SDM Process Steps

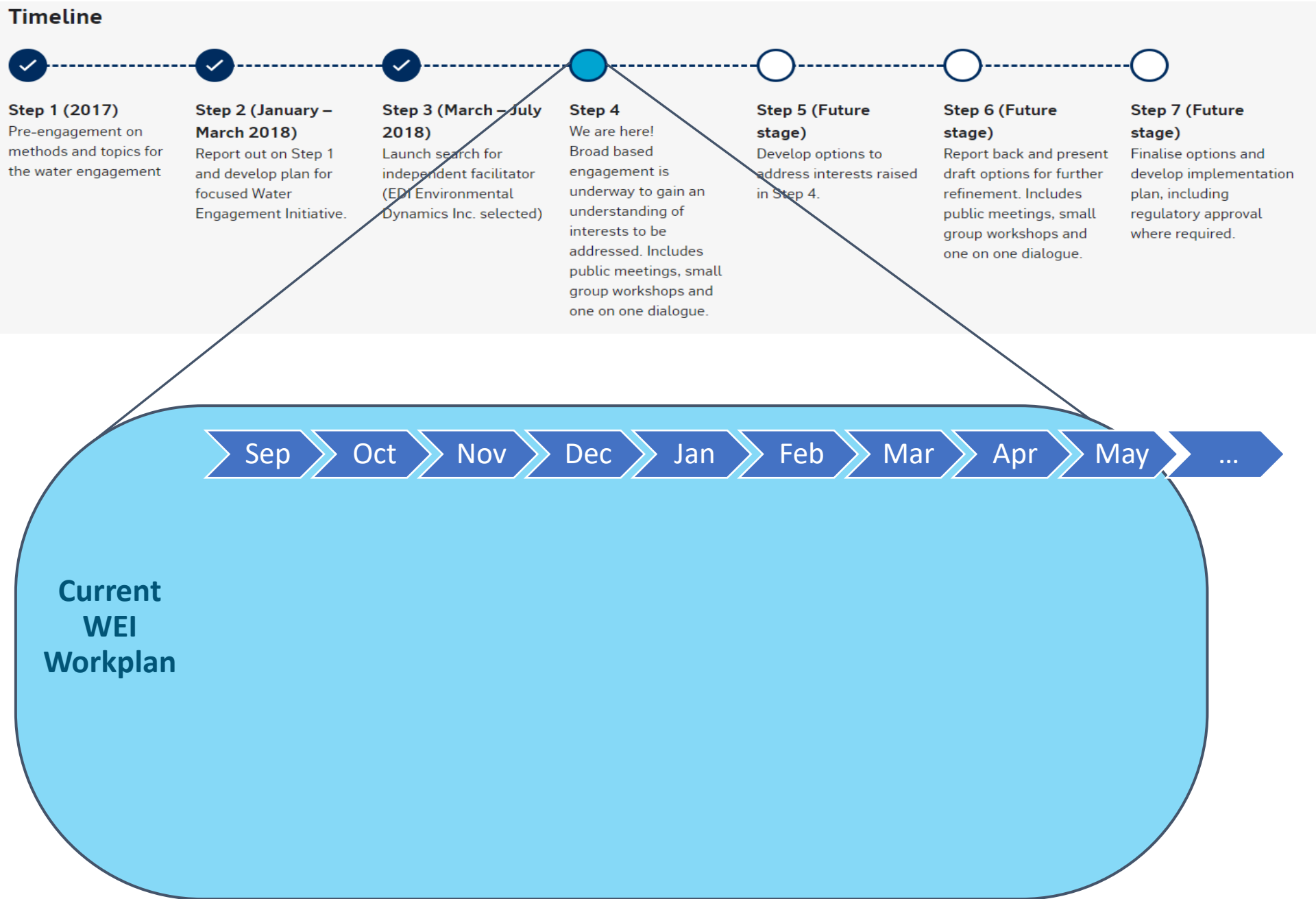
WEI Meeting 26 - Wednesday, April 6, 2022

Michael Harstone, Compass Resource Management (SDM)

What is Structured Decision Making?

compass

WEI Process Steps



WEI Process Steps

Timeline

Step 1 (2017)
Pre-engagement on methods and topics for the water engagement

Step 2 (January – March 2018)
Report out on Step 1 and develop plan for focused Water Engagement Initiative.

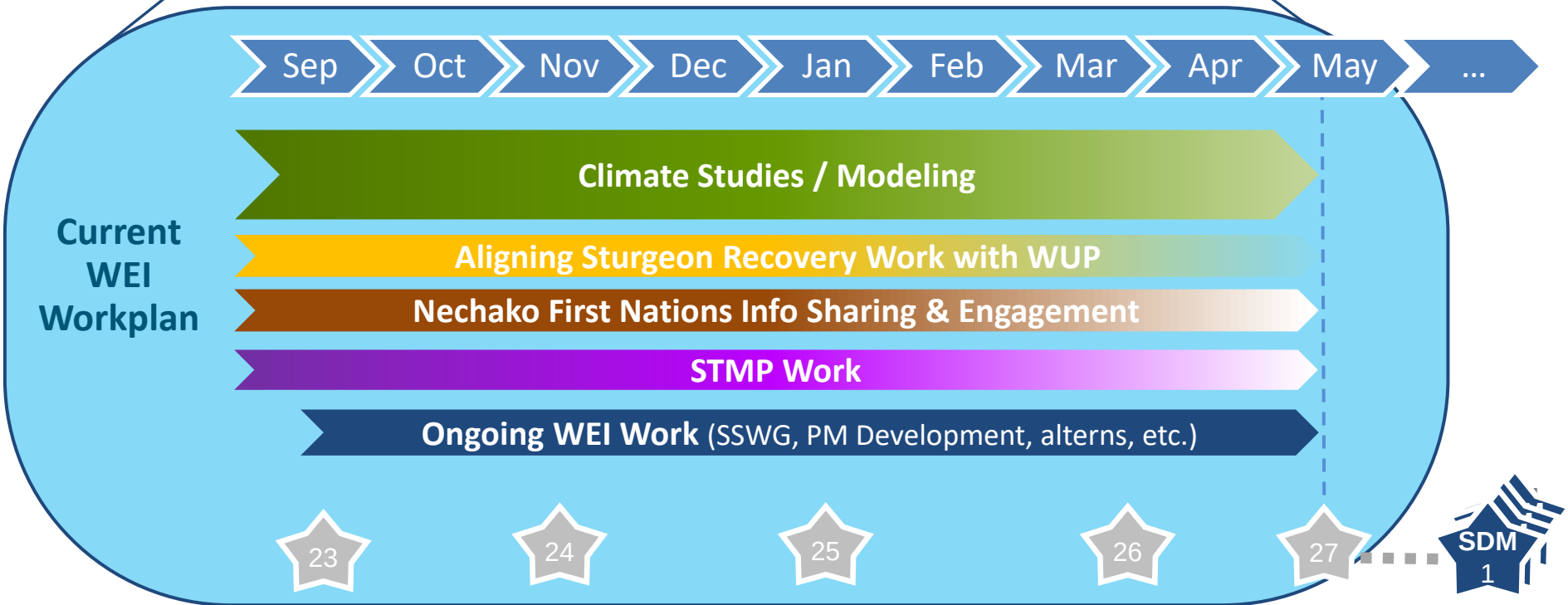
Step 3 (March – July 2018)
Launch search for independent facilitator (EDI Environmental Dynamics Inc. selected)

Step 4
We are here! Broad based engagement is underway to gain an understanding of interests to be addressed. Includes public meetings, small group workshops and one on one dialogue.

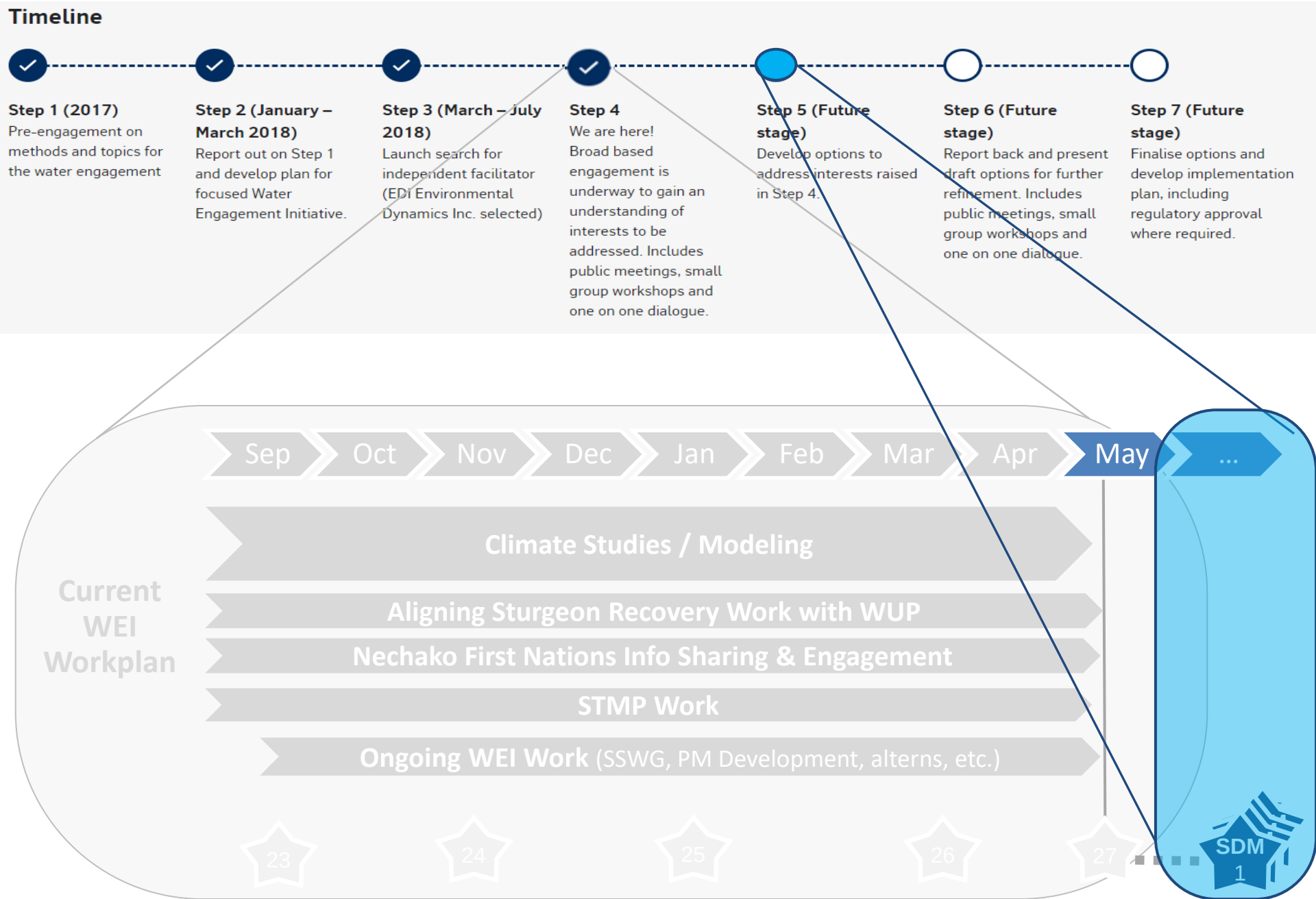
Step 5 (Future stage)
Develop options to address interests raised in Step 4.

Step 6 (Future stage)
Report back and present draft options for further refinement. Includes public meetings, small group workshops and one on one dialogue.

Step 7 (Future stage)
Finalise options and develop implementation plan, including regulatory approval where required.

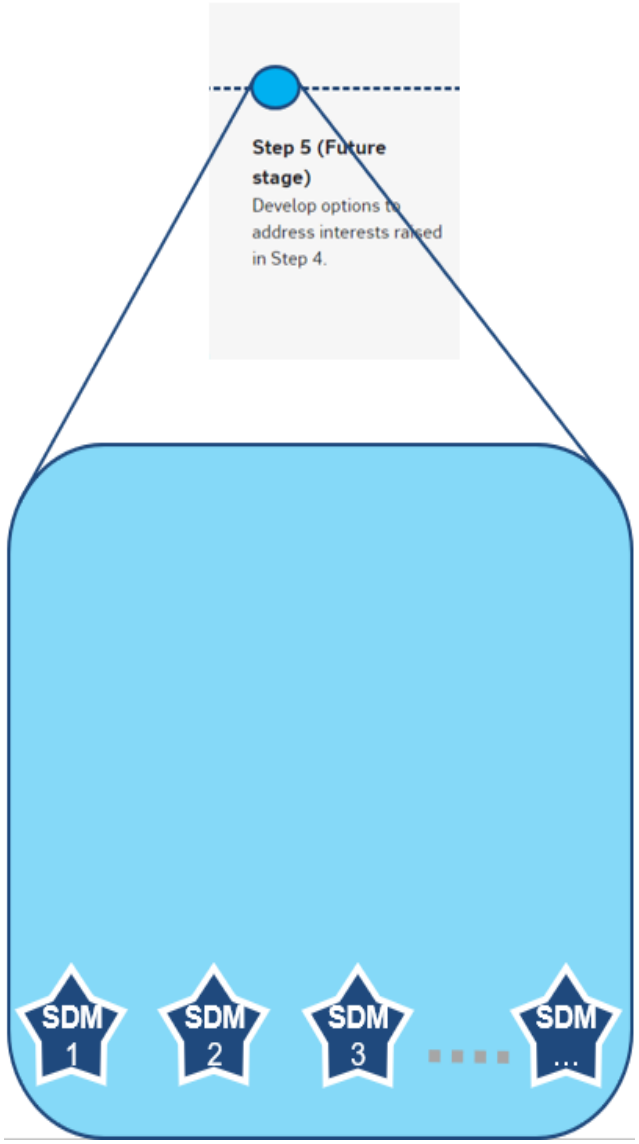


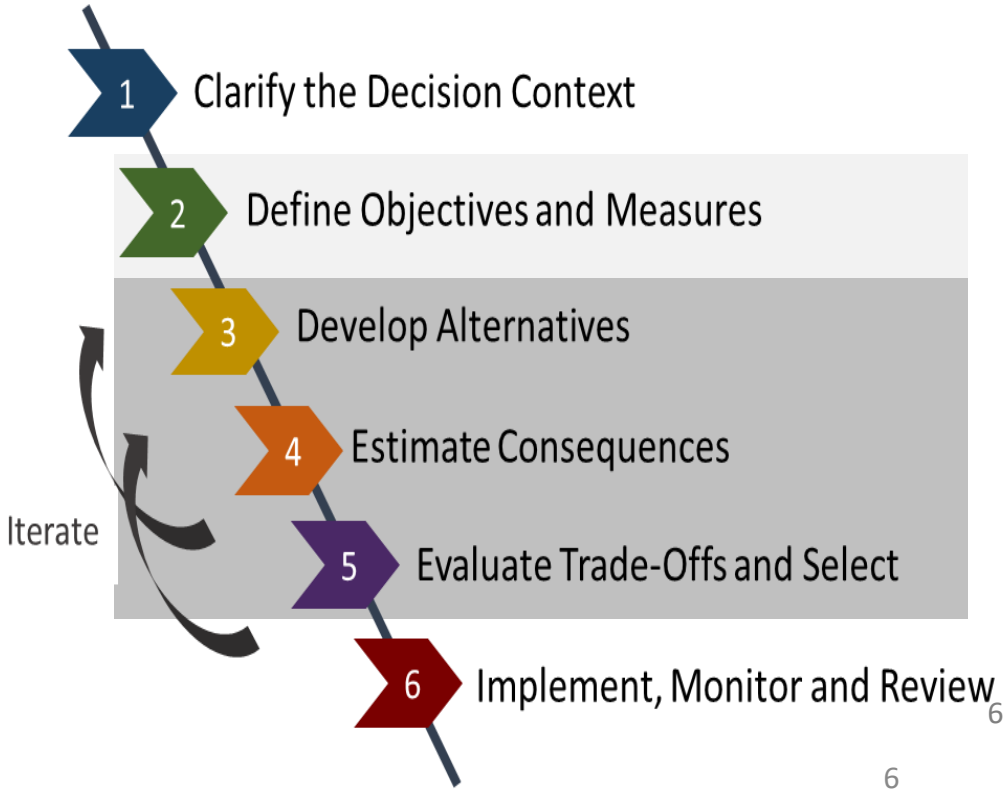
WEI Process Steps



SDM Process Steps: A Picture for the WEI

Collaborative Development and Evaluation of Operational Flow Alternatives





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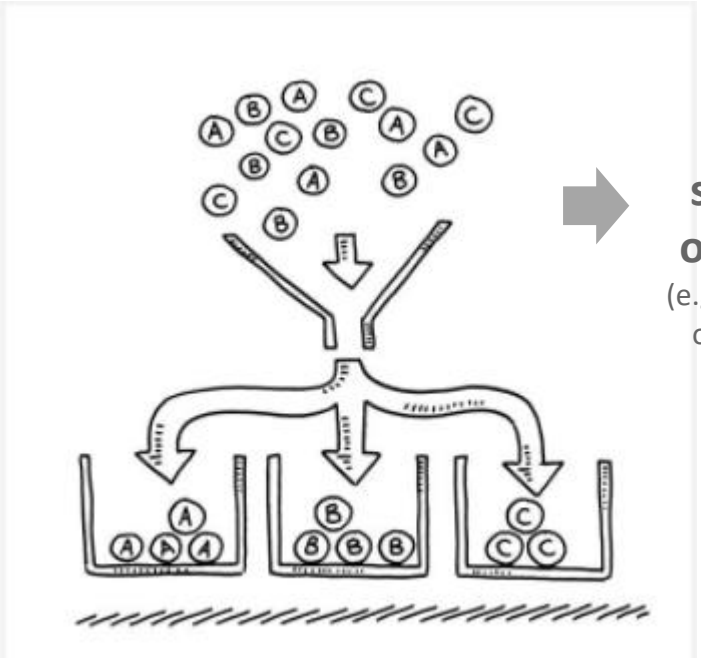
SDM Process Steps: A Picture for the WEI

Collaborative Development and Evaluation of Operational Flow Alternatives

2 Define Objectives and Measures

Issues Scoping & Characterization



Issues sorted & organized
(e.g., sensitive to operations & water mgt)

Health of the river

Fish
- Nechako Reservoir - Fish
- Murray-Cheslatta - Fish
- Nechako River - Anadromous Fish

Wildlife
- Nechako Reservoir - Caribou
- Nechako Reservoir - Moose
- Nechako Reservoir - Waterfowl & ground nesting birds
- Nechako Reservoir - Osp
- Nechako Reservoir - life hab
- Nechako Reservoir - Aq ic mam (Otter, muskrat, beaver)
- Nechako River - Beavers
- Nechako River - Waterfowl & ground nesting birds

Human Health
- Nechako Reservoir - Water quality

Culture & Heritage
- Murray-Cheslatta - Gravesites
- Salmon harvest (Nechako River)
- Flooding & Erosion
- Nechako Reservoir - Bank Erosion
- Murray-Cheslatta - Bank Erosion
- Ne - Municipal flooding
- Ne Private property flooding &
- ech River nent transport
- hak iver - Backwatering

Recreation & Navigation
- Nechako Reservoir - Boat docks & launches
- Nechako Reservoir - Dead trees
- Nechako Reservoir - Submerged hazards
- Nechako Reservoir - Beaches
- Nechako River - Float planes and canoes
- Nechako River - Hiking trails

RT Operations
- Revenue
- Operational flexibility

Draft

SDM Process Steps: A Picture for the WEI

Collaborative Development and Evaluation of Operational Flow Alternatives

2 Define Objectives and Measures

Objective	Performance Measure	Units
Environment - River		
Fish Passage	Adult summer CHK migration (10%tile)	HSI
Fish Passage	Adult fall CHK migration (10%tile)	HSI
Lateral Connectivity	Side channel connectivity (10th %tile)	%
Rearing	Steelhead parr (10th %tile)	HSI
Rearing	Chinook fry (10th %tile)	HSI
Spawning	Early Steelhead incubation (10%tile)	HSI
Environment - Lake		
Vancouver Lamprey	Lamprey rearing habitat (Scale 1-6)	#
Littoral Productivity	Littoral rearing habitat	#
Industry and Commercial		
Catalyst Paper	Impacted operations days	days/yr
Agriculture	Placeholder	
Commercial Fisheries	See fish PMs	
Lakefront Properties		
Flooding and innundation	Max High Water Event - Mar 1 to Apr 30	meters
Private Property Lkfrnt Areas	Frontage length - un-vegetated, mod slope	meters
Municipal		
Community Water Supply	Intake pumping cap. - Town of Lake Cowichar	days/yr
Community Water Supply	Intake invert El. - Town of Lake Cowichan	days/yr
Waste Water Dilution	Effl dilution ratio (200:1) – Upper River	days/yr
Recreation and Tourism		
Beach Use Areas - Lake	Beach user days - un-vegetated, steep slope	wt days
Boat Access/Navigtn-Lake	Decrease in dock use days	days
Boating & Tubing - River	Decrease in river boating days	days
Lake Aesthetics	Visual Quality	#
Water Management		
Capital Costs	Capital costs	M$
Operational Costs	AVG Operational costs (over 10yrs)	M$

PMs

Health of the river

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RT Operations
- Revenue
- Operational flexibility

Draft

SDM Process Steps: A Picture for the WEI

Collaborative Development and Evaluation of Operational Flow Alternatives

3 Develop Alternatives

ROUND 1	ROUND 2	ROUND 3
Alt 1	Alt 1	Alt 1
Alt 2	Alt 2	Alt 2
Alt 3		
Alt 4		
Alt 5		
Alt 6		
Alt 7	Alt 7	
	Alt 10	Alt 10
	Alt 11	Alt 11
	Alt 12	Alt 12
	Alt 13	Alt 13
		Alt 20
		Alt 21
		Alt 22
		Alt 23
		Alt 24

Illustrative

Example Menu

- SLS Flow Releases (e.g., monthly targets)
  - ❑ +/- 0cms
  - ❑ +/- 5cms
  - ❑ +/- 10cms
  - ❑ +/- … etc.
- Reservoir Targets (e.g., monthly)
  - ❑ 0m
  - ❑ +/- 0.15m
  - ❑ +/- 0.3…
  - ❑ …etc.
- Fisheries Flows Targets
  - ❑ STMP
  - ❑ Murray – Cheslatta
  - ❑ Nechako River
  - ❑ Etc.
- Other operational changes
  - ❑ Ramp rates
  - ❑ Kemano diversion
  - ❑ Etc.

Illustrative

SDM Process Steps: A Picture for the WEI

Collaborative Development and Evaluation of Operational Flow Alternatives

4 Estimating Consequences

Stepped Evaluation Approach:

Hydrological Modeling

1. Review changes in hydrological conditions (i.e., water levels and flows)
2. Review performance measure values
3. Review supplemental information

Local & Indigenous Knowledge

Deliberative & Structured Assessment of Flow Alternatives

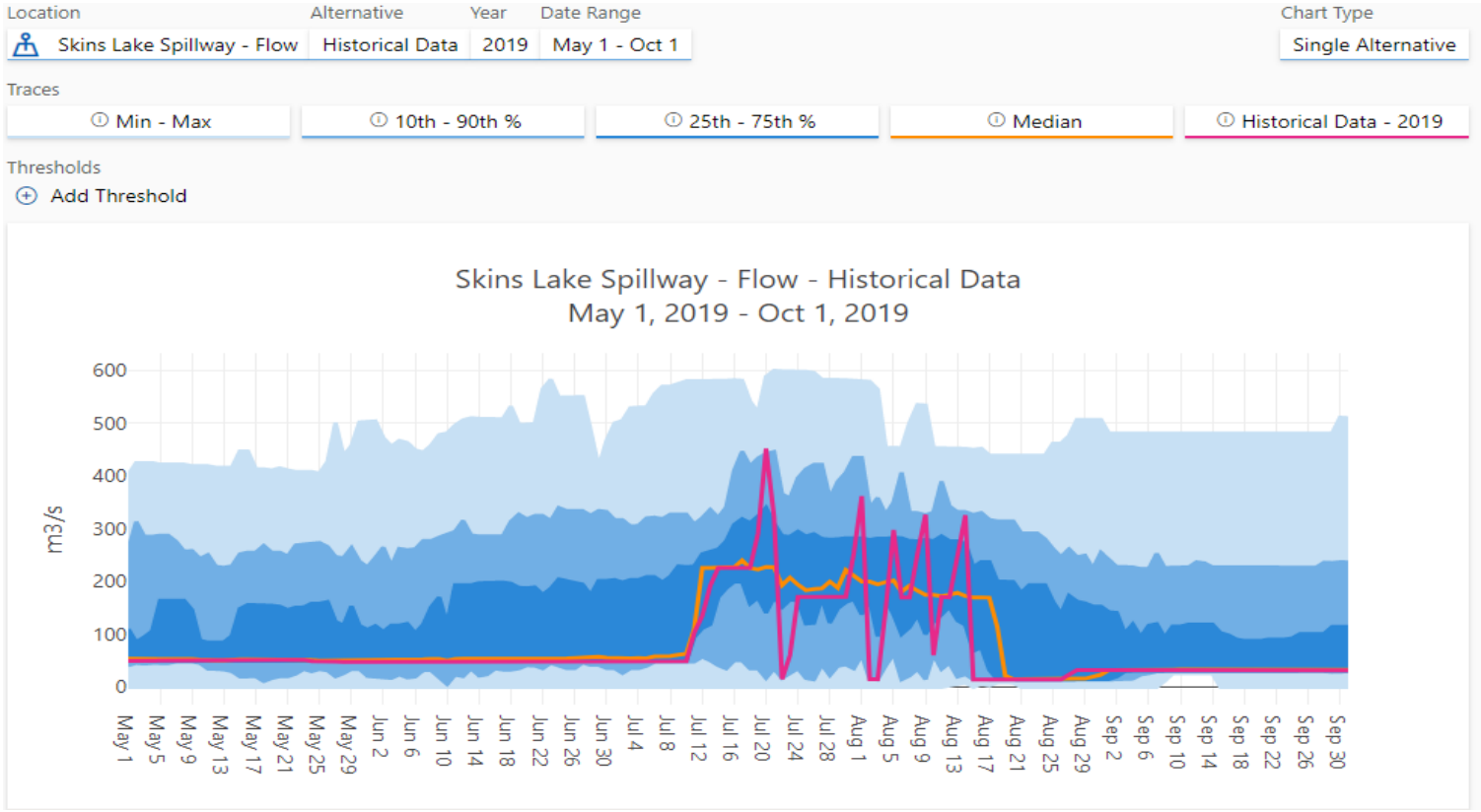
SDM Process Steps: A Picture for the WEI

Collaborative Development and Evaluation of Operational Flow Alternatives

4 Estimating Consequences

HydroViz

Interactive and comparative hydrographs



SDM Process Steps: A Picture for the WEI

Collaborative Development and Evaluation of Operational Flow Alternatives

4 Estimating Consequences

Consequence Table

Reviewing PM Values

Objective (Expand All Collapse All)	Performance Measure	Unit	Preferred Direction	Altern 1	Altern 2	Altern 3
Salmon (Nechako)						
Min temp effects salmon migration	Avg daily flow (Jul 1 - Sep 30)	m3/s	Higher	229	176	291
Min salmon incubation mortality	Diff. betw AVG spawning flow and minimum (Sep 1 - Oct 15)	m3/s	Lower	137	25.5	81.9
River Fish						
Min fish stranding mortality	Max daily change in water level	m	Lower	.22		.14
Wildlife (caribou)						
Min land connections to calving islands	# Days reservoir elev is < 852m (May 1 - Jun 30)	#	Lower	48		
Flooding						
Min open-water, overbank flooding	# Days where flows >			5.3	2.6	31.0
Recreation						
Min flooding of hiking trails (river)	# Da ow 255cms	#	Lower	35.2	16.0	74.2
Max access to boat docks / launcl ese)	VG r voir eleva (Ma Oct 3	m	Higher	851.7	851.7	
Rio Tinto Operations						
Max RTA revenue	AVG daily flow (powerhouse)	m3/s	Higher	86.4	118	0
Environment (River)						
Flushing Flows	# Days flows > 200% MAD (468cms)	#	Higher	15.2	7.7	46.8

Illustrative

SDM Process Steps: A Picture for the WEI

Collaborative Development and Evaluation of Operational Flow Alternatives

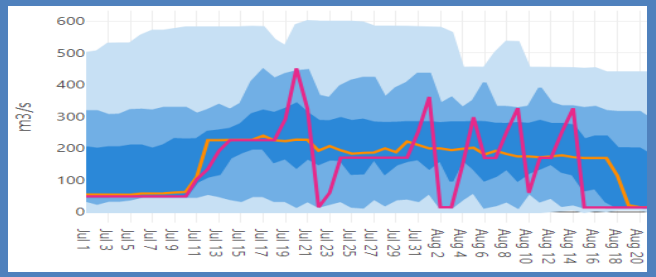
4 Estimating Consequences

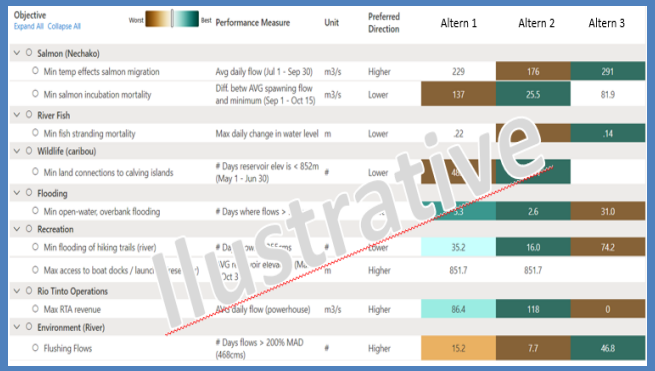
Supplemental Analysis
(as carried out and/or reviewed by TWG)

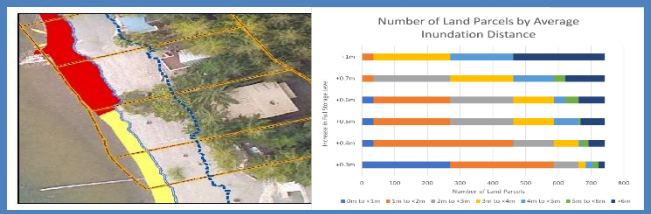
SDM Process Steps: A Picture for the WEI

Collaborative Development and Evaluation of Operational Flow Alternatives

5 Evaluate Trade-Offs



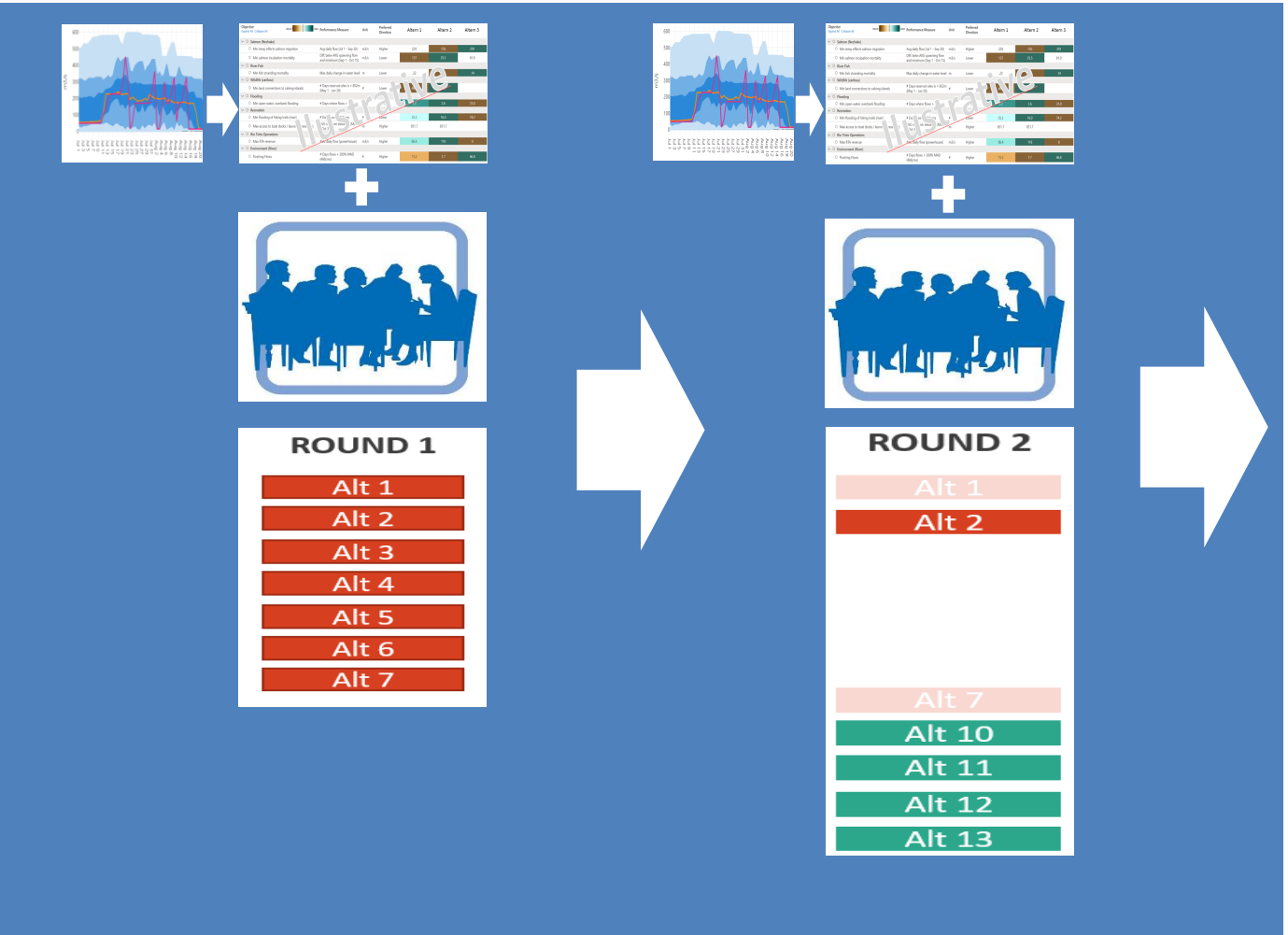




SDM Process Steps: A Picture for the WEI

Collaborative Development and Evaluation of Operational Flow Alternatives

5 Evaluate Trade-Offs (and reaching agreement)



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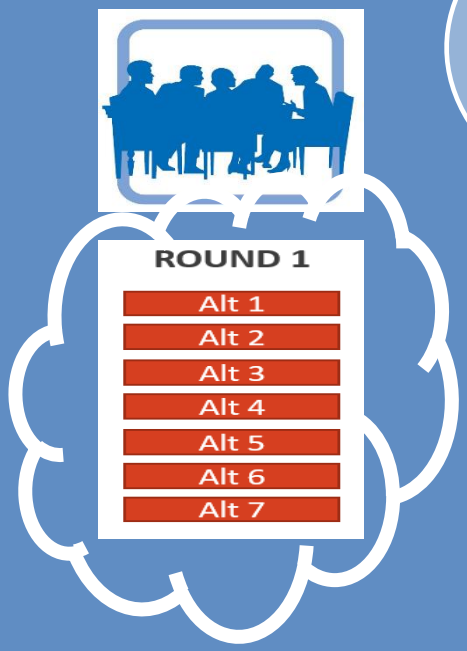
Collaborative Development and Evaluation of Operational Flow Alternatives

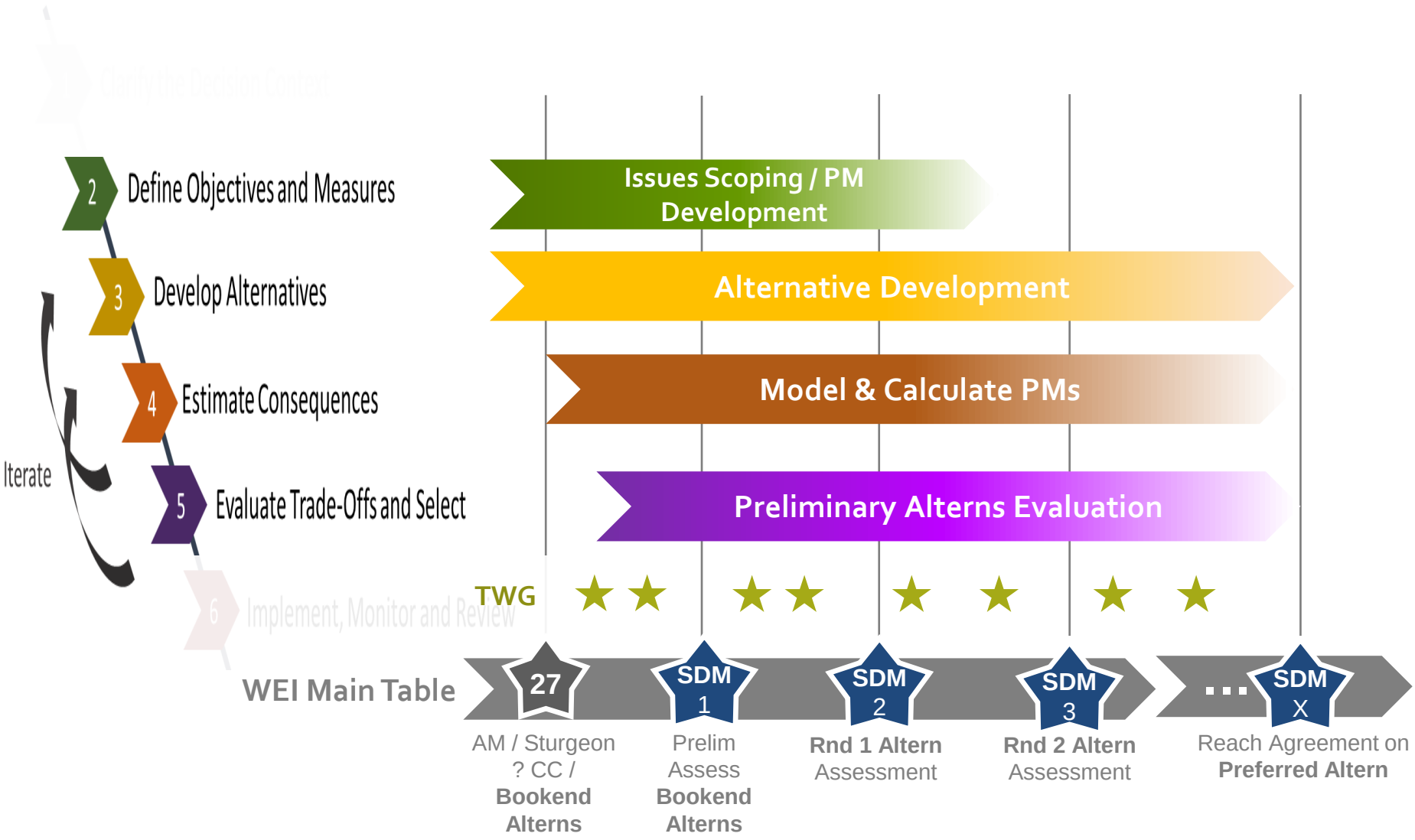
3 Develop Alternatives



So where to start?

SDM Process Steps: A Picture for the WEI

Collaborative Development and Evaluation of Operational Flow Alternatives



Nechako
Water Engagement Initiative

Structuring & Sequencing

Bookend Alternatives

Alternatives

A word or two on Bookend Alternatives

A word or two on Bookend Alternatives

Purpose:

- To explore and better understand the opportunities, challenges and constraints of the **hydrology** flowing into and out of the Nechako reservoir
- To further scope out **water uses and interests** and identify which may be most sensitive (+/-) to potential operational flow changes
- To test out the **preliminary performance measures** and how well they are doing characterizing potential effects
- To gain insight into the performance of different potential flow alternatives in order to develop creative and **improved flow alternatives**
- To gain insight into each others' **values** and identify which flow alternatives may offer the best path to reaching consensus on a preferred flow alternative

A word or two on Bookend Alternatives

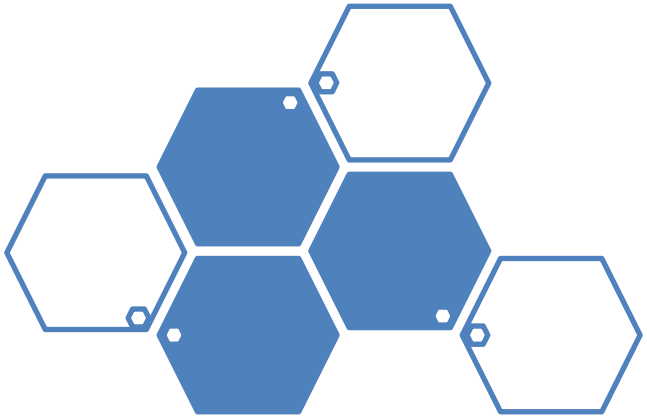
Characteristics of Developing Bookends:

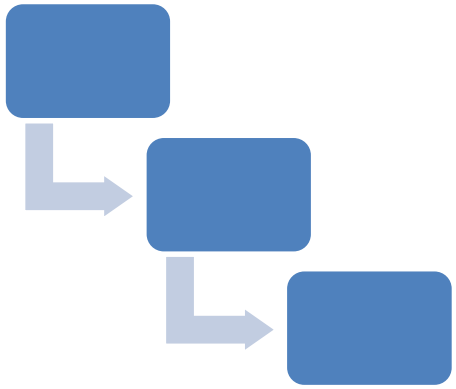
Generally, **theme based** according to a particular water use interest

As such,

- **THEY ARE NOT** designed to be **acceptable** *but should be considered a starting point to begin the exploration of flows alternatives*
- **THEY ARE** designed as a **basis to learn from** *in order to build the next round of flow alternatives that are multi-interest focused*

Structure and Sequencing – Bookend Alterns

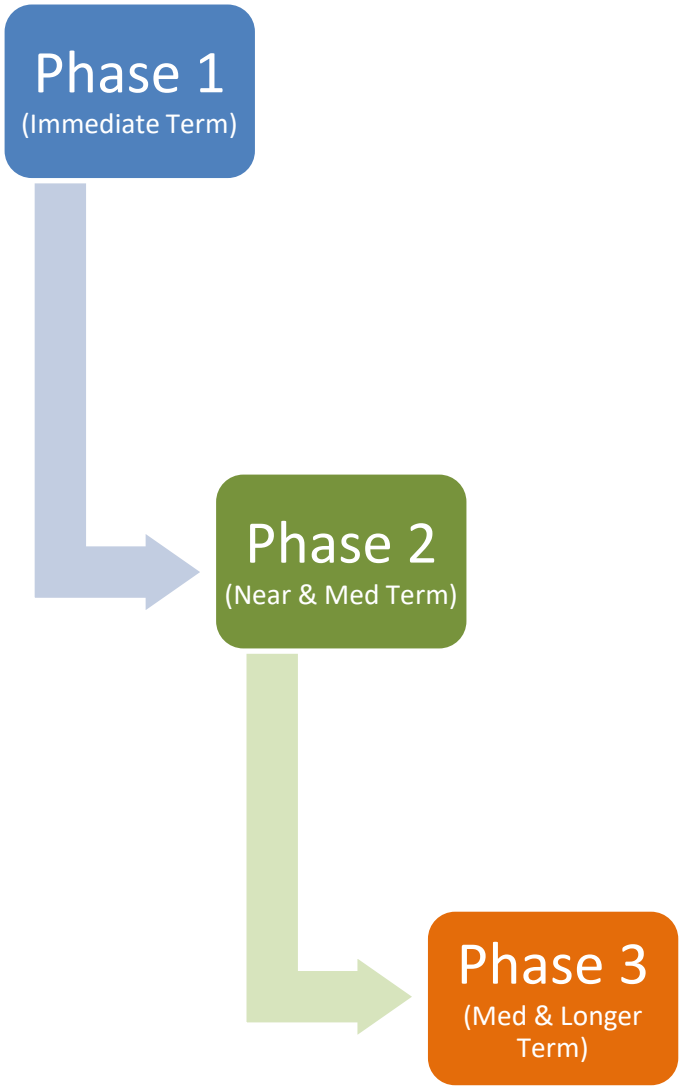




Context:

- Operational flow alternatives from Rio Tinto's water control facilities are complex and complicated.
- Water management and flow releases are based on existing water licenses, flow related agreements and may be linked with other potential future regulations and legislation
- RT's operations are also influenced through flow targets that have been adopted over the years to mitigate and lessen impacts
- Water management and flow releases are also inherently tied to the hydrology on any given year and will be significantly affected by future climate changes
- New initiatives and water management projects may also provide opportunities that fundamentally affect current and future operations
- All these factors influence the sequence and structure for developing bookends

Structure and Sequencing – Proposed



Structure and Sequencing – Proposed

Phase 1
(Immediate Term)

Phase 2
(Near – Med Term)

Phase 3
(Med – Longer Term)

Phase 1 Flow Alternatives

- Flow alternatives that Rio Tinto could unilaterally make within the immediate term (e.g., next calendar year) with notification to regulators, First Nations and stakeholders with time to undertaken any internal assessments that may need to be carried out

  (i.e., changes are permitted within their current authorized operations)

Approx Implementation Timeline: 0 to 2 years
(once decided, how long to implement changes)

- Could be implemented once any needed assessments and/or notifications are completed

Some example operational levers:

- Re-distributing the current AWA across the monthly flow releases from SLS (e.g., more naturalized, increase min base flows)
- Changing ramping rates (e.g., at end of STMP)

Note. Proposed changes would be within the current water budget for the Nechako River

Structure and Sequencing – Proposed

Phase 1
(Immediate Term)

Phase 2
(Near & Med Term)

Phase 3
(Med – Long Term)

Phase 2 Flow Alternatives

- Flow alternatives that would require Rio Tinto to seek some form of approval / authorization(s) according to their existing water license and/or flow related agreements and/or commitments with First Nations.

Approx Implementation Timeline: 2 to 4 years

- Could be implemented once any needed assessments, approvals and any consultations are completed.

Some example operational levers:

- Changes to the STMP flow release schedule and/or cooling targets.
- Changes / increases to current min or max monthly flow targets that have been agreed to from SLS (e.g., AWA).
- Establish different flow targets at downstream points on the system (e.g., Nechako River)

Structure and Sequencing – Proposed

Phase 1
(Immediate Term)

Phase 2
(Near – Med Term)

Phase 3
(Med & Longer Term)

Phase 3 Flow Alternatives

- Combination of new water management facilities (mitigation / enhancement projects) and potential changes to flow releases to the Nechako River to maintain and/or improve conditions related to key water uses.

Approx Implementation Timeline: 4 to 7 years

- Depends on the project and the corresponding approval process requirements, but generally these are likely implementable in the medium term based on necessary approvals, EAs, and consultation requirements being carried out.

Some example operational levers:

- Water release facility at Kenney Dam
- Options for increasing flexibility of reservoir management
- New flow release schedule at SLS and at any new release structure.
- Other non-flow mitigation works to address water management impacts from the facilities

Structure and Sequencing – Proposed

Phase 1
(Immediate Term)

Phase 2
(Near & Med Term)

Phase 3
(Med & Longer Term)

Hold on…

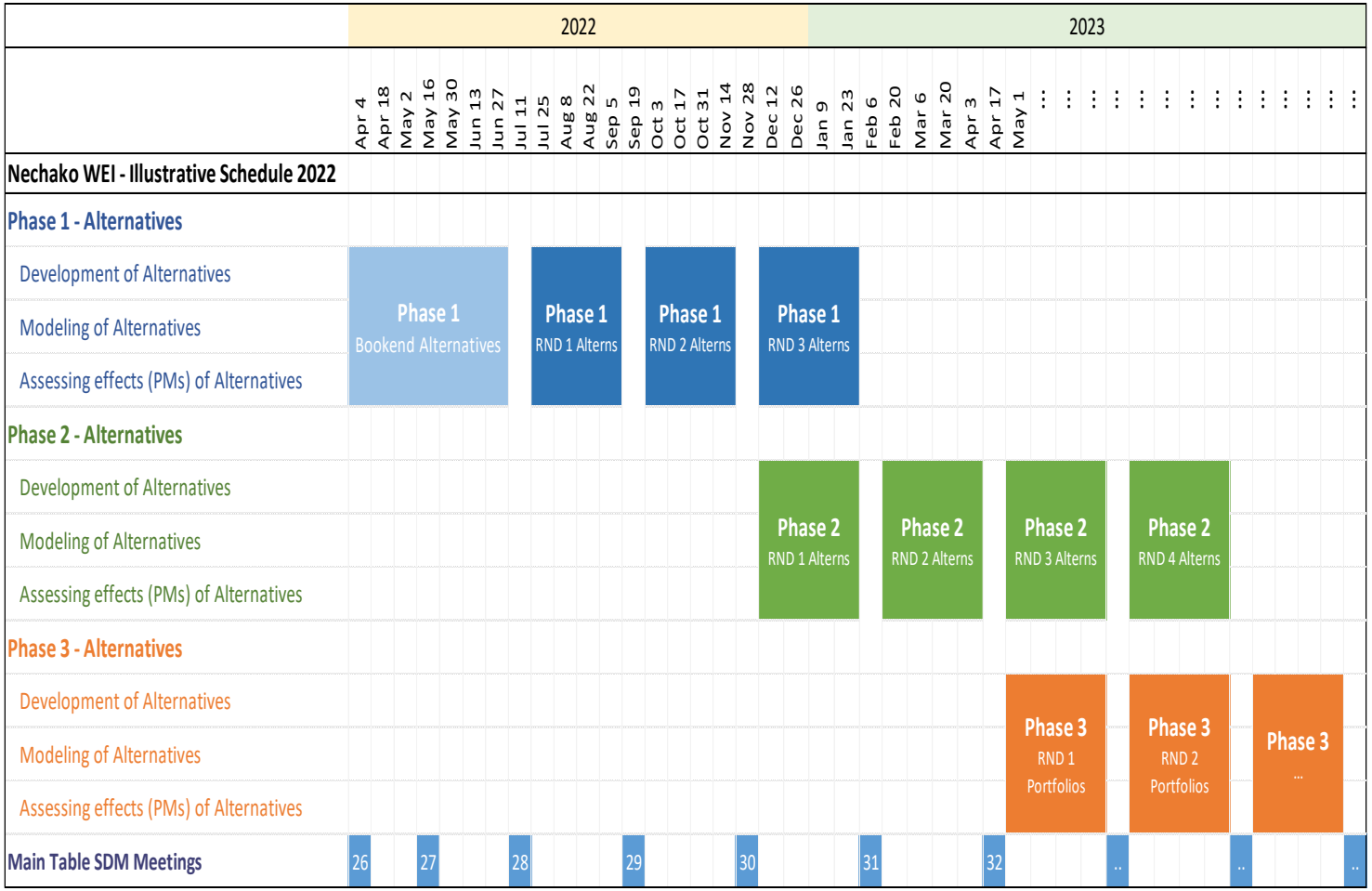
So what does this look like in practice and over what period of time?

Structure and Sequencing – Proposed

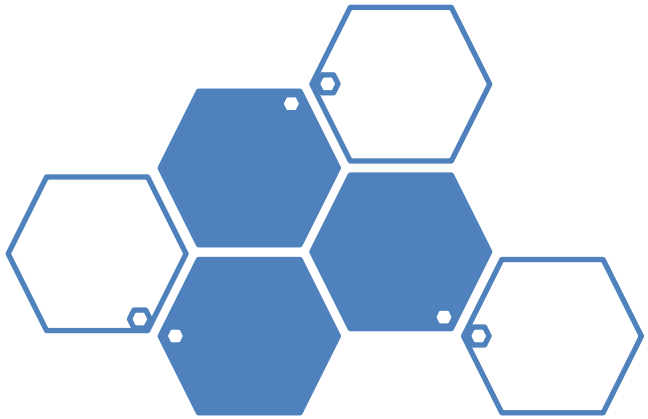
Phase 1 (Immediate Term)

Phase 2 (Near & Med Term)

Phase 3 (Med & Longer Term)



Building
Phase 1 Bookend Alternatives



- **Some illustrative ideas towards developing bookend alternatives**
- **They are meant to be "illustrative" and provide a cross section of the nature and type of bookends that could be developed**
- **Over next month Ecofish working with the TWG will develop some preliminary ideas for review and discussion at our next Main Table Meeting to be held in May**
- **NOTE: The TWG reviewed the sequencing and preliminary structuring of some bookend alternatives at their meeting last week**

Illustrative Ideas for Bookend Alternatives

	Altern 1	Altern 2	Altern 3	Altern 4	Altern 5	Altern 6	Altern 7	Reference (Unregulated Flows)
Primary Purpose	**Status Quo** To serve as a reference to explore the benefits and costs of making flow changes	**Nechako River** **Aquatic Species & Ecosystems** *Provide a more naturalized hydrograph ("freshet") and promote ecosystem functions that benefit a range of aquatic species*	**Nechako River** **Sockeye** *Lower STMP temperature targets (18°c or 19°c) for sockeye migration*	**Murray-Cheslatta** **Aquatic Species & Ecosystems** *Provide a more naturalized hydrograph (flow variability) and promote ecosystem functions that benefit a range of aquatic species.*	**Reservoir** **Wildlife** *Minimize flooding of bird nests.* *(Note: Alternate wildlife objectives could be (a) maintain caribou calving islands, (b) maintain connectivity wetlands to riparian areas)*	**Reservoir** **Aquatic Species & Ecosystems** *Maximize reservoir productivity*	**Murray-Cheslatta & Nechako River** **Flood Mitigation** *Minimize flooding of Cheslatta gravesites.* *Minimize overland flooding at Vanderhoof*	To better understand hydrology and the context of the current water control facilities
Operational Changes / Targets	None	TBD *E.g., during high inflow years, release "extra" water coinciding with Nautley or Stuart freshet (rather than releasing in the fall, winter, or early spring)*	TBD *E.g., increase SLS discharge between July 20 and Aug 20.*	TBD *E.g., revise the range of SLS flow extremes and ramping rates through STMP and other periods*	TBD *E.g., delay reservoir level increases during bird breeding season (April – July)*	TBD *E.g., maintain high water level in the reservoir during the growing season (May – Sept)*	TBD *E.g., further reduce risk of gravesite flooding through earlier, longer and/or pre-emptive flow releases to avoid larger spills*	TBD
Some Key Questions to be explored...		• *What are the benefits of increased spring base flows?* • *Is there enough "extra" water (and how often) to provide a meaningful improvement?*	• *How much additional water is needed to make a difference (and from where – reservoir vs. Kemano) and what - if any – are the impacts to other water use interests (e.g., flooding, power)*	• *What are the benefits of a slightly more natural hydrograph?* • *What would be the benefits to M-C fish species and impacts to other ecological interests (e.g., Nechako sockeye) and costs (e.g., $ with slower ramping rates)?*	• *How much early discharge is required at SLS to match snowmelt and minimize increasing reservoir level?* • *How will this effect reservoir filling and will there be enough water for later in the year?* • *How will this affect other issues (e.g., flooding, summer fish habitat, fall river temperature)?*	• *What are the benefits from increased productivity on the ecosystem or target species (e.g., #/size of rainbow trout)?* • *What are the impacts to other issues?*	• *To what degree can operational changes (e.g., pre-spilling) reduce the frequency and intensity of high flow releases from SLS?* • *What is the impact of preemptive flow releases on other issues (e.g., aquatic species, power generation)?*	

Illustrative