

**South Saskatchewan  
River Operational Model  
(SSROM) – Collaborative  
Watershed Management**

**2024 Roadmap & Next  
Steps**

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C.O.O.

February 23, 2024

# SSROM – Collaborative Watershed Management

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Why do we engage in this work?

2

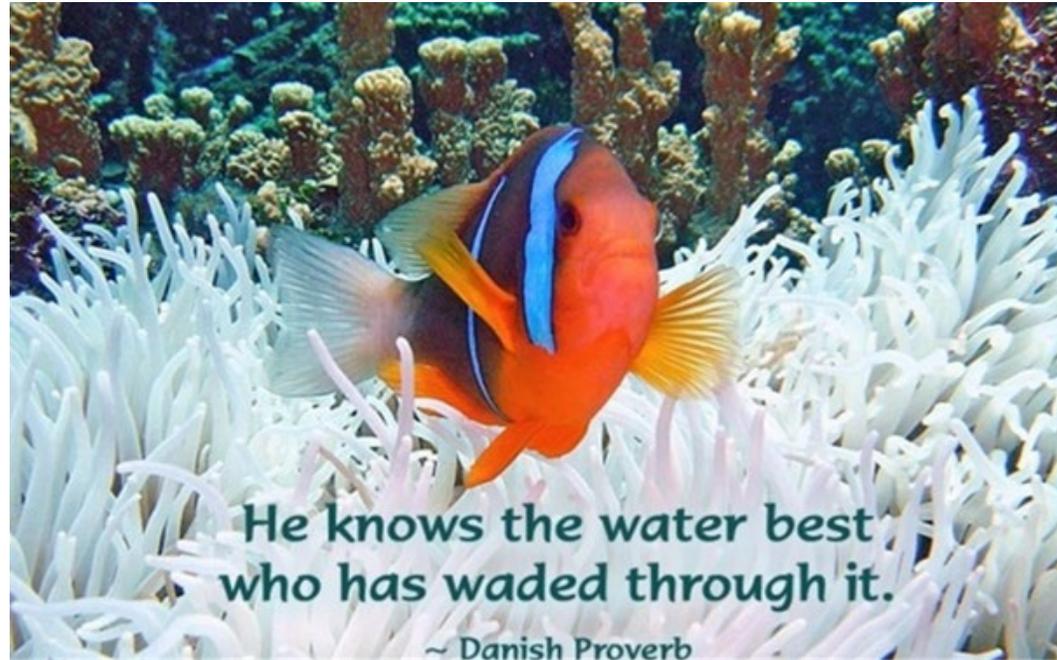
How do we do it, what is the SSROM?

3

2024 Outcomes & next steps

# Thanks to the SSR0M Phase 3 Funders





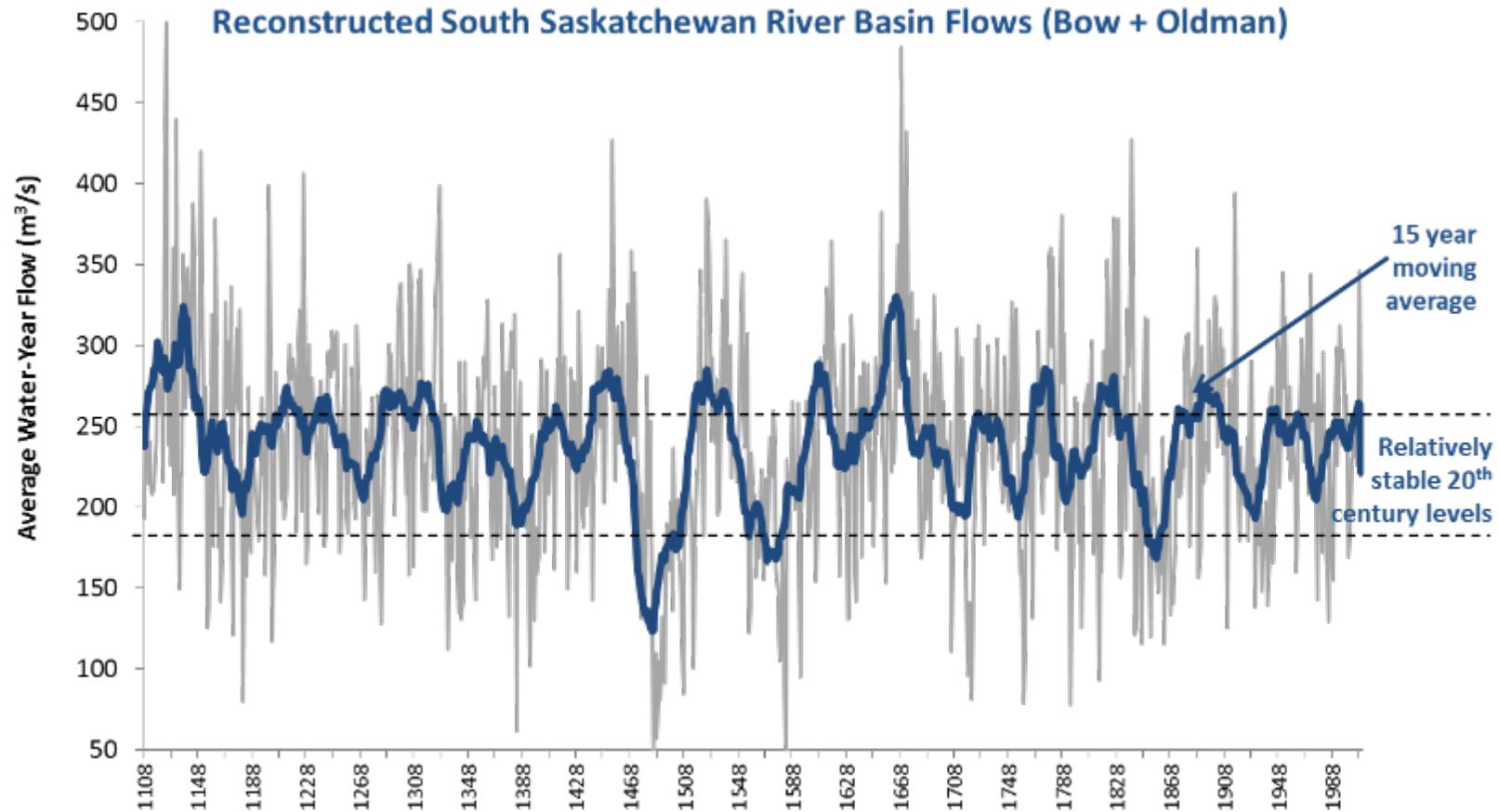
**Why do we engage in this work?**

# What drove this work? The collaborative response to the drought

***“2000 – 2001: Worst Drought in 800 years”*** *Globe and Mail, July 2012*



# We can expect more extreme weather events



Source: Dr. David Sauchyn, Prairie Adaptation Research Collaborative, 2015

Similar profiles in all the major river basins in the West

# Water is a shared resource ... How do we slice the pie?

## The Environment



Photo: Rasa Kasparaviciene

Photo: John Werner

## Food



Photo: Timothy Eberly



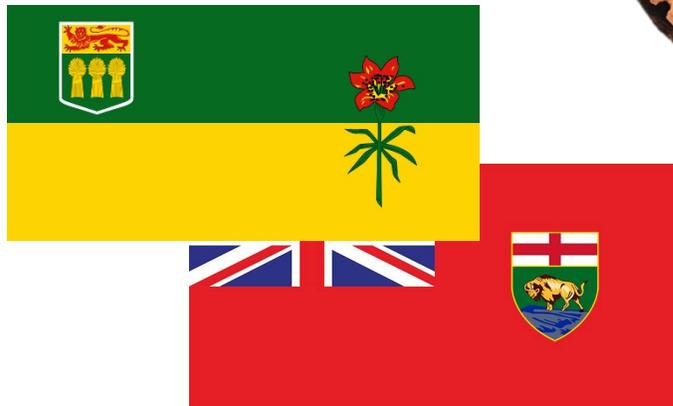
Photo: Danil Aksenov

## Energy



Photo: Zbynek Burival

## Other Provinces

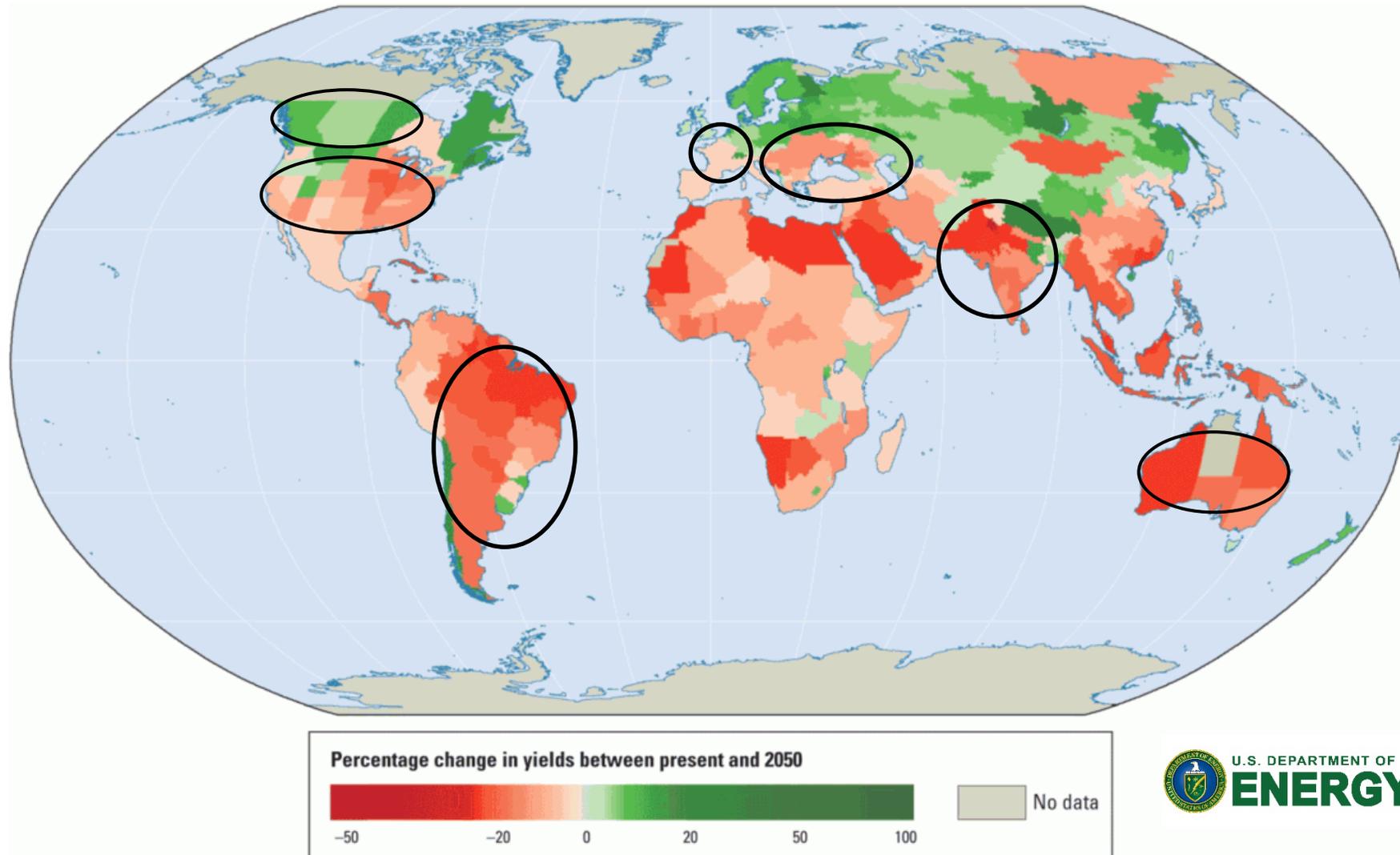


## People



Photo: Kyler Nixon

# Of the top 10 water exporters in food, Canada is the only country where yields increase on existing agricultural land over the next 30 years

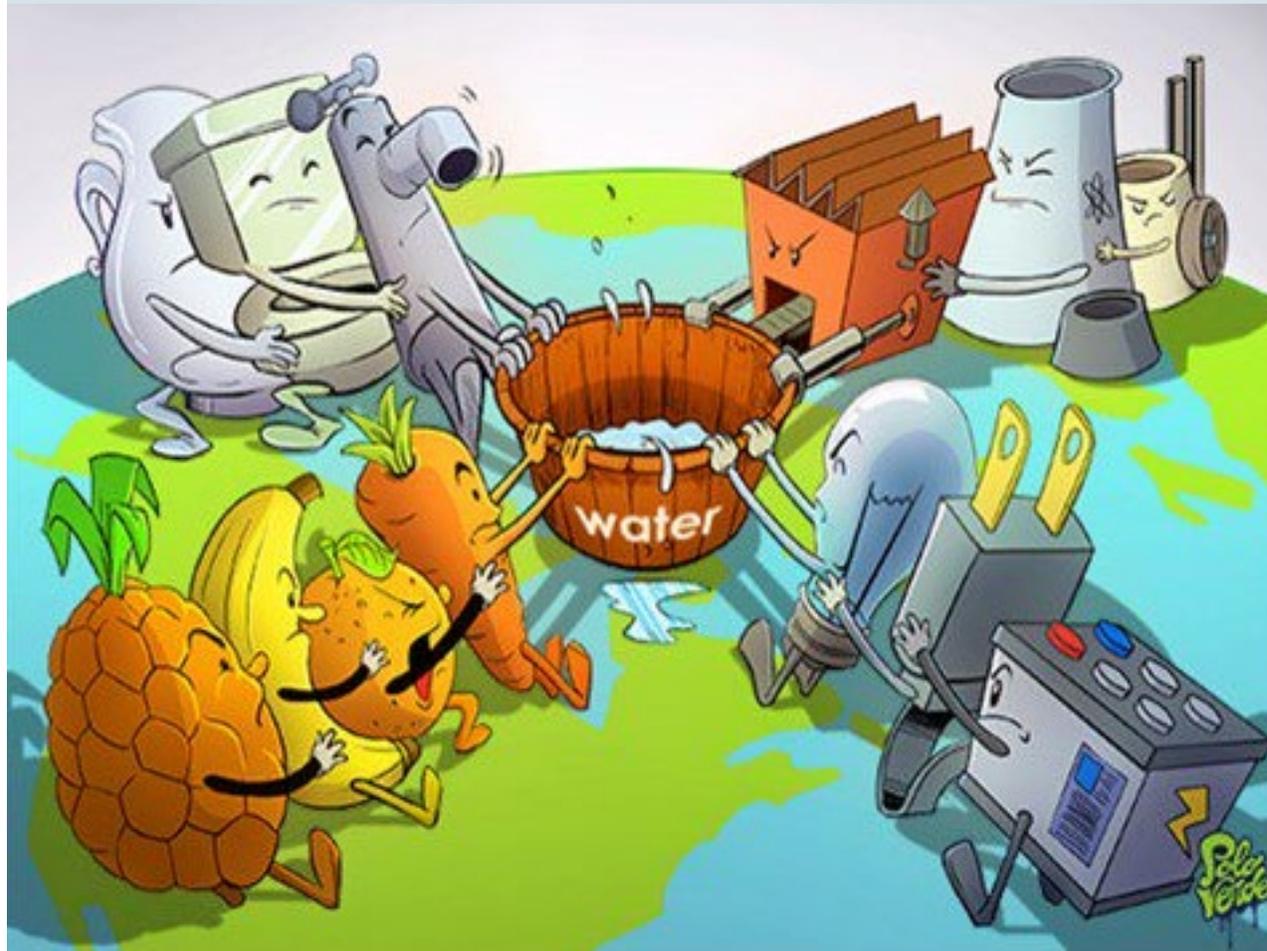


Source: Steven E. Koonin, Under Secretary for Science, U.S. Department of Energy

# The NEXUS – The challenge in a water scarce world

## What is the Nexus?

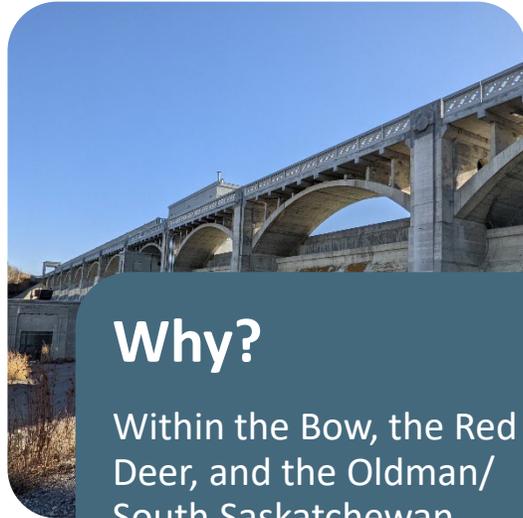
The interconnectedness and interdependency of our global resources including **water, food, and energy**



Source: Water and Sanitation Program

[watersmartsolutions.ca](http://watersmartsolutions.ca)

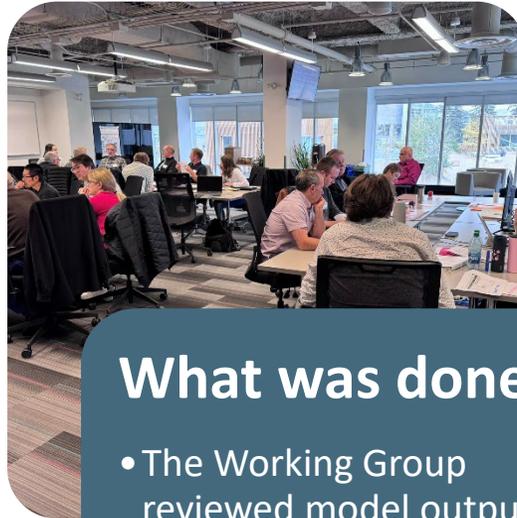
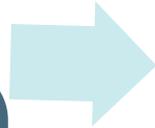
# Why is this project important?



## Why?

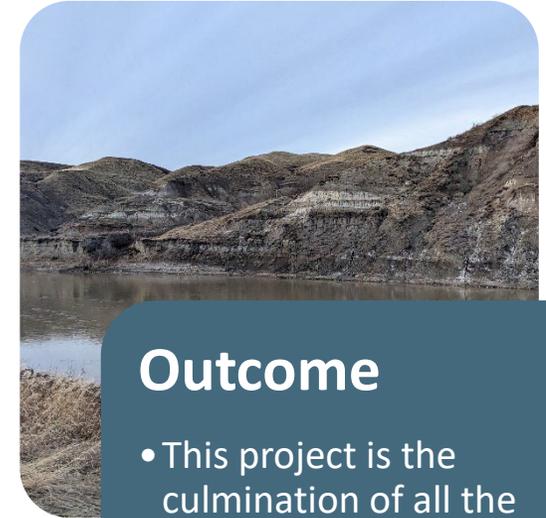
Within the Bow, the Red Deer, and the Oldman/South Saskatchewan...

- Demand continues to grow
- Supply largely remains the same and is impacted by climate change
- The Red Deer, Bow, and the Oldman are source watersheds for many downstream residents and water users



## What was done?

- The Working Group reviewed model outputs, analyzed systems, and developed adaptation strategies
- The Working Group showed there is potential to improve our resilience, flexibility and adaptation to historic and future supply/demand scenarios



## Outcome

- This project is the culmination of all the current, ongoing, and future work in the SSRB
- The goal is to provide guidance to government, water managers, and water users toward an overall direction for water management throughout Southern Alberta

**How we do it...**  
**What is the SSROM?**

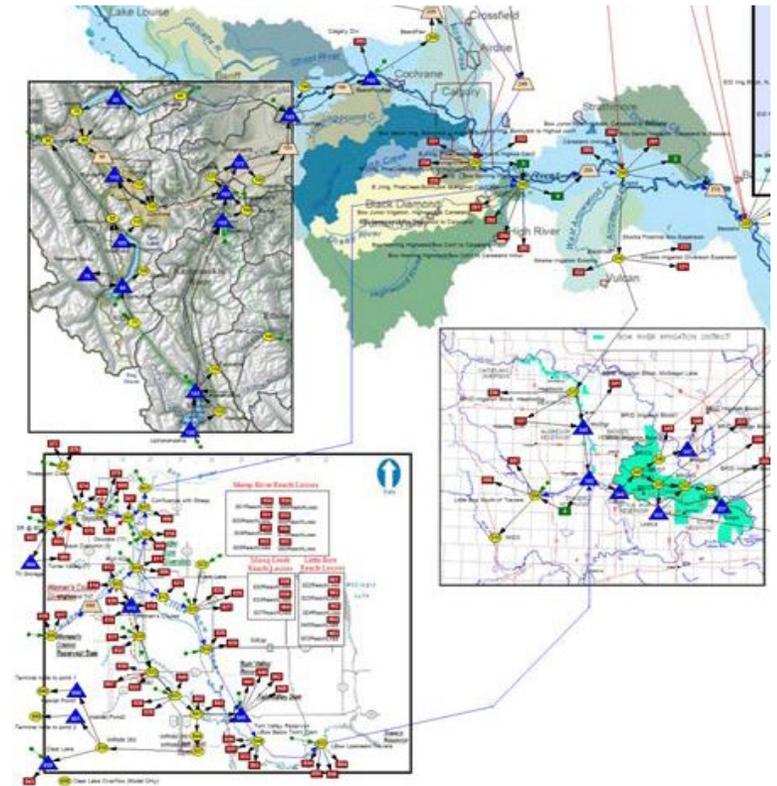
# South Saskatchewan River Operational Model (SSROM)

## The South Saskatchewan River Operational Model

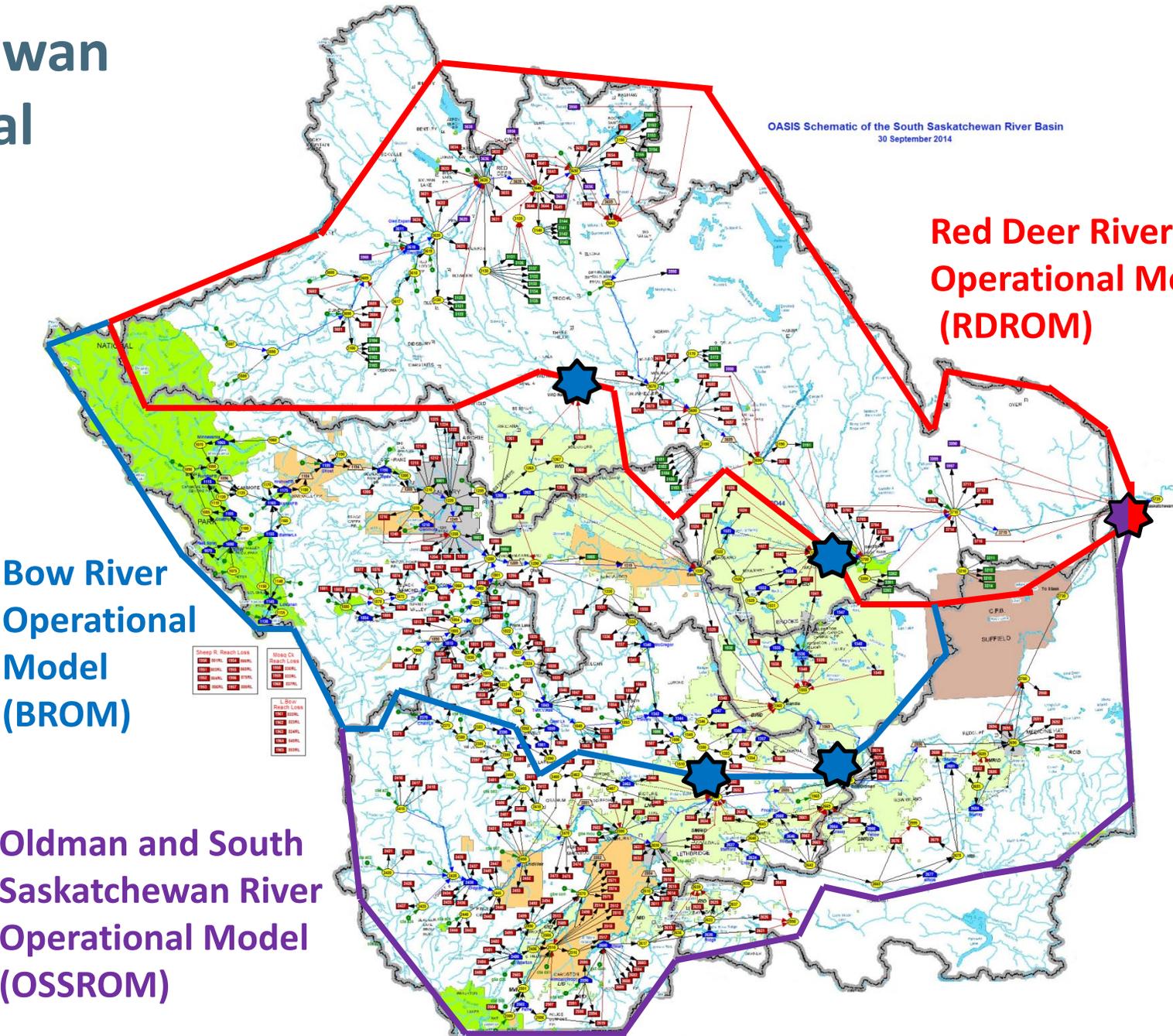
- Combines the Red Deer River Basin (RDRM), Bow River Basin (BROM), Oldman and South Saskatchewan River Basins (OSSROM)
- Based on best available data from WRMM and stakeholders
- Most recent data update completed in 2021/2022 thanks to AIDA and GoA
- The SSROM is a decision support tool
- Uses historic flows and current operations and demands

## Built on the OASIS platform

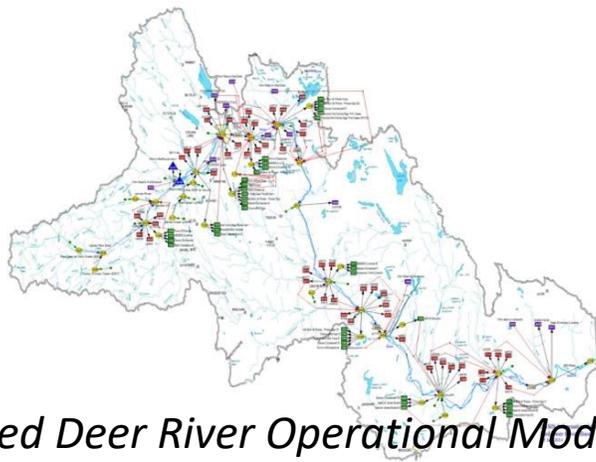
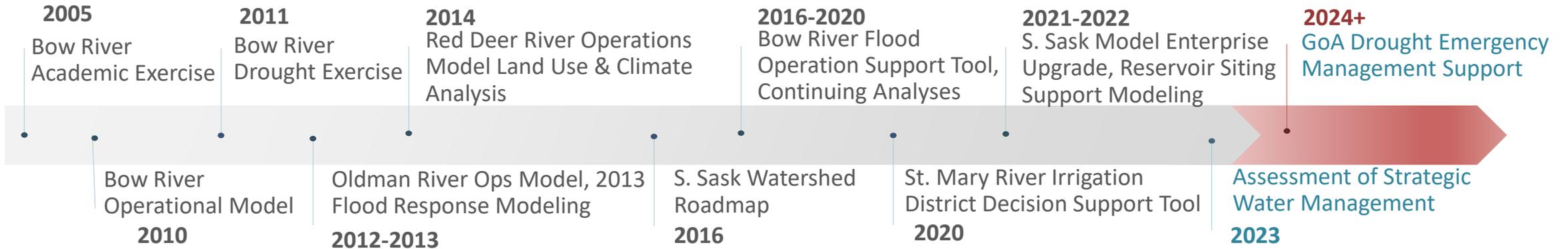
- Mass-balance model
- Runs on a daily time-step
- Operating rules in “plain English” language intelligible to operators
- User-friendly Graphical User Interface
- Easily modifiable “on-the-fly”



# South Saskatchewan River Operational Model (SSROM)

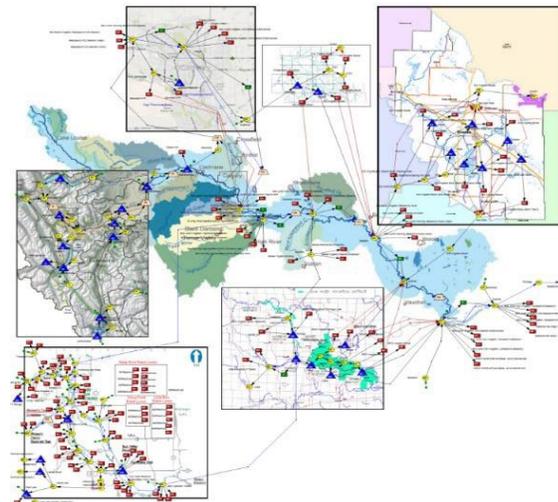


# History of the SSROM Model



*Red Deer River Operational Model (RDRM)*

*Bow River Operational Model (BROM)*



*Oldman and South Saskatchewan River Operational Model (OSSROM)*

# Adaptation Roadmap for Sustainable Water Management in the SSRB 2016

A collaborative project engaging southern Albertans to explore practical options for adapting to environmental and climatic change

- Water is fundamental to community sustainability and growth
- How water is managed in the SSRB will become even more important in the face of changing climate and use of shared resources

This project built on existing data, tools, capacity and knowledge to:

- Build and apply an integrated SSRB river system model to explore opportunities throughout the whole basin
- Improve shared understanding of environmental and climatic impacts
- Develop and use a comprehensive river system model to explore opportunities in the SSRB for watershed resilience

**GOAL : Increase capacity for water resource management**

# 2016 SSRB Adaptation Roadmap – a proven method

Increasing degrees of adaptive capacity →

Already  
In Progress

Level 1

Level 2

Level 3

- Achieve CEP Plan targets
- Assign and transfer water allocations
- Share water within IDs
- Upgrade critical water management infrastructure
- Release functional flows (Oldman)
- Build flood defence berms where necessary
- Institute Ghost Reservoir flood operations agreement
- Develop large scale flood mitigation facility on the Elbow
- Replace Glenmore stop logs with operable gates

- Institute a long term watershed management agreement with TransAlta for the Bow
- Raise winter carryover in irrigation serving reservoirs
- Further shortage sharing within and between IDs
- Develop shortage sharing frameworks by sub-basin
- Restrict greenfield development in the floodplain

- Increase St Mary operating FSL by 1M
- Effectively implement Alberta's wetland policy
- Improve and resource forecasting
- Adjust Dickson Dam operations (for WCOs, supply, functional flows)
- Advance conveyance opportunities (Room for the River)
- Advance natural detention opportunities (Room for the River)
- Apply land use best management practices
- Promote further municipal conservation

- Redesign operations of all upstream Bow reservoirs for water supply purposes
- Expand and balance Chin Reservoir (Oldman)
- Build new SAWSP and Acadia off stream storage

- Pursue more extensive relocation and buyouts in floodplain
- Build series of new off stream storage in the Oldman sub-basin
- Build series of new off-stream storage in the Red Deer sub-basin

- Build new storage low in the Bow sub-basin (~Eyremore)

- Build new off stream storage in the WID
- Build new on stream storage in the Southern Tributaries (~Kimball)
- Build new on stream storage low in the Red Deer basin (~Ardley)
- Reduce minimum flows through municipalities as an exceptional measure

- Complete
- In Progress
- To Be Assessed (SSROM Phase 3)
- No Progress or Plan to Progress

Blue highlights the most promising strategies within a level

**SSROM Phase 3**  
**December 2022 – January 2024**

# Working Group Members

A total of 79 participants from the organizations in the table contributed over **1450 hours** through attendance at:

- Project Kickoff Meeting
- 7 Working Group Meetings
- Mini-Climate Workshop
- EcoMetrics® Working Group Meeting



Organization	
Alberta Agriculture and Irrigation	Oldman Watershed Council (OWC)
Alberta Environment and Protected Areas	Palliser Economic Partnership (PEP)
Alberta Irrigation District Association	Piikani Nation
Blood Tribe Agricultural Project	Red Deer River Watershed Alliance (RDRWA)
Blood Tribe Tribal Government	Red Deer River Municipal Users Group (RDRMUG)
Bow River Basin Council	Rocky View County
Bow River Irrigation District (BRID)	Siksika Nation
Calgary Metropolitan Region Board (CMRB)	South East Alberta Watershed Alliance (SEAWA)
City of Calgary	Special Areas Board
City of Lethbridge	St. Mary River Irrigation District (SMRID)
City of Red Deer	Stoney Nakoda Nations
Department of Fisheries and Oceans (DFO)	Stoney Nakoda Nations (Bears paw Band)
Ducks Unlimited Canada	Stoney Nakoda Nations (Chiniki Band)
Eastern Irrigation District (EID)	Town of Cochrane
Economic Development Lethbridge (EDL)	Town of Strathmore
Ghost Watershed Alliance Society (GWAS)	TransAlta Utilities
International Institute for Sustainable Development (IISD)	Trout Unlimited Canada
Lethbridge Northern Irrigation District (LNID)	United Irrigation District (UID)
Medicine Hat	Western Irrigation District (WID)
Nutrien	Wheatland County

# Data Set Overviews from SSRM (2021 onwards)

## Inflows

- Source: AEP Naturalized Streamflow dataset (2009 dataset with a 2010-2015 extension)
- Disaggregated to a daily level from weekly data

## Reservoir Net Evaporation

- Precipitation and Evaporation from AEP dataset combined to net evaporation in inches
- Applied to each reservoir based on area-elevation relationship

## Physical data

- Reservoir and canal/pipe physical information from operator's datasets

## Non-Irrigation Demand

- Pattern data from the Water Resources Management Model (WRMM)
- Assumed full license demand
- Some individual licenses in the Red Deer

## Irrigation Demand

- Alberta Agriculture's Irrigation Demand Model (IDM)
  - 2018 acreages and crop mix
  - Reports 90% of optimal crop demand based on historical conditions
  - Acreages scaled up to 2020 assessed acres
  - Includes seepage and evaporative losses

## Municipal Demand

- Demand for the largest municipal users has been manually entered (e.g. Calgary, Lethbridge, etc.)
- Assumed full allocation for all other licences

# Reference Case

**Base Case** – Represents the SSRB as it operates today reflecting the current demands, operations, agreements and regulatory framework of the SSRB.

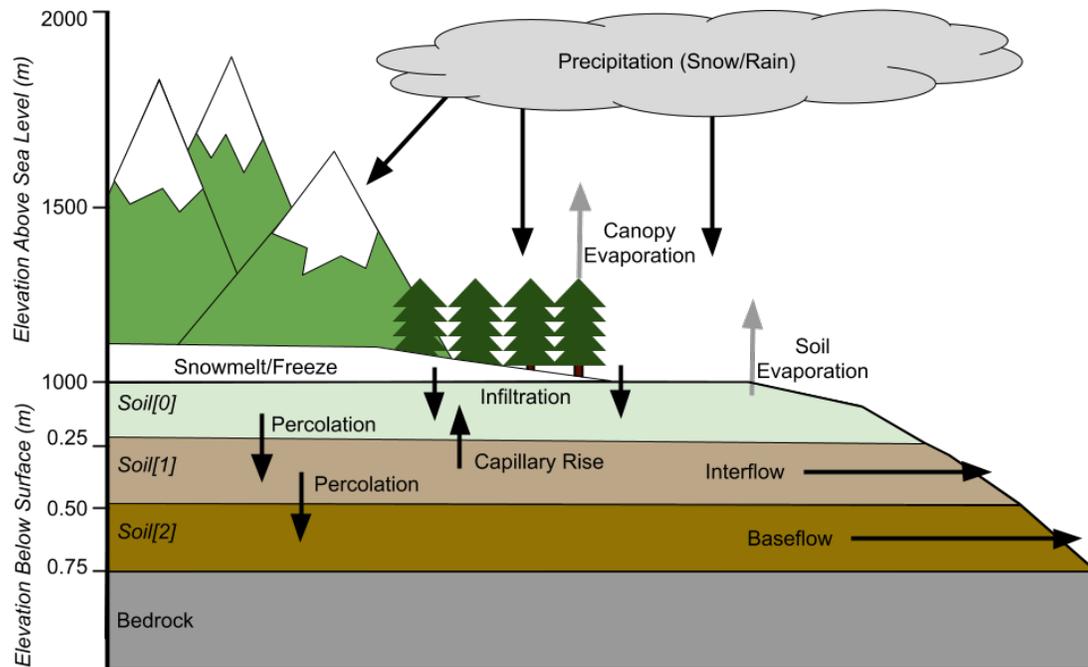
**Reference Case** – Represents a plausible future scenario that includes projects that are approved or underway and reflects a higher demand reference than the Base Case.

- There are several projects that are **underway but not yet completed** that are important to consider when looking considering an adaptive water management system into the future.
- These projects are not included in the Base Case so a Reference Case has been developed that includes projects that could be operational in the near future.

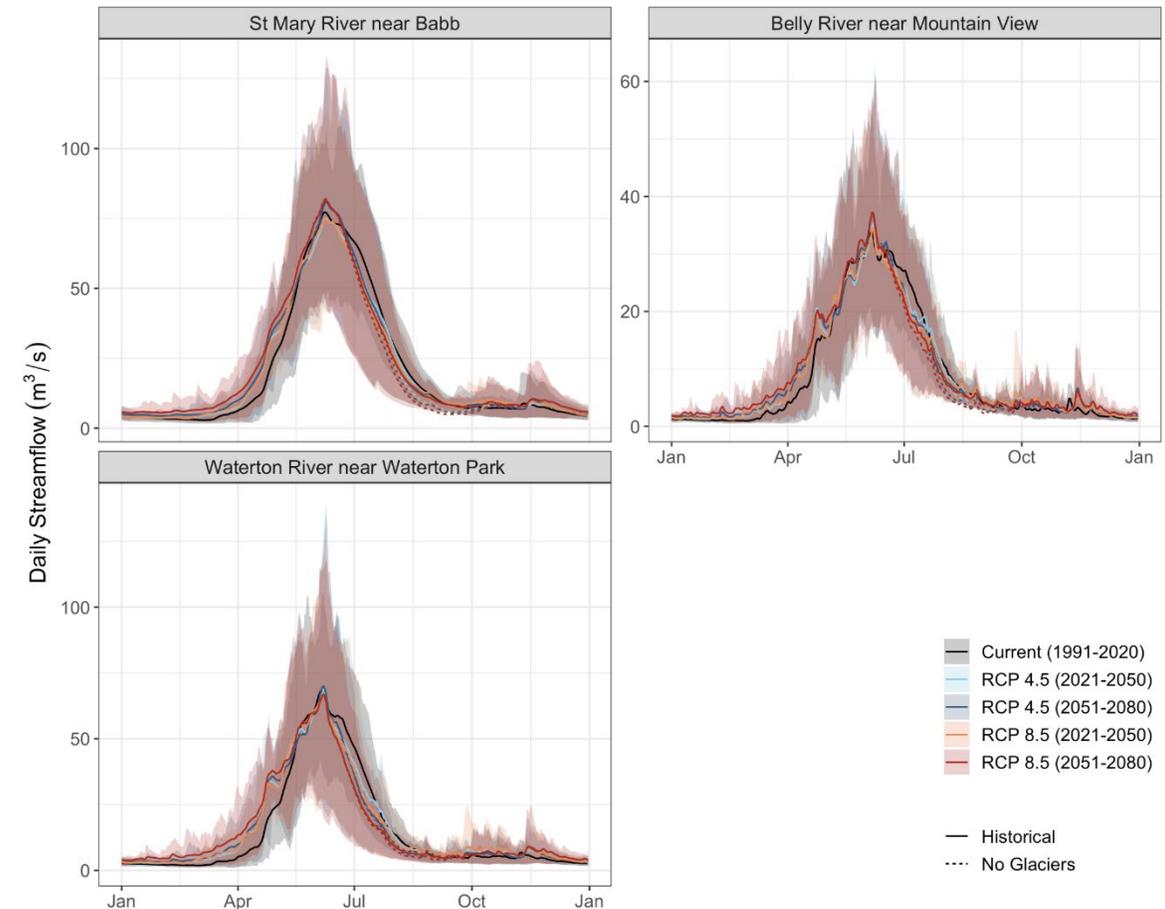
Project name	Associated new live storage	Associated expansion
East Central Irrigation Project (Acadia and Special Areas)	167,000 dam <sup>3</sup>	108,000 acres
Deadhorse Coulee Reservoir	12,000 dam <sup>3</sup>	10,000 acres
Chin Reservoir Expansion	128,000 dam <sup>3</sup>	41,000 acres
Snake Lake Reservoir Expansion	65,000 dam <sup>3</sup>	5,000 acres

# Climate Change Scenarios

- Adapted the HBV-EC model using Raven Hydrological Modelling Framework.
- Coupled to the SSROM to provide inflows under a range of climate change scenarios.



## Example of changes in streamflow for the St. Mary River Basin



# Climate Change Scenarios Overview

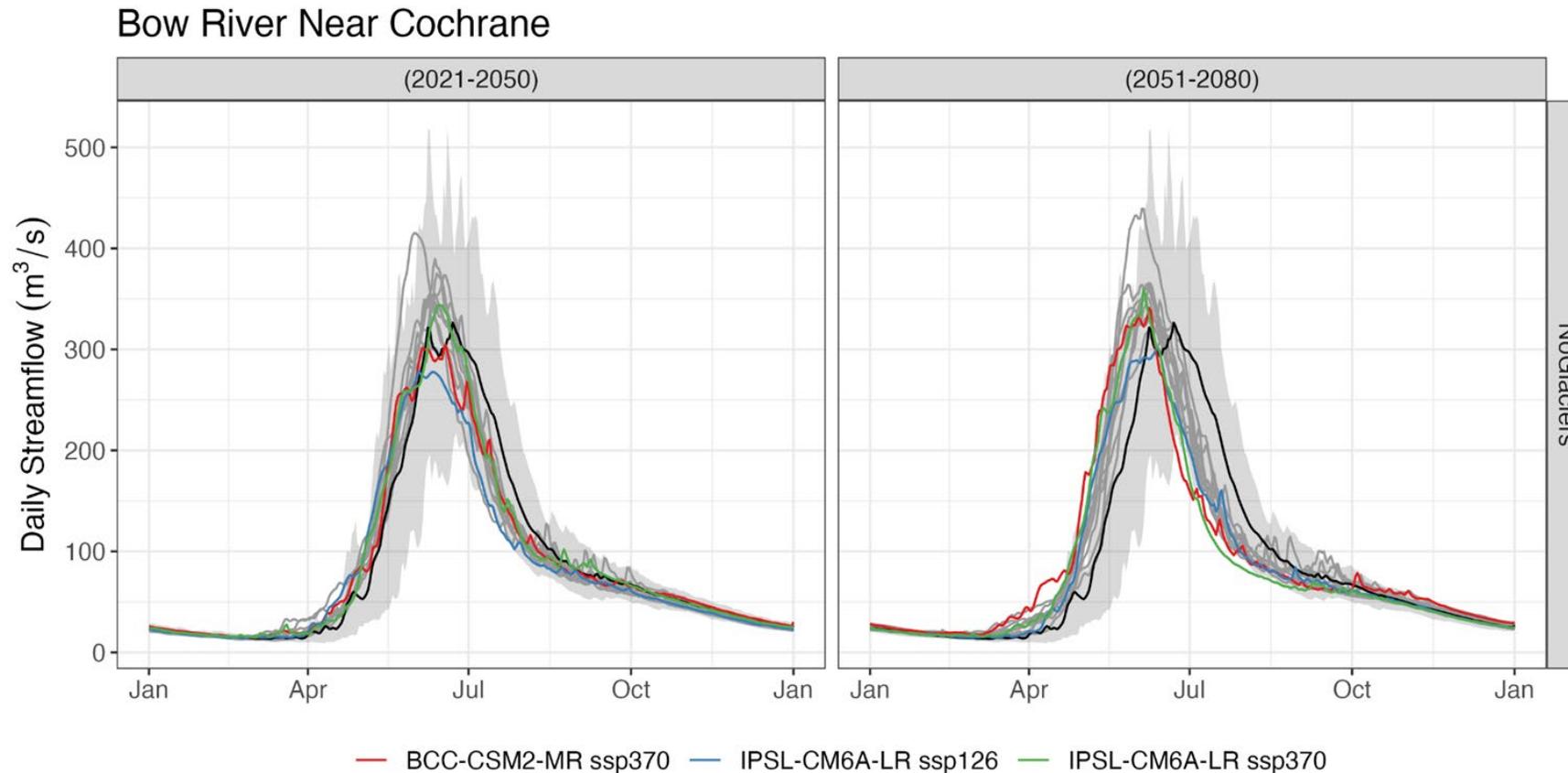
- Twelve future climate scenarios available from AEPA for a set of representative CMIP6 climate projections.
- All scenarios were run through the hydrological model.
- Climate change scenarios run in the SSROM were selected to demonstrate “stress tests” (i.e., scenarios where the future has less summer water availability).
- Hotter and drier conditions; in particular lower winter snowpack
- Glacier ice loss (each scenario run with and without glaciers).
- “Plausible worst case scenario”.

Number	GCM	SSP-RCP
1	BCC-CSM2-MR	126
2		370
3	CNRM-CM6-1	126
4		585
5	EC-Earth3-Veg	126
6		370
7	GFDL-CM4	245
8	GFDL-ESM4	585
9	IPSL-CM6A-LR	126
10		370
11	MRI-ESM2-0	370
12		585



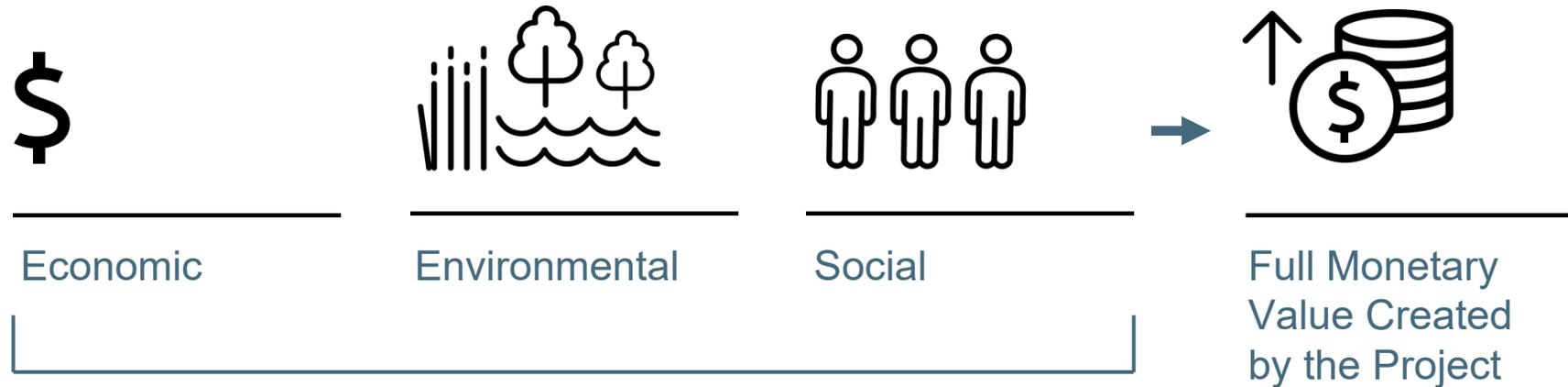
# Climate change will impact available water volumes and timing

- Climate scenarios consistently predict earlier freshet, lower July-August flows compared to historic (black line)



# Valuation of impacts - EcoMetrics

The economic co-benefits of the water management opportunities identified by the working group were assessed using the EcoMetrics® methodology



- Methodology that **identifies**, **quantifies**, and values, in monetary terms, the environmental, economic, and social benefits of a project or activity.
- Can be applied to a variety of project and activity types, specifically designed for projects involving **nature-based solutions and/or natural resources**

# Outcomes

# 2024 SSRB Roadmap

## SSROM Phase 3: Assessment of Strategic Projects to Support Economic Development Roadmap



<b>Continuous implementation</b>	<ul style="list-style-type: none"> <li>• Implement more natural infrastructure projects (e.g., wetland reclamation and conservation) across the SSRB</li> <li>• Consider and explore options to reduce impact to water quality, especially during low flow river conditions. (e.g., upgrade municipal wastewater treatment plants as required with population growth.)</li> <li>• Promote further water conservation across the SSRB</li> <li>• Improve land use best practices across the SSRB</li> <li>• Promote collaborative water management working groups</li> </ul>				
	<b>Basin-wide</b>				<ul style="list-style-type: none"> <li>• Build new on-stream water storage on the Bow River (Eyremore Reservoir)</li> <li>• Build upstream water storage on the Bow River</li> <li>• Build new on-stream water storage on the Red Deer River (Ardley Reservoir)</li> </ul>
		<b>Sub-basin</b>	<ul style="list-style-type: none"> <li>• Develop water sharing agreements among licence holders during water shortages</li> <li>• Build Deadhorse Coulee Reservoir</li> <li>• Build Chin Reservoir expansion</li> <li>• Build Snake Lake Reservoir expansion</li> </ul>	<ul style="list-style-type: none"> <li>• Spatial prioritization of natural infrastructure project</li> <li>• Implement releases for downstream water demands at Dickson Dam</li> <li>• Renew TransAlta Agreement for flood and drought management in the Bow River basin</li> <li>• Increase Bow River Irrigation District diversion rate at Carseland to allow McGregor Reservoir to fill when water is available</li> <li>• Increase minimum flow past Lethbridge for additional dilution</li> </ul>	<ul style="list-style-type: none"> <li>• Improve spillway capacities on Kananaskis Dams (Barrier, Pocaterra, Interlakes) to increase available water storage</li> <li>• Restore Spray Lake Reservoir to its full supply level</li> <li>• Remove canal bottleneck between Waterton and St. Mary Canal</li> <li>• Build off-stream water storage in the Red Deer River basin (to support Acadia and Special Areas Irrigation Project)</li> <li>• Build new Western Irrigation District water storage</li> </ul>
	<b>Local</b>		<ul style="list-style-type: none"> <li>• Complete Springbank Off-stream Reservoir for flood protection</li> <li>• Complete flood mitigation projects (City of Calgary flood protection barriers e.g., Bonnybrook Berm and Sunnyside Barrier, Town of Drumheller flood berms)</li> <li>• Implement flood protection policies for greenfield areas (2022 CMRB Growth Plan)</li> </ul>		<ul style="list-style-type: none"> <li>• Construct weir at Medicine Hat to increase water level at intake</li> <li>• Develop clear and comprehensive provincial stormwater and effluent reuse policies and guidelines</li> </ul>
<b>Already in progress</b> <i>Funding secured, regulatory process and engineering are underway</i>		<b>Level 1</b> <i>Less than 2 years</i>	<b>Level 2</b> <i>Up to 10 years</i>	<b>Level 3</b> <i>Up to 20+ years</i>	
<b>Minimum time to realized impact from time of initiation</b>					

# All Adaptations



ALL LEVELS

waterSMART  
Water Management Solutions

# 2024 SSRB Project – What is next?

## KEY THEME

The most effective adaptation strategies take a long time to implement – start them now!

- SSROM final report and Roadmap will be published in early March. Thanks to all participants!
- SSROM collaborative model and working group are currently being used to develop water sharing agreements for 2024 drought planning; first workshop February 9<sup>th</sup>, second meeting March 1<sup>st</sup>.
- SSROM Roadmap supports on and offstream storage projects already underway (AB1), in development (upstream Bow), and moving into conceptual assessment (Eyremore, Ardley, Belly).
- SSROM supporting continued development of municipal water security plans to identify efficiencies and projects to reduce long term water demands, such as water reuse (e.g. City of Calgary).
- Progress Natural Infrastructure (NI) conversation... an inventory of NI with enhanced environmental performance measures is being pitched.

# 2024 Drought Response

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- The SSRM is being used, in a collaborative setting, by large licence holders to develop voluntary flexible water sharing agreements.
- Large licence holders are voluntarily participating in this process and have come to the table ready to collaborate.
- Water sharing agreements will mean that everyone takes less water so that more can have some.

# Water: The key to our sustainable future



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Water Management Solutions

[www.watersmartsolutions.ca](http://www.watersmartsolutions.ca)

**Water is everyone's business. Let us help you with yours.**

# References

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Alberta's Water Challenges 2022 Issues and Opportunities

<https://watersmartsolutions.ca/knowledge-base/albertas-water-challenges-2022-issues-and-opportunities/>

Adaptation Roadmap for Sustainable Water Management in the SSRB (2016 Roadmap)

[albertawater.com/dmdocuments/SSRB Water Project Final Report Adaptation Roadmap for Sustainable Water Management in the SSRB January 2016.pdf](http://albertawater.com/dmdocuments/SSRB%20Water%20Project%20Final%20Report%20Adaptation%20Roadmap%20for%20Sustainable%20Water%20Management%20in%20the%20SSRB%20January%202016.pdf)

Updates to the South Saskatchewan River Operational Model (SSROM) and the Underlying OASIS Platform

<https://watersmartsolutions.ca/knowledge-base/updates-to-the-south-saskatchewan-river-operational-model-ssrom-and-the-underlying-oasis-platform/>

SSROM Overall History and High Level Information – Alberta WaterPortal Site

<https://albertawater.com/the-south-saskatchewan-river-operation-model-ssrom/>