

DECEMBER 2022
PERFORMANCE MEASURE INFORMATION SHEET
ARROW LAKES RESERVOIR: RECREATION AND TOURISM

SUMMARY

Goal: Maximize community benefits from quality and diversity of recreation and tourism

Recommended Performance Measure:

Objective/ Location	Performance Measure	Description
Recreation/ Arrow Lakes Reservoir	Recreation Access and Experience Days	Total number of days/year that the reservoir water level is within the preferred range (1420ft – 1437ft / 432.8m – 438m) during the recreation season (1 Apr to 15 Oct). More is better.

Sub-measures representing preferred elevation ranges for specific recreational activities or sites will inform detailed scenario evaluation.

INTRODUCTION

Arrow Lakes Reservoir provides for a variety of recreational opportunities. The most popular activities include fishing, boating and day use (swimming and picnicking). In the drawdown zone of the Revelstoke Reach, foot, bike, and motorized recreation on historic road and rail beds are also popular. Recreation use by both residents and tourists has been enhanced by several public boat ramp improvement projects that were completed as part of BC Hydro’s Water Licence Requirement Program, including construction of new ramps at Burton and Anderson Point and upgrades to existing ramps at Fauquier, MacDonald Creek, Shelter Bay, and Edgewood.

Recreation access and associated benefits are important in Arrow Lakes Reservoir. A number of key factors that affect recreational quality and use include:

- diversity and abundance of fish and wildlife, since many recreational activities are focused on enjoyment of these natural resources;
- ability to safely access the water or shorelines for water-based and shore-based activities;
- visual quality of viewscapes (appearance of the reservoir related to avoidance of exposed mudflats/dust and exposed standing debris); and
- avoidance of navigational hazards associated with standing and floating debris.

PAST PERFORMANCE MEASURES

A number of past processes have developed performance measures to support analysis of recreation activities on the Arrow Lakes Reservoir. A summary follows. For full details on past performance measures, please review the Research Summary documents for the Arrow Lakes reservoir.

During the [Columbia WUP consultation process](#), which concluded in 2005, the Recreation Technical Subcommittee recommended two recreation-focused performance measures—one for shoreline access and one for boating access—for each of the “Mid-Columbia” portions of the reservoir (i.e., the section from Revelstoke to Shelter Bay, also called the Revelstoke Reach) and the main body of the Arrow Lakes Reservoir (Table 1). These measures used elevations that the committee understood would provide “good opportunity” for a broad range of boating and shoreline interests, considering both access and quality of experience. These measures were not tied to site-specific elevation issues. Modified versions of these measures were adopted as “soft constraints” on Arrow Lakes Reservoir operations.

Table 1: Recreation and tourism elevations from the Columbia Water Use Plan Consultative Committee process (BC Hydro, 2005)

Location	Units	Description
Revelstoke to Shelter Bay	Boat access days	# of days at or above 437.4m (1435ft), May 1 – Sep 30
	Shoreline access days	# of days below 437.4m (1435ft), May 1 – Sep 30
Shelter Bay to Hugh Keenleyside Dam	Boat access days	# of days between 437.5m (1435.4ft) and 440.1m (1443.9ft), May 1 to Sep 30
	Shoreline access days	# of days between 434.3m (1425ft) and 437.4m (1435ft), May 1 to Sep 30

During the [Non-Treaty Storage Agreement Options Assessment \(2010\)](#), the approach of using different performance measures for different activities was continued with two additional approaches also developed for the main Arrow Lakes portion of the reservoir. These new approaches did not distinguish by activity but instead considered recreation as a whole. Similar performance measures were used during the Columbia River Treaty Review [Technical Studies Process](#) (Table 2).

Table 2: Recreation and tourism performance measures from the Columbia River Treaty Review Technical Studies process (BC Hydro, 2013)

Location	Units	Description
Revelstoke to Shelter Bay	Boat access days	# of days at or above 437.4m (1435ft), May 1 – Sep 30
	Shoreline access days	# of days below 437.4m (1435ft), Apr 1 – Sep 30
Shelter Bay to Hugh Keenleyside Dam	Approach 1	Boat access days - # of days between 437.4 m (1435ft) and 440.1m (1444ft), May 1 to Sep 30
		Shoreline access days - # of days between 434.3m (1425ft) and 437.4m (1435ft), May 1 to Sep 30
	Approach 2	Overall recreation days - # of days between 434.3m (1425ft) and 438.9m (1440ft), April 1 to Oct 15.
	Approach 3	Weighted recreation days by season and elevation- Annual weighted days over the entire year

NEW INFORMATION

Since the Non-Treaty Storage Agreement Options Assessment, a number of studies have been completed—notably the multi-year Arrow Reservoir Recreation Demand Study ([final report](#) in 2015) and [secondary analysis](#) of results (2017), as well as the [Arrow Lakes Reservoir Mid-Elevation Scenarios Scoping Study](#) (2018). Residents and members of the Columbia Basin Regional Advisory Committee (CBRAC) and Columbia River Treaty Local Governments Committee (LGC) have also shared pictures and opinions about preferred recreation levels directly with the Columbia River Treaty Socio-Economic Integration Team. Collectively, this new information provides evidence to help refine perspectives of preferred elevations for recreation. Full research results are detailed in the Research Summary documents. Notable findings include:

- Public boat ramp improvements completed by BC Hydro in 2015-16 substantially reduced public barriers to boat access at a number of sites around the reservoir (Lees + Associates, 2020), which reduces some of the conflict between boating and shoreline access needs documented in past reports. For example, boating and shoreline access recreation performance measures developed for the Revelstoke Reach during the WUP process, before boat ramp improvements, were in direct conflict with each other (see Previous Performance Measures, above). There is limited information regarding elevation requirements for public boat ramps or docks not managed by BC Hydro, and privately owned boat ramps or docks, with the exception of the Revelstoke Centennial boat ramp which has a toe elevation of 1434ft (437.2m) (Moffatt & Nichol, 2007) and a presumed minimum operable elevation of 1437ft (438m).
- Given the increase in full-time residency along the reservoir, the recreation season is longer than it has been in decades past (BC Hydro, 2010). One CBRAC member shared their opinion that the recreation season would extend throughout the entire year if public boating access challenges didn't exist. Climate change is also extending the warmer seasons. This trend is increasing over time, making the abrupt seasonal weightings developed in the NTSA process irrelevant.
- Schwarz (2017) found that, overall, recreational users prefer levels between 1424ft and 1435ft (434.0m and 437.5m). This study mainly surveyed boating users at public ramps so the team has interpreted this to reflect public boating interests.
- Thomson et al. (2018) found that recreational boaters had little preference for specific reservoir elevations. Interviews with terrestrial recreationists indicated a strong preference for more constant lower water levels, and shoreline property owners preferred higher levels (likely 1430ft–1435ft/ 435.9m–437.4m) because that is where their docks, wharves, and personal launches operate most efficiently. This point was reiterated in a follow-up community meeting, where many property owners shared that they preferred constant levels in the 1430ft-1435ft range.
- Despite the finding above, individual activities have access needs and preferred elevations, and these vary from site to site across the reservoir. Preferred elevations for individual activities often conflict with others. Known access needs and preferred elevations are provided below (Table 3) with acknowledgement that this list is based on best available information and is an incomplete snapshot of recreation activity access needs and preferences on the reservoir.

Table 3: Known access restrictions and preferred elevations for various recreational activities

Activity and Season	Access Restrictions	Preferred Elevations
WATER-BASED		
<p>Motorized boating (Apr 1 – Oct 15)</p>	<p>Minimum operable elevations for public boat ramps constructed by BC Hydro from Lees + Associates 2020:</p> <ul style="list-style-type: none"> - Shelter Bay: 1391ft (423.9m) and above - Nakusp: 1383ft (421.5m) and above - McDonald Ck: 1401ft (427m) and above - Burton South: 1399ft (426.4m) and above - Fauquier: 1397ft (425.7m) and above - Edgewood: 1400ft (426.7m) and above - Anderson Point: 1398ft (426m) and above - Syringa: 1387ft (422.8m) and above <p>Toe elevation of Centennial (Revelstoke) boat ramp: 1434ft (437.1m) (Moffatt & Nichol, 2007). Presumed operational elevation is 1437ft (438m) and above.</p> <p>Minimum operable range of launch ramp at Scottie’s Marina: 1408ft (429.2m) (Thompson et al., 2018).</p>	<p>Preferred level for optimal boating experience: 1424ft–1435ft (434m-437.4m) (Schwarz 2017).</p> <p>Known elevation for potential dock damage at Nakusp marina (T. Zeleznik, pers. comm.): 1420ft (432.8m) and below.</p> <p>Preferred elevation for Scotties Marina: 1428ft–1430ft (435.3-435.9m) (Thomson et al., 2018).</p> <p>Preferred elevations for use of private docks/boat launches: 1430ft–1435ft. (435.9m–437.4m) (Thomson et al., 2018; BC MEM 2016).</p>
Boat-based angling	See ‘motorized boating’	No information
Non-motorized boating (canoeing/kayaking/paddle boarding, etc.)	No information	No information
Sailing	No information	No information
Swimming	See ‘beach activities’ below	No information

		Nakusp floating dock is usable at 1437ft (437.1m) and above.
SHORELINE-BASED		
General shoreline access (Apr 1 – Oct 15)	N/A	Revelstoke Reach: See 'non-motorized travel' below. Shelter Bay to Hugh Keenleyside Dam: 1425ft–1435ft (434.3m-437.4m) (BC Hydro, 2005).
Beach activities (June 15 to Sep 15)	Known elevations where high use beaches are submerged and not accessible: <ul style="list-style-type: none"> - Nakusp: 1444ft (440.1m) - Syringa: 1440ft (438.9m) (J. Jones, pers. comm.) <p>Minimum elevations for beach access are not known.</p>	Known preferred elevations at various beach sites: <ul style="list-style-type: none"> • Nakusp: 1437ft (438m) (C. Eichenauer, Karen Hamling, pers. comm.) • Syringa: 1425-1435ft (437.4m) (J. Jones, pers. comm.) • Small, unofficial beaches: below full pool (J. Hughes, pers. comm.)
Shore-based angling	No information	No information
Camping	No information	No information
Non-motorized travel (hiking, biking, horseback riding, cross country skiing, etc.) (full recreation season)	Hiking, biking, and motorized recreation is popular in the Revelstoke Reach drawdown zone when water levels are below 1424ft (434m) (McPhee, 2007).	No information
Motorized travel (quadding, snowmobiling, etc.)	See 'non-motorized travel'	No information
Nature study/wildlife viewing	No information	No information
Hunting/foraging	No information	No information

RECOMMENDED PERFORMANCE MEASURES

Based on the information above, the research team recommends:

- a) amalgamating previous recreation-focused performance measures into a single combined performance measure for all recreational activities across the entire reservoir. This measure would be used for initial scenario evaluation; and

- b) creating a series of “sub measures” that reflect interests for which the research team has documented a known elevation range. The sub measures will help ensure results for the combined recreation performance measure do not obscure negative results for individual recreational interests that the team has information about. Results for these sub-measures would be available during scenario evaluation and reported to the public for preferred scenarios. The recommended sub-measures are summarized in Table 5.

Combined PM

The recommended combined performance measure, detailed below in Table 4:

- Roughly adheres to the finding in Schwarz (2017) that recreation users, regardless of their activity (though the study primarily focused on public boat ramp users) prefer elevations between 1424ft (434m) and 1435ft (437.4m); however, the following modifications to the upper and lower elevations have been made:
 - The minimum elevation has been set at 1420ft (432.8m) to ensure that recreation on the drawdown zone in the Revelstoke Reach is not excluded from the PM and damage to the Nakusp marina dock is avoided; and
 - The maximum elevation has been set at 1437ft (438m) to ensure that use of the Revelstoke Centennial boat ramp, the only public ramp at the far north end of the Reservoir, which has a toe elevation of 1434ft (437m) and an assumed minimum operational elevation of 1437ft (438m), is not excluded from the PM;
- Uses the same extended season dates as recommended in the NTSA and CRT Technical Studies processes (Apr 1 – Oct 15).

Table 4: Recommended Recreation and Tourism performance measure for the Arrow Reservoir

Area	Performance Measure	Dates	Critical Elevation Zone
Arrow Lakes Reservoir	Recreation Access and Experience Days	April 1 – October 15	Total number of days per year between 1420ft and 1437ft (432.8m–438 m)

Sub-Measures

The recommended sub-measures are summarized in Table 5.

Table 5: Recommended sub-measures for analysis during the modeling process

Sub-Measure Objective	Season	Elevation Range
Nakusp beach floating dock use preference	Jun 15 – Sep 15	1437ft (438m) and above
Motorized boating access (Revelstoke Centennial Ramp)	Apr 1 – Oct 15	1437ft (438m) and above
Private boat launch and dock use preference	Apr 1 – Oct 15	1430ft–1435ft (435.9m–437.4m)
Scotties Marina preference	Apr 1 – Oct 15	1428ft–1430ft (435.2m-435.9m)

General shoreline preference (Shelter Bay to Hugh Keenleyside Dam)	Apr 1 – Oct 15	1425ft–1435ft (434.3m-437.4m)
Syringa beach preference	Jun 15 – Sep 15	1425 –1435 ft (434.3 - 437.4 m)
Motorized boating experience preference	Apr 1 – Oct 15	1424ft–1435ft (434m-437.4m)
Motorized/non-motorized access to the Revelstoke reach drawdown zone	Apr 1 – Oct 15	Below 1424ft (434m)
Nakusp Marina dock damage avoided	Apr 1 – Oct 15	Above 1420ft (432.8m)
Motorized boating access (Scotties Marina boat ramp)	Apr 1 – Oct 15	1408ft (429.2m) and above
Motorized boating access (BC Hydro Boat Ramps)	Apr 1 – Oct 15	Above 1401ft (427m)

The research team also recommends additional research to improve documentation of access needs, preferred elevations, and seasons for activities and locations that are not known to the research team at this time. Such an effort could allow for creation of a performance measure that effectively tracks the access needs and preferences of the many diverse recreational activities that occur around the reservoir. This research should focus on activities that were not well tracked through the Arrow Reservoir Recreation Demand Study (which sampled primarily at public boat launches and day use beaches) and answer:

- What activities happen at various sites around the reservoir;
- What seasons are preferred for different activities;
- What contribution the activity/site makes to overall recreational activity on the reservoir (i.e., how many recreationists participate); and
- What elevations enable/constrict the activity at main use locations.

COMPARISON OF PROPOSED PERFORMANCE MEASURE WITH HISTORICAL OPERATIONS

Achieving the minimum elevation by April 1 is unlikely as the reservoir is drawn down at this time of the year to create storage space for the upcoming freshet and high inflows, to avoid downstream flooding. The maximum elevation is likely to be exceeded later in the season in some years as the reservoir fills to store the freshet, again to avoid downstream flooding (Figure 1).

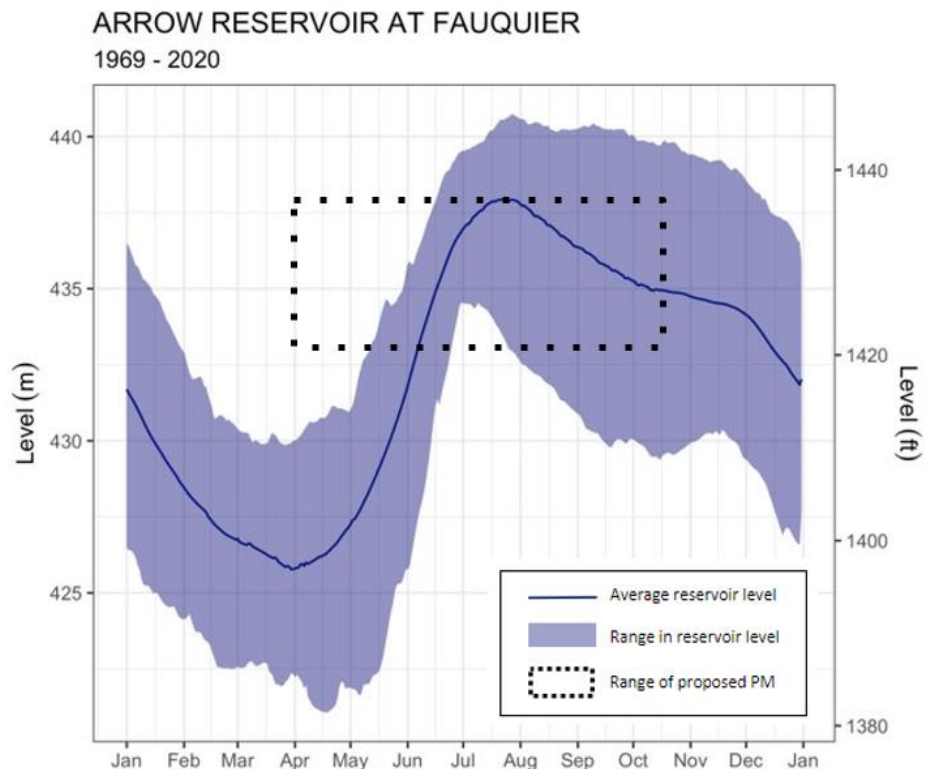


Figure 1: Range of recommended performance measure in comparison to historic reservoir elevations

CALCULATIONS

For each scenario:

1. Assemble the daily simulated results for the recommended elevation range.
2. Count the number of days between the upper and lower thresholds for the recreation season
3. Summarize all statistics.

KEY ASSUMPTIONS AND UNCERTAINTIES

- Each scenario is simulated using the same set of system constraints, input assumptions (e.g., load forecasts) and historic basin inflows.
- Assumes that there is minimal recreational use outside the defined recreation season.
- Assumes that the preferred season and elevations are accurate.

REFERENCES

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