



Sounding Board Columbia River Treaty Review

Nakusp, June 3, 2013



Ministry of
Energy and Mines



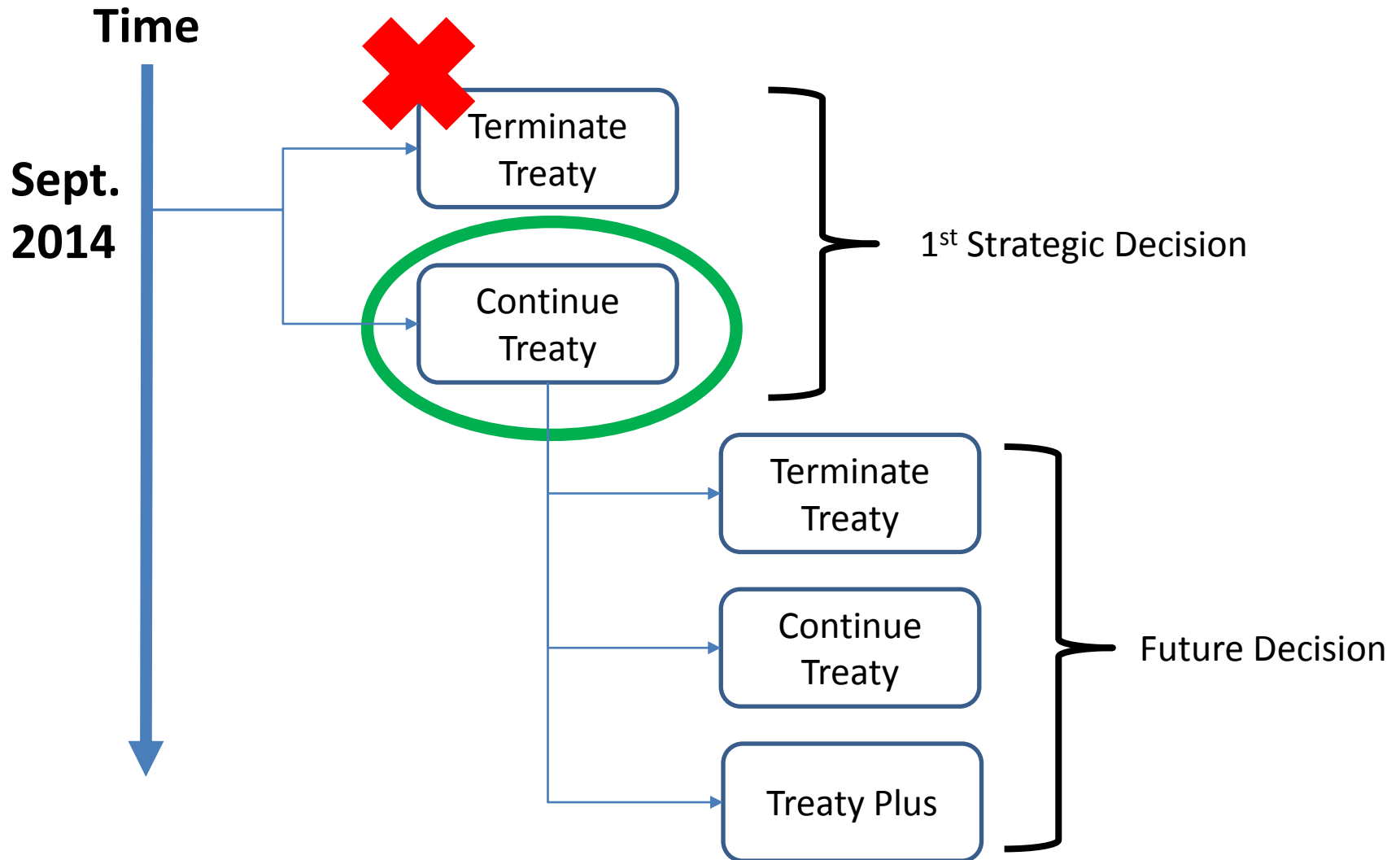
Strategic Decision Overview

Columbia River Treaty

- Signed in 1964, the Columbia River Treaty coordinates flood control and optimizes power production in the US and Canada.
- The Treaty has prescriptive requirements for border flows, reservoir storage and dam discharges at the 3 Canadian Treaty Dams – Mica, Hugh Keenleyside, and Duncan.
- At any point, the US and Canadian entities can agree to deviate from the original Treaty provisions for their mutual benefit.



Strategic Decision Overview





Implications of Strategic Decision

September 2024

**Treaty
Continue**

**Treaty
Terminate**

Required Border Flows
(Arrow / Kinbasket Balance)

Canadian Entitlement

**Called Upon
Flood Control**

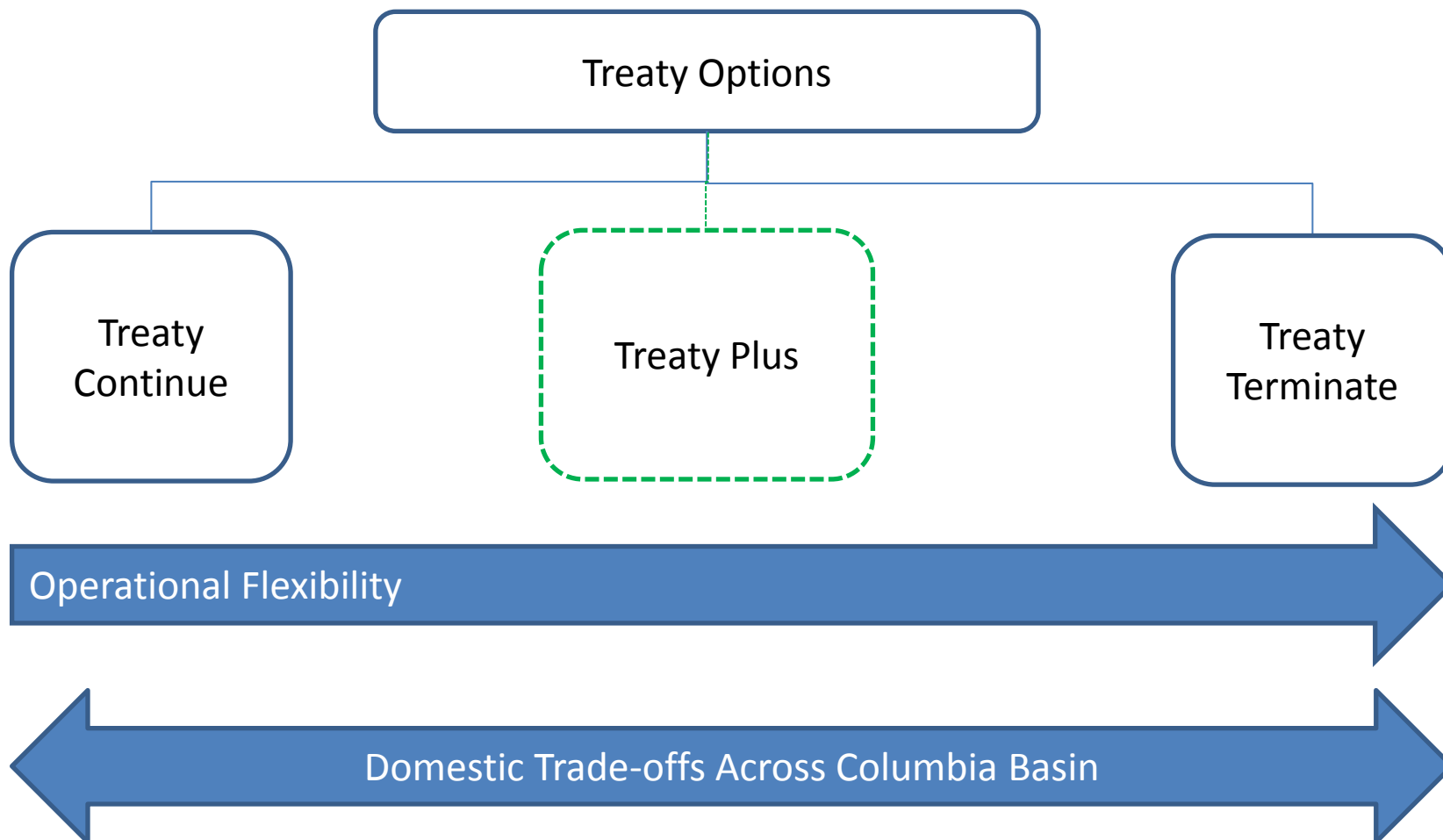
**Libby
Coordination**

**Minimum Restrictions on
Canadian Operations**
(More flexibility for Arrow & Kinbasket)

No Canadian Entitlement



Strategic Decision Overview





First Question for Sounding Board

What are the top three considerations citizens on both sides of the border should think about when reflecting on the short and long term future of the Treaty?



Interests and Topics Affecting the 1st Strategic Decision

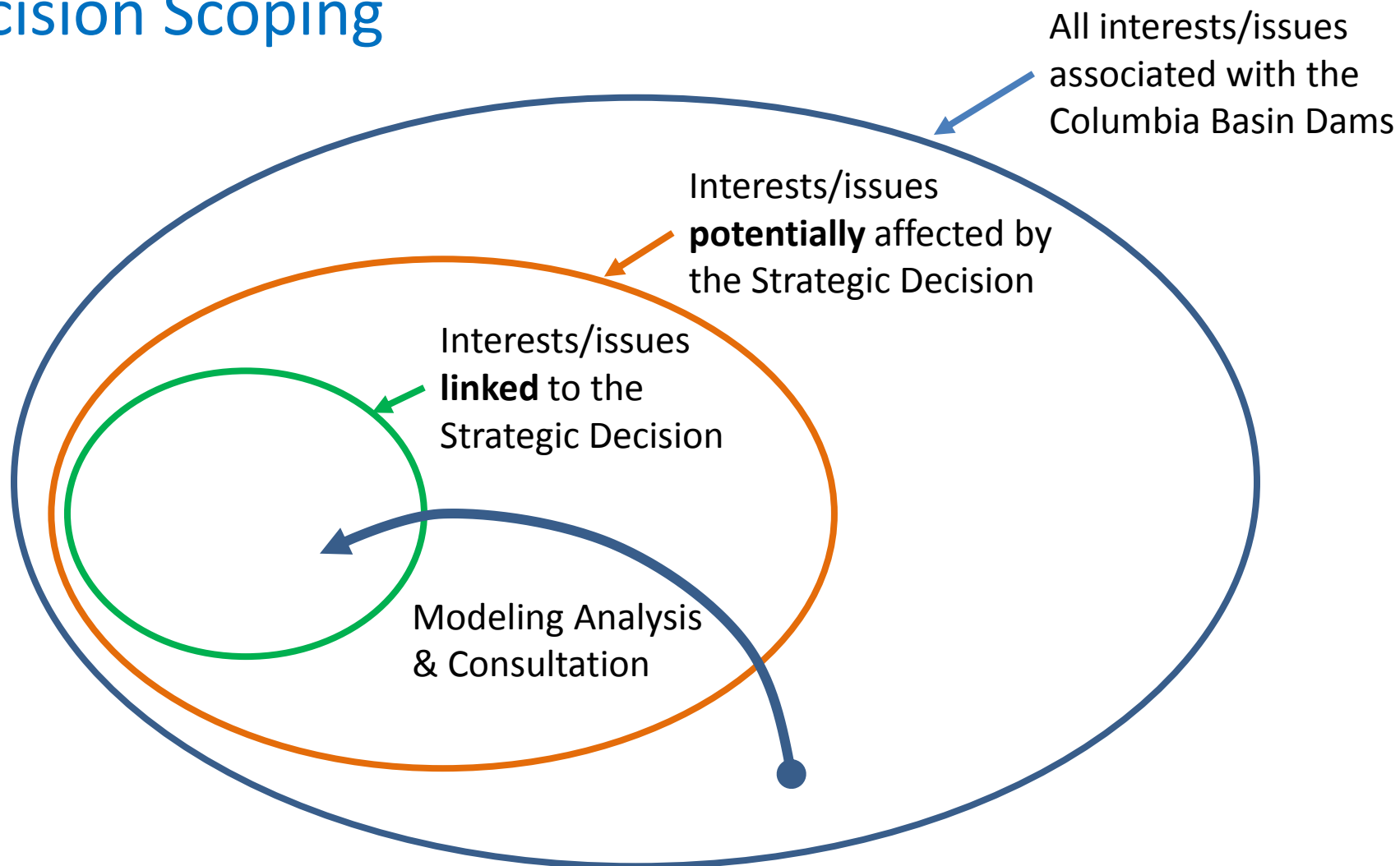


Consultation Reports on Issues / Interests in the Basin

- October 2012 Summary of Interests and Values Shared by Columbia Basin Residents
- November 2012 Summary Report of Community Consultations
- March 2013 Local Governments' Committee Summary of Canadian Dam and Reservoir Issues
 - Summarizes 22 community-level CRT Information sessions held by the Province and the Columbia Basin Trust in fall 2011 and spring 2012
- March 2013 Community Consultations: Golden and Nelson
- Past Consultation Reports from Water-Use Planning



Decision Scoping





What decisions potentially affect these issues / interests?

#	Issue/Interest Category	Description of Comment	Strategic Decision on Future of Treaty	Domestic Decisions (Provincial, WUP, FWCP, CBT)	Process
	Kinbasket / Mica				
1	NTSA	Non-Treaty Storage Agreement - concern over how water is managed.			
2	Debris	Large amounts of debris on Kinbasket Reservoir - BC Hydro has spent significant resources in recent years but more needs to be done.			
3	Dust	Increased dust levels from low water levels and poor vegetation.			
4	Transportation - Road	Kinbasket - Poor road access to reservoir. For example, gravel roads are poor and there's no access for 5 months of the year.			
5	Forestry	Impacts on forestry industry - especially around Golden due to high cost of maintaining transportation infrastructure.			
6	Recreation / Tourism	Reservoir levels should be at appropriate levels in summer months for recreation activities.			
7	Recreation / Tourism	Kinbasket is a widely fluctuating reservoir since there is no minimum drawdown zone (unlike Revelstoke Reservoir). Water levels vary far more in Kinbasket than other reservoirs in the Basin.			
8	Recreation / Tourism	A water retention structure at the top end of Canoe Reach (NW end of Kinbasket) or in the SE end of Kinbasket reservoir could help maintain more stable water levels for recreation. (A BC Hydro study presented in Golden and Valemount in June 2012 stated that the cost for this would be too high).			
9	Recreation / Tourism	A boat ramp at Bush Harbour does not provide low-water access and is in need of upgrading or replacement.			
10	Recreation / Tourism	No provincial campground on Kinbasket.			
11	Recreation / Tourism	Many residents and tourists use their ATVs to recreate on the mudflats but if there was a prolonged period of full-pool, ATVs would potentially go elsewhere and impact sensitive habitat.			



Break-out groups

Matching Issues/Interests with Decisions

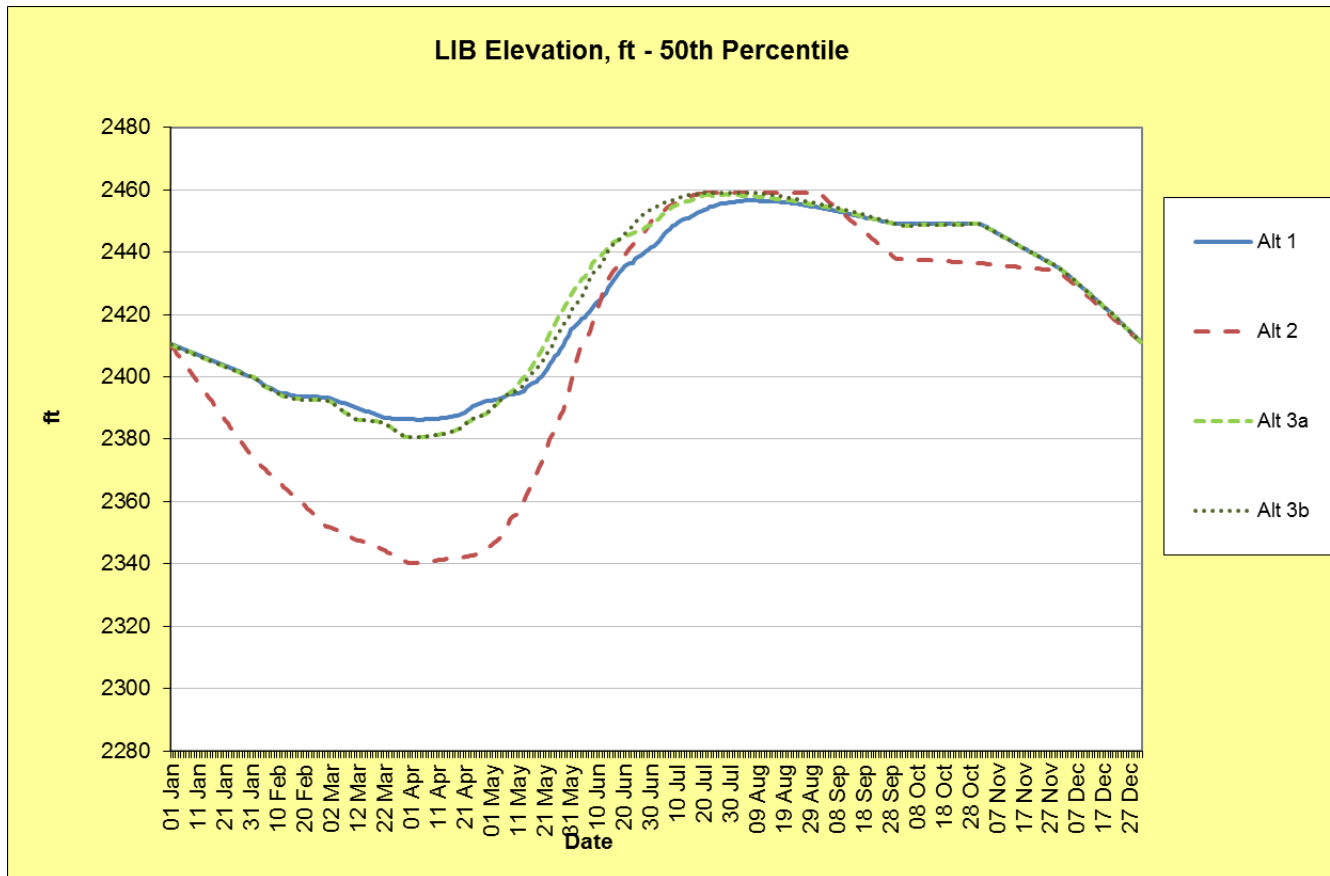
1. What issues / interests are linked to the Strategic Decision on whether to continue or terminate the Columbia River Treaty?
2. What issues / interests are affected by domestic decisions – Water-use Plans and Fish, Wildlife Compensation Program, distribution of grants and other funding?



Alternatives and Consequence Tables

Kootenay Alternatives

- Alternative 1: Current Conditions (VarQ flood control & sturgeon spring flows)
- Alternative 2: Power & Standard Flood Control
- Alternative 3b: Refill by 30 Jun



Summary of Results – Kootenay

Objective	Performance Measure	Units	Dir	Alt 1	Alt 2	Alt 3b	PM #
Kootenay Reservoir							
Reservoir Vegetation and Wildlife	Hectares flooded >10 wks	Hectares	L	2,673	1,443	2,720	(#50)
Fish and Aquatic Ecosystem Health	Primary production	Tons	H	14.5	12.6	15.2	(#51)
General Recreation and Tourism	Preferred Elevation Range	Days	H	28.5	16.5	27.0	(#52)
Kokanee Angling	Angling Effort	Angler Days	H	23,629	26,627	29,008	(#52)
Kootenai River and Creston Valley Floodplain							
Dyke Management Operations	Preferred Lake Elevation	Days	H	163	165	165	(#53)
Farming Equipment Handling	Preferred Lake Elevation	Days	H	21	19	21	(#53)
Kootenay Lake							
Fish and Aquatic Ecosystem Health	West Arm Spawner Length	cm	H	31.1	30.2	30.9	(#55)
Recreation, Tourism and Industry	Preferred Lake Elevation	Days	H	67	65	73	(#56)
Flooding	% Yrs above 1752'	Days	L	14%	6%	8%	(#57)
Kootenay River Downstream of Corra Linn Dam							
Vegetation and Wildlife	Cumulative Habitat Loss	Ha	L	4,307	3,242	4,089	(#58)
Fish and Aquatic Ecosystem Health	Total Dissolved Gases	% Sat'n Days	L	45	29	40	(#59)
System-Wide Impacts							
Canadian Financial Value	Increase in Value of Energy	\$m/yr	H	-	19.4	4.6	(#60)
US Jurisdiction							
Sturgeon & Bull trout in the Kootenai R	Meets US regulations	Yes / No	H	Yes	No	No	App H
Salmon in the United States	Meets US regulations	Yes / No	H	Yes	No	Maybe	App H

Legend

Better than highlighted

Worse than highlighted

Highlighted

Key Findings - Kootenay

- **Deeper Libby drafts from called upon flood control**
 - **Benefits of Deeper draft:** Less flooding on Kootenay Lake, more power benefit, improvements for aquatic health in Kootenay River below Nelson, potential benefit to vegetation and wildlife on Koocanusa Reservoir.
 - **Impacts of Deeper Draft:** Potential negative impacts on aquatic productivity and recreation on Koocanusa reservoir
- **Current operations could potentially be altered to benefit a wider range of interests in Canada**
 - **Benefits:** May benefit Koocanusa resident fish and recreation, flood reduction at Kootenay Lake, reduced spill in the Kootenay River which produces environmental benefits and power benefits
 - **Impacts:** May increase the risk of surcharging Koocanusa Reservoir. Does not meet the current U.S. fisheries requirements
- **Others??**

Strategic Decision Scenarios - Columbia

Terminate

Treaty Continue

Treaty Plus



Possible Operating Alternatives

- Power
- Power + current fish operations
(includes Arrow recreation)
- Arrow wildlife & vegetation
- Mica environmental/recreation
- Fisheries #1– below Arrow
- Fisheries #2– sturgeon



Possible Operating Alternatives

- Power
- Power + current fish operations
- Arrow wildlife & vegetation
- Mica environmental/recreation



Possible Operating Alternatives

- Not modelled

Which elements?

CRT Alternatives

Alternative	Description
Ref- TC (reference)	Current Operating Constraints (TC) – This alternative includes all current hard operating constraints and the Treaty power operations. Flows below Arrow are adjusted to meet whitefish and rainbow trout spawning flows. For whitefish, Arrow discharge is reduced in Jan and then excessive flow reductions are managed through March. Rainbow trout require increasing flow April through June.
Ref - TT (reference)	Optimum Power (TT) – This alternative includes all current hard operating constraints but is not constrained by the Treaty. To optimize power, Arrow reservoir is held close to full throughout the year. Trout spawning flows are met. Whitefish spawning flows are met in approximately 40% of years.

CRT Alternatives

Alternative	Description
Alt 3 TC	Arrow Wildlife/Vegetation (TC) – This alternative holds Arrow Lakes Reservoir lower until mid-July to allow vegetation to extend into lower elevations, provides benefits to nesting birds, increases the length of flowing river, and provides shore based recreation in the Revelstoke reach. The following maximum month end elevations are used as constraints to model this alternative: April (1427.2 ft/435.0 m) , May (1427.2 ft/435.0 m), June (1427.2 ft/435.0 m), July (1433.8 ft/437.0 m), August (1433.8 ft/437.0 m)
Alt 3 TT	Arrow Wildlife/Vegetation (TT) – same as above except no Treaty constraints

CRT Alternatives

Alternative	Description
Alt 4 TC	Mica Environmental/Recreation (TC) – This alternative generally supports fish, navigation and recreation on Kinbasket Reservoir. Its objective is to maintain a minimum elevation of 2395 ft (730 m) year round.
Alt 4 TT	Mica Environmental/Recreation (TT) - same as above except no Treaty constraints

CRT Alternatives

Alternative	Description
Alt 5 TT	Fisheries hydrograph #1- Flushing flow (TT) – Provide flushing flows of 200 kcfs (5663.4 cms) at Birchbank for 5 days.
Alt 6 TT	Fisheries hydrograph #2 – Sturgeon (TT) – Provide flows of 185 kcfs (5238.6 cms) at Birchbank for 4 weeks starting ~ mid-June in at least 60 % of the years. The ramping up rate doubles the discharge in about 2 weeks, and the ramping down rate reduces flows to 55% of the peak flow in 4 weeks.

Columbia Performance Measures (Appendix F)

FOR GENERATIONS

- Example 1 - Kinbasket Reservoir

- Vegetation

- # of 2m elevation bands between 735-755m that are inundated more than 18 weeks per year

- Example 2 – Arrow Reservoir

- Bull trout & Kokanee tributary access in Arrow Lakes Reservoir

- # of days reservoir is > 1430 ft between 25 August to 15 November (spawning period)

- Example 3 – Lower Columbia River

- Frequency of Flood Flows

- # of days per year flows > 165,000 kcfs (at Birchbank)
- # of days per year flows > 177,000 kcfs (at Birchbank)



Examine uncertainties and trade-offs of alternatives

Kinbasket Reservoir

Objective	Performance Measure	Units	Dir	Ref TC	3TC	4 TC	Ref TT	3 TT	4 TT	5 TT	6 TT	PM
Kinbasket												
Veg & Wildlife	Elevation bands flooded > 18 wks	# 2m bands	L	6.1	7.2	6.0	6.8	6.8	8.6	6.8	7.0	(#5)
Aquatic Productivity	Residence time	Days	H	622	529	427	687	709	496	670	727	(#7)
Heritage	Site erosion	Weighted Days	L	203	239	238	203	201	267	204	202	(#3)
Heritage	Site inundation	Weighted Days	H	524	627	568	556	555	770	555	559	(#3)
Rec - Water - Canoe	Pref range: 2404 < days < 2475	Days	H	148	170	170	145	145	185	146	146	(#2)
Rec - Water - Columbia	Pref range: 2375 < days < 2475	Days	H	52	68	69	51	52	52	52	50	(#2)
Rec - Shore - Columbia	Pref range: 2444 < days < 2473	Days	H	175	182	184	175	175	184	176	176	(#2)
Dust	Areal extent	SqKm - Days	L	1,468	1,134	1,133	1,393	1,240	991	1,407	1,229	(#6)
Erosion	Elev >= 2470	Days	L	54	85	35	70	65	123	68	79	(#4)
Navigation	Downie Timber access (>=2360)	Ave Days/yr	H	348	362	365	362	364	365	363	361	(#1)

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Mid-Columbia River

Objective	Performance Measure	Units	Dir	Ref TC	3TC	4 TC	Ref TT	3 TT	4 TT	5 TT	6 TT	PM
Mid Columbia River												
Veg & Wildlife - Veg Flooding	Hectares flooded > 18 wks	Hectares	L	2,352	1,388	1,388	3,234	2,352	3,426	3,234	1,871	(#11)
Veg & Wildlife - Nesting birds	% Useable habitat	Percent	H	20	48	40	-	17	-	0	70	(#13)
Veg & Wildlife - Fall Mig. Birds	% Useable habitat	Percent	H	15	87	71	-	55	-	0	34	(#13)
Aquatic - River Habitat	Functional large river habitat	Km	H	31	35	34	18	23	19	19	26	(#12)
Aquatic - Sturgeon	Larval habitat availability	Km	H	2.84	2.85	2.85	2.77	2.85	2.83	2.79	2.85	(#12)
Rec - Boat Access	Days > 1435	Days	H	64	2	21	153	26	153	145	59	(#10)
Rec - Shore Access	Days < 1435	Days	H	119	181	162	-	157	-	8	94	(#10)

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Arrow Reservoir

Objective	Performance Measure	Units	Dir	Ref TC	3TC	4 TC	Ref TT	3 TT	4 TT	5 TT	6 TT	PM
Arrow Lakes												
Aquatic - Kok Trib. Access	Days > 1430'	Days	H	60	37	50	82	82	82	82	22	(#20)
Aquatic Productivity	Epilimnetic residence time	Days	H	107	101	98	95	93	84	94	70	(#7)
Heritage	Site erosion	Weighted Days	L	227	135	151	365	332	357	363	233	(#17)
Heritage	Site inundation	Weighted Days	H	190	56	95	763	524	750	735	430	(#17)
Recreation - General	1435 < days < 1440	Days	H	97	75	72	197	197	197	197	41	(#16)
Dust	days < 1410	Days	L	41	61	61	-	-	-	-	-	(#18)
Navigation	Weighted-Days	Days	H	219	226	219	211	248	211	226	248	(#15)

Legend

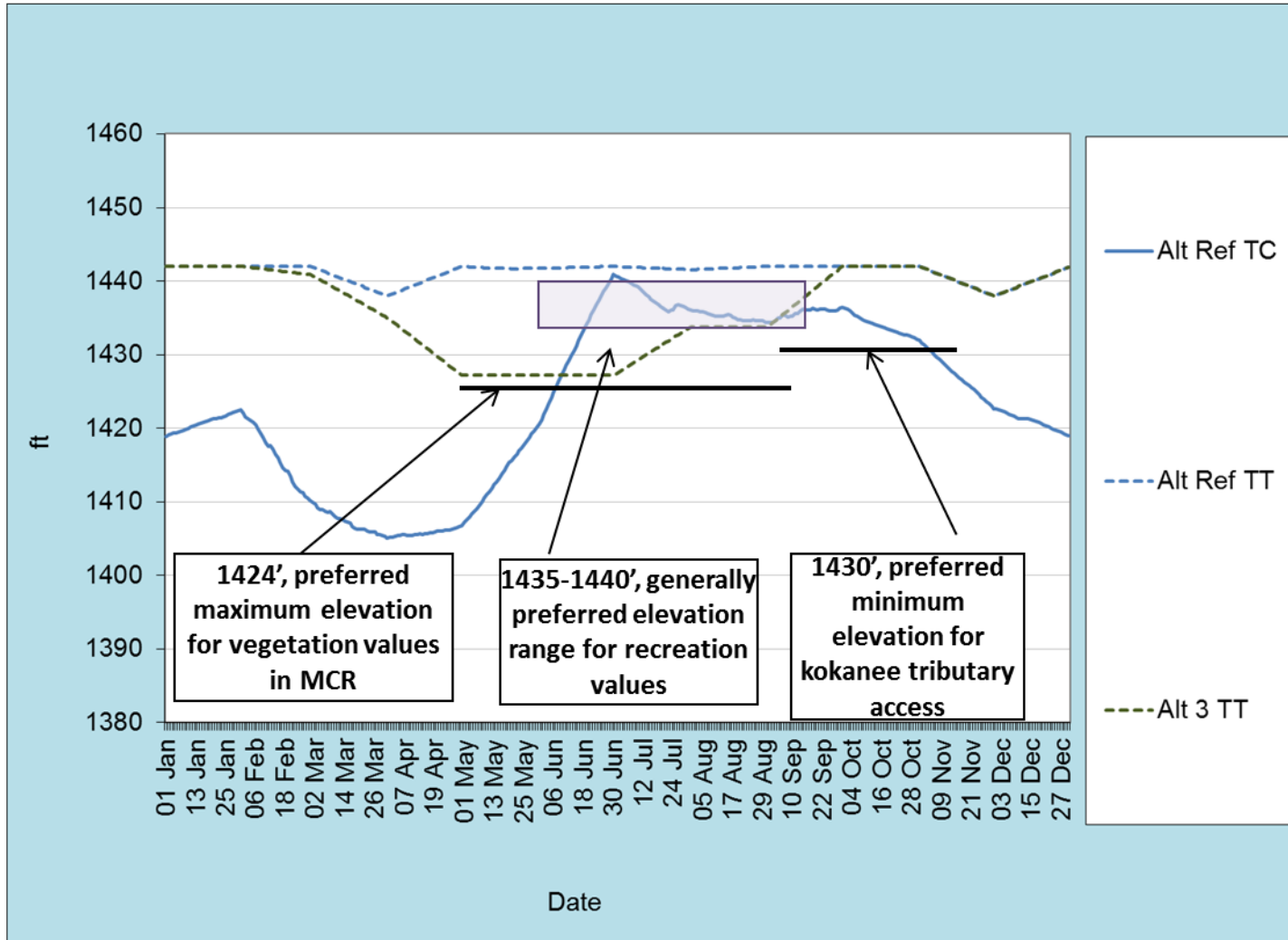
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Key Findings – 3 – Arrow

- Preferred ranges for vegetation, recreation, tributary access



Lower Columbia River

Objective	Performance Measure	Units	Dir	Ref TC	3TC	4 TC	Ref TT	3 TT	4 TT	5 TT	6 TT	PM
Lower Columbia River												
Boat Access	40000 < days < 103000	Days	H	95	98	94	79	78	71	75	83	(#26)
Shoreline Access	60000 < days < 99000	Days	H	79	75	86	61	65	54	57	45	(#26)
Flooding at Genelle (1)	days > 165 kcfs	Days	L	2	2	2	6	6	8	6	32	(#27)
Flooding at Genelle (2)	days > 177 kcfs	Days	L	1	1	1	3	3	4	3	11	(#27)
Whitefish / Trout	INDEX	INDEX	H	-	-	- 0.13	0.63	- 0.18	0.97	0.36	- 0.15	APPX E
TGP	days > 115%	Days	L	NA	NA	NA	NA	NA	NA	NA	NA	(#28)
Sturgeon	Pulse provided	Yes / No	H	No	No	No	No	No	No	No	Yes	NA

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System Wide – Financial

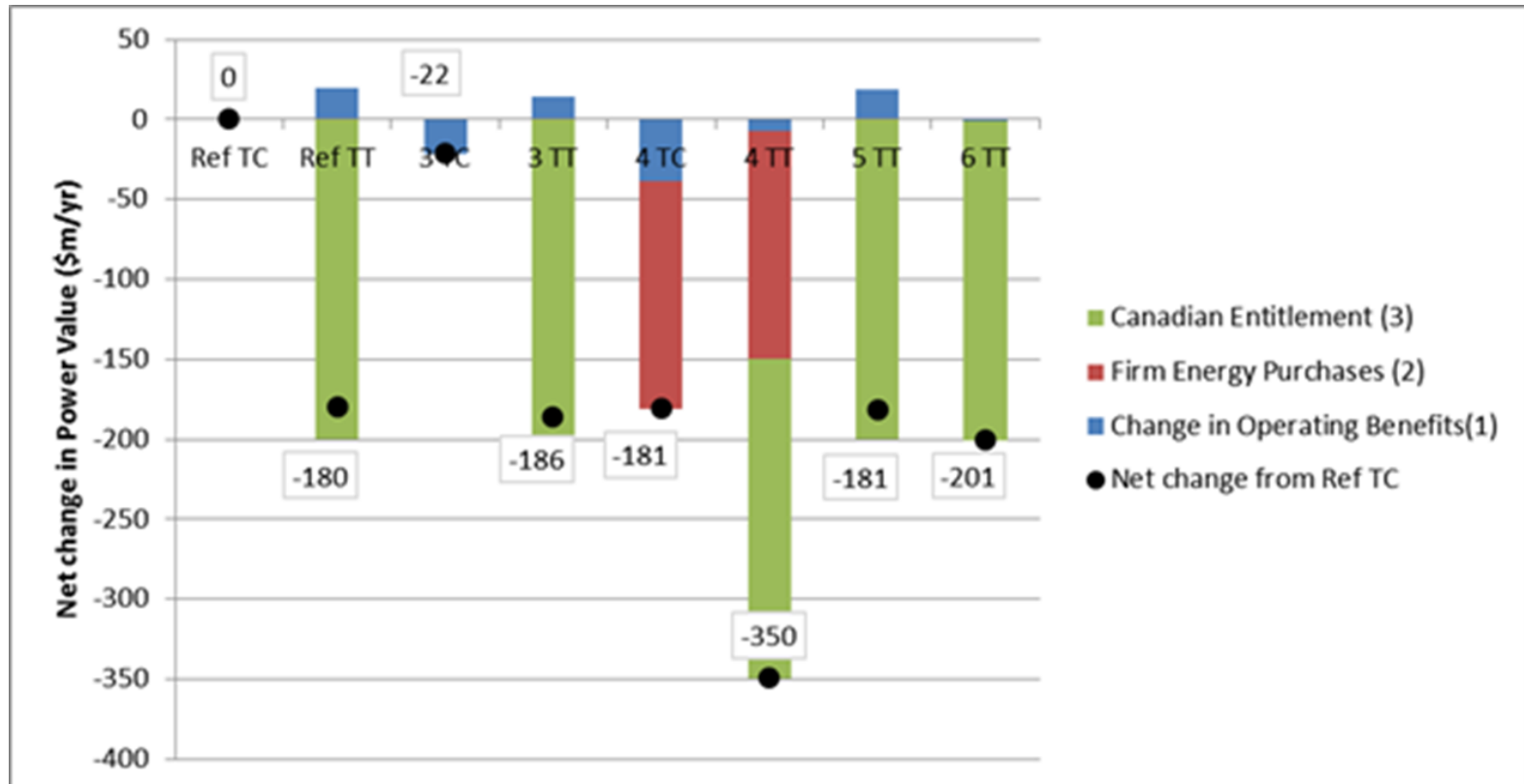
Objective	Performance Measure	Units	Dir	Ref TC	3TC	4 TC	Ref TT	3 TT	4 TT	5 TT	6 TT	PM
System Wide												
Relative loss in Power Values	Incremental Cost	\$M/yr	L	-	22	181	180	186	350	181	201	(#30)

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Systemic Trade-offs

	Treaty Continue			Treaty Terminate				
	Ref TC	3TC Veg/ Wildlife	4 TC Kinbasket Env/Rec	Ref TT Optimum Power	3 TT Veg/ Wildlife	4 TT Kinbasket Env/Rec	5 TT Fish Flow 5 days	6 TT Fish Flow 4 weeks
Kinbasket Rec/ Nav / Dust	NA	Rec Days (+15-30%)	Rec Days (+5- 30%)			Rec Days (+0- 20%)		
Mid-Columbia River Veg / Wildlife/River Habitat		Veg Area (+40%)	Veg Area (+40%)	Veg Area (-38%)		Veg Area (-46%)	Veg Area (-38%)	Veg Area (+70%)
		Bird Hab. (+>100%)	Bird Hab. (+>100%)	All Bird Habitat Lost		All Bird Habitat Lost	All Bird Habitat Lost	Bird Hab. (+>100%)
		River Hab (+12%)		River Hab (-40%)	River Hab (-25%)	River Hab (-40%)	River Hab (-39%)	River Hab (-17%)
Arrow Rec / Dust /Kokanee access		Rec Days (-23%)	Rec Days (-26%)	Rec range all season	Rec range all season	Rec range all season	Rec range all season	Res drops 60' in summer
		Kok Access (-38%)	Kok Access (-17%)	Full Kok Trib Access	Full Kok Trib Access	Full Kok Trib Access	Full Kok Trib Access	
LCR Fish				Possibly better for MW / RBT		Possibly better for MW / RBT		Major sturgeon pulse
LCR Flooding							Flow >177kcfs (5012 cms) every year	Flow >177kcfs (5012 cms) every year
Annual Power Value Change		-\$22m	-\$180m	-\$180m	-\$190m	-\$350m	-\$180m	-\$200m

Key Findings – Columbia River System

- **Operating constraints on Kinbasket reservoir have the highest costs (especially if firm energy is impacted), regardless of Treaty Termination**
- **With Treaty Termination, Arrow Lakes operational choices become less linked to choices made at Kinbasket**
- **Regardless of the Treaty's future, value trade-offs at Arrow will remain**
- **Treaty Terminate opens up new trade-off opportunities / constraints between Arrow and the Lower Columbia River**
- **Others??**

Key Findings – 1

Operating constraints on Kinbasket reservoir have the highest costs (especially if firm energy is impacted), regardless of Treaty Termination

Improvements to recreation, navigation and potentially vegetation/wildlife and the operating cost and cost of building new sources of firm energy are similar whether the Treaty continues or is terminated.

Treaty Continue	Treaty Terminate
Due to the large generation capability at Mica and Revelstoke (5700 MW, ~50% of BC Hydro's capacity), changes at Mica are the most costly and provide limited gains for interests around the reservoir.	In Treaty Terminates, more radical changes to operations could be developed that could provide greater benefits to interests around the reservoir, but at an even higher cost. This domestic trade-off remains the same.

Key Findings – 2

With Treaty Termination, Arrow Lakes operational choices become less linked to choices made at Kinbasket

Treaty Continue

Under the Treaty Continue scenario, there will always be a need to balance between Kinbasket/Arrow as the *border flow* releases from Canadian storage are set by the Treaty operations. If Arrow is low, Kinbasket will be higher and vice versa.

Treaty Terminate

Under a Treaty Terminate scenario, Arrow reservoir levels can change without having the same impact on Kinbasket reservoir, thereby creating more opportunity to operate Arrow for other interests.

Key Findings – 3

Regardless of the Treaty's future, value trade-offs at Arrow will remain

Treaty Continue	Treaty Terminate
Alternative 3 demonstrates the trade-off at Arrow reservoir under a Treaty Continue scenario where significant benefits to vegetation, bird and wildlife values in the Mid-Columbia River can be gained by a lower reservoir elevation, however these result in the loss of power revenues and declines in kokanee tributary access and recreation days in Arrow Lakes Reservoir	The de-linking of Kinbasket and Arrow reservoirs enables different operations at Arrow reservoir that could provide a different (and potentially better) balance between the high and low Arrow reservoir interests. However, as Figure 6 illustrates, several of the key interests in Arrow Lakes reservoir are mutually exclusive, and so tough trade-off choices will remain.

Key Findings – 4

Treaty Terminate opens up new trade-off opportunities / constraints between Arrow and the Lower Columbia River

Treaty Continue	Treaty Terminate
<p>Under the Treaty Continue scenario, BC Hydro is able to meet Lower Columbia River spawning flows in the January through June period, although this does result in high Arrow reservoir levels in the spring which impacts the Mid-Columbia interests that prefer lower levels in the spring but benefits reservoir based recreation.</p>	<p>The potential for different operations creates quite different trade-offs between Arrow reservoir and the downstream river section that were not investigated in the WUP.</p>



Key Question for Sounding Board

What are the key interests and issues decision makers should consider for the first strategic decision?