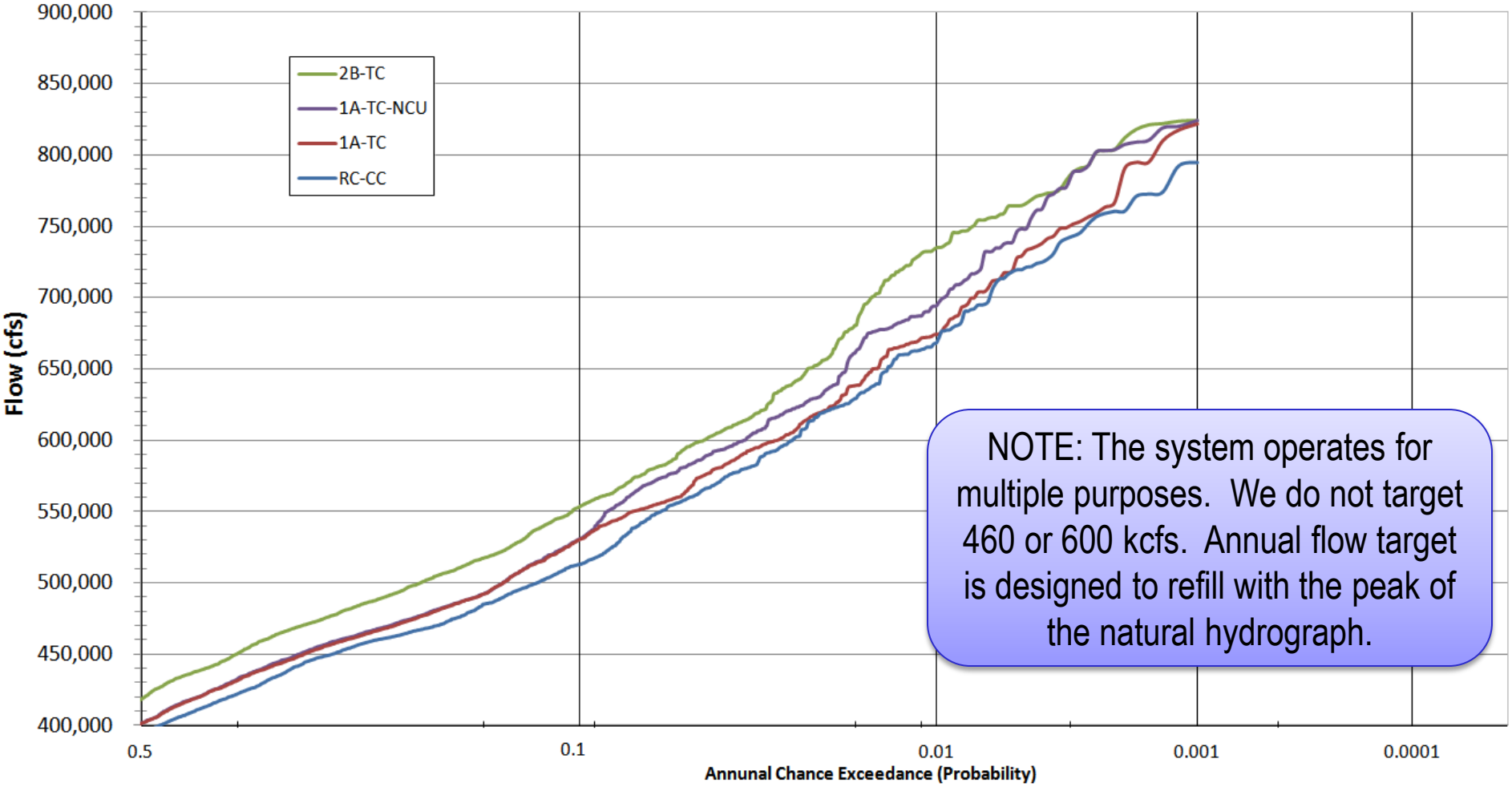
Flood Risk Consequence Area



The Dalles Flow Frequency



NOTE: The system operates for multiple purposes. We do not target 460 or 600 kcfs. Annual flow target is designed to refill with the peak of the natural hydrograph.

Draft, daily, regulated, spring, peak flows for CRT Review

Probability of Flow @ The Dalles

	RC-CC	1A-TC	2B-TC
450 kcfs	28.9 %	31.8 %	39 %
600 kcfs	2.8 %	3.2 %	5.0 %
800 kcfs	0.07 %	0.15 %	0.27 %

Flood Risk Metric Assumptions

- Focused on Treaty Review consequence area
- Spring flood peaks only
- Current conditions (hydrology, levees, economics, etc as of 2010)
- Sampling based on frequency at The Dalles
- It is not damages prevented
- Alternative comparison demonstrates change in flood risk (probability of flow x consequences)

Flood Risk Analysis Preliminary Conclusions

- Final analysis that informs the Treaty recommendation will add additional risk metrics and uncertainties.
- Flood consequences are created by infrequent/high damage events and more frequent/low damage events.
- The difference between total consequences for each alternative evaluated to date is in Reach 1. This is due primarily to adhering to local flood operations under all alternatives & mainstem development and infrastructure.
- 1A-TC flood risk increases over CC due to how Called Upon and Effective Use was implemented. The increase in Reach 1 is significant. Future alternatives will alter 1A-TC to achieve a level of flood risk similar to CC.
- 2B-TC has a significant and unacceptable flood risk increase over CC; 97% of the increase is within Reach 1.

Flood Risk Key Messages

- None of the iteration 2 alternatives have “similar” flood risk compared to CC
- TT has flood risk unknowns that have not yet been included
- Basin-wide, levees are very robust
  - 98.6% of damages in non-leveed areas
- Bottom Line: decreased draft for a given forecast increases risk
  - Coulee and Arrow are the most important reservoirs based on current alts.

Downstream Power Benefit (DPB) and Canadian Entitlement (CE)

- Treaty roughly doubled storage of Columbia River System
  - Reduced uncontrolled spring flows
  - reduced flood risk in US and Canada
  - Increased fall, winter and late-summer flows for power benefit
- Increased power generation in US enabled by Canadian dams is called the Downstream Power Benefit (DPB)
  - By Treaty negotiations, Canada is entitled to 1/2 of an agreed formula for the DPB, called the “Canadian Entitlement” (CE). The DPB is the value of coordination to the U.S. with and without Treaty storage projects.
  - DPB calculated 6 years in advance, not based on actual observed benefits
  - In the Treaty : Negotiated formula to calculate the DPB; does not include new reservoirs after 1961 (i.e. Libby and Dworshak, new operating constraints, and 60% of export market for non-firm energy was excluded).

2025 Value of Canadian Entitlement if Treaty Continues Under Existing Methodology

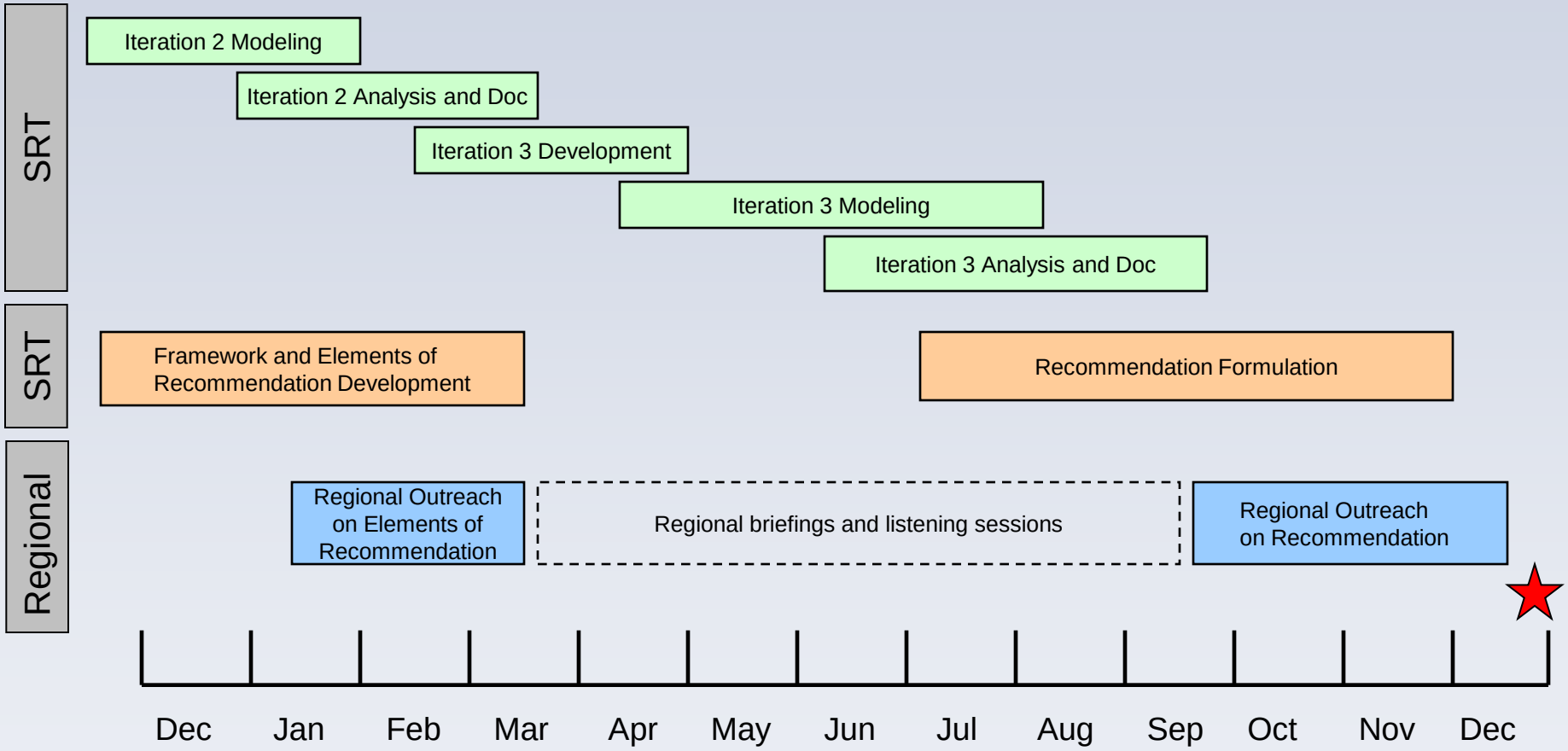
- About 450 aMW, with about 1,300 MW capacity
- Worth roughly $250-300 million per year (including capacity), which is the long-term annual value of a similar sized combustion turbine resource.
- U.S. has to keep equivalent of 1,300 MW generation plant available for Canada and reserve 1,300 MW of transmission capacity.
- Canada can specify delivery on highest value hours each month (with day-ahead scheduling)
- Mid Columbia Utilities obligated to return 27.5% of the CE until 2024.
- This formula calculates value of DPB and CE based on 1961 system, with and without existence of Canadian Treaty dams.
- The current short-term market value of the CE likely in the range of $100 million or greater (low market prices and no capacity benefit).

US Entity Perspective of DPB Post-2024

- Canadian investment in the Treaty dams is fully compensated by 2024.
- The value of coordination to the U.S. is the benefit of an agreed Assured Operating Plan for Treaty storage as compared to a non-coordinated Canadian only operation.
- The post-2024 Canadian Entitlement payment should reflect ½ of the actual U.S. benefit received from Treaty coordination.
  - The estimated value of continued coordination benefit to the US is in the range of $50 million to $60 million, which would result in a Canadian Entitlement value of $25 to $30 million.
  - U.S. must still estimate the value of other power benefits of Treaty coordination such as certainty of operations and the firm energy value.
- Mid Columbia utilities have expressed concern over the high level of Canadian Entitlement under the existing Treaty formula. Other PNW power interests have expressed similar concerns.
- The agreement that provides for the return of CE over existing transmission lines ends in 2024. The Treaty requires the build of transmission to Oliver, BC, unless otherwise agreed.

- Canadian and U.S. perspectives may differ on where the appropriate starting point for

Schedule


SRT
Iteration 2 Modeling
Iteration 2 Analysis and Doc
Iteration 3 Development
Iteration 3 Modeling
Iteration 3 Analysis and Doc
SRT
Framework and Elements of Recommendation Development
Recommendation Formulation
Regional
Regional Outreach on Elements of Recommendation
Regional briefings and listening sessions
Regional Outreach on Recommendation
Dec
Jan
Feb
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Apr
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Nov
Dec

Questions?