



The Good, the Bad and Everything in Between:

Evaluating water quality indices and their use in monitoring agricultural BMPs and aquatic ecosystem health in a southern Alberta watershed

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Photo credit: J. Scott

Study Watershed: Lower Little Bow River, Alberta

- **Semi-arid mixed grass/dry mixed grass prairie**
 - Temp. range: -14C to +25C; 379 mm rain, 126 cm snow; Chinooks!
 - **Variety of watershed land uses**
 - 13 farms, cattle ranching, intensive dryland and irrigated agriculture, Confined Feeding Operations (beef)
 - **Historical water management developments**
 - dam regulated flows, canal diversions for irrigation supply
 - **Identified water quality concerns**
 - nutrient loading, pathogen introduction (E.coli); degradation of downstream water uses and aquatic habitats
-



Aerial perspective of surrounding land uses. Note the green irrigation pivots and grey pasture lands.



Lower Little Bow River
(50°00'03"N, 112°37'03"W)

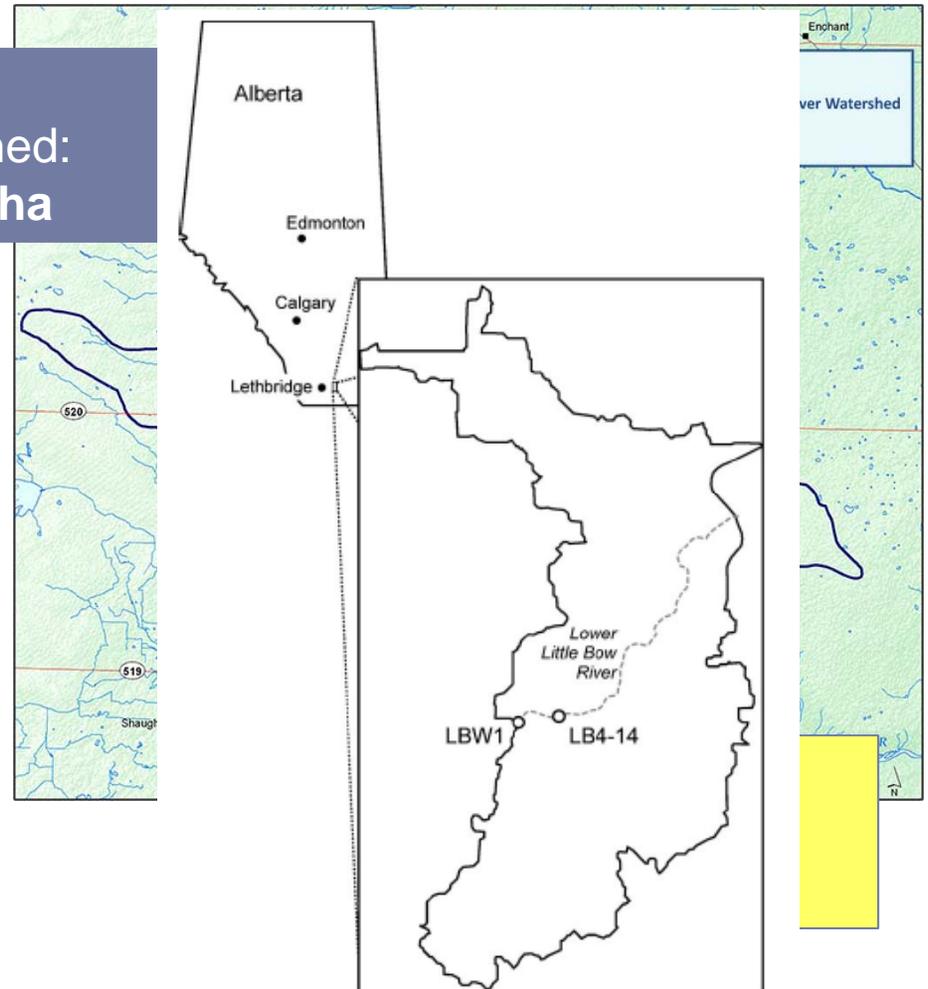
http://www.swcs.org/documents/resources/u_miller_water_shed_evaluation.pdf



Study Watershed: Lower Little Bow River, Alberta

- **WEBS:**
Watershed
Evaluation of
Beneficial
Management
Practices
 - a national program of the Agro-Environment Services Branch of Agriculture and Agri-food Canada

Whole watershed:
55,664 ha



Lower Little Bow River BMPs

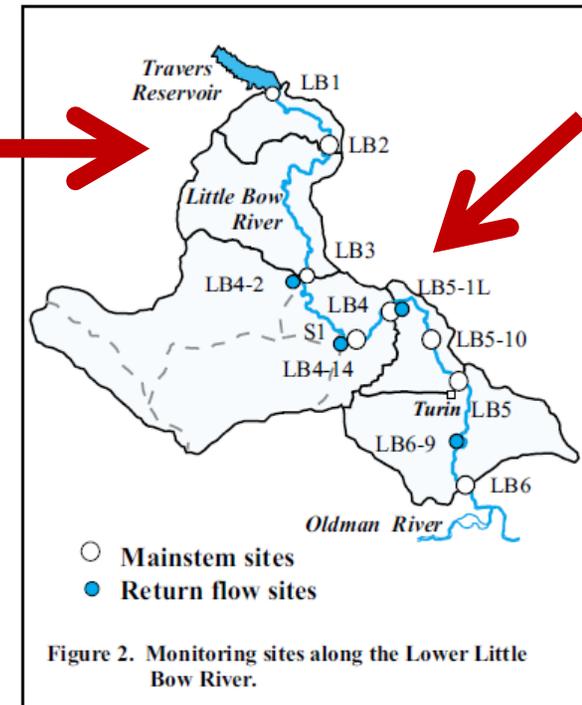
- 1. Off-stream cattle watering**
 - with and without exclusion fencing
 - 2. Installation of vegetated filter strips**
 - 3. Land conversion to perennial forage/ greencover**
 - 4. Manure management**
 - timing, quantity, method
- *Small scale application of BMPs: edge of field, single pasture, “farm-scale” ...any change in river WQ?*



Lower Little Bow WEBS Study Design

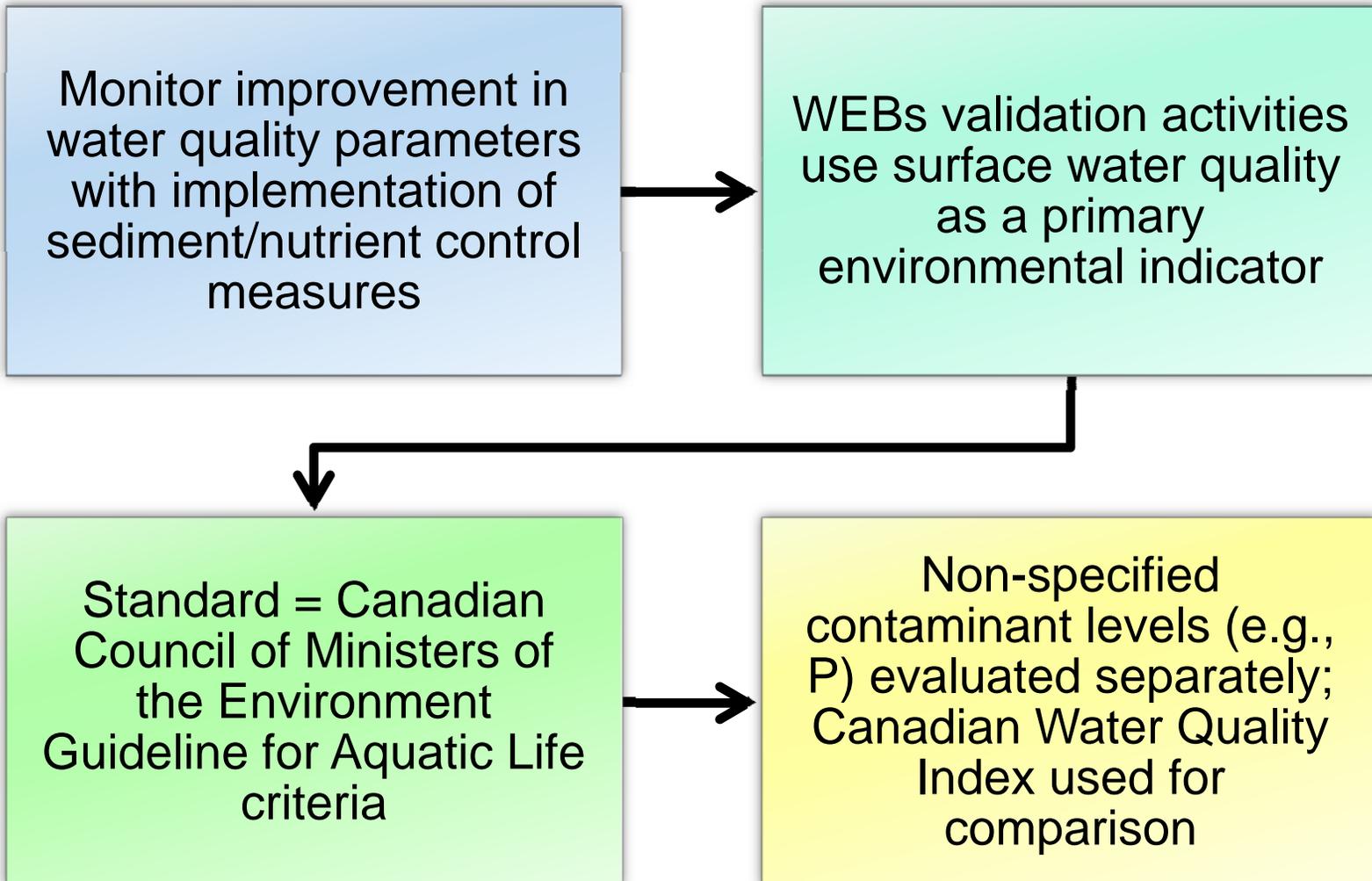
- **Water Quality Monitoring**

- **1999 – 2002:** stations monitored through entire watershed through provincial Oldman River Basin WQ Initiative
- **2004 – present:** WEBS monitors 6 stations along 5.5 km river mainstem
 - Nitrogen, phosphorus fractions
 - Total suspended solids, turbidity
 - E.coli, faecal coliform
 - Dissolved oxygen, pH, conductivity



http://www.oldmanbasin.org/orbwqi/pdfs/lower_little_bow_2002.pdf

BMP Effectiveness Monitoring



Monitoring Challenges

- **Change –response detection**
 - Issues with ‘signal strength’, high background values
 - Natural flow variation, manipulation of system flow for water management
 - **Understanding site condition influences**
 - on runoff mechanisms, BMP pathways of effect, aquatic ecosystem requirements for water quality
 - **Timing of effects**
 - Instantaneous, required establishment period?
-

BMP Pathways

DESIGNED
EFFECT

SITE
CONDITIONS

OBSERVED
EFFECT

- Runoff mechanisms
- Flow variation due to climate (e.g., drought)
- Animal use variation

- Indicators:
 - Individual surface water quality parameters
 - But what about other indicators?
 - Biological measures
 - Indices/aggregated indicators
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Lower Little Bow River: Expanding beyond Water Quality

- **Riparian health assessments**
 - 2001, 2005, *future*
 - Riparian pastures, cattle exclusion
- **Fish community assessments** – 2009, *future*
 - Baseline of fish community and aquatic habitats
- **Information tools:**
 - Further development of
 - Watershed modelling
 - Water Quality Indices
 - Indices of biological integrity



Current Project Work

- Custom fitting a Water Quality Index
 - CCME water quality index based
 - **Scope**
 - **Frequency**
 - **Magnitude**of exceedances
 - Site appropriate criteria, sub-indices?
 - Comparisons of:
 - index ratings to single parameter trends
 - 2004-2007 data to 1998-2002 index values
 - Integration of results from multiple parameters

Considering the ideal condition for the lower Little Bow River

Good, bad, or somewhere in between?

Information gained or lost?

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References

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