



Performance Measures

Wapiti River Water Management Plan

Four high-level objectives, and associated sub-objectives, were identified as having the potential to be affected by different flow management options. Performance Measures (PMs) were used to objectively assess how well these objectives were being met for each of the different flow options.

Objective	Sub-Objective	Performance Measure (PM)
Aquatic ecosystem health	<ul style="list-style-type: none"> • Fish populations • Water quality • Geomorphology/riparian maintenance 	<ul style="list-style-type: none"> • Changes in fish habitat • No significant differences in river dilution capacity and water quality were found among the flow alternatives evaluated. Based on this analysis PMs were not required. • A threshold PM was developed to indicate if water consumption under a proposed flow alternative reached a level that could influence geomorphology, channel, and riparian maintenance.
Safe and reliable water source for human consumption	<ul style="list-style-type: none"> • Existing users and new users 	<ul style="list-style-type: none"> • A series of PMs and supporting metrics were developed to estimate the performance of flow alternatives on water supply objectives.
Access to water for economic development purposes (access to water for current licence holders and new water applications)	<ul style="list-style-type: none"> • Existing users and new users 	<ul style="list-style-type: none"> • A series of PMs and supporting metrics were developed to estimate the performance of flow alternatives on water supply objectives.
Maintaining or enhancing water-based recreational opportunities	<ul style="list-style-type: none"> • Boating opportunities • Angling opportunities • Swimming • River aesthetics 	<ul style="list-style-type: none"> • A PM was developed to estimate the performance of flow alternatives and impact on the number of boating days • Assessed through fish habitat and water quality (no PM required) • Assessed through water quality assessment (no PM required) • Assessed through water quality assessment (no PM required)

Fish Habitat Performance Measure

The objective for fish habitat is to maintain the natural dynamic patterns of abundance, biomass, and diversity of native fish populations. Changes in fish habitat with varying flow alternatives were used as a representation for potential changes in fish populations. Increases to fish habitat are assumed to be equivalent to increases in fish populations. Fish habitat for the following species was included in the analysis: bull trout, arctic grayling, mountain whitefish, longnose sucker, walleye, burbot, and slimy sculpin. These species were selected based on their recreational, social and cultural importance, and to cover the range of habitat niches present in the river mainstem. Fish habitat changes were measured by comparing habitat under a proposed flow alternative relative to the habitat that would have been available under natural flow conditions¹.



Summary of Key Findings

Under projected future water use and the recommended Water Conservation Objective (WCO), the most sensitive species was mountain whitefish, experiencing a 7% habitat loss during the lowest flows in winter compared to what would have been available under natural

winter flows¹. The lowest flow periods are defined as the lowest 20% of flows across the entire hydrological record of 1968-2010. This habitat loss may result in measurable but reversible declines in their population.

Some key issues identified by Sturgeon Lake Cree Nation and Horse Lake First Nation include protecting the Wapiti River for future generations and for the practice of their traditional way of life. Specifically, protecting the water quality, aquatic ecosystem health for fish and other aquatic species, and to maintain healthy wetland areas associated with the river and its tributaries. Setting allowable net use of water as a percent of natural flow when the Wapiti River flows fall below 10 m³/s (as identified in the WCO) provides increased protection during periods when water use would have the most impact on fish habitat.

¹ Natural flow refers to the flow prior to any withdrawals, storage, returns or other human use.

Water Quality Performance Measure

An analysis was conducted to understand how the concentrations of five water quality parameters of interest (nutrients, temperature, ammonia, biochemical oxygen demand, and fecal coliform) change under different water use scenarios. The analysis included estimates of point and non-point sources of pollution covering the entire Wapiti River basin except for Bear Creek, which enters the Wapiti River downstream from International Paper's discharge point. This analysis provided an understanding of how water quality parameters may change when the flow volume of the Wapiti River is reduced.



Summary of Key Findings

The water quality analyses found projected future water use would result in negligible changes in dilution capability in the mainstem of the Wapiti River for the five parameters of concern. Water quality is best managed through source control and not dilution and will be addressed in future regional watershed planning processes.

Water Supply Performance Measure

The water supply performance measure focused on maximum shortage events and was measured as the maximum number of consecutive days that a licensee or group of licensees could not meet their water demand because of the WCO over the 42-year flow record.



Summary of Key Findings

Under the recommended WCO and projected future water use, available water supply is expected to result in:

- No shortages to all current licences and registrations in the basin (including Aquatera's 2013 licence).
- Small short-term impact (1 week) to new term licences in winter in less than 5% of the years.
- Small short-term impact (few days) to temporary diversion licences (or new term licences to the oil and gas sector) in late winter or very early spring, in less than 5% of the years. A key requirement to meeting this result, however, requires the oil and gas sector to draw upon stored water during the winter.

Geomorphology / Riparian Performance Measure

The objective for geomorphology is to maintain naturally high flow events such that channel forming and natural channel maintenance will not be limited, fish habitat is rejuvenated, and the healthy ecological state of the river and floodplains is maintained.



The objective for riparian areas is to maintain a range of high flow conditions such that natural processes required to sustain riparian areas will not be limited, and a healthy ecological state can be maintained.

Performance measures were developed to assess the influence of water use on geomorphology and riparian areas.

Summary of Key Findings

Analysis found that the projected future water use and respective flow conditions in the basin were well below the threshold impacts (identified from geomorphological analysis) that would affect geomorphology and riparian habitat. Water use would need to exceed $9.5 \text{ m}^3/\text{s}$ before significant impacts to channel morphology and changes to riparian habitat were expected to occur. The maximum water use recommended in the WCO is $2 \text{ m}^3/\text{s}$.

Some key issues identified by Sturgeon Lake Cree Nation and Horse Lake First Nation include protecting the Wapiti River for future generations and for the practice of their traditional way of life. Specifically, protecting the water quality, aquatic ecosystem health for fish and other aquatic species, and to maintain healthy wetland areas associated with the river and its tributaries, which provide important moose habitat and habitat for other terrestrial species. The estimated future water use and water withdrawal limitations as stated in the WCO are expected to have negligible, if not a positive impact on tributaries, wetlands, and lakes within the Wapiti River basin, and will provide a level of protection by limiting future water withdrawals and maintaining natural flow characteristics.

Recreational Boating Performance Measure

Recreational use was identified as an important value amongst Grande Prairie area residents and visitors, second only to water quantity. The objective is to maintain water-based recreational opportunities supporting sub-objectives of motorized and non-motorized boating, angling, swimming and river aesthetics. Focus groups and online surveys were conducted with the goal of determining the acceptable minimum flow thresholds for in-stream activities (RC Strategies, 2016).



Fish habitat assessments were used as representative for estimating how flow alternatives could influence angling opportunities.

The water quality assessment for fecal coliforms was used as a performance measure to assess swimming and river aesthetics.

Summary of Key Findings

Projected future water use is expected to have a negligible effect on recreational boating. Analysis showed that loss of boating days to be at most an average of one day per year and only 3 days in the worst year over the entire hydrological record of 1968-2010.

Angling opportunities could be impacted as a small loss of winter mountain whitefish habitat is predicted (see fish habitat performance measure above). However, as habitat loss is small, impacts to angling are also expected to be small and reversible.

No effect on swimming and river aesthetics is expected from the recommended WCO, as negligible effects on fecal coliform concentrations are predicted.

Other Key Findings

Traditional Use

The Steering Committee commissioned work to collect traditional use information and held a workshop (September 2016) to explore how traditional use information could inform water quantity, quality and other objectives in the Wapiti River Water Management Plan. A summary of publicly available information was collected and compiled in a report titled ***Traditional Land Use Information and the Wapiti River Water Management Plan*** (Petra Rowell Consulting, 2016).

Members of the Horse Lake First Nation expressed that the Wapiti River and surrounding area has spiritual, cultural and ecological values that have sustained their Nation for thousands of years. They expressed a strong interest in the protection of the Wapiti River for future generations, and for the practice of their traditional way of life.

The Sturgeon Lake Cree Nation expressed an interest in the Wapiti River as it is within their traditional territory and all waterways are important to their way of life. They further identified the following issues of specific interest: water quality, water use by industry, aquatic habitats, water for wildlife, aesthetic beauty of the lakes and streams, fishing (net fishing and angling), moose hunting, wading, and gathering places for families at rivers.



Climate Change and Drought

To test the performance measures (including water supply and fish habitat) against a potential long-term drought, a 6-year long drought test dataset was created. This analysis revealed that the performance measures were not substantively different using the 6-year drought dataset compared to the 42-year flow record (1968-2010). Therefore, it is assumed that the 42-year flow records provide a sufficient range of natural variability to test the resiliency of the WCO during extreme drought conditions.

The results of the analysis also showed that the predicted long-term average flows in the Wapiti River are expected to remain within the range of variation for the next 30 years as it has been in the past 50 years.

Cumulative Effects

The environmental assessments conducted considered cumulative effects in the following ways:

- Total cumulative water use in the Wapiti River basin was used to inform the Plan and evaluate the recommended WCO.
- Estimates for point and non-point sources for water quality constituents were used to evaluate changes in water quality from the recommended WCO.
- Resiliency of the recommended WCO to climate variability was evaluated.
- A main recommendation within the Plan is for the development of a watershed management plan to further study cumulative effects risk with other stressors.

