



Jumpingpound Creek

Integrated Watershed Management Plan - Final

May 2014

*Jumpingpound Creek
Watershed Partnership*



Palliser Environmental Services Ltd.

DEDICATION

Dedicated to the memory of Rick Butler,
whose belief in the importance of land and water stewardship,
and enthusiasm for community-based planning and leadership,
encouraged the development of
the Jumpingpound Creek
Integrated Watershed Management Plan.

ACKNOWLEDGEMENTS

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Rick Butler, Landowner
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Financial Sponsors

Agriculture and Agri-Food Canada (Prairie Farm Rehabilitation Administration)
Alberta EcoTrust
Alberta Stewardship Network
Bow River Basin Council
EcoAction
Rocky View County
Shell Canada
Town of Cochrane

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JUMPINGPOUND CREEK IWMP MUNICIPAL SUPPORT

ROCKY VIEW COUNTY

Rocky View County passed the following motion on September 27, 2011:

**INFRASTRUCTURE &
OPERATIONS COMMITTEE**
1-11127-06
(D-5)
ALL DIVISIONS
File: 1006 - 400

General Business

Recommendations from the September 13, 2011 Infrastructure and Operations Committee meeting

Presented by : Councillor Sacuta, Chair

Draft Jumpingpound Creek Integrated Watershed Management Plan

MOVED by Councillor Sacuta that Council:

- a) Receive the Jumpingpound Creek Integrated Watershed Management Plan report for information and direct Administration to use it as a guidance document and planning tool; and
- b) Direct Administration to work with the JCWP to implement strategies that will achieve the outcomes of the Plan.

Carried

MD OF BIGHORN

MD of Bighorn accepted the following recommendation outlined in March 27, 2012 Decision Report on April 10, 2012:

Recommendation: That Council:

- a) accepts the Jumpingpound Creek Integrated Watershed Management Plan for information and direct Administration to use it as a guidance document and planning tool; and
- b) Direct Administration to work with the JCWP as resources and funds allow to implement strategies that will achieve the outcomes of the Plan.

TOWN OF COCHRANE

The Town of Cochrane's Environmental Committee passed the following Motion on April 4, 2012:

MOTION: Moved by Lajos Varga to accept the Jumpingpound Creek Integrated Watershed Management Plan as information, and request Council, in their deliberations, to have Administration look into how the document will affect development to Fireside and Towers Trail.

Unanimously Carried

JUMPINGPOUND CREEK IWMP PROVINCIAL SUPPORT



Environmental Operations
South Saskatchewan Region
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May 7, 2014

John Buckley
Chair, Jumpingpound Creek Watershed Partnership
gcxranch@xplomet.com

Dear Mr. Buckley:

**Subject: Alberta Environment and Sustainable Resource Development (ESRD)
Support of the Jumpingpound Creek Integrated Watershed Management Plan**

Thank you for sending us a copy of the Jumpingpound Creek Integrated Watershed Management Plan – Final, dated May 2014. I again congratulate the Jumpingpound Creek Watershed Partnership on the successful completion of their Integrated Watershed Management Plan. I trust this milestone will be a valuable guide for all watershed partners in the stewardship and sustainable management of the Jumpingpound Creek watershed, with the latest changes.

ESRD can support the Jumpingpound Creek Integrated Watershed Management Plan – Final, dated May 2014 and will use the Plan as a guidance document and decision support tool.

Please feel free to contact me, or Rob Wolfe, if you have any questions and thanks again for the efforts of the local ranchers, municipalities, non-profit organizations and industry that have come together to develop the Jumpingpound Creek Integrated Watershed Management Plan.

Sincerely,

A handwritten signature in blue ink that reads "Kevin Wilkinson". The signature is fluid and cursive.

Kevin Wilkinson
Regional Approvals Manager
Alberta Environment and Sustainable Resource Development

CC: Martin Foy, Regional Director
Rob Simieritsch, Resource Manager

TABLE OF CONTENTS

1.0	INTRODUCTION.....	1
2.0	PURPOSE.....	1
3.0	STATEMENT OF ISSUES	1
4.0	OBJECTIVES.....	2
6.0	PUBLIC CONSULTATION PROCESS	3
7.0	GEOGRAPHICAL EXTENT	4
8.0	INTEGRATED WATERSHED MANAGEMENT PLAN AND IMPLEMENTATION STRATEGY.....	6
8.1	SURFACE WATER QUANTITY	6
8.1.1	Policy Statement	6
8.1.2	Targets and Thresholds (Water Conservation Objective)	6
8.1.3	Recommendations	6
8.1.4	Implementation of Surface Water Quantity Recommendations	10
8.2	SURFACE WATER QUALITY	12
8.2.1	Policy Statement	12
8.2.2	Targets and Thresholds	12
8.2.3	Recommendations	13
8.2.4	Implementation of Surface Water Quality Recommendations.....	13
8.3	GROUNDWATER.....	15
8.3.1	Policy Statements.....	15
8.3.2	Targets and Thresholds	15
8.3.3	Recommendations	15
8.3.4	Implementation of Groundwater Recommendations	16
8.4	RIPARIAN AREAS AND WETLANDS.....	19
8.4.1	Policy Statement	19
8.4.2	Targets and Thresholds	19
8.4.3	Recommendations	20
8.4.4	Implementation of Riparian Area and Wetland Recommendations.....	25
8.5	BIODIVERSITY	28
8.5.1	Policy Statement	28
8.5.2	Targets and Thresholds	28
8.5.3	Recommendations	31
8.5.4	Implementation of Biodiversity Recommendations	33
8.6	LAND USE.....	34
8.6.1	Policy Statement	34
8.6.2	Targets and Thresholds	35

8.6.3	Recommendations	35
8.6.4	Implementation of Land Use Recommendations	37
9.0	GLOSSARY OF TERMS	40
10.0	LITERATURE CITED	43
APPENDIX A. Summary of valued ecosystem components within the Jumpingpound Creek watershed.		45
APPENDIX B. Summary of issues in the Jumpingpound Creek watershed.		47
APPENDIX C: Rationale for setting Jumpingpound Creek WCOs and thresholds.		51
APPENDIX D: Water Quality Objectives: Mainstem Bow River Below Park Boundary and Elbow River (Upper) (BRBC 2008).		52
APPENDIX E. Summary of fish species habitat requirements.		54
APPENDIX F: Summary of wildlife indicators and reported targets/thresholds for various metrics.		56
APPENDIX G. Summary of land cover types in the Jumpingpound Creek watershed and calculation of current wildlife habitat.		57
APPENDIX H. Land ownership in the Jumpingpound Creek watershed.		58
APPENDIX I. Summary of priorities, goals, indicators, targets and thresholds.		59
APPENDIX J. Available floodplain map for Jumpingpound Creek.		61
APPENDIX K. Jumpingpound Creek watershed surficial geology map.		62

1.0 INTRODUCTION

The Jumpingpound Creek watershed is located west of Calgary and south of the Town of Cochrane. This region is currently experiencing unprecedented population growth and urban expansion. The Jumpingpound Creek Watershed Partnership was formed to facilitate the Jumpingpound Creek Integrated Watershed Management Plan process, in partnership with all watershed stakeholders, with the purpose of ensuring good water quality and ample water quantity to sustain future generations. The integrated watershed management plan will encourage good management of watershed resources that will benefit the people living and working in the watershed, as well as the wildlife and unique vegetation relying on Jumpingpound Creek, its tributaries and wetlands.

The Jumpingpound Creek Watershed Partnership is a multi-stakeholder group represented by government, non-government and industry representatives and local landowners. The Partnership is represented by a ten member Steering Committee who oversee the development of the integrated watershed management plan.

2.0 PURPOSE

The purpose of the Jumpingpound Creek Integrated Watershed Management Plan is to maintain surface water and groundwater quality in sufficient supply to sustain the environmental integrity, community well-being and economic prosperity within the watershed.

The overall intent is that any change in land use within the Jumpingpound Creek watershed should not adversely impact other water users¹ in the watershed.

3.0 STATEMENT OF ISSUES

Concerns within the Jumpingpound Creek watershed include:

- Limited, secure water supply,
- Water licence transfers,
- Maintenance of surface and groundwater quality,
- Potential fragmentation of landscape,
- Maintenance of wildlife and biodiversity,
- Potential loss/degradation of wetlands and riparian areas,
- Impact of land use (e.g. forestry, recreation, oil and gas, agriculture and residential development) on watershed resources,
- Potential cumulative impacts,
- External pressure on agricultural production, and
- Lack of accurate information regarding the role of agriculture in watershed protection.

¹ Water users refer to humans, fish, wildlife and vegetation reliant on good water quality and ample water supply.

4.0 OBJECTIVES

1. Identify Water Conservation Objectives² (WCOs) for Jumpingpound Creek.

Rationale: A WCO identifies targets for management and protection of streams and the aquatic environment.

The South Saskatchewan River Basin Water Management Plan establishes WCOs for the Bow River and its tributaries. The WCO for tributaries of the Bow River is based on natural flows and must be determined for each watercourse. To date, natural flow determination has not been completed for Jumpingpound Creek.

2. Specify matters and factors, in the form of recommendations, which should be considered by federal and provincial decision makers³ prior to approving a transfer of an allocation of water under a licence or issuing an approval for work that may impact on the quality of land and water resources.
3. Specify matters and factors, in the form of recommendations, which should be used by municipal decision makers⁴ when considering development permit applications and land use changes.

Rationale: Development is occurring at a rapid pace in areas surrounding the Jumpingpound Creek watershed. To ensure that long-term viability of water resources in the future, and to maintain valued ecosystem components⁵ in the watershed, the factors that should be considered must be identified and brought to the attention of decision-makers well in advance of application submissions. Some of the matters and factors that should be considered in the watershed management plan include water quality, riparian areas, wetlands and groundwater.

4. Specify good management practices that would assist landowners and industry operators active in the Jumpingpound Creek watershed to enhance land stewardship practices and protect valued land and water resources.

² A WCO pertains to the amount and quality of water established by the Director [under the *Water Act*] to be necessary for the:

- protection of a natural water body or its aquatic environment, or any part of them;
- protection of tourism, recreational, transportation or waste assimilation uses of water;
- or management of fish or wildlife,

and may include water necessary for the rate of flow of water or water level requirements.

³ Fisheries and Oceans Canada, Transport Canada, Environment Canada, Alberta Agriculture and Food, Alberta Environment, Sustainable Resource Development, Alberta Transportation

⁴ Rocky View County, MD of Bighorn and the Town of Cochrane

⁵ Valued ecosystem components are appraised, evaluated or estimated elements of a biological community and its non-living environmental surroundings. A preliminary list of valued ecosystem components was developed during a working group meeting and is reported in Appendix D.

5.0 INTENDED USE AND AUTHORITY

The Jumpingpound Creek Integrated Watershed Management Plan will link the issues of water quality, water quantity, riparian habitat and aquatic species with the watershed's economic and social priorities. The plan will provide recommendations that will help guide the community's activities for generations to come. The approach will include balanced and representative public consultation.

On completion, the Jumpingpound Creek IWMP will be presented as a guidance document to all stakeholders, including municipal, provincial and federal jurisdictions in the watershed.

A recommendation will be put forward by the Jumpingpound Creek Watershed Partnership, on behalf of all stakeholders, requesting support for the IWMP from decision makers who would consider the document when reviewing proposals and applications (approval and/or permits) that may impact land and water resources and management in the Jumpingpound Creek watershed.

6.0 PUBLIC CONSULTATION PROCESS

The Jumpingpound Creek Watershed Partnership frequently consulted with the public and stakeholders in accordance with the *Framework for Water Management Planning* (AENV 1999) to ensure that the Jumpingpound Creek Integrated Watershed Management Plan reflects local objectives and ideals.

Consultation has included:

- Public meeting to receive input on draft targets and thresholds
 - Town of Cochrane (June 10, 2010)
- Public meeting to receive input on the draft Integrated Watershed Management Plan (June 16, 2011)
- Correspondence with technical experts (2010-2012)
- Municipal progress reports
 - Rocky View County – IOC Committee (October 12, 2010)
 - MD of Bighorn (January 11, 2011)
- Meetings with municipal staff to review recommendations and implementation strategy
 - Rocky View County (July 7, 2011)
 - Town of Cochrane (September 13, 2011)
 - MD of Bighorn (September 14, 2011)
- Meetings with municipal Committees to present draft Integrated Watershed Management Plan
 - Rocky View County Infrastructure and Operations Committee (September 13, 2011)
 - MD of Bighorn - Agriculture Service Board (March 16, 2012)
 - Town of Cochrane – Cochrane Environmental Committee (April 4, 2012)
- Meetings with municipal Councils to endorse the final draft Integrated Watershed Management Plan
 - Rocky View County (September 27, 2011)
 - MD of Bighorn (March 13, 2012)
 - Town of Cochrane (April 10, 2012)

7.0 GEOGRAPHICAL EXTENT

The Jumpingpound Creek watershed encompasses an area of approximately 604 km² and is located west of the City of Calgary, and south and west of the Town of Cochrane (Figure 1). Jumpingpound Creek bisects the watershed, flowing northeast a distance of about 87 km before joining the Bow River. Jumpingpound Creek is the largest tributary to the Bow River between the Ghost Dam and Bearspaw Dam.

The watershed represents a diverse landscape having elevations ranging from 1,123 m at the confluence of the Bow River to 2,492 m at the highest peak. Jumpingpound Creek originates in the Rocky Mountains, in the Alpine and Subalpine Natural Subregions. A number of permanent and intermittent creeks join Jumpingpound Creek from the north and the south. The most notable permanent creeks include Coxhill, Moose and Muskeg creeks to the south and Little Jumpingpound Creek to the north.

North of Highway 1, tributaries are generally intermittent, contributing large flow volumes during wet years and virtually no flow in average and dry years. Intermittent creeks include Scott Creek, Park Creek and Cope Creek which flow in a south eastern direction, and Towers Creek that flows north. All areas within the watershed contribute to flow in the Jumpingpound Creek.

The watershed is currently managed by five jurisdictions. These are the Kananaskis Improvement District, MD of Bighorn, Rocky View County, Stoney Nation and Town of Cochrane.

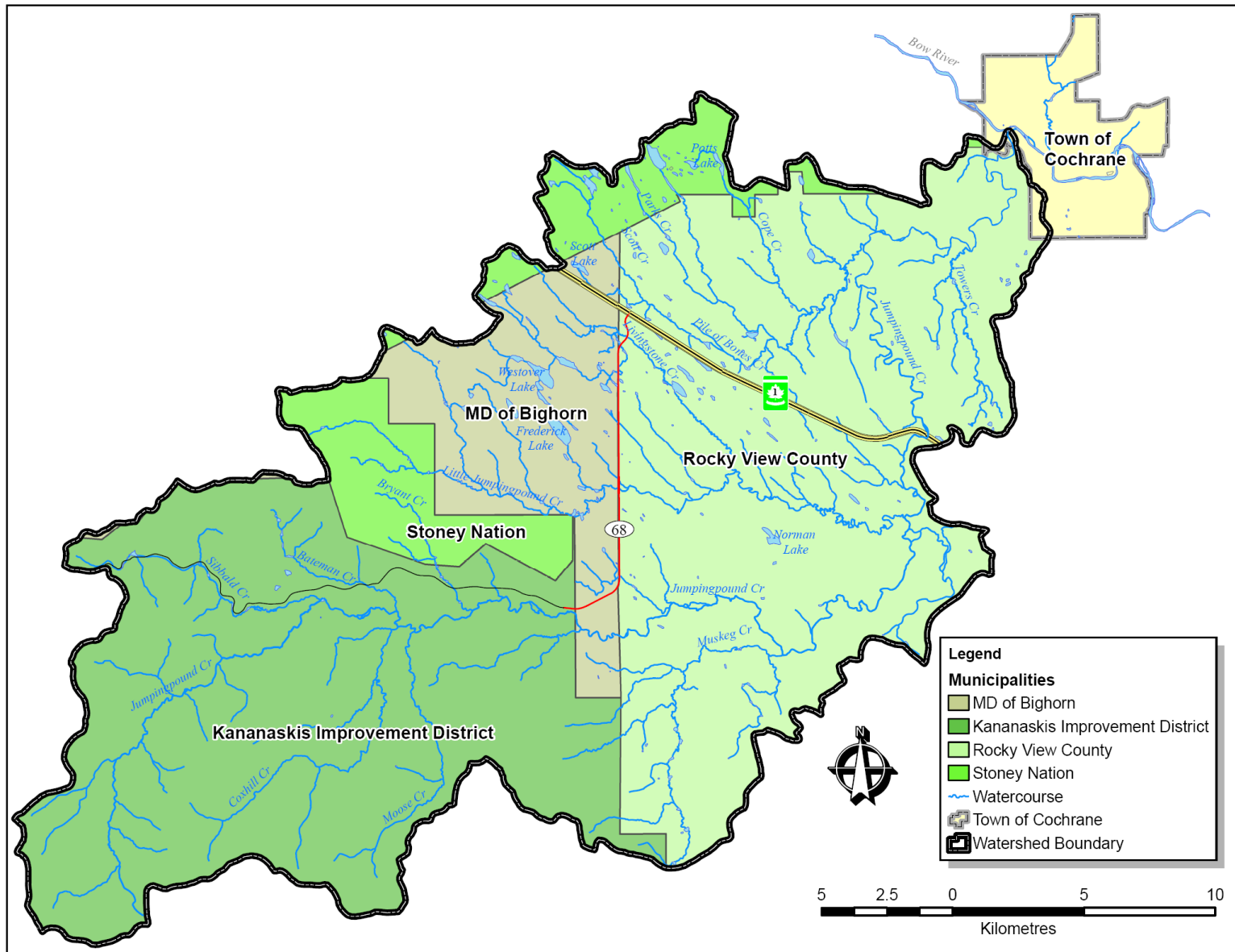


Figure 1. Map of the Jumpingpound Creek Watershed and governing jurisdictions.

8.0 INTEGRATED WATERSHED MANAGEMENT PLAN AND IMPLEMENTATION STRATEGY

8.1 SURFACE WATER QUANTITY

8.1.1 Policy Statement

Water quantity in Jumpingpound Creek watershed is preserved to maintain ecosystem function.

8.1.2 Targets and Thresholds (Water Conservation Objective)

Target: Existing streamflow in Jumpingpound Creek and Little Jumpingpound Creek should be maintained, recognizing existing surface water and groundwater licenses (i.e., as of 2012) are used to full capacity.

The **water conservation objective (WCO)** should equal the existing weekly streamflow hydrograph for upper Jumpingpound Creek, lower Jumpingpound Creek, Jumpingpound Creek at the mouth and Little Jumpingpound Creek (Figures 1 through 4).⁶

Rationale: The natural flow is used to set the maximum peak flow target and maximum low flow targets. Increasing flows above natural during the peak flow period can cause streambank erosion, increased sediment transport and ultimately widen the stream channel. Increasing flows above natural during the low-flow winter period can cause substrate scour that is detrimental to over-wintering fish eggs.

8.1.3 Recommendations

- a) *To meet streamflow targets, Water Conservation Objectives should be developed for Jumpingpound Creek and Little Jumpingpound Creek. Alberta Environment and Sustainable Resource Development should develop WCOs using a consistent approach for multiple headwater tributaries. Until a WCO is established for Jumpingpound Creek and Little Jumpingpound Creek, an interim Environmental Flow of 85% of natural flow should be observed.*

For Jumpingpound Creek and Little Jumpingpound Creek, any newly established WCOs should consider the following documents, scientific studies and recommendations:

- *Jumpingpound Creek State of the Watershed Report (2009)*
- *Jumpingpound Creek IWMP (2012; revised 2014)*
- *Jumpingpound Creek Water Balance Study (AMEC 2010)*
- *Water Supply and Demand Management Assessment (AMEC 2011)*
- *Water Supply and Demand Management Assessment: Groundwater Component (AMEC 2011)*

- *Consider that the water conservation objectives should equal the existing weekly streamflow hydrograph for upper Jumpingpound Creek, lower Jumpingpound Creek, Jumpingpound Creek at the mouth and Little*

⁶ Refer to AMEC 2011a Technical Memorandum.

Jumpingpound Creek (Figures 1 through 4).⁷ This WCO would support multiple goals outline for Jumpingpound Creek (e.g., water supply, biodiversity).

- *Consider that water license transfers should be permitted only within the Jumpingpound Creek watershed, and should not be permitted between other sub-basins within the Bow River Basin, in order to make full use of existing licenses.*
- *Consider removing the 10% holdback for the environment during the water license transfer process since water demand modeling (AMEC 2011a) has shown minor reductions to streamflow at the existing licensed volume; thus, the environmental requirements are accounted for within the recommended water conservation objective.*

Other compelling reasons for removing the holdback may include:

- *Domestic wells are not regulated – future development of wells may reduce baseflows to Jumpingpound Creek. The 10% holdback may offset this future growth by maintaining streamflow availability in the watershed.*
- *A loss of 10% of the volume might impede future growth and development in the watershed.*

Note to Reader: It is understood that ESRD can only support a holdback recommendation that considers the larger basin (e.g., the Bow River Basin or the South Saskatchewan River Basin).

- *Consider that the timing of surface water withdrawals obtained through water license transfers should occur during the peak flow period (between May 15 and June 30th).*
- b) *Flow rates and volumes should not be increased above natural (i.e., no increase in flow rate or volume from pre-development conditions).*
- c) *Maximum Allowable Release Rates should be developed for Jumpingpound Creek to support Recommendation 8.1.3 b.*

⁷ Refer to AMEC 2011a Technical Memorandum.

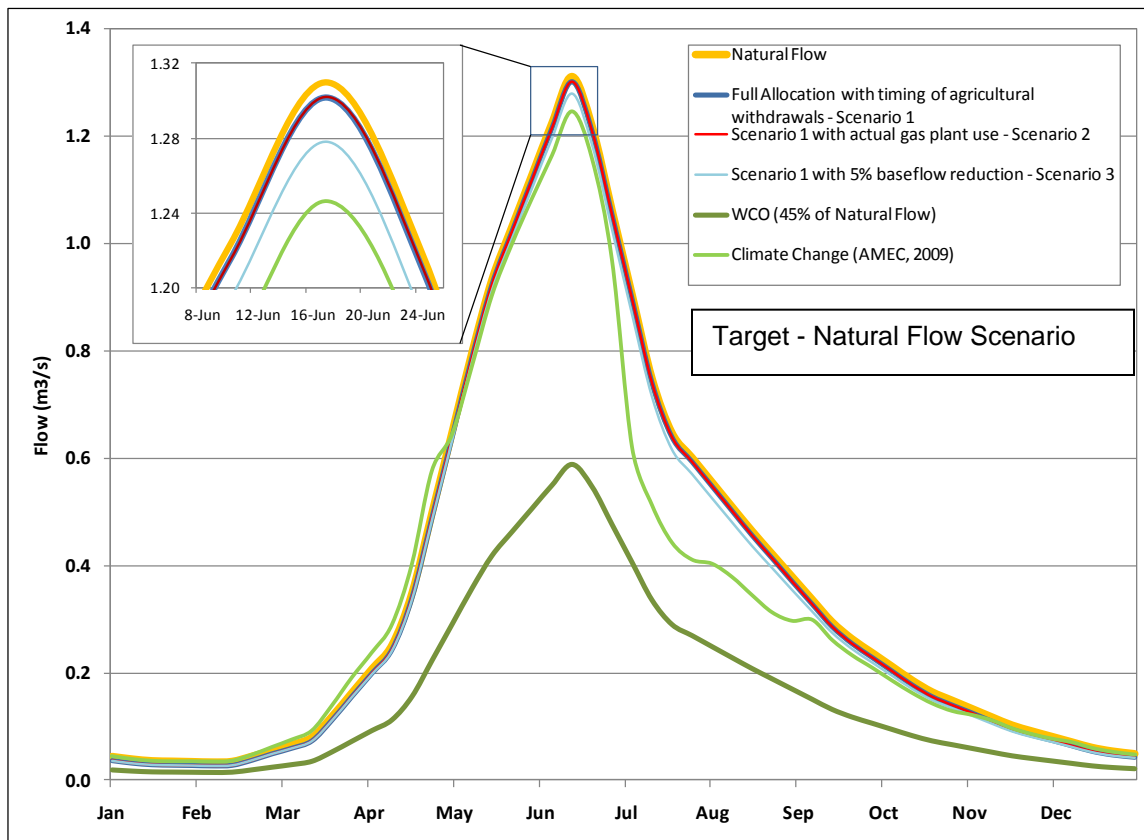


Figure 1. Hydrograph for Upper Jumpingpound Creek (AMEC 2011).

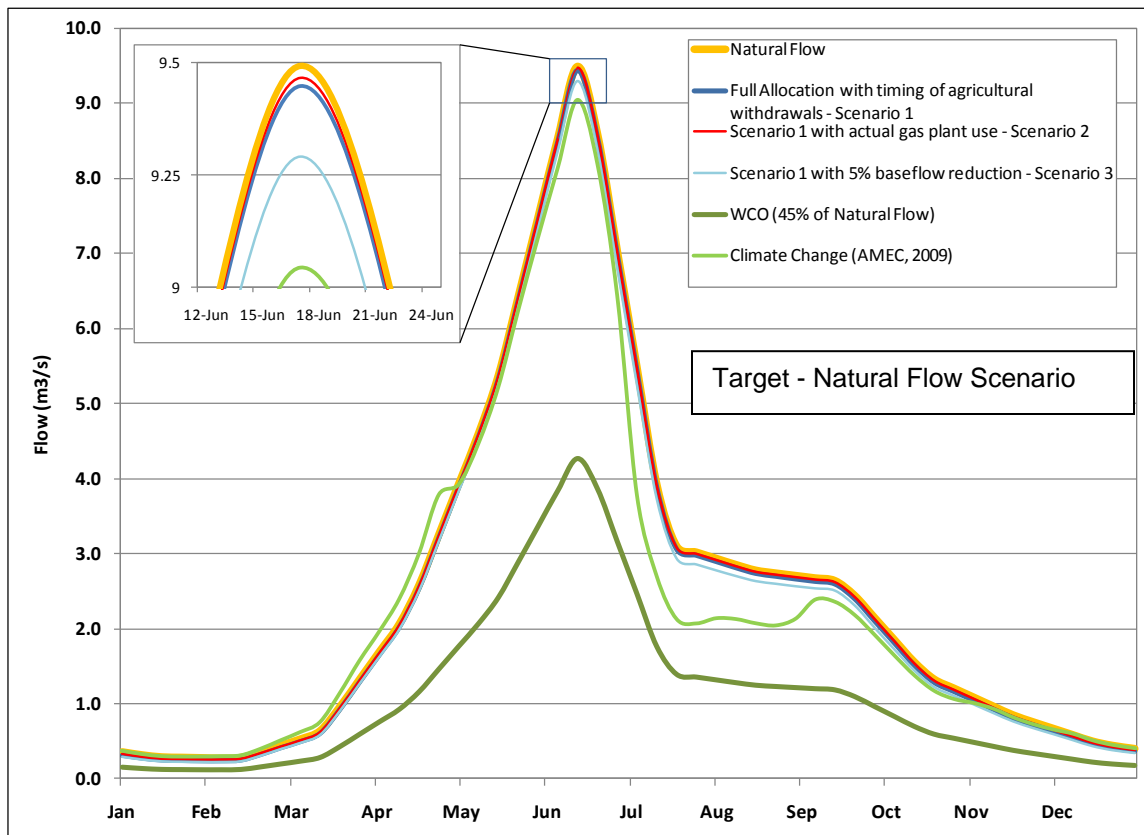


Figure 2. Hydrograph for Lower Jumpingpound Creek (AMEC 2011).

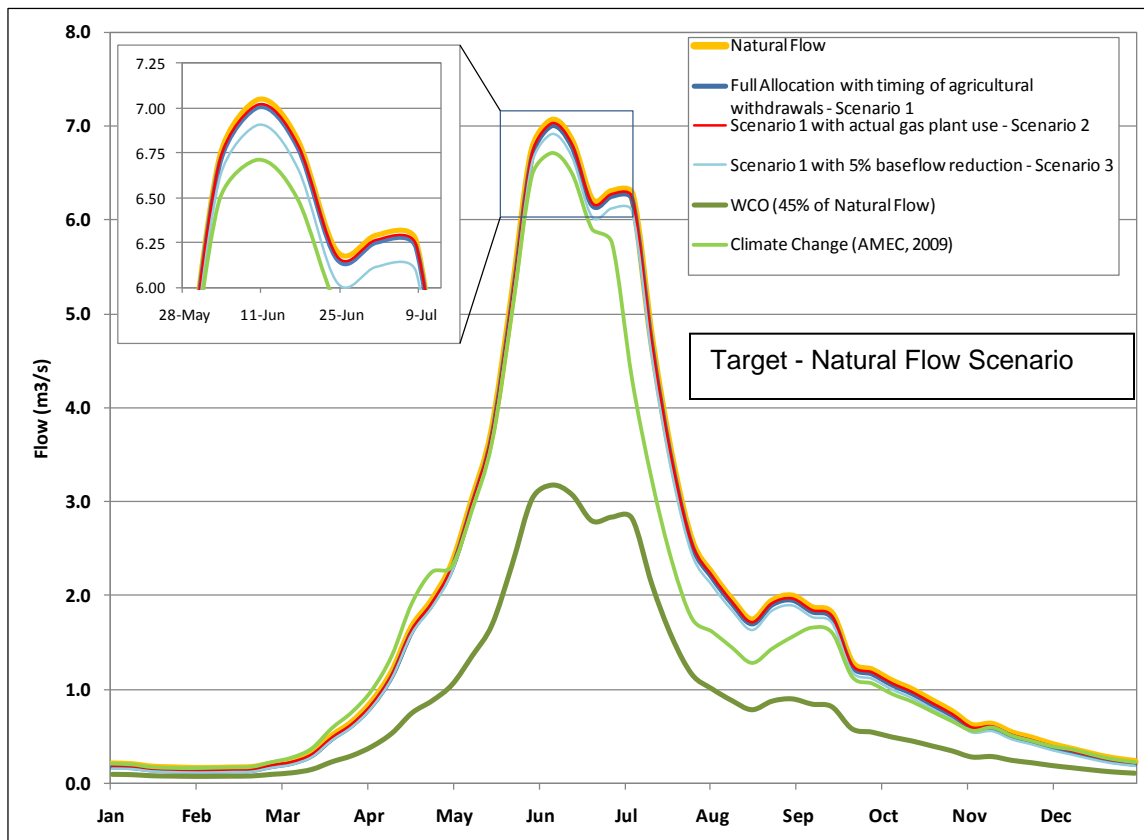


Figure 3. Hydrograph for Jumpingpound Creek at Mouth (AMEC 2011).

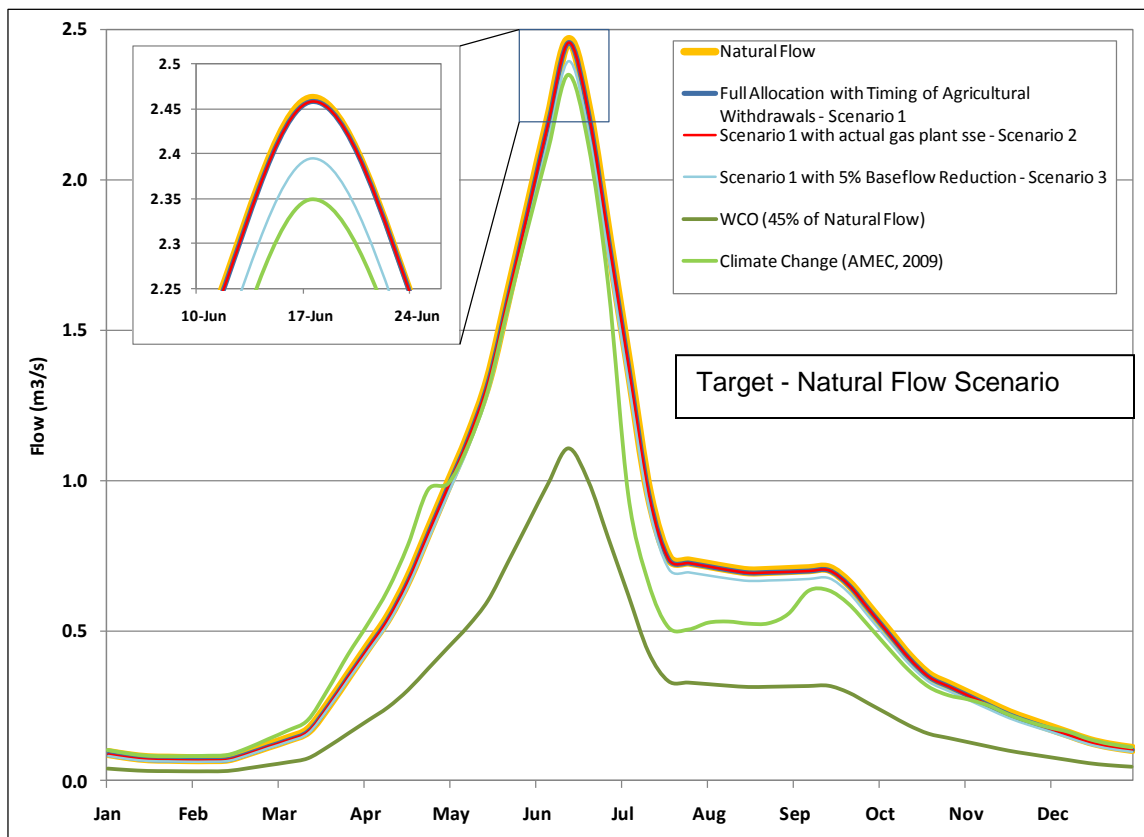


Figure 4. Hydrograph for Little Jumpingpound Creek (AMEC 2011).

8.1.4 Implementation of Surface Water Quantity Recommendations

Recommendation	Action	Jurisdiction	Timeframe
Water Conservation Objectives	<p>The task of setting the level of Protected Water is the responsibility of the Provincial Government and other stakeholder planning bodies. However, once it is determined, Protected Water must receive effective legal protection.</p> <p>Using tools that currently exist under legislation, the level of Protected Water for environmental purposes may be identified by the government as a Water Conservation Objective (WCO). A WCO is a tool identified in the <i>Water Act</i> that can be used to balance ecological, social and economic considerations. Its definition covers the attributes of Protected Water set out above. A WCO can be set and licensed for the needs of a basin, stream, tributary, reach, lake, or groundwater source (AWC 2009).</p>	Alberta Environment and Sustainable Resource Development	H
8.1.3 a Water license transfers within the watershed and 10% holdback; timing of surface water withdrawals.	<p>Require monitoring and reporting on old licenses including water transfers and temporary transfers.</p> <p>As opportunities present, ESRD will provide technical support to the JCWP for performance monitoring (e.g., flow monitoring, water quality monitoring, monitoring program development). This may be in the form of manpower for data collection, management and review and/or funding. Data should be housed in the provincial water quality database.</p> <p>The water data should be used to determine if water conservation objectives and water quality objectives are being met in the longterm (link to Recommendation 8.2.3 a).</p> <p>Create a working Team to undertake performance monitoring.</p> <p>Refine Water Conservation Objectives in partnership with stakeholders as new information becomes available.</p> <p>Stipulate timing of water withdrawals to match peak stream flow periods.</p>	<p>Alberta Environment and Sustainable Resource Development</p> <p>JCWP, Rocky View County, MD of Bighorn, Town of Cochrane</p> <p>Alberta Environment and Sustainable Resource Development</p>	<p>H</p> <p>H</p> <p>H</p>
8.1.3 b and c Flow rates and volumes.	<p>Work with municipalities to review and make recommendations to amend existing regulations to meet streamflow and volume targets.</p>	Alberta Environment and Sustainable Resource Development	M

Recommendation	Action	Jurisdiction	Timeframe
<p>8.1.3 b and c Flow rates and volumes.</p>	<p>Amend existing policies, guidelines and procedures to adopt the no increase in stream flow or runoff volume above predevelopment conditions recommendation. Amendments should take effect for all new developments, with existing approvals grandfathered.</p> <p>Manuals and guidelines should be updated within all jurisdictions to reflect a new approach and terminology used for Integrated Stormwater Management (ISM) that will help to achieve the flow rate and volume recommendation.</p> <p>Design standards, construction specifications and maintenance procedures should be developed for Low Impact Development.</p> <p>Require that absorbent landscaping (e.g., increase in minimum soil depths to 300 mm), green roofs, rainwater capture and reuse, reuse of stormwater in wetponds for irrigation, porous pavements and reduction of impervious areas be incorporated in all new developments where possible.</p> <p>Municipalities to set date (e.g., 2015) as a target for all new subdivisions to meet minimum standards for Low Impact Development and landscaping. LID and landscaping specifications should be incorporated in engineering design guidelines and planning documents.</p>	<p>MD of Bighorn, Rocky View County, Town of Cochrane</p>	<p>H</p>

H = High Priority, 2012-2014; M = Medium Priority, 2015-2018; L = Low Priority, 2018-2021

8.2 SURFACE WATER QUALITY

8.2.1 Policy Statement

Water quality in the Jumpingpound Creek watershed continues to provide for aquatic life, livestock and communities.

8.2.2 Targets and Thresholds

The following designated water uses should be recognized for Jumpingpound Creek:

- Aquatic life (also Refer to Fisheries Section 8.5.2.1)
- Healthy fish populations
- Swimming and other high contact recreation
- Agriculture (irrigation/livestock watering)
- Industry

Table 1. Select interim water quality objectives (WQOs) for Jumpingpound Creek.

Indicator	Jumpingpound Creek WQOs	Revised Using City of Calgary Data 2000-2011	Bow River WQOs ^a
Dissolved Oxygen	9.5 mg/L for spawning and incubation ⁸ 5.0 mg/L (acute daily minimum), 6.5 chronic (7-day average) ⁹ (also refer to Section 8.5.2)	9.5 mg/L for spawning and incubation ⁹ 5.0 mg/L (acute daily minimum), 6.5 chronic (7-day average) ⁹ (also refer to Section 8.5.2)	9.5 mg/L for spawning and incubation 6.5 mg/L for acute daily minimum
Water Temperature	Maximum water temperature ⁹ should not rise above: Reach 1: 20°C Reach 2: 20°C Reach 3: 16°C Reach 4: 16°C	Maximum water temperature ^c should not rise above: Reach 1: 20°C Reach 2: 20°C Reach 3: 16°C Reach 4: 16°C	Should not exceed 22°C at any time or a 7-day mean of 18°C.
Fecal coliforms	100 fecal coliforms/100 mL (no single value to exceed objective) at point of withdrawal.	100 fecal coliforms/100 mL (no single value to exceed objective) at point of withdrawal. 228.2 CFU/100 mL ⁹⁰ 98.5 CFU/100 mL ⁷⁵ 27.9 CFU/100 mL ⁵⁰ 5.2 CFU/100 mL ²⁵	100 fecal coliforms/100 mL (no single value to exceed objective) at point of withdrawal.
Total Dissolved Phosphorus	0.018 mg/L ^b	0.011 mg/L ⁹⁰ 0.006 mg/L ⁷⁵ 0.003 mg/L ⁵⁰ 0.002 mg/L ²⁵	0.005 mg/L during the growing season for aquatic plants.
Total Phosphorus	0.034 mg/L ^b	0.036 mg/L ⁹⁰ 0.009 mg/L ⁷⁵ 0.005 mg/L ⁵⁰ 0.004 mg/L ²⁵	0.014 mg/L

⁸ Alberta Environment 1999; CCME

⁹ Water temperature refers to fish habitat requirements, see Appendix E.

Indicator	Jumpingpound Creek WQOs	Revised Using City of Calgary Data 2000-2011	Bow River WQOs ^a
Total Suspended Solids	26 mg/L ^b	12.8 mg/L ⁹⁰ 3.7 mg/L ⁷⁵ 1 mg/L ⁵⁰ 1 mg/L ²⁵	CCME

^a Water Quality Objectives: Mainstem Bow River Below Park Boundary (BRBC 2008) (See Appendix D).

^b Interim, currently heavily weighted by spring data. Based on 90th percentile data set from Jumpingpound Creek at Mouth.

^c City of Calgary water temp. at Mouth was 15.6°C⁹⁰; maximum temperature recorded was 18.6°C.

8.2.3 Recommendations

- a) *Data collected by the City of Calgary at the mouth of Jumpingpound Creek should be reviewed annually and compared to WQOs. Once every five years, it should be determined if the water quality is deviating from historical 50th, 75th and 90th percentile objectives (if specified). The annual and five-year review should be shared with the JCWP or its successor at an annual meeting*
- b) *Implement riparian restoration and streambank stabilization measures within the 3.2 km (2 miles) above the confluence of the Bow River (i.e., in Reach 1) to meet Water Quality Objectives for temperature, and to reduce sediment transport and stream widening.*
- c) *No new stormwater outfalls should be directed to Jumpingpound Creek or its tributaries, without a proper catchment area study completed that identifies appropriate water release rates and water volumes.*
- d) *Monitor stormwater outfalls to determine compliance with established water quality guidelines.*
- e) *Promote Beneficial Management Practices for agriculture consistent with Environmental Farm Plans and the Agricultural Operations Practices Act (AOPA).*

8.2.4 Implementation of Surface Water Quality Recommendations

Recommendation	Action	Jurisdiction	Timeframe
8.2.3 a Refine WQOs with more comprehensive data set.	Sign a data sharing agreement with City of Calgary to access water quality data collected at the mouth of Jumpingpound Creek.	MD of Bighorn, Rocky View County, Town of Cochrane	H
8.2.3 b Restore riparian area and stabilize streambanks in Reach 1.	Develop a restoration and maintenance plan for the lower reach of Jumpingpound Creek. Aspects of the plan should focus on: 1) revegetation and maintenance of understory and woody material at creeks edge, 2) an education program for residents on stream ecology and recreational impacts, and 3) access restrictions during critical fisheries periods.	Town of Cochrane, Rocky View County	M-H

8.2.3 c No new stormwater outfalls directed to Jumpingpound Creek or its tributaries without proper catchment area study completed.	Complete appropriate catchment area studies to determine Maximum Allowable Release Rates as per Recommendation 8.1.3 c.	MD of Bighorn, Rocky View County, Town of Cochrane	H
	Encourage capture and re-use of stormwater according to government policy and Low Impact Development principles in new residential and industrial developments.	MD of Bighorn, Rocky View County, Town of Cochrane	H
8.2.3 d Monitor water quality from stormwater outfalls.	Develop and implement a water monitoring program to determine compliance with established WQOs.	Town of Cochrane	H
8.2.3 e Promote Beneficial Management Practices for Agriculture.	Identify and implement appropriate BMPs on public and private lands.	Alberta Environment and Sustainable Resource Development, MD of Bighorn, Rocky View County	M-H

H = High Priority, 2012-2014; M = Medium Priority, 2015-2018; L = Low Priority, 2018-2021

8.3 GROUNDWATER

8.3.1 Policy Statements

The significant contribution of groundwater (baseflow) to streamflow in the Jumpingpound Creek watershed is recognized and reflected in land use decisions.

Existing baseflows to creeks and wetlands in the Jumpingpound Creek watershed are maintained, as well as recharge to the regional aquifer through infiltration.

8.3.2 Targets and Thresholds

Target: Existing streamflow conditions are maintained in the Jumpingpound Creek watershed, based on an annual water balance assessment.

Target: Groundwater quality is protected and able to provide for human, livestock and aquatic life, as well as upland functions.

Threshold: An increase in existing groundwater demand from 328 dam³ to 656 dam³ in areas of low to medium-low risk, or other areas proven to be low risk through appropriate study and qualified professionals.

Rationale: Increasing groundwater use allows for a potential doubling of the population (1,381 to 2,762) in addition to some growth in recreation, agriculture and oil and gas activity. Increasing groundwater use in low to medium-low risk areas should limit potential impacts to streamflow and wetland function (see AMEC 2011b) (Figure 5). (See Appendix C for more detail).

8.3.3 Recommendations

Note to Reader: Groundwater wells that are hydrologically connected to a surface water are considered surface water.

- a) *Until it is determined that deeper aquifers are present and suitable for potable use, the threshold and conservative approach to managing groundwater demand should apply.*
- b) *Development should be directed towards lands having an Aquifer Vulnerability Index of "low" or "medium-low". "No significant harm" to local water yield, water quality or baseflow should result (Figure 5).*

Areas shown as "high" risk on the groundwater vulnerability map are those that have porous bedrock, are in wetland zones or are in low-yield areas.

Areas shown as "medium-high" risk are likely associated with alluvial aquifers that are connected to surface water.

- c) *Limit new development within "medium-high" and "high" risk areas to those that are compatible with protecting the groundwater resource.*
- d) *Development regulations should include a groundwater recharge overlay zone, in which residential development and/or densities are restricted (refer to Figure 5). The zone should be mapped and used by municipal staff. It should also be available to the public at municipal offices. Development regulations should also include a*

groundwater management/protection plan, especially for high risk areas (groundwater recharge areas adjacent to Jumpingpound Creek).

- e) *Low impact development principles should be applied where possible to all new developments to ensure that infiltration of precipitation can occur in order that recharge areas are protected and baseflows maintained.*
- f) *The status of groundwater wells in the Jumpingpound Creek watershed should be verified (e.g., active, abandoned, decommissioned) and the location of these wells identified beyond the quarter section detail.*
- g) *Provide positive incentives for landowner-initiated closure of abandoned and/or deteriorated water wells through the establishment of an abandoned well plugging fund.*
- h) *Advance groundwater management and protection through enhanced data collection, data availability and research:*
 - i. *Support Rocky View County’s effort in the regional groundwater level monitoring program.*
 - ii. *Refine the characterization of groundwater-surface water interactions (AMEC 2010) as more data becomes available.*
- i) *Landowners should adopt Beneficial Management Practices (BMPs) for groundwater protection including proper disposal of harmful materials and proper use of pesticides and fertilizers as per Environmental Farm Plans and the Agricultural Operations Practices Act (AOPA).*

8.3.4 Implementation of Groundwater Recommendations

Recommendation	Action	Jurisdiction	Timeframe
8.3.3 a Conservative approach to groundwater demand	Determine the presence of deeper aquifers within the Jumpingpound Creek watershed. Review the threshold value accordingly.	AESRD	L
8.3.3 b and c Development on low and medium-low risk lands; Limit development on high and medium-high risk lands.	Review groundwater license/registration applications for Jumpingpound Creek using the groundwater risk overlay map. An application for deep groundwater that is confined by a “barrier” to the shallow groundwater is an example of an approval that may be granted to those developments that comply with the groundwater risk overlay map.	Government of Alberta (AESRD)	L
	Develop a groundwater risk overlay map to assist with development applications. Approvals granted for those developments that comply with the groundwater risk overlay map. Approval should not be granted for water wells planned for medium-high to high risk areas, unless the applicant can clearly demonstrate no risk to groundwater quality or to neighbouring groundwater production volumes/rates. Develop a policy mechanism to refuse applications that are not consistent with groundwater protection	MD of Bighorn, Rocky View County, Kananaskis Improvement District	M-H

Recommendation	Action	Jurisdiction	Timeframe
	recommendations.		
8.3.3 d Develop groundwater recharge overlay map and determine appropriate development density based on aquifer vulnerability.	In addition to the groundwater risk overlay map, well yields should be highlighted on an overlay to assist with determining appropriate development densities. This should be available to the public and to Alberta Environment and Sustainable Resource Development.	Alberta Environment and Sustainable Resource Development in cooperation with MD of Bighorn, Rocky View County	L (Long-term Goal)
8.3.3 e Low impact development.	Require new development applications use Low Impact Development principles that align with the goals of the Jumpingpound Creek IWMP. Refer to the Alberta Low Impact Development Partnership (ALIDP) and Engineering Services Standards methods.	MD of Bighorn, Rocky View County, Town of Cochrane	M
8.3.3 f Verify status of groundwater wells.	<p>Alberta Environment and Sustainable Resource Development and municipalities should pool resources and verify the location and status of abandoned wells to conserve the groundwater resource.</p> <p>Possibly partner with the University of Calgary to complete by way of a M.Sc. Thesis.</p>	Alberta Environment and Sustainable Resource Development, MD of Bighorn, Rocky View County, Kananaskis Improvement District, Stoney Nation	L Note that local knowledge of wells is being lost as time passes.
8.3.3 g Decommission abandoned groundwater wells.	Funds should be made available on a cost-share basis to decommission abandoned wells. The GOA should consider developing a funding program through the <i>Water for Life Strategy</i> and <i>Land Use Framework</i> to address this. This would be compatible with current policies and programs available in Rocky View County.	Government of Alberta (AESRD)	L
	Seek funds to provide incentives through grant programs/provincial government to begin process of decommissioning abandoned wells.	MD of Bighorn, Rocky View County	M
	Develop an education resource document for landowners who would like to decommission abandoned wells.	MD of Bighorn, Rocky View County	M-H
8.3.3 h Expand groundwater monitoring network.	Continue efforts to expand the groundwater monitoring network with landowners in the watershed.	MD of Bighorn, Rocky View County	H
8.3.3 i BMPs for groundwater protection.	Identify and implement appropriate BMPs.	Landowners	H

H = High Priority, 2012-2014; M = Medium Priority, 2015-2018; L = Low Priority, 2018-2021

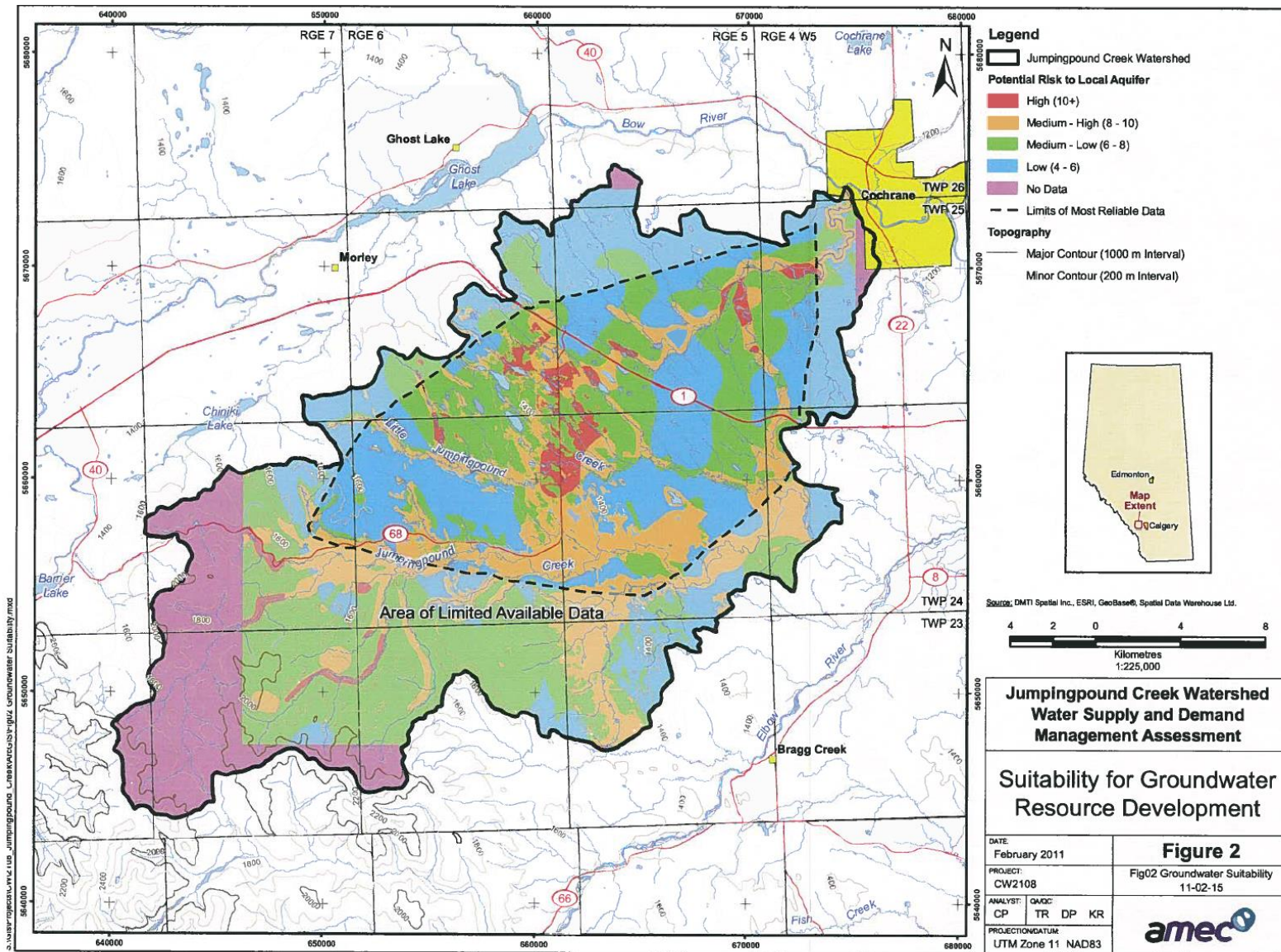


Figure 5. Groundwater vulnerability map (AMEC 2011).

8.4 RIPARIAN AREAS AND WETLANDS

8.4.1 Policy Statement

Riparian areas are recognized as an integral part of the Jumpingpound Creek watershed since they provide for water storage/supply, flood protection and water quality, as well as for critical wildlife habitat (e.g., moose and Trumpeter Swans).

8.4.2 Targets and Thresholds

8.4.2.1 Wetlands (*lentic (non-flowing) areas*)

Target: Ten percent of the Jumpingpound Creek watershed should remain as wetland.

Table 2. Target and threshold for wetland land cover in the watershed.

Land Cover	Dominant Land Use	Target (% of watershed)	Threshold (% of watershed)
Wetland	Wildlife Habitat/Grazing	10	10

Rationale: Currently, about 10% of the Jumpingpound Creek watershed is considered a wetland environment. This large wetland area is a recharge zone for groundwater, which currently accounts for about 68-72% of baseflow in Jumpingpound Creek.

To maintain an appropriate water balance in watersheds, a variety of seasonal and permanent wetlands is required (van der Kamp and Hayashi 2009). About 3 to 7% of the watershed area should remain for flood protection and water quality (Johnston et al. 1990).

8.4.2.2 Riparian Areas (*lotic and lentic (flowing and non-flowing) areas*)

Health Target: Riparian health scores should range within the “healthy” category but should be greater than 90 in Reach 4 (Headwaters) and equal to or greater than 80 in Reaches 1 to 3 (Table 3).

Health Thresholds: Riparian health scores should not fall below 90 in Reach 4 (Headwaters) and 70 in Reaches 1 to 3 (Table 3).

Table 3. Targets and thresholds for riparian health by land cover and land use type.

Land Cover	Dominant Land Use	Reaches	Target (Score)	Threshold (Score)
Mixed Forest	Forestry/Grazing/Recreation	Reach 4 (Headwaters)	≥ 90	90
Shrubland	Grazing	Reach 3 (Middle)	≥ 80	70
Grassland	Grazing/Cropland	Reach 2 (Middle)	≥ 80	70
Urban	Recreation/	Reach 1 (Lower)	≥ 80	70
Wetlands	Mixed	Entire watershed	≥ 80	70

No reach should have more than 5% of sites rating unhealthy, due to natural or unforeseen reasons, at any point in time.

Notes: Riparian health score categories as defined by Cows and Fish: Healthy (Score 80 and above), Healthy with Problems (Score 60 to 79), Unhealthy (Score less than 60).

Rationale: Riparian areas stabilize streambanks, improve water quality, store water, provide flood protection and give cover for livestock and fish and wildlife. Riparian health scores within the upper end of the healthy with problems category provide the greatest benefits to biodiversity, while scores above 80 in the healthy category provides higher quality habitat for more sensitive species. A mix of riparian areas rated “Healthy” and “Healthy with Problems” will maintain the function of land, water and wildlife resources into the future. Health scores are generated using approved methods as per the Alberta Riparian Habitat Management Society (Cows and Fish).

8.4.3 Recommendations

8.4.3.1 Wetlands (Non-flowing)

- a) *No further net loss of wetlands (Classes I – VII of the Stewart and Kantrud (1971) wetland classification system).¹⁰*
- b) *A minimum 20 m setback should be applied adjacent to all wetlands (see also Recommendation 8.5.3.2 e for preservation of wetlands significant to Trumpeter Swans).*
- c) *Stormwater should not be directed into existing natural wetlands, unless appropriate studies have been conducted demonstrating no adverse effect on surface water quantity and quality, groundwater quantity and quality and biodiversity.*

Rationale: Groundwater provides a significant contribution to baseflows in Jumpingpound Creek and wetlands are intricately connected to surface water.

- d) *Land that is marginally productive for annual crops should be converted into long-term forage production or retained in its natural state (e.g., ephemeral wetlands).*
- e) *Connectivity among wetlands and natural drainage ways should be maintained and restored where possible.*

8.4.3.2 Riparian Areas (Flowing)

- a) *Riparian setbacks should be applied to new developments adjacent to Jumpingpound Creek and its tributaries (See Table 4, Figure 6).¹¹*
- b) *Floodplain mapping should be completed for Reach 1, at a minimum, and possibly Reach 2 of the Jumpingpound Creek watershed.*

Rationale: Development pressure is increasing rapidly in Reach 1.

- c) *Permitted and restricted activities within the riparian setback and flood fringe should be specified in accordance with Table 5.*
- d) *Complete riparian health assessments for the entire Jumpingpound Creek mainstem, particularly in the lower reaches near the mouth.*

¹⁰Also refer to Rocky View County’s Wetland Conservation and Management Policy (Policy 420, March 2010) that provides protection for wetlands Classed III and greater.

¹¹Consistent with Rocky View County’s Riparian Land Conservation and Management Policy (Policy 419, March 2010).

- e) *Continue to monitor riparian health every 5 to 7 years using methods derived by the Alberta Riparian Habitat Management Society (Cows and Fish).*
- f) *Grazing of livestock should be permitted in the riparian area if Beneficial Management Practices (BMPs) are implemented, including but not limited to:*
 - i. *Rotational grazing*
 - ii. *Timing restrictions – Cattle should not be grazed in riparian areas during the spring thaw or when soils are moist. Most appropriate grazing periods are summer and/or winter.*
 - iii. *Stocking rate – Cattle should be grazed at the appropriate stocking rate based on forage production and proximity to a watercourse.*
 - iv. *Off-stream watering – Where the sole source of livestock water is Jumpingpound Creek or a tributary to Jumpingpound Creek, an offstream watering system should be used to protect riparian function.*
- g) *When timing restrictions and stocking rates cannot match a pasture's carrying capacity, temporary or permanent fencing should be used to protect water bodies.*
- h) *In cropping systems, the application of manure and fertilizer on agricultural lands should be consistent with the standards outlined in the Agricultural Operations Practices Act (AOPA) for manure and fertilizer application on forages or direct seeded crops.*
- i) *Landowners within Jumpingpound Creek watershed should complete an Environmental Farm Plan to enhance water and land management.*
- j) *Encourage/facilitate upgrades to older agricultural facilities to meet riparian and water quality targets.*
- k) *Develop a restoration and maintenance plan for the lower reach of Jumpingpound Creek. Aspects of the plan should focus on:*
 - i. *revegetation and maintenance of understory and woody material at creeks edge,*
 - ii. *an education program for Town residents on stream ecology and recreational impacts,*
 - iii. *access restrictions during critical fisheries periods.*
- l) *Develop strategy to address invasive and undesirable plants, particularly in Reach 4.*

Table 4. Riparian Area Setback Objectives

Reach	Management Objective	Setback ¹²	Notes
Riparian Areas (Lotic)			
Reach 1 – Urban	Floodplain protection	1:100 year floodplain map or 50 m, whatever is greater. In cases where the coarse alluvium is greater than the 50 m setback, the additional width of the entire alluvium will be considered flood fringe and be included in the setback calculation. Within the flood fringe, certain activities may or may not be permitted.	Coarse Stream Alluvium Additional steep slope setback of 12 m may be required where lands are >25% slope The area defined as “coarse and fine alluvium” draws strong correlation to the flood fringe identified by AESRD in the lower reach of Jumpingpound Creek and should have the same level of protection as flood fringe.
Reach 2 – Grassland	Water quality protection, biodiversity	50 m	Coarse Stream Alluvium; Refer to Reach 1 Notes
Reach 3 – Shrubland	Water quality protection, biodiversity	50 m	Coarse Stream Alluvium Refer to Reach 1 Notes
Reach 4 – Mixed Forest	Water quality protection, biodiversity	50 m	Coarse Stream Alluvium Refer to Reach 1 Notes
Little Jumpingpound Creek and Livingstone Creek	Water quality protection, biodiversity	50 m	Fine Stream Alluvium Refer to Reach 1 Notes
Ephemeral and Intermittent Streams and Gullies	Water quality protection, biodiversity	The greater of: 20 m on lands having leach till as the dominant surficial geology Or 6 m strip of native vegetation or perennial grasses adjacent to the stream channel crest, plus an additional 1.5 m for every 1% of slope greater than 5%.	Leached till A survey of vegetation and soils should be required for any new developments to ensure that unique and local characteristics of the site are not overlooked.

¹²Adapted from AENV (2011).

Reach	Management Objective	Setback ¹²	Notes
Wetlands			
Class I and II Wetlands		20 m strip of willow and perennial grasses	
Class III – VII		20 m strip of willow and perennial grasses	
Trumpeter Swan Wetlands		Breeding Wetlands: 500 m Resting/Feeding Wetlands: 100 m	ASRD (2001) All Activities: <ol style="list-style-type: none"> 1. April 1 to Sept. 30, no activity within 800 m of the high water mark of identified water bodies. 2. No long term development (roads, wells, pipelines, etc.) within 500 m of the high water mark on identified water bodies. Livestock Grazing: <ol style="list-style-type: none"> 3. No new grazing leases issued adjacent to identified water bodies. 4. No range improvement within 500 m of the high water mark on identified water bodies. Timber Harvesting: <ol style="list-style-type: none"> 5. No timber harvesting within 200 m of high water mark for identified water bodies. Establishment of a special management zone for timber harvesting between 200 m and 500 m from high water mark, with a detailed plan, is required.

See groundwater risk map to protect shallow groundwater.

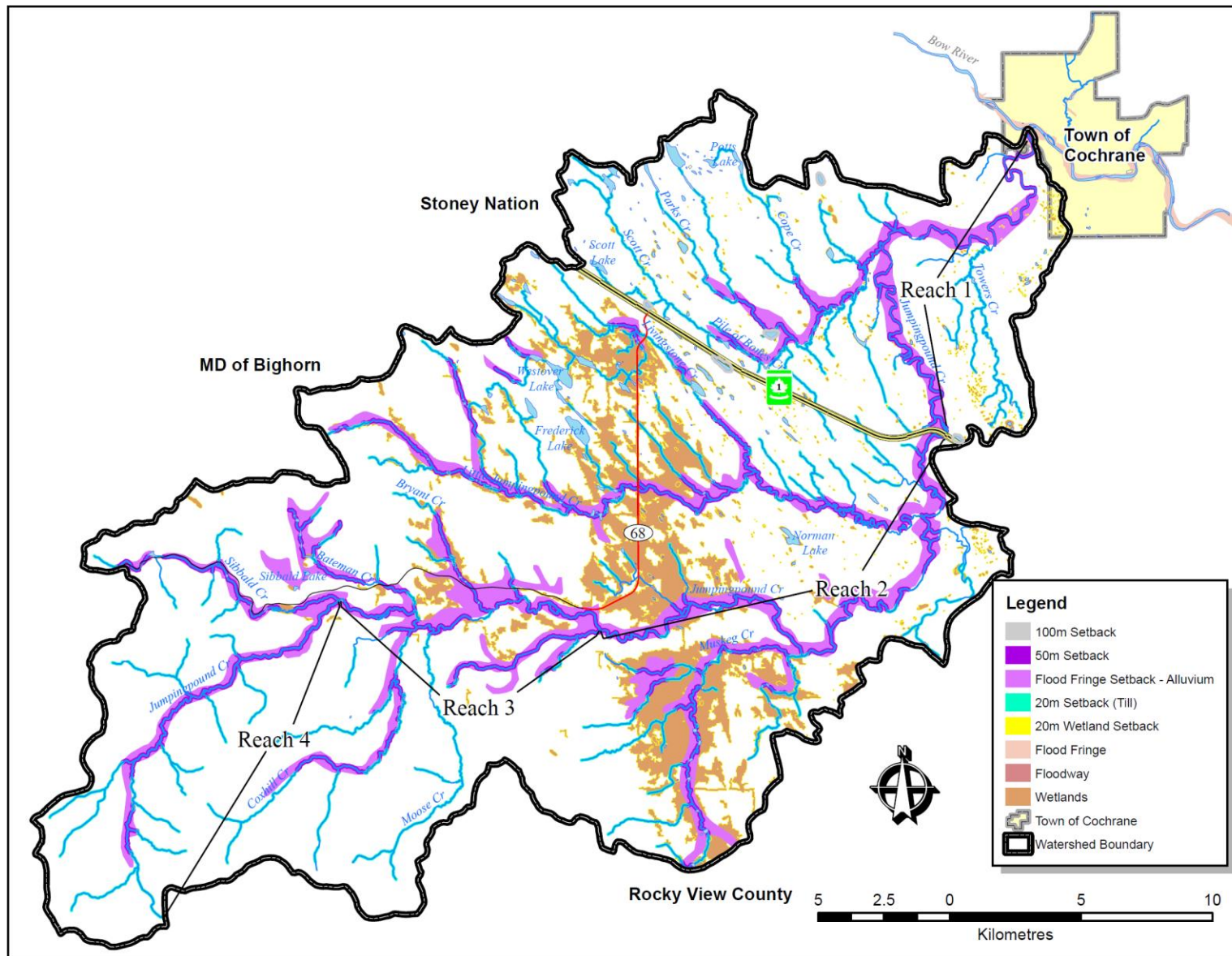


Figure 6. Map showing proposed riparian setbacks for the Jumpingpound Creek watershed.

Table 5. Recommended permitted and restricted activity within the riparian setback and flood fringe zones.

Activity	Riparian Setback	Flood Fringe
Permitted	<ul style="list-style-type: none"> Existing buildings and structures Existing public and private roads Existing and new public and private linear utilities (mitigation to reduce impacts) Existing public and private non-linear utilities Maintenance and repair of infrastructure Livestock grazing (where BMPs are applied) Passive recreation (depending on wildlife sensitivities) Existing pathways and trails (mitigation to reduce impacts) New pervious pathways and trails (i.e., no concrete) discouraged, but may be considered Public education 	<ul style="list-style-type: none"> Existing buildings and structures Existing public and private roads Existing public and private linear utilities New public and private non-linear utilities (discretionary) Cultivation (using appropriate BMPs) Livestock grazing (where BMPs are applied) Passive recreation (depending on wildlife sensitivities) Recreation infrastructure (discretionary) Pathways and Trails (with mitigation to reduce impacts) Public education
Restricted	<ul style="list-style-type: none"> New buildings and structures New public and private roads New public and private non-linear utilities Stormwater management infrastructure Cultivation Recreation infrastructure Resource extraction Damage to native vegetation 	<ul style="list-style-type: none"> New buildings and structures New public and private roads Stormwater management infrastructure Resource extraction Damage to native vegetation

8.4.4 Implementation of Riparian Area and Wetland Recommendations

Recommendation	Action	Jurisdiction	Timeframe
Wetlands			
8.4.3.1 a No further loss of wetlands.	AESRD and the Alberta Water Council should coordinate the development of a provincial riparian policy to complement the efforts by other jurisdictions and organizations.	Alberta Environment and Sustainable Resource Development and Alberta Water Council	H
	Any work within a water body requires an Approval under the <i>Water Act</i> . Wetland retention and compensation are considered in AESRD's decisions.		
	Amend policy, plans, bylaws and procedures to achieve goal. ¹³	MD of Bighorn, Rocky View County, Kananaskis Improvement District,	H
	Require development applications		

¹³ Recommendations should be incorporated into Municipal Development Plans (MDPs), Regional Policy Plans, Areas Structures Plans (ASPs), Outline Plans, Concept Plans, Servicing Standards (SS), Development Permits (DPs) and Development Agreements (DAs).

Recommendation	Action	Jurisdiction	Timeframe
	<p>include documentation to show how the project considered riparian areas and water quality in the planning process.</p> <p>Create a map overlay showing wetland environments and make available to land use planners for decision-making.</p>	Town of Cochrane	
<p>8.4.3.1 b Establish buffers adjacent to wetlands.</p>	<p>Amend policy, plans, bylaws and procedures to achieve goal.¹⁴</p>	<p>MD of Bighorn, Rocky View County, Kananaskis Improvement District, Town of Cochrane</p>	M-H
<p>8.4.3.1 c Apply appropriate stormwater management practices.</p>	<p>Encourage capture and re-use of stormwater using engineered stormwater ponds. Apply Low Impact Development principles in new developments to reduce stormwater volumes requiring management.</p>	<p>MD of Bighorn, Rocky View County, Kananaskis Improvement District, Town of Cochrane</p>	M-H
<p>8.4.3.1 d Marginal lands maintained in forage or native vegetation.</p>	<p>Identify marginal lands and ensure that these are maintained in either forage or native vegetation.</p>	Landowners	M
<p>8.4.3.1 e Maintain connectivity between wetlands.</p>	<p>Develop a wetland/habitat overlay for use by municipal planners to identify wetland connections and habitat patches/corridors.</p>	<p>MD of Bighorn, Rocky View County, Kananaskis Improvement District, Town of Cochrane</p>	M-H
<p>Riparian Areas (flowing)</p>			
<p>8.4.3.2 a Riparian setbacks applied to new developments.</p>	<p>Municipalities to look at the implications of the defined setback widths.</p> <p>Alternative site design scenarios should be considered when exploring implications including, density, flexible MR and conservation development that coincides with JCWP biodiversity objectives.</p> <p>Require development applications include documentation to show how the project considered riparian areas in the planning process.</p> <p>Amend policies, guidelines and other documents to include the riparian setback criteria and other riparian protection recommendations.</p> <p>Integrated floodplain mapping provided by AESRD into land use plans and bylaws so it is available at the counter for review by landowners and</p>	Municipalities	H

¹⁴ See Footnote 10.

Recommendation	Action	Jurisdiction	Timeframe
	developers.		
8.4.3.2 b Complete floodplain mapping for at least Reach 1 within the Jumpingpound Creek watershed.	Complete the floodplain mapping for Jumpingpound Creek, beyond the approximate 3.2 km (2 miles) upstream of the confluence with the Bow River, to include at least Reach 1. This could be completed during an update of the mapping for the Town of Cochrane.	Alberta Environment and Sustainable Resource Development	H M-L for Reach 2
8.4.3.2 c Permitted and restricted activity	Municipalities to develop and adopt policy, and update land use bylaws and servicing standards to reflect permitted and restricted activities.	MD of Bighorn, Rocky View County, Town of Cochrane	H
8.4.3.2 d Complete riparian health assessments	Encourage Town of Cochrane to complete riparian health assessment to address data gaps in this reach.	JCWP	H
8.4.3.2 e Monitor riparian health every 5 to 7 years.	Work with Cows and Fish to develop a long-term monitoring program and reporting structure.	MD of Bighorn, Rocky View County, Town of Cochrane, Stoney Nation	M
	Work with Cows and Fish to develop a long-term monitoring program and reporting structure.	Kananaskis Improvement District	M
8.4.3.2 f Encourage beneficial management practices for riparian management	Host field days to demonstrate the use of BMPS for riparian management in conjunction with Public Lands, Cows and Fish and Trout Unlimited.	JCWP	M-H
	Make information available to landowners on the use of BMPs for riparian management.	MD of Bighorn, Rocky View County, Town of Cochrane, Stoney Nation	M-H
8.4.3.2 g Use of temporary or permanent fencing.	Use temporary or permanent fencing when stocking rates or grazing practices do not meet riparian objectives.	Landowners	M
8.4.3.2 h Setbacks for manure application.	Use the guidelines set out in the <i>Agricultural Operation's Practices Act (AOPA)</i> for safe manure application around water.	Landowners	H
8.4.3.2 i Upgrade older agricultural facilities for riparian health and improved water quality.	Assist landowners to obtain funding and technical support to improve older agricultural facilities.	JCWP	L-M
	Assist landowners to obtain funding and technical support to improve older agricultural facilities.	MD of Bighorn, Rocky View County	L-M
8.4.3.2 j Restoration plan for Reach 1	Develop restoration plan for Reach 1.	Town of Cochrane	H
	Implement aspects of Reach 1 riparian restoration plan with local NGOs and residents to maintain in the long-term.	Town of Cochrane/ Local Non-Government Organizations	M-H
8.4.3.2 k Invasive Species	Continue to monitor and actively manage for invasive species in the Jumpingpound Creek watershed.	MD of Bighorn, Rocky View County, Town of Cochrane, Stoney Nation	H

Recommendation	Action	Jurisdiction	Timeframe
	Develop strategy to address invasive and undesirable plants in Reach 4.	Kananaskis Improvement District	H

H = High Priority, 2012-2014; M = Medium Priority, 2015-2018; L = Low Priority, 2018-2021

8.5 BIODIVERSITY

8.5.1 Policy Statement

The Jumpingpound Creek watershed continues to support a diverse fish, wildlife and plant population by providing quality and contiguous tracts of land for habitat and movement.

8.5.2 Targets and Thresholds

8.5.2.1 Fish

Indicators: Rainbow Trout in Reach 1 and Reach 2; Cutthroat Trout in Reach 3 and Reach 4 (Figure 6). Refer to Appendix E for fish habitat requirements.

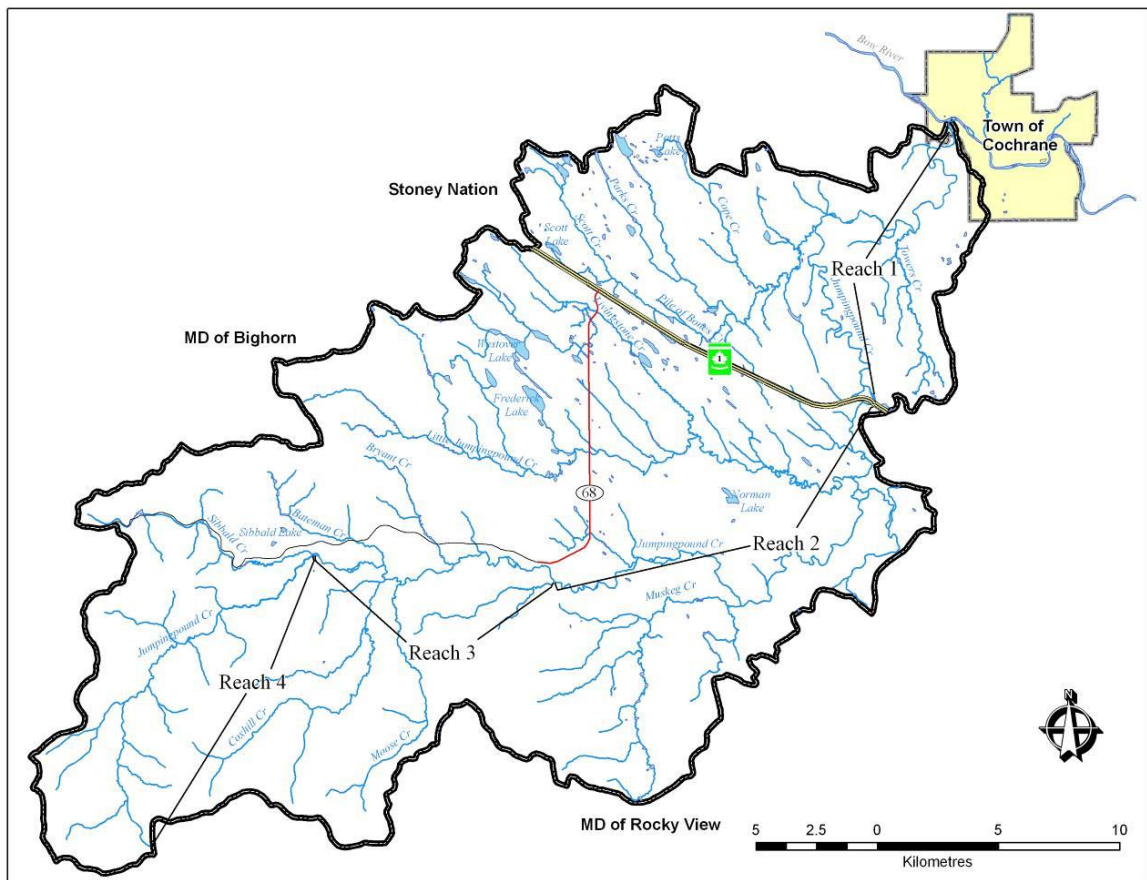


Figure 6. Fisheries management reaches in the Jumpingpound Creek watershed.

Table 6. Summary of targets recommended to maintain fish communities in the Jumpingpound Creek watershed.

Metric	Targets	Rationale
Road Density	Road density should not increase substantially above the current density of 0.40 km/km ² .	The threshold for healthy bull trout populations in Alberta is estimated between 0.28 to 0.87 km/km ² . In Alberta, bull trout is designated a 'sensitive' species. High road densities can impact fish populations through increased sedimentation, impassable culverts that prevent upstream migration and increased harvest due to improved accessibility.
Water Temperature	<p>The temperature threshold for Reach 1 and 2 is set at 20°C to support healthy populations of rainbow trout, which is the most common sport fish species in the lower two reaches and a popular recreational species.</p> <p>The temperature threshold for Reach 3 and 4 is set at 16°C to support healthy populations of cutthroat trout, which is the most common native sport fish species in the upper two reaches and a popular recreational species.</p>	<p>The upper lethal limit for rainbow trout is 25°C and stream rainbow trout select water temperatures between 12 and 19°C. The 20°C threshold will also protect other fish species occurring in Reaches 1 and 2 including mountain whitefish, brown trout and brook trout. Reach 1 has periodically had stream temperatures above 20°C.</p> <p>The extreme headwaters of Jumpingpound Creek is confirmed to contain pure westslope cutthroat trout, a species designated 'At Risk' in Alberta and 'Threatened' by COSEWIC. Optimum water temperatures for cutthroat trout have been reported to be between 4.5 and 15.5°C. The 16°C threshold will also protect other fish species in these Reaches including bull trout, brook trout and rainbow trout.</p>
Dissolved Oxygen	The oxygen targets for the Jumpingpound Creek watershed are from the provincial guidelines and are intended to provide protection for all species and in particular trout species. The 'acute' guideline is a one day minimum of 5 mg/L and the chronic guideline is a 7 day average of 6.5 mg/L. For incubating eggs and inter-gravel larval fish, the guideline is 9.5 mg/L (water column) which assumes dissolved oxygen in the gravel of 6.5 mg/L.	Dissolved oxygen (and temperature) is the most important water quality parameter for fish. Dissolved oxygen can decrease to lethal concentrations in the summer during periods of prolonged warm air temperatures when water levels are low, algae blooms are present and biochemical oxygen demand is high. During the winter, thick ice, low water levels, and high biochemical oxygen demand can lead to winter kill of fish. Sibbald Meadows Pond, Sibbald Lake, Muskeg Creek and Pile of Bones Creek have winter killed in the past. Portions of Little Jumpingpound, Bryant, Bateman and Sibbald creeks may be susceptible to low oxygen concentrations.
Fish Habitat	Refer to Section 6.3.2 for riparian targets and thresholds. In general, the target for riparian condition is to have a riparian zone in Reach 1 that as a minimum is classified as 80% Healthy and 20% Healthy with Problems.	Fish habitat in the Jumpingpound Creek watershed is generally regarded as healthy. However, Reach 1 of Jumpingpound Creek has been assessed as wide, with warmer water and higher silt loads. Instream cover is minimal due to low amounts of large woody debris and sparse fine woody debris. The establishment of a healthy riparian zone with a mix of trees and shrubs and a variety of age-classes will contribute large and fine woody debris to the creek, reduce water temperatures through shade and promote channel narrowing.

8.5.2.2 Wildlife

Indicators: cougar, grizzly bear, moose, elk, mule deer, Trumpeter Swans

Table 7. Targets and thresholds for preservation of wildlife.

Description	Target	Threshold
Habitat^{a,b}	70% of natural habitat conserved	60% of natural habitat conserved
Habitat Patch Size^b	Protect and maintain habitat patches >55 ha (137.5 acres)	-
Buffer for Habitat	300 m around edge peripheries	230 m around edge peripheries

^aCurrently ~ 77% of natural habitat remains in the Jumpingpound Creek watershed (Appendix F).

^bEnvironmental Law Institute (2003).

Rationale: The Jumpingpound Creek watershed provides significant areas for wildlife identified in the SLS FMA (2006), including:

- Mixedwood forests in riparian settings - rare vegetation cover types that are diverse botanically and structurally and are productive as habitat for birds and rare plants.
- Shallow marshes, wetlands and beaver pond complexes - rare and are high quality habitat for a number of bird and herpetile Species at Risk.
- Deciduous mixedwood and pure deciduous forest cover types >110 years old - limited supply and are subject to loss due to natural succession in a fire suppressed system. These are highly diverse and productive wildlife habitat sources.
- Late seral and old growth conifer forests - high quality habitat for a number of listed wildlife species including marten, Northern Goshawk, Pileated Woodpecker, Northern Pygmy Owl, Barred Owl, Bay-breasted Warbler, Black-throated Green Warbler, Cape May Warbler, and lynx.
- Upland Grasslands - essential habitat for elk and mule deer, which are key species for large carnivores. This habitat is of limited and diminishing supply due to fire suppression.

8.5.2.3 Vegetation

Target: To maintain native grassland within the Jumpingpound Creek watershed.

Table 8. Targets and thresholds for forage and litter biomass by plant community.

Natural Region	Plant Community	Indicator	Target (lbs/acre)	Threshold (lbs/acre)
Montane Natural Region	Rough fescue-Idaho fescue-Parry oat grass	Forage Biomass	1850	1500
		Litter Biomass	1200	780
	Kentucky bluegrass-Rough fescue	Forage Biomass	1600	1200
		Litter Biomass	1000	700
Foothills Parkland	Foothills Fescue-Parry oat grass-Idaho fescue	Forage Biomass	1702 (avg)	-
		Litter Biomass	1200	800

Table 9. Targets and thresholds for range health.

Health Category	Current Range Health (%) (2003 to 2009; 140 sites)	Target (%)	Threshold (%)
Healthy	55	90	80
Healthy with Problems	30	10	20
Unhealthy	15		
No site should have more than 5% of the area rating unhealthy, due to natural or unforeseen reasons, at any point in time.			

Notes: Range health score categories: Healthy (Score 75 and above), Healthy with Problems (Score 50 to 74), Unhealthy (Score less than 50). Range health is assessed using the Rangeland Health Assessment for Grassland, Forest & Tame Pasture (Adams et al. 2003).

8.5.3 Recommendations

8.5.3.1 Fish

- a) *For the protection of the fisheries resource, road density should not increase substantially above the current density of 0.40 km/km².¹⁵*
- b) *Research is required to determine if oxygen and water temperature thresholds are being exceeded at Muskeg, Little Jumpingpound, Bateman and Bryant creeks and Reach 1 of Jumpingpound Creek.*
- c) *Ongoing riparian monitoring and improvements should be implemented at Reach 1 of Jumpingpound Creek to improve fish habitat conditions in the lower reach. Also refer to Recommendation 8.3.3 b.*
- d) *Adopt recommended Beneficial Management Practices that include:*
 - i) *Limit new stream crossings, particularly culverts, and improve existing stream crossings to ensure fish passage (i.e., single-span bridges or open-bottom culverts).*
 - ii) *Maintain healthy riparian areas that have stable banks supported by deep rooted vegetation, particularly in Reach 1 of Jumpingpound Creek.*
 - iii) *Use natural bio-engineering (e.g., willow cuttings or wattle fences) to stabilize and repair areas of eroded streambanks.*
 - iv) *Provide off-stream watering sites so that cattle do not wade in streams which can damage streambanks and introduce bacterial and nutrient contamination.*
 - v) *Establish and maintain riparian management areas and plans for cattle grazing.*
 - vi) *Minimize or eliminate the use of herbicides and fertilizers adjacent to streams.*

¹⁵ Links to Rocky View County's Agriculture Master Plan Recommendations 11 and 12 related to Smart Growth development principles (November 2011).

8.5.3.2 Wildlife

- a) *Retain large contiguous areas that contain critical habitat in sufficient patch size.*
- b) *Maintain stepping stones or corridors that connect habitat patches.*
- c) *Preserve rare landscape elements (and associated species).*
- d) *Establish a buffer adjacent to critical habitat areas to reduce edge effects.*
- e) *Unless the developer can demonstrate that the development will not negatively affect the species, discourage development:*
 - i) *on elk, moose and mule deer migration routes and winter ranges*
 - ii) *within 50 m of cutthroat trout spawning areas*
 - iii) *within 100 m of Trumpeter Swan migration wetlands (resting areas) (ASRD 2001)*
 - iv) *within 400 m of Bald Eagle nests*

Rationale: Key Trumpeter Swan migration wetlands must be protected, including Jumping Pound wetlands, Sibbald Flats and Sibbald Flat East ponds, and Pile of Bones Creek (Alberta Trumpeter Swan Recovery Plan 2006).

- f) *Develop an updated and unified access management plan for the Jumpingpound Creek watershed to address wildlife recommendations a – e.*

Rationale: Grizzly bear population viability is affected by enhanced mortality risk associated with open roads, motorized vehicles and firearms. This is a problem that needs to be addressed by regional and cooperative access management measures (SLS FMA 2006). Note that Spray Lakes Sawmills and Kananaskis Country currently have individual plans.

Rationale: Greater access in the watershed increases pressure on the fishery and may impact the ability of the fishery to be self-sustaining.

8.5.3.3 Vegetation

- a) *Encourage development on lands that have previously been disturbed to discourage development on native grassland.*
- b) *Well-managed grazing programs should be used to maintain healthy native grasslands, including appropriate stocking rates and timing restrictions.*
- c) *Range health assessments should be used to document changes in the health of grasslands.*

8.5.4 Implementation of Biodiversity Recommendations

Recommendation	Action	Jurisdiction	Timeframe
Fish			
8.5.3.1 a Maintain appropriate road density.	Develop a unified access map among the jurisdictions. Also refer to recommendation 6.5.3.3 f.	Kananaskis Improvement District, MD of Bighorn, Rocky View County, Town of Cochrane	M-H
8.5.3.1 b Research water temperature and oxygen in tributaries.	At select sites, install data sondes that collect continuous data (e.g., YSI or Hydrolabs).	JCWP	M-H
8.5.3.1 c Riparian monitoring and restoration.	Work with Cows and Fish to develop a long-term monitoring program and reporting structure. Also refer to Recommendation 6.4.3.2 e.	JCWP, Kananaskis Improvement District, MD of Bighorn, Rocky View County, Town of Cochrane	M
8.5.3.1 d Adopt recommended Beneficial Management Practices.	Adopt BMPs into policies and engineering design guidelines.	MD of Bighorn, Rocky View County, Town of Cochrane	M-H
	Adopt BMPS for livestock grazing and lawn maintenance.	Landowners, residents in the watershed, industry	M-H
Wildlife			
8.5.3.2 a Retain contiguous tracts of land in the watershed.	Partner with AESRD to map important areas for wildlife at various life stages and their migration routes. Make available to municipal planning staff, landowners, residents and the development community.	Alberta Environment and Sustainable Resource Development, Kananaskis Improvement District, MD of Bighorn, Rocky View County, Town of Cochrane	H
8.5.3.2 b Maintain corridors that connect habitat patches.	Partner with AESRD to map important areas for wildlife at various life stages and their migration routes. Make available to municipal planning staff, landowners, residents and the development community.	Alberta Environment and Sustainable Resource Development, Kananaskis Improvement District, MD of Bighorn, Rocky View County, Town of Cochrane	H
8.5.3.2 c Preserve rare landscape elements.	Partner with AESRD to map rare landscape elements. Make available to municipal planning staff, landowners, residents and the development community.	Alberta Environment and Sustainable Resource Development, Kananaskis Improvement District, MD of Bighorn, Rocky View County, Town of Cochrane	H
8.5.3.2 d Establish buffers next to critical habitat to avoid edge effects.	Adopt established buffer widths that protect critical habitat (e.g., nesting sites, migration wetlands). Make available to municipal planning staff,	Alberta Environment and Sustainable Resource Development,	H

Recommendation	Action	Jurisdiction	Timeframe
	landowners, residents and the development community.	Kananaskis Improvement District, MD of Bighorn, Rocky View County, Town of Cochrane	
8.5.3.2 e Prohibit development where wildlife may be impacted.	Partner with AESRD to map wildlife movement and important habitat for wildlife at various life stages. Make map available to municipal planning staff, landowners, residents and the development community.	Alberta Environment and Sustainable Resource Development, Kananaskis Improvement District, MD or Bighorn, Rocky View County, Town of Cochrane	H
8.5.3.2 f Develop a unified access map among all jurisdictions.	Partner with AESRD to map wildlife movement and important habitat for wildlife at various life stages.	Alberta Environment and Sustainable Resource Development, Kananaskis Improvement District, MD of Bighorn, Rocky View County, Town of Cochrane	H
Vegetation			
8.5.3.3 a Encourage development on previously disturbed lands.	Municipal plans and bylaws to encourage development on previously disturbed land, maintaining native grassland in green space or natural habitat contributing to wildlife corridors and patches.	MD of Bighorn, Rocky View County, Town of Cochrane	H
8.5.3.3 b Adopt Beneficial Management Practices for grazing lands.	Adopt Beneficial Management Practices for grazing lands.	Landowners, residents in the watershed	H
8.5.3.3 c Range health assessments to document change in grassland health.	Alberta Environment and Sustainable Resource Development should continue to monitor range health and report results to the community.	Alberta Environment and Sustainable Resource Development – Public Lands Division, landowners, residents in the watershed	M

H = High Priority, 2012-2014; M = Medium Priority, 2015-2018; L = Low Priority, 2018-2021

8.6 LAND USE

8.6.1 Policy Statement

Land is a limited, non-renewable resource and should be managed efficiently for multiple uses and the natural function of the Jumpingpound Creek watershed.

In Land Management Unit 1 (Freehold Area), land use within the Jumpingpound Creek watershed continues to support:

- Agriculture,
- Managed urban development (Low Impact Development)

- Environmental Goods and Services – streamflow, grasslands, wetlands, biodiversity
- Other uses: mineral extraction

In Land Management Unit 2 (Crown Land), land use within the Jumpingpound Creek watershed continues to support:

- Forestry
- Agriculture
- An active, managed recreation Area
- Environmental Goods and Services – streamflow, forest, wetlands, biodiversity
- Other uses: mineral extraction

8.6.2 Targets and Thresholds

Table 10. Targets and thresholds for land cover types related to critical habitat in the Jumpingpound Creek watershed.

Land Cover	Entire Watershed		Crown Lands		Freehold Area		Target	Threshold
	Area sq km	%	Area sq km	%	Area sq km	%		
Water Bodies	3.7	0.6	1.5	0.4	2.2	0.9	70% Habitat	60% Habitat
Wetland	60	9.9	30.8	8.5	29.2	11.9		
Grassland	115.5	19.1	41.4	11.5	74.1	30.3		
Shrubland	19.6	3.2	16.6	4.6	3	1.2		
Coniferous Forest	204.8	33.8	180.7	50.1	24.1	9.9		
Deciduous Forest	54	8.9	36.3	10.1	17.7	7.2		
Mixed Forest	34.9	5.8	30	8.3	4.9	2		
Annual Cropland	26.7	4.4	1.6	0.4	25.1	10.3		
Perennial Cropland/Pasture	70.1	11.6	7.8	2.2	62.3	25.5		
Developed Land	2.9	0.5	1	0.3	1.9	0.8		
Exposed Land	13	2.2	12.9	3.6	0.1	0.1		
Totals	605.1	100	360.6	100	244.6	100		
Habitat	492.3	81.4	337.3	93.5	155.1	63.4		

8.6.3 Recommendations

8.6.3.1 Land Management Unit 1 –Freehold Area (Refer to Appendix H for map)

- Ensure that only appropriate lands are taken from undeveloped areas for permanent use for residential, commercial, industrial, transportation, utility corridors and/or intensive recreational purposes. Habitat and wetlands should not be considered as appropriate in this case.*
- Future development should reflect the goals and objectives outlined in the Jumpingpound Creek IWMP, meeting targets and thresholds for water quantity, water quality, riparian areas and wetlands, and biodiversity.*

- c) *Support development where:*

 - j) *infrastructure capacity already exists (e.g., water, sewer, road and other infrastructure),*
 - ii) *land has been previously disturbed, and*
 - iii) *environmentally significant areas are not impacted (e.g., significant fish and wildlife habitats, native grassland)*

- d) *Development proposals in environmentally significant areas should require a biophysical assessment of environmental impacts on the land, water and air (and biodiversity).*
- e) *Stripping, grading or filling of escarpment areas should not be permitted for new developments.*
- f) *Stripping grading and/or filling should be minimized to preserve riparian areas, escarpments, wetlands and native grassland.*
- g) *To preserve existing topography and natural hydrology, buildings and roads should be strategically located to reduce the area disturbed by cutting and filling and minimize the amount of surface area susceptible to erosion.*
- h) *Natural drainage swales should be used to convey runoff from new developments to the receiving waters at predevelopment volumes, rates and quality so as not to alter the native vegetation community.*
- i) *High density, low impact development should take place in urban areas. Higher densities should be encouraged where re-development opportunities occur.*
- j) *Low impact development principles should be incorporated in new development projects to reduce impacts on natural systems, including:*

 - i) *Stormwater capture and re-use resulting in communities that discharge runoff at predevelopment volumes*
 - ii) *A reduction in hard surface areas*
 - iii) *Absorbent landscaping*
 - iv) *Adoption of compact development forms and alternative site development standards.*

- k) *Current agricultural land uses should be supported into the future to maintain ecological function and historic values, recognizing the role of land use to functioning natural systems.*

8.6.3.2 Land Management Area 2 – Upper Reach (Mainly Crown Lands)

Note that the principles outlined for Land Management Area 1 (Freehold Area) also apply to Land Management Area 2 (Crown Lands).

- a) *Create a unified access management plan within the Jumpingpound Creek watershed to maintain quality habitat for fish and wildlife within a functioning ecosystem where riparian areas, stream flow and water quality are protected.*
- b) *Low impact development principles should apply for any new developments (e.g., trails, buildings, wells, interpretive centres, roads, parking lots, and washrooms) and*

should minimize impacts on natural processes, including vegetation and wildlife communities, stream flow and water quality.

- c) *The forestry and mineral extraction industries should continue to apply best management practices within the watershed to meet the objectives of the Jumpingpound Creek Integrated Watershed Management Plan.*
- d) *A monitoring program should be established to 1) better understand wildlife movement and habitat use in the Jumpingpound Creek watershed, 2) understand how land use within the freehold area may impact on habitat value in Crown lands, and 3) identify a possible target and threshold for the number of visitors/anglers that may be suitable within the watershed.*

8.6.4 Implementation of Land Use Recommendations

Recommendation	Action	Jurisdiction	Timeframe
Land Management Area 1			
8.6.3.1 a Minimize land conversion from undeveloped to developed areas.	Municipal staff should be familiar with the targets and thresholds within the IWMP and incorporate into Municipal Development Plans, Land Use Bylaws and other appropriate standards and guidelines.	MD of Bighorn, Rocky View County, Town of Cochrane, Stoney Nation, Kananaskis Improvement District	H
8.6.3.1 b New developments should meet targets and thresholds identified in the IWMP.		MD of Bighorn, Rocky View County, Town of Cochrane, Stoney Nation, Kananaskis Improvement District	H
8.6.3.1 c Support development where infrastructure exists, on disturbed lands and where impacts to environmentally significant areas are limited.		MD of Bighorn, Rocky View County, Town of Cochrane, Stoney Nation, Kananaskis Improvement District	H
8.6.3.1 d Biophysical assessments to be completed for environmentally significant areas.		The developer should provide site-specific detailed maps identifying, but not limited to, the following: <ul style="list-style-type: none"> - Watercourses, lakes and other water bodies (e.g., creek/valley corridors, wetlands) - Areas of significant vegetation, including provincially, regionally and locally significant species. No earthworks should be permitted within 3 to 5 metres of the vegetation drip line to protect root systems - Critical recharge areas - Floodplain mapping - Erosion areas susceptible to bank instability - Escarpment areas having slope of $\geq 15\%$. 	MD of Bighorn, Rocky View County, Town of Cochrane, Stoney Nation, Kananaskis Improvement District
		Landowners	

Recommendation	Action	Jurisdiction	Timeframe
8.6.3.1 e Stripping, grading and filling of escarpment areas should not be permitted.	Require that sediment control measures for construction sites are included in all development plans submitted to municipalities or provincial departments.	MD of Bighorn, Rocky View County, Town of Cochrane, Stoney Nation, Kananaskis Improvement District	H
8.6.3.1 f Where undertaken, stripping, grading and filling should minimize impacts.	Design a program within each jurisdiction to encourage departments to participate in enforcement of sediment and erosion control. An example may be department staff who work outdoors in the watershed (e.g., Parks or Public Works) and may be able to identify violations.	MD of Bighorn, Rocky View County, Town of Cochrane, Stoney Nation, Kananaskis Improvement District	H
8.6.3.1 g Preserve existing topography and natural hydrology.	Ensure that a map showing natural hydrology and existing topography of Jumpingpound Creek is available and considered when reviewing development permit applications.	MD of Bighorn, Rocky View County, Town of Cochrane, Stoney Nation, Kananaskis Improvement District	H
8.6.3.1 h Natural drainage swales should be used to convey runoff from new developments to the receiving waters at an appropriate volume and rate.	Amend policy, plans, bylaws and procedures to achieve goal.	MD of Bighorn, Rocky View County, Town of Cochrane, Stoney Nation, Kananaskis Improvement District	H
8.6.3.1 i High density, Low Impact Development.	Conduct internal review of existing Low Impact Development policies to identify changes required to implement these practices.	MD of Bighorn, Rocky View County, Town of Cochrane	M
8.6.3.1 j Adopt Low Impact Development principles.	Develop (or adopt from other municipalities) Low Impact Development design standards, construction and maintenance procedures. Amend policy, legislation and procedures to include Low Impact Development standards as a minimum practice.	MD of Bighorn, Rocky View County, Town of Cochrane, Stoney Nation, Kananaskis Improvement District	H
8.6.3.1 k Maintain current land uses and recognize the importance of these uses to functioning ecosystems.	Undertake long-term planning within Jumpingpound Creek watershed that considers current land uses.	MD of Bighorn, Rocky View County, Town of Cochrane, Stoney Nation, Kananaskis Improvement District	M
Land Management Area 2			
8.6.3.2 a Create a unified access map for the watershed.	Create a Steering Committee to review future growth scenarios that apply road density thresholds identified in the IWMP.	MD of Bighorn, Rocky View County, Town of Cochrane, Kananaskis Improvement District, Alberta Tourism,	H

Recommendation	Action	Jurisdiction	Timeframe
		Parks and Recreation	
8.6.3.3 b Apply low impact development principles to new developments.	Identify low impact development options for any new developments (e.g., trails, buildings, wells, interpretive centres, roads, parking lots, and washrooms)	Alberta Tourism, Parks and Recreation, Kananaskis Improvement District	M-H
8.6.3.4 c Best Management Practices for industrial activity.	Encourage industry to continue to adopt and apply best management practices as new management practices are identified.	Forestry, Oil and Gas and Agriculture Industries	H
8.6.3.5 d Develop a monitoring program.	Monitor fish and wildlife and recreational use within the Jumpingpound Creek watershed to identify indicator species and support the establishment of targets and thresholds.	Alberta Tourism, Parks and Recreation, Alberta Environment and Sustainable Resource Development, Kananaskis Improvement District	M-H

H = High Priority, 2012-2014; M = Medium Priority, 2015-2018; L = Low Priority, 2018-2021

9.0 GLOSSARY OF TERMS

AOPA *Agricultural Operations Practices Act*

Aquifer An underground bed or layer of sand, earth, gravel or porous stone that contains water or permits its passage (Armantrout 1998).

Development a) An excavation, stockpile or the creation of them; b) A building or an addition to, or replacement or repair of a building and the construction or placing in, on, over or under land of any of them; c) A change of use of land or a building or an act done in relation to land or a building that results in or is likely to result in a change in the use of the land or building; or d) A change in the intensity of use of land or a building or an act done in relation to land or a building that results in or is likely to result in a change in the intensity of use of the land or building (MGA 17 Definition).

Environmentally Significant Areas An important and/or unique and/or sensitive part of the landscape. An ESA can be important for performing critical ecosystem services such as floodwater storage and water purification or for providing critical winter habitat, spawning and nesting areas, hibernacula, travel corridors, and refugia. ESAs may contain unique landforms or old-growth forests, may support rare or endangered species; or may be areas that are excellent representatives of particular ecosystems or landscapes.

The identification and documentation of ESAs provides important information that can be used to improve land-use decisions and protect biodiversity. Environmentally significant areas can serve: as ecological benchmarks against which changes may be compared; as research areas; to protect water and air quality, fisheries, sensitive terrains, and soils; as places for public education and recreation; as areas that moderate global warming through sequestering of carbon dioxide; etc. (Timoney 1998)

Fen A peat-accumulating wetland that receives some drainage from surrounding mineral soil and usually supports marsh-like vegetation.

Floodway The portion of the flood hazard area where flows are deepest, fastest and most destructive. The floodway typically includes the main channel of a stream and a portion of the adjacent overbank area. The floodway is required to convey the design flood. New development is discouraged in the floodway and may not be permitted in some communities.

Flood Fringe The portion of the flood hazard area outside of the floodway. Water in the flood fringe is generally shallower and flows more slowly than in the floodway. New development in the flood fringe may be permitted in some communities and should be flood-proofed.

Groundwater Water located interstitially in the substrate of the earth that is recharged by infiltration and enters streams through seepage and springs (Armantrout 1998).

Groundwater Under the Direct Influence (GUDI) The groundwater source is located close enough to nearby surface water, such as a river or lake, to receive direct surface water recharge.

Habitat Specific type of place within an ecosystem occupied by an organism, population or community that contains both living and nonliving components with specific biological, chemical and physical characteristics including the basic requirements of food, water and cover or shelter (Armantrout 1998).

Headwaters Upper reaches of tributaries in a drainage basin (Armantrout 1998).

Lentic An aquatic system with standing or slow flowing water (e.g., lake, pond, reservoir, swamp, marsh and wetland). Such systems have a non-directional net flow of water (Armantrout 1998).

Lotic An aquatic system with rapidly flowing water such as a brook, stream or river where the net flow of water is unidirectional from the headwaters to the mouth (Armantrout 1998).

Recharge Process by which water is added to an aquifer (Armantrout 1998).

Recharge Area Area where water infiltrates into the ground and joins the aquifer through hydraulic head (Armantrout 1998).

Riparian Area 1) Of, pertaining to, situated or dwelling on the margin of a river or other water body. 2) Also applies to banks on water bodies where sufficient soil moisture supports the growth of mesic vegetation that requires a moderate amount of moisture. Also referred to as riparian zone or riparian habitat (Armantrout 1998).

Target Either numerical or written statements that will provide measurable indication of success in achieving Jumpingpound Creek IWMP objectives

Threshold The point at which a relatively small change in external conditions causes a rapid change in an ecosystem. When an ecological threshold has been passed, the ecosystem may no longer be able to return to its natural state. The trespassing of an ecological threshold often leads to a rapid change of ecosystem health.

Water Conservation Objectives Water Conservation Objectives (WCOs) pertain to the amount and quality of water established by the Director (an Alberta Environment staff with delegated authority) to be necessary for the:

- Protection of a natural water body or its aquatic environment, or any part of them,
- Protection of tourism, recreational, transportation or waste assimilation uses of water, or
- Management of fish and wildlife

Water conservation objectives may also include water necessary for the rate of flow of water or water level requirements. Instream needs are defined as the quantity and quality of water required to satisfy hydrological process demands instream and to protect river ecology and riparian environments. Instream needs include fish habitat, water quality, riparian vegetation, channel structure, human safety and recreational uses. Instream flow needs differ from water conservation objectives in that they are strictly a scientific assessment. Water conservation objectives, on the other hand, refer to the quantity of water that should be present in a stream to meet instream needs and socio-economic factors.

Watershed A geographic area defined by topographic divides that has a common outlet for its surface runoff.

Wetland Land areas that are wet at least for part of the year, are poorly drained and are characterized by hydrophytic vegetation, hydric soils. Permanent or periodic inundation by water or prolonged soil saturation generally results in anaerobic soils (Armantrout 1998).

Wildlife Wildlife indicators include cougar, grizzly bear, moose, elk, mule deer and Trumpeter Swans.

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APPENDIX A. Summary of valued ecosystem components within the Jumpingpound Creek watershed.

Ecosystem Component	Value
Forests	<ul style="list-style-type: none"> • The Jumpingpound Creek watershed contains the only surviving old growth forest north of the Crowsnest Pass. • The forest contributes to the local economy (i.e. Spray Lakes Saw Mills). • The forest represents the headwaters of the Jumpingpound Creek and represents a water storage area.
Wildlife Habitat	<ul style="list-style-type: none"> • Unique moose wintering habitat is found in the muskeg area of the watershed. • The Jumpingpound Creek Watershed lies within the trumpeter swan migration route. • There is an abundance of wildlife in the watershed: grizzly bears, cougars, deer, resident elk herd, wolves, coyotes and fox.
Fish Habitat	<ul style="list-style-type: none"> • Jumpingpound Creek provides significant trout spawning habitat upstream of Bearspaw Dam.
Archaeological and Historical Resources	<ul style="list-style-type: none"> • Numerous buffalo jumps and tipi rings in the southern reaches of the watershed. • One of the oldest native camp sites is found at Sibbald flats. • Remnants of an irrigation dam is found in the watershed that dates back to the early 1900's. • Remnants of a coalmine operation can be found in the watershed.
Surface Water Resources	<ul style="list-style-type: none"> • No impoundments restricting streamflow currently exist on the Jumpingpound Creek. • Jumpingpound Creek is fed by numerous seasonal creeks.
Groundwater	<ul style="list-style-type: none"> • There is a strong groundwater/surface water interaction with the presence of alluvial aquifers. • Springs. • On occasion, seasonal creeks dry up during the summer months but remain in tact in underground streams.
Vegetation	<ul style="list-style-type: none"> • There are large tracts of rough fescue remaining in the watershed. • There are a number of protected species of flowers in the watershed, including lady slippers and calipso orchids. • The watershed may be the (northern?) extent for fir tree growth.
Wetlands	<ul style="list-style-type: none"> • There are large areas of land that are muskeg in the watershed. These wetland areas contribute to base flows in the Jumpingpound Creek and tributaries as well as to groundwater. • The muskeg areas provide a filter for the preservation of groundwater and surface water quality. • Numerous oxbows that provide wetland habitat.
Geology	<ul style="list-style-type: none"> • Black shale layers underlie the Jumpingpound Creek watershed. • Sandstone protection from fractures is critical to surface water quality and groundwater quality protection. • Fossils are found within various rock outcrops.
Land use	<ul style="list-style-type: none"> • Ranching • Low rates of cultivation • High proportion of native grass
Social and Cultural	<ul style="list-style-type: none"> • The Jumpingpound Creek watershed contains some of the oldest ranches in Alberta and contributes to the social history of Alberta. • A strong sense of community still remains in the Jumpingpound Creek watershed. • First Nations (e.g. Stoney Nation) still use the ancient camp site.

Ecosystem Component	Value
Landscape	<ul style="list-style-type: none">• There is a great aesthetic value of the unobstructed viewscales in the watershed.• Minimal fragmentation of the landscape has occurred.• There is limited access to the Jumpingpound Creek and surrounding area.
Population	<ul style="list-style-type: none">• Population density in the watershed is very low.• Original ranch families still exist in the watershed.

APPENDIX B. Summary of issues in the Jumpingpound Creek watershed.

A preliminary list of watershed issues were identified by various stakeholders in the Jumpingpound Creek, Bighill Creek and Horse Creek watersheds during the Living in Watershed Workshops. Additional concerns were identified by the Ranchers of the Jumping Pound during a working group meeting held in June 2007 (Table 1).

Description of Current Watershed Issues (from Living in Watersheds Workshops)

- As tributaries of the Bow River, the watersheds are closed to new licence applications under the *Water Act* as of 2006. Water transfers are being negotiated and in some cases this results in water transferred from one designated use to another (e.g. an agricultural designation on Livingstone Creek was transferred to a recreational use (golf course)).
- Water use and allocation in the three watersheds are a concern. Water diversions from the creek are generally for the Shell Gas Plant, Springbank Irrigation District and agricultural users. In 2000, Trout Unlimited Canada asked for a moratorium on the issuance of any additional water licences on the creek (Norris 2003).
- There is no local-level water management plan for the watersheds in use by Alberta Environment and Sustainable Resource Development for deciding whether to approve a transfer of an allocation of water or issue an approval, preliminary certificate or licence.
- The rate of increase and aerial extent of residential housing developments in the three watersheds has local landowners concerned about the lack of information available regarding headwaters (e.g., groundwater, aquifers, springs and wetlands) and the watershed in general (e.g., water quality, riparian health and fisheries).
- There are numerous competing land uses (e.g., recreation, forestry, agriculture, oil and gas, and industrial/residential development) in the watersheds that are resulting in cumulative impacts in the watersheds, but there is no process available to address these impacts.
- Cumulative impacts in the watershed may lead to degradation or loss of riparian function and to poor management decisions that permanently impact the health of the Creeks (e.g., channelization).

Table 1. Preliminary issues identified for the Jumpingpound Creek watershed.

What are the problems/concerns in the Jumpingpound Creek watershed?	What do you think caused the problems?	Are there any future threats to contribute to this problem?	What would you like to see for your watershed (Goals)?
Limited, secure water supply.	<p>Poor communication.</p> <p>Lack of understanding of water rights and process.</p>	<p>The demand that the City of Calgary will place on water use. City of Calgary may have greater political power because of population. The City of Calgary may pre-empt historical rights to the water in Jumpingpound Creek and there is a potential for local loss of water rights.</p> <p>Concern that Notice of Applications will be missed through the current notification process.</p> <p>First Nations use of water.</p>	<p>Water use protected when at its lowest level (low flow years).</p> <p>Change Notification of affected parties for applications for changes in use, transfers. Notification list will pertain to entire watershed rather than 3 km radius.</p>
Water licence transfers.	<p>Lack of understanding of water supply availability and allocation.</p>	<p>Increase in number of water licences transferred from agricultural use to non-agricultural use.</p>	<p>A proper inventory of water supplies and carrying capacity for the watershed.</p>
<p>Lack of protection for agricultural land from external pressure.</p> <p>Loss of ability to farm or ranch because of external pressures.</p>	<p>Limited and/or poor land use planning in the region.</p> <p>Public perception that environmental groups have a “responsibility” for agricultural land management.</p> <p>Perception that private lands also need to be preserved.</p>	<p>Continued growth of the region as land is subdivided and people move from urban centres.</p> <p>Growing disconnect between the rural-urban interface.</p>	<p>Proper valuation of agriculture, recognizing the contribution of agriculture and agricultural land to the regions environmental, social and economical viability.</p> <p>Public remuneration for natural capital instead of at the expense of agricultural industry.</p> <p>Valuation of natural capital.</p>
Public perception of agriculture.	<p>General lack of understanding regarding agriculture (e.g. impression that agricultural users are bad water stewards).</p>		<p>Greater public understanding of farmer/rancher land stewardship initiatives.</p>

What are the problems/concerns in the Jumpingpound Creek watershed?	What do you think caused the problems?	Are there any future threats to contribute to this problem?	What would you like to see for your watershed (Goals)?
<p>Recreational use in the watershed.</p>	<p>Recreational users are cutting fences to gain access to private land. Private landowners are liable for trespassers.</p> <p>High valued area for recreation.</p> <p>Limited understanding of right of private landowners.</p>	<p>Increased number of people who want access to creek for recreation, including kayakers, bird watchers, snowmobilers and campers.</p>	<p>More public information and education about rights of access to river and private property rights.</p> <p>Declassify Jumpingpound Creek from a navigable stream to a non-navigable water body.</p> <p>Recognition of private ownership of bed and shore in some areas of the Jumpingpound Creek watershed.</p>
<p>Fragmentation of landscape</p>	<p>Acreage developments and land subdivision.</p> <p>Lack of knowledge of acreage owners and urban residents in watershed regarding land management.</p> <p>Oil and gas development.</p>	<p>Increased fragmentation.</p> <p>Weed management.</p> <p>Improper use of fertilizer.</p> <p>Loss of riparian function due to landscaping to waters edge.</p> <p>Loss of watershed health (e.g. riparian function, wetlands, wildlife habitat, surface and groundwater quality).</p>	<p>Setbacks for development and landscaping requirements in the watershed.</p> <p>Education for new land owners.</p>
<p>Wildlife management and diversity</p>	<p>Ungrazed areas are less attractive to wildlife than grazed areas. Areas in the watershed where land is managed as natural areas, wildlife (e.g. elk) tend to migrate to agricultural land.</p>	<p>Fragmentation may displace wildlife.</p>	<p>Proper management of agricultural land and/or small holdings.</p> <p>The Jumpingpound Creek watershed continues to support a diverse wildlife population by providing contiguous tracts of land for habitat and movement.</p>

What are the problems/concerns in the Jumpingpound Creek watershed?	What do you think caused the problems?	Are there any future threats to contribute to this problem?	What would you like to see for your watershed (Goals)?
Maintenance of surface and groundwater quality	Abandoned wells (historical reclamation activity not up to present standards and may be leaking (iron present at creeks edge – may or may not be attributed to leaking wells).	Urban growth and development. Oil and gas exploration and development. Drilling into black shale layers that confine aquifer. Fracturing sandstone layers to allow inter-mixing of groundwater intervals. Loss of muskeg and draining of wetlands with future urban/industrial development. Forestry in the headwaters.	Better understand reclamation status of abandoned wells.
Forestry		Need for forestry to act responsibly.	Partnership agreements among all stakeholders. Ranchers of Jumping Pound as a member on the Spray Lakes Advisory Committee.

APPENDIX C: Rationale for setting Jumpingpound Creek WCOs and thresholds.

The Water Conservation Objective (WCO) for the South Saskatchewan River mainstem is either 45% of the natural rate of flow, or the existing instream objective increased by 10%, whichever is greater at any point in time. Currently there is no instream objective identified for Jumpingpound Creek.

Water Demand: There are 245 licensed allocations of water in the Jumpingpound Creek watershed. Three licenses are for commercial use and make up the largest volume of water allocated at 767 dam³ (actual use reported at 373 dam³ of which 157 dam³ are returned to the Creek). Six licenses are designated for stockwatering (94 dam³ licensed, 15 dam³ actually used).

Although the Bow River Basin is closed to new licenses, this does not prevent the negotiation of water license transfers from other water bodies to Jumpingpound Creek or vice versa.

At time of setting the 45% of natural flow, the Bow River basin was deemed over-allocated, thus applying a 45% of the natural rate of flow target seemed reasonable. However, Jumpingpound Creek is a headwater stream that exists relatively in its natural state. Applying the 45% rule to this tributary would significantly alter the annual hydrograph with potential negative impacts on downstream water users.

The Jumpingpound Creek WCO must consider instream flow needs that include:

- flooding for riparian health,
- flushing for water quality,
- and quality for a sustainable fishery.

Current Surface Water Demand

Allocations 959 dam³
 Actual Use (2006) 433 dam³
 Returns 157 dam³

Current Groundwater Demand

Allocations 148 dam³
 Actual Use 328 dam³ (unlicensed users + stockwater)

Table 1. Summary of model scenarios predicting shortfalls using SSRB WCO.

Scenario		Average Shortfalls	Worst Case Shortfall Years	Period of Deficit
Scenario 1	Current Conditions	2.6%		December – April
Scenario 2	Maximum Allocation	3.2 %		Dec – Apr, Aug, Sep
Scenario 3	Inc. GW Demand (x2)	3.3 %	17%	Nov – Apr, Aug, Sep
Scenario 4	Climate Change	2.6 %		Dec - Apr

APPENDIX D: Water Quality Objectives: Mainstem Bow River Below Park Boundary and Elbow River (Upper) (BRBC 2008).

Indicator	WQOs	Elbow River (Upper)	Rationale
Attached Algae (Periphyton) Biomass defined as <i>Chlor a</i>	150 mg/m ² maximum value during the open water season.	150 mg/m ² maximum value during the open water season. Target: 47 mg/m ² maximum.	
Dissolved Oxygen	9.5 mg/L for spawning and incubation 6.5 mg/L for acute daily minimum	9.5 mg/L for spawning and incubation 6.5 mg/L for acute daily minimum	
Macrophytes	No macrophyte biomass that adversely affects users.		
Nitrate (nitrate+Nitrite (as N))	0.267 Warning Level 0.163	0.013 mg/L during the open water season.	
Pathogens as indicated by E.coli	No single value to exceed 400 E.coli/100 mL or <200 E.coli/100 mL (geometric mean 5 samples/30 d)	No single value to exceed 400 E.coli/100 mL or <200 E.coli/100 mL (geometric mean 5 samples/30 d)	
Pathogens as indicated by fecal coliforms	100 fecal coliforms/100 mL (no single value to exceed objective) at point of withdrawal.		
Pathogens as indicated by Total Coliforms	Should not exceed 20,000 total coliforms/100 mL at intake for drinking water treatment plant.	Should not exceed 20,000 total coliforms/100 mL at intake for drinking water treatment plant.	
Pathogens – Giardia	Should not exceed 100 cysts per 100L (instantaneous) for the Bearspaw Water Treatment Plant.	Not set for this reach.	
Pesticides and Degradation Products	Should not exceed the lower of < 1/10 of federal drinking water guidelines or < CCME guidelines for aquatic life in the river.	Should not exceed the lower of < 1/10 of federal drinking water guidelines or < CCME guidelines for aquatic life in the river.	
Total Ammonia	Should not exceed 0.04 mg/L in the river for municipal water supply, and should not exceed CCME guideline for protection of aquatic life. To apply outside the mixing zone (AENV 1995).	Should not exceed CCME guideline for protection of aquatic life.	
Total Dissolved Phosphorus	0.005 mg/L TDP during the growing season for aquatic plants.	0.006 mg/L	
Total Organic Carbon	Should not exceed 3.0 mg/L (instantaneous).	Should not exceed 5.0 mg/L (instantaneous).	
Total Phosphorus	0.014 mg/L TP	0.019 mg/L	
Total Suspended Solids	CCME	CCME	

Indicator	WQOs	Elbow River (Upper)	Rationale
Water Temperature	Should not exceed 22°C at any time or a 7-day mean of 18°C.	Should not exceed 18°C at any time or a 7-day mean of 15°C.	To protect most sensitive native fish, namely mountain whitefish (Bull Trout in Elbow River). Maximum values are based on Taylor & Barton (1992)
Riparian Condition	Maintaining a “healthy” rating using Cows and Fish rating system.	Maintaining a “healthy” rating using Cows and Fish rating system.	Targets set at one level higher than initial conditions measured using the Cows and Fish Riparian Health Inventory rating system. The long-term goal is “healthy”.
Soil Erosion	An erosion and sediment control (ESC) plan should be designed with a T-value or maximum soil erosion rate target of 2t/ha/yr where disturbed land has direct connection to a water body (no buffer, no interception). Applies to all construction sites and endures for the life of the project (during and post construction phases).	An erosion and sediment control (ESC) plan should be designed with a T-value or maximum soil erosion rate target of 2t/ha/yr where disturbed land has direct connection to a water body (no buffer, no interception). Applies to all construction sites and endures for the life of the project (during and post construction phases).	<p>For new developments that are permitted within the defined boundaries, Operating Ground Rules are in place to minimize erosion and sedimentation (AESRD).</p> <p>An erosion and sediment control plan (ESC) must be developed, implemented and monitored for construction sites with any direct connection to surface water.</p> <p>An ESC plan should be prepared by a qualified professional (a professional certification that includes erosion and sediment control as a field of expertise).</p> <p>Based on methods described in Wall et al. (2002).</p>

APPENDIX E. Summary of fish species habitat requirements.

Life Stage Habitat Characteristics	Species							
	Brook Trout	Bull Trout	Rainbow Trout	Cutthroat Trout	Mountain Whitefish	Longnose Dace	White Sucker	Brook Stickleback
Spawning								
Season	Fall	Fall	Spring	Spring	Fall	Spring	Spring	Spring
Temperature (Incubation) °C	6	2 to 4	10 to 15	8 to 12	2 to 6	14 to 19	12 to 16	8 to 18
Oxygen (Incubation) mg/L	>8.8	9.5	> 6	6 to 8	> 8			
Flow cm/s	3 to 60; groundwater influence	20 to 65; groundwater influence	25-75	30 to 60	60 to 160	40 to 100	25 to 65	
Substrate	Gravel, < 15% fines	Cobble, large gravel, with groundwater influence	Small gravel to large gravel; < 15% fines	< 10% fines, small gravel to large gravel	Large gravel to rubble	Coarse gravel to rubble	Coarse gravel, but sand to boulders utilized	Organic, detritus, filamentous algae, emergent/submergent vegetation
Channel Unit	> 10 cm, tail out of pools	15 to 85 cm deep; runs, riffles, glides	Riffles/runs	10 to 30 cm deep, riffles, runs, pools	10 to 100 cm deep; riffles, runs	Riffle, 25 to 80 cm deep	12 to 30 cm deep; riffles	
Rearing								
Temperature °C	13 to 16	9 to 15	8 to 20	8 to 16	12 to 20 (9 to 12 optimum)	12 to 20	14 to 26	
Oxygen mg/L	> 7	> 8	> 7	> 9	> 8		> 6	Tolerant of very low oxygen
Flow cms	~ 10 to 35; slow	10 to 20	10-25	10 to 50	30 to 80	25 to 75	0 to 15	0 to 10
Substrate	Cobble, gravel	Coarse gravel, predominantly cobble, small cobble	Small gravel to small boulders, limited fins	Cobble to boulder	Gravel to cobble	Rocky riffles	Sand, silt and mud, gravel	Variable, usually abundant aquatic vegetation
Channel Unit	0.4 to 0.7 m	Riffle, run, pool	0.3 to 1.2 m deep, riffles, run, pool		0.5 to 2 m deep; run habitat, pool	5 to 25 cm deep	0.3 to 2 m deep; pools, runs	0.35 to 1 m deep; beaver ponds

Life Stage Habitat Characteristics	Species							
	Brook Trout	Bull Trout	Rainbow Trout	Cutthroat Trout	Mountain Whitefish	Longnose Dace	White Sucker	Brook Stickleback
					habitat			
Overwintering								
Oxygen mg/L	> 6	Assumed similar to rearing	> 7	> 9				
Flow cms	< 15; flow > 55% of the average annual daily flow	Groundwater influence	50% of average annual daily flow		Groundwater influence	Assumed similar to rearing		
Channel Unit (depth)	> 0.3 m deep; pools	> 0.8 m deep; pools	> 1.5 m deep pools	> 1.5 m deep pools/run, cobble to boulder, > 25% pools	> 1 m deep; pools, runs			Deep pools
Substrate					Rubble to boulder			

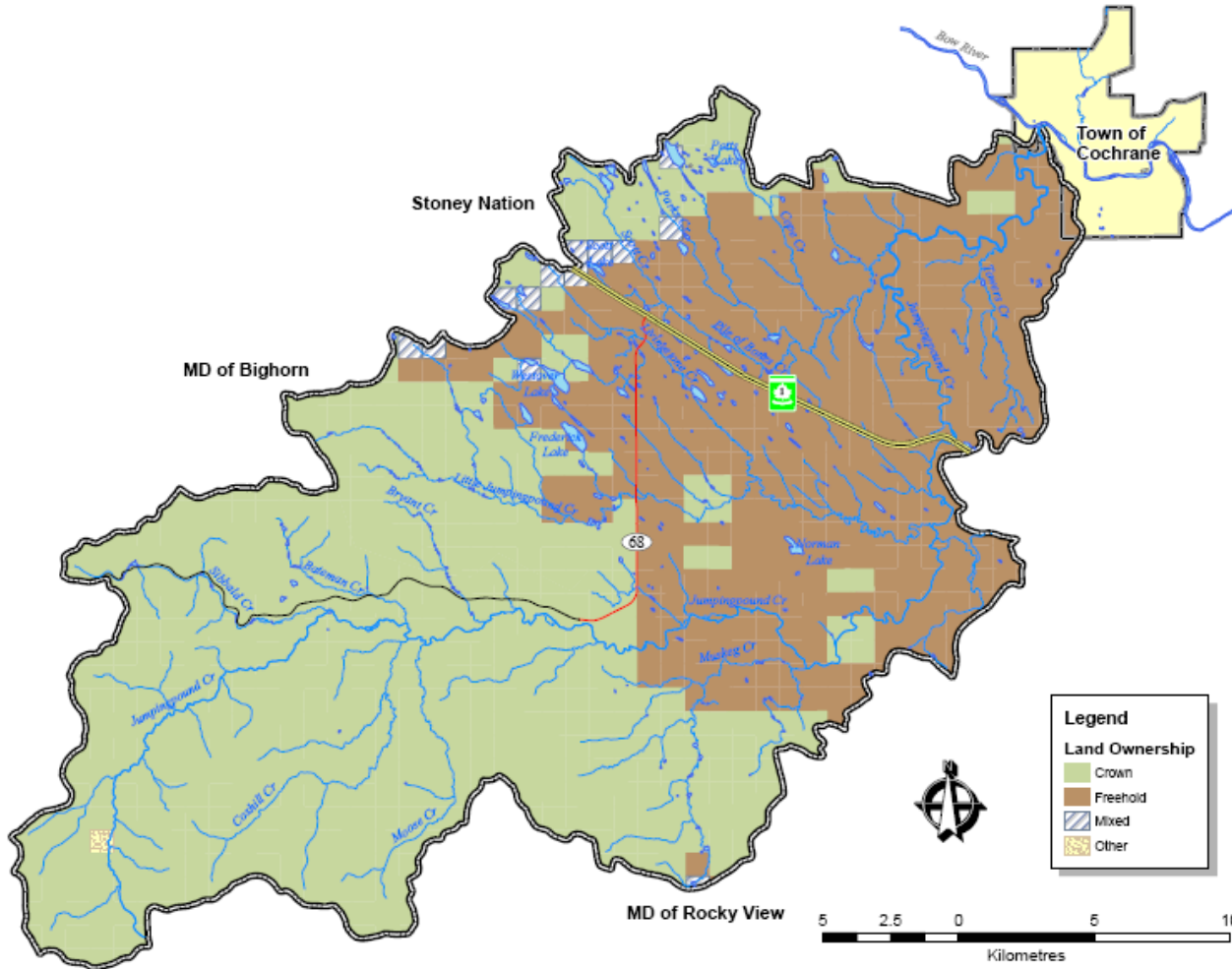
APPENDIX F: Summary of wildlife indicators and reported targets/thresholds for various metrics.

Wildlife Indicators	Target/Threshold	Study Location	Reference
Grizzly Bear	0.6 km/km ² (max. road density)		(2008 Grizzly Bear Recovery Plan (ASRD))
Elk	≤0.5 km/km ² (max. road density)	Lower Foothills of Rocky Mountains, AB	Disassociating roads from foraging habitats or managing human access to roads may maintain effective elk habitat at higher road densities (>0.5 km/km ²) Frair et al. 2008
Trumpeter Swans	500m (buffer for breeding wetlands)		Key migration wetlands must be protected, including Jumping Pound wetlands, Sibbald Flats and Sibbald Flat East ponds, and Pile of Bones Creek (Alberta Trumpeter Swan Recovery Plan 2006).
Bull Trout	Road densities of less than 0.28 km/km ² support strong bull trout populations. Bull trout populations decrease when road densities are 0.87 km/km ² or greater, and bull trout populations are typically absent when road densities are 1.06 km/km ² .		Saskatchewan Watershed Authority (2006) (Hammer 2003 and British Columbia Ministry of Water, Land, and Air Protection 2002)

APPENDIX G. Summary of land cover types in the Jumpingpound Creek watershed and calculation of current wildlife habitat.

Land Cover	Entire Watershed		Freehold Area Only		
	Area sq km	%	Area sq km	% Freehold	% Watershed
Water Bodies	3.7	0.6	2.2	0.9	59.1
Wetland	60.0	9.9	29.2	11.9	48.7
Grassland	115.5	19.1	74.1	30.3	64.2
Shrubland	19.6	3.2	3.0	1.2	15.1
Coniferous Forest	204.8	33.8	24.1	9.9	11.8
Deciduous Forest	54.0	8.9	17.7	7.2	32.8
Mixed Forest	34.9	5.8	4.9	2.0	14.0
Annual Cropland	26.7	4.4	25.1	10.3	93.9
Perennial Cropland/Pasture	70.1	11.6	62.3	25.5	88.8
Developed Land	2.9	0.5	1.9	0.8	65.5
Exposed Land	13.0	2.2	0.1	0.1	1.1
Totals	605.1	100.0	244.6	100.0	
Habitat	492.3	81.4	155.1	63.4	
Developable Land				36.0	

APPENDIX H. Land ownership in the Jumpingpound Creek watershed.



Land Ownership	Sq Km	Acres	¼ Sections
Crown	350.69	86 657	
Freehold	244.27	60 360	377
Mixed	7.8		
Other	0.64		

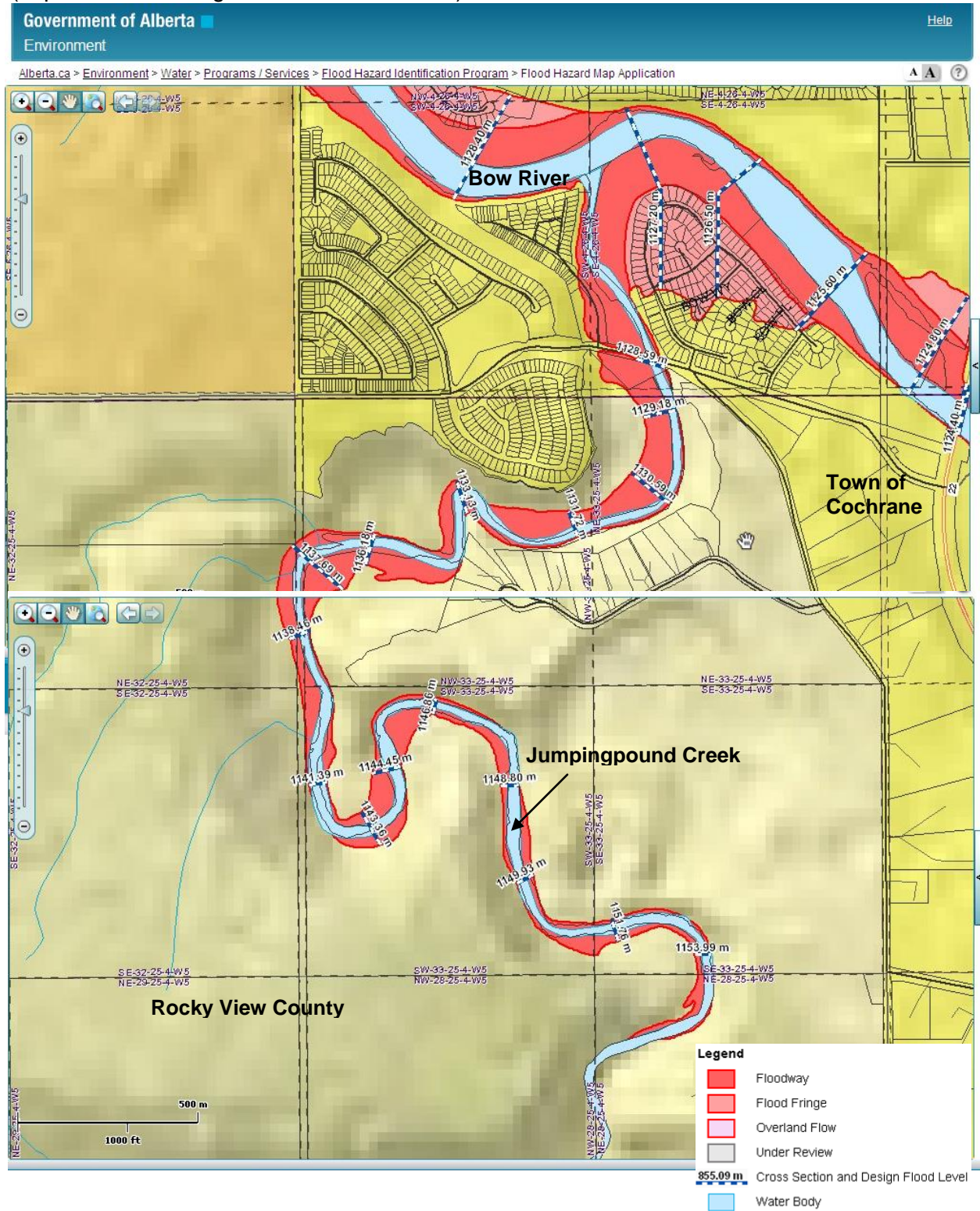
APPENDIX I. Summary of priorities, goals, indicators, targets and thresholds.

Watershed Priority	Goal	Indicators	Target/Threshold	Present Condition	Rationale
Water Quantity	Sufficient quantity to provide for water quality, environmental integrity, communities and economic prosperity in the watershed.	Water Volume	Maintain existing flow, recognizing full use of existing licenses.	Existing flow equals approximately natural flow.	
		Groundwater well density	Density that will maintain 100% of current estimated recharge volumes.	520 wells 0.86 wells/km ²	Groundwater contributes 68 to 72% of Jumpingpound Creek flows.
		Wetland Area	Wetlands cover 10% of watershed area.	63.6 km ² (about 10% of watershed area)	Wetlands store water that contributes to groundwater and baseflows.
Water Quality	Good water quality that supports communities, industry and aquatic biodiversity.	Water Quality Parameters	Dissolved Oxygen Temperature Total Phosphorus		
		Riparian Health	Riparian Health Targets (Thresholds): Reach 1: 80 and above (> 70) Reach 2: 80 and above (> 70) Reach 3: 80 and above (>70) Reach 4: 90 and above (> 90) No greater than 5% of sites should rate unhealthy at any point in time (score < 60)	Assessed sites (2007): 39% Healthy 61% Healthy but Problems	A certain level of disturbance will increase biodiversity without loss of key riparian functions.
Land Use	Terrestrial and aquatic biodiversity is preserved.	Species: Bull Trout Grizzly Bear Cougar Moose Elk	Road Density Threshold 0.28-0.87 km/km ² 1.24 km/km ² - - 0.62 km/km ²	Watershed area: 604 km ² Roads: 240.1 km Density: 0.40 km/km ²	Road density thresholds (km road/km sq) determine the level of species displacement.
		Water Temperature (Fish)	Maximum water temperature should not rise above: Reach 1: 20°C Reach 2: 20°C Reach 3: 16°C Reach 4: 16°C	Reach 1: >20°C reported in 1986, 2000 and 2001 Reach 2: unknown Reach 3: unknown Reach 4: unknown	Reach 1 and 2 targets for rainbow trout, Reach 3 and 4 for cutthroat trout. Temperature (and oxygen) is the most important water quality parameter for trout, particularly during summer.
		Dissolved Oxygen (Fish)	Juvenile/Adults: 5.0 mg/L (1 day minimum) Juvenile/Adults: 6.5 mg/L (7 day	Mainstem conditions unknown but assumed to be adequate. Some	Oxygen (and temperature) is the most important water quality parameter for trout and is critical

Watershed Priority	Goal	Indicators	Target/Threshold	Present Condition	Rationale
			average) Eggs/Larvae: 9.5 mg/L (during incubation and emergence)	tributaries and lakes have historically had low oxygen conditions.	for incubating eggs.
		Fish Habitat	Reach 1: Stable and healthy riparian zone (75% Healthy, 25% Healthy with Problems)	Majority of sites in Reach 1 rated as Healthy with Problems	Downstream reach assessed as wide, with warmer water and higher silt loads. Instream cover is low. A healthy riparian zone will contribute large and fine woody debris (instream cover), reduce water temperatures through shade and promote channel narrowing.
		Range Health	No more than 5% of rangeland should rate unhealthy at any point in time.	Assessed sites (2003-2008): 55% Healthy 30% Healthy with Problems 15% Unhealthy	Some land disturbance increases biodiversity, providing habitat types for more species.
		Recreation			Access can impact on fisheries and landowner rights.
		Future Development		2.9 km ² developed	
	Agriculture continues to be viable and to provide economic stability for families in the watershed.				

APPENDIX J. Available floodplain map for Jumpingpound Creek.

(<http://www.envinfo.gov.ab.ca/FloodHazard/>)



APPENDIX K. Jumpingpound Creek watershed surficial geology map.

