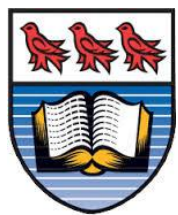


How much groundwater can we pump and protect environmental services through time?

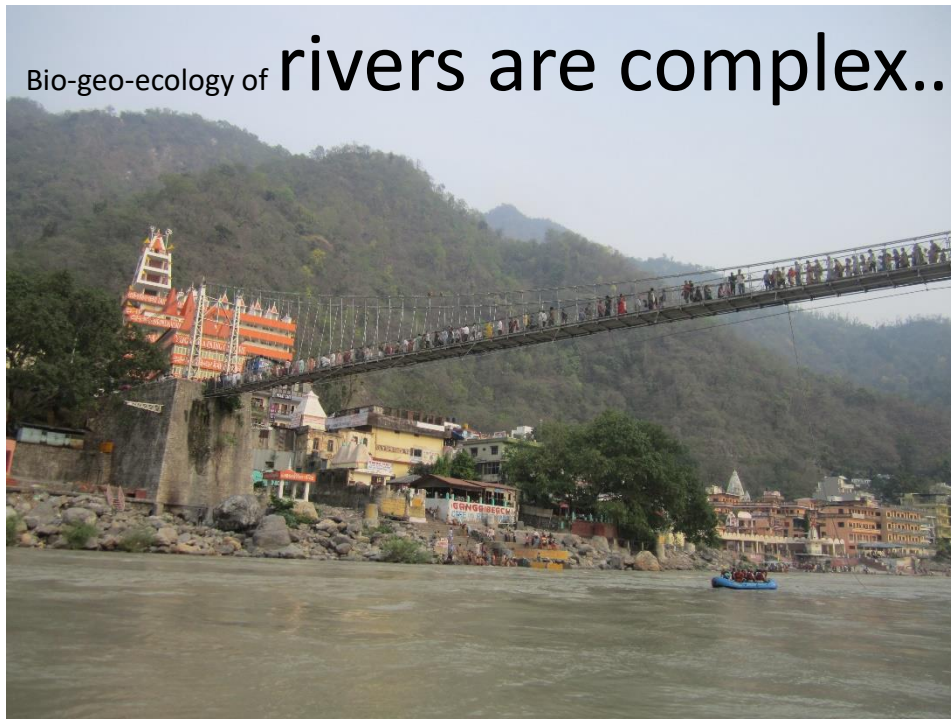
Applying a presumptive standards for conjunctive management of aquifers and rivers with progressive water law in British Columbia, Canada

Tom Gleeson

University of Victoria



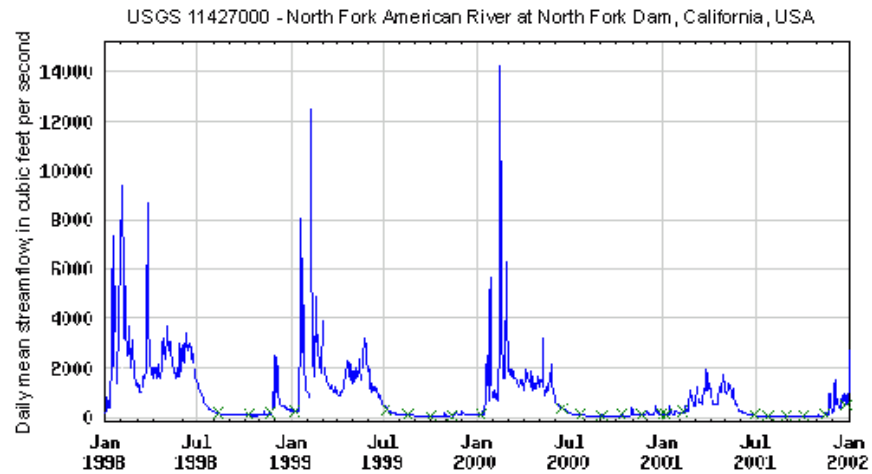
Bio-geo-ecology of rivers are complex...



like orchestras!

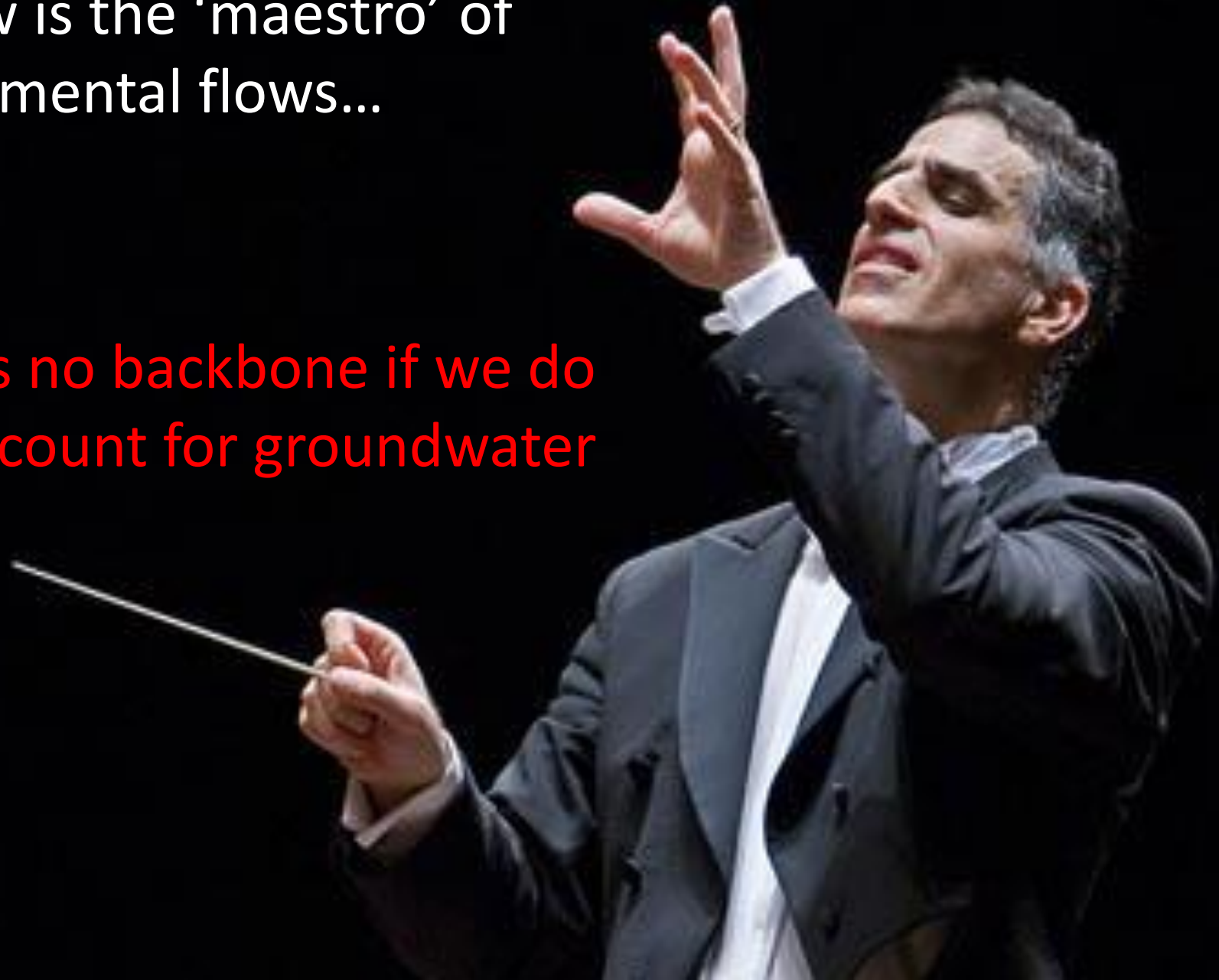


Streamflow is 'master variable' or 'maestro' of orchestra....

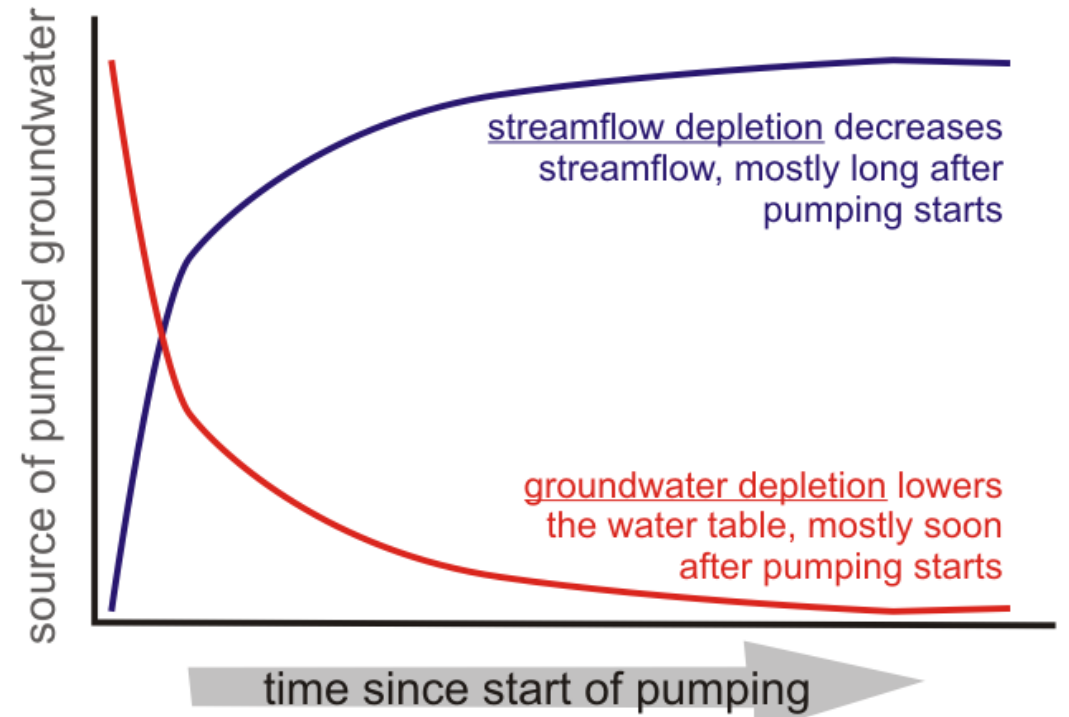
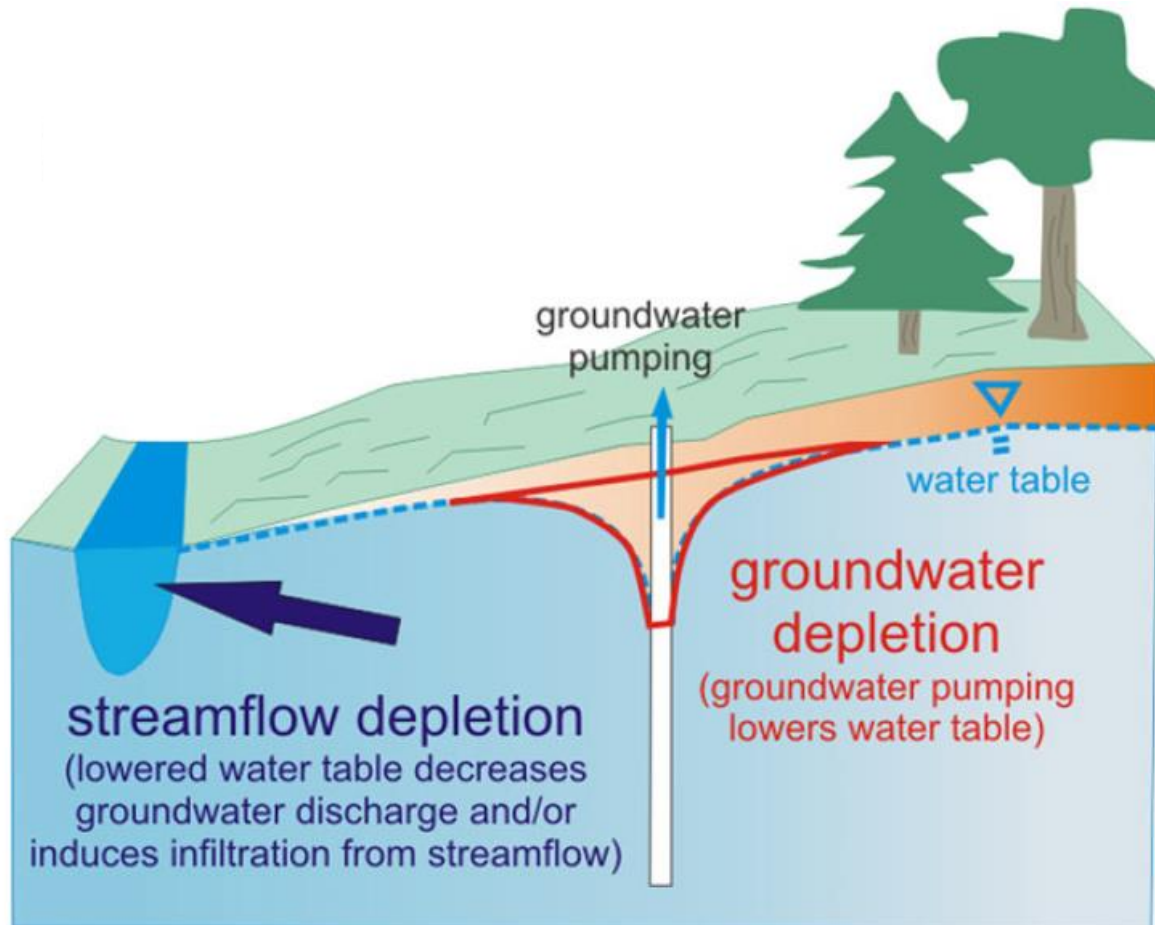


If streamflow is the 'maestro' of
environmental flows...

the maestro has no backbone if we do
not explicitly account for groundwater



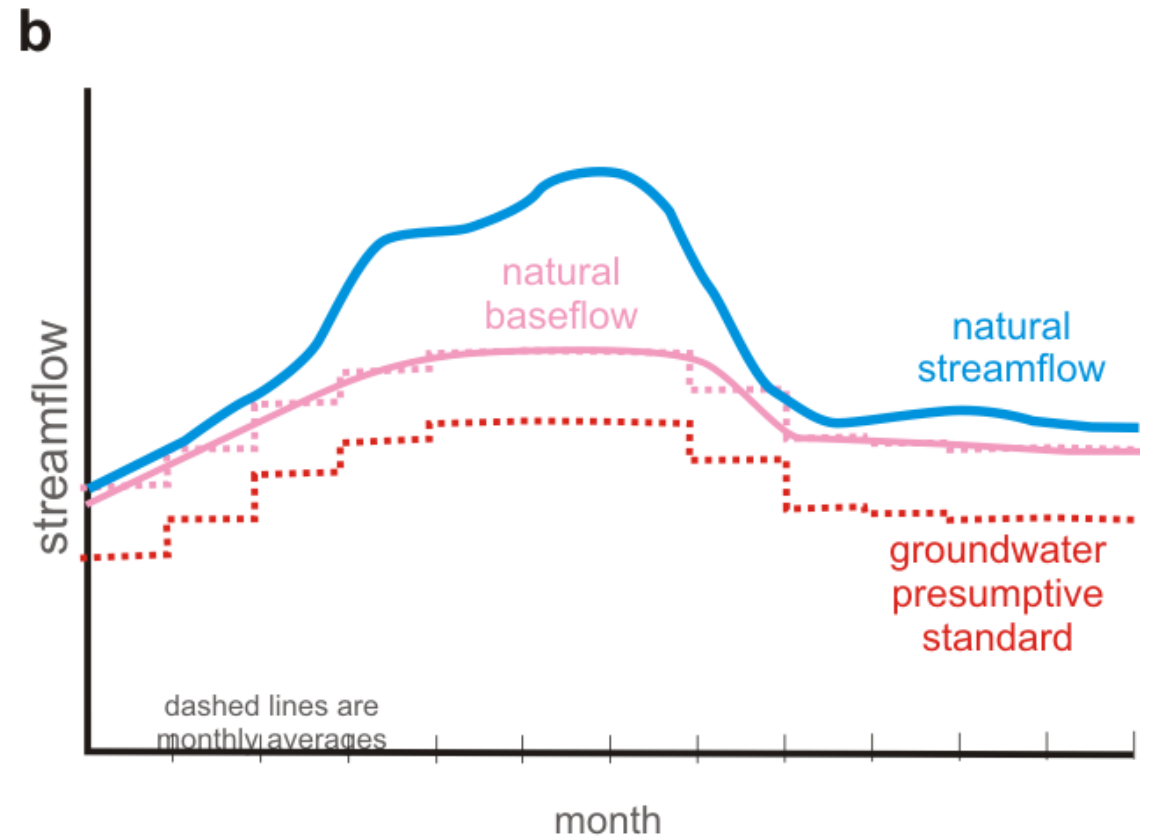
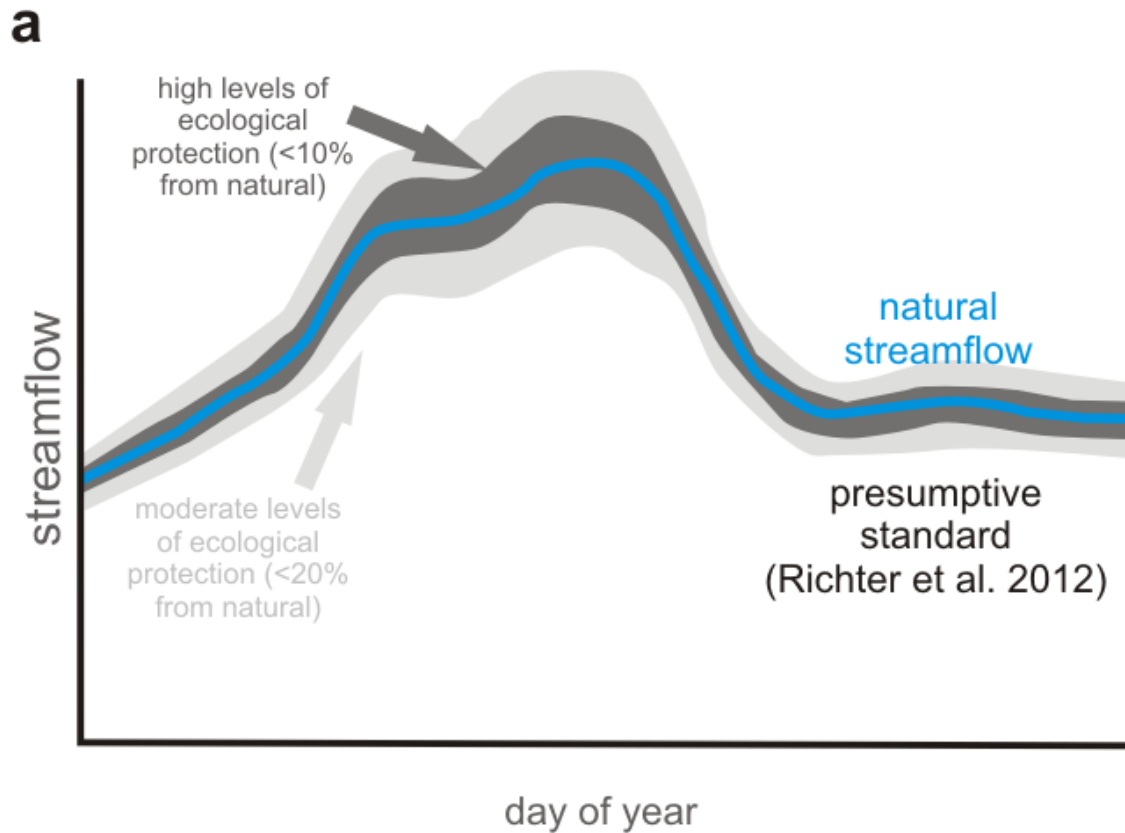
HOW THE MAESTRO'S BACKBONE GETS BROKEN...



Over long timescales, all pumped water depletes streamflow.

SO THAT WE DON'T NEED THE CHIROPRACTOR...

Groundwater presumptive standard



New Law



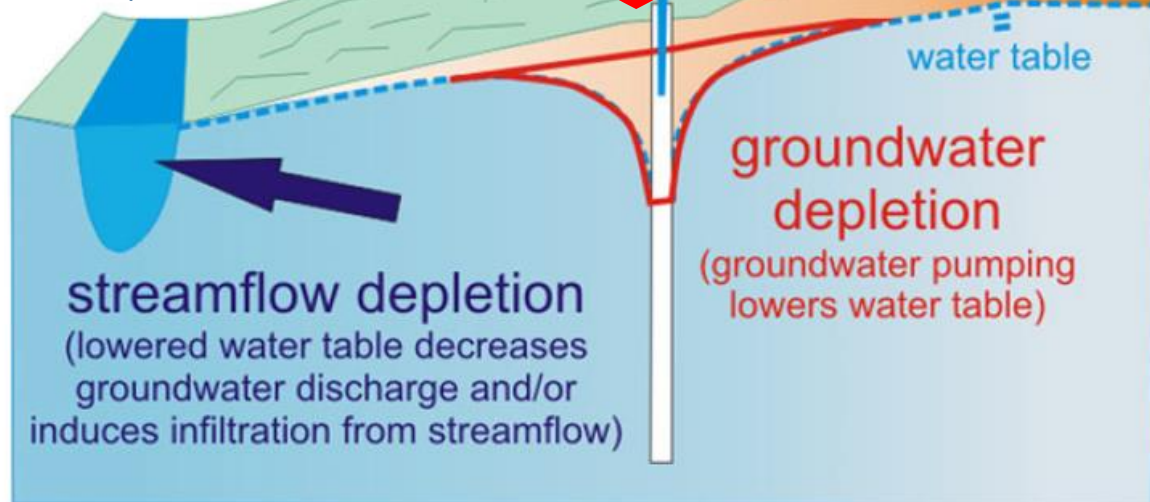
Water Sustainability Act



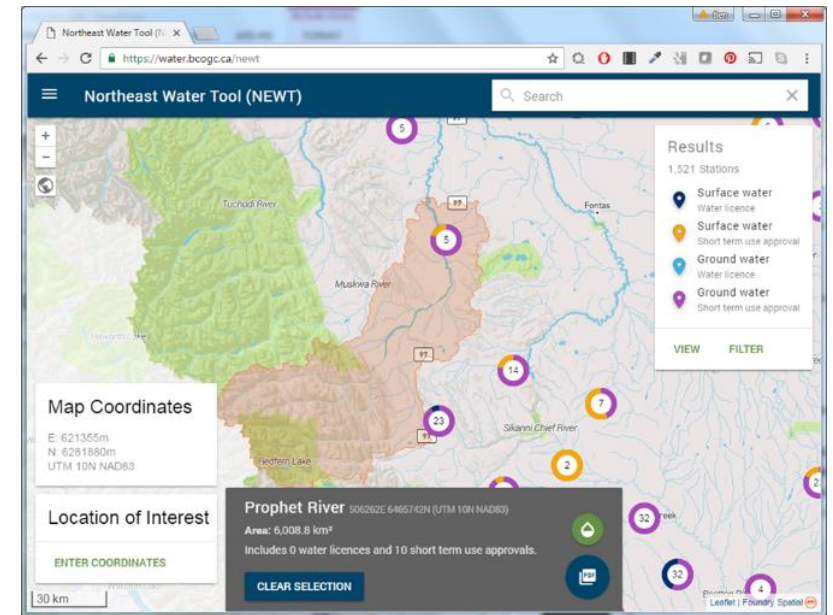
Source: Ryan Bushby (Wikipedia)

Aquatic ecosystem service

Terrestrial ecosystem service



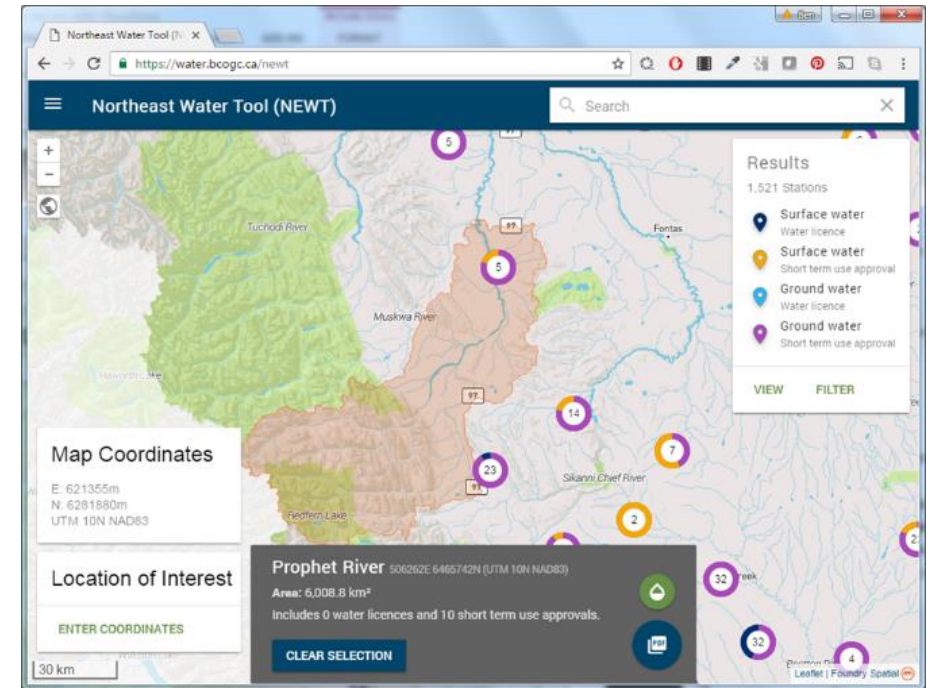
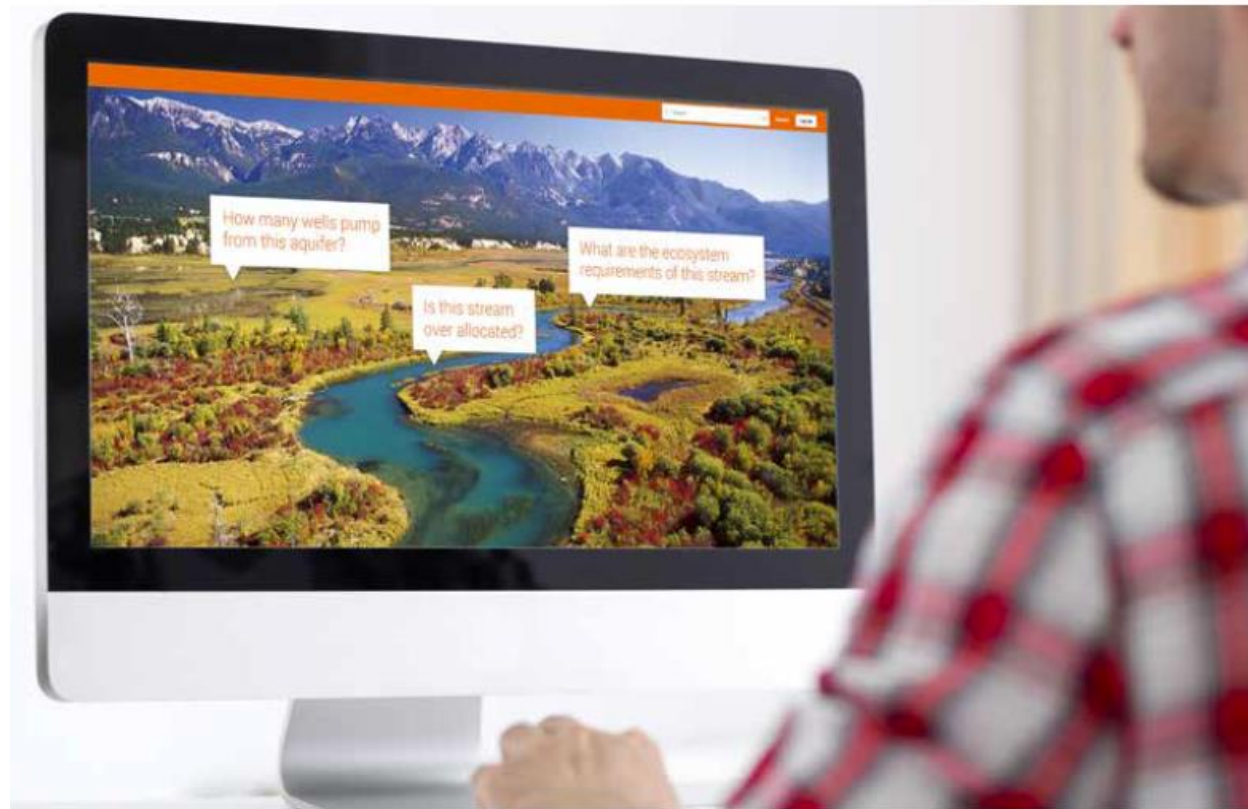
New Tools



BC Water Tools

- Decision support tools for water allocation
- Integrated hydrology models, licensing data, environmental flow needs policy
- Planned 2019: Integrate streamflow depletion models

Can you imagine if information on how much water we have, use and need for every stream, lake and aquifer was only a click away?



Academic-industry-NGO-government partnership



**University
of Victoria**



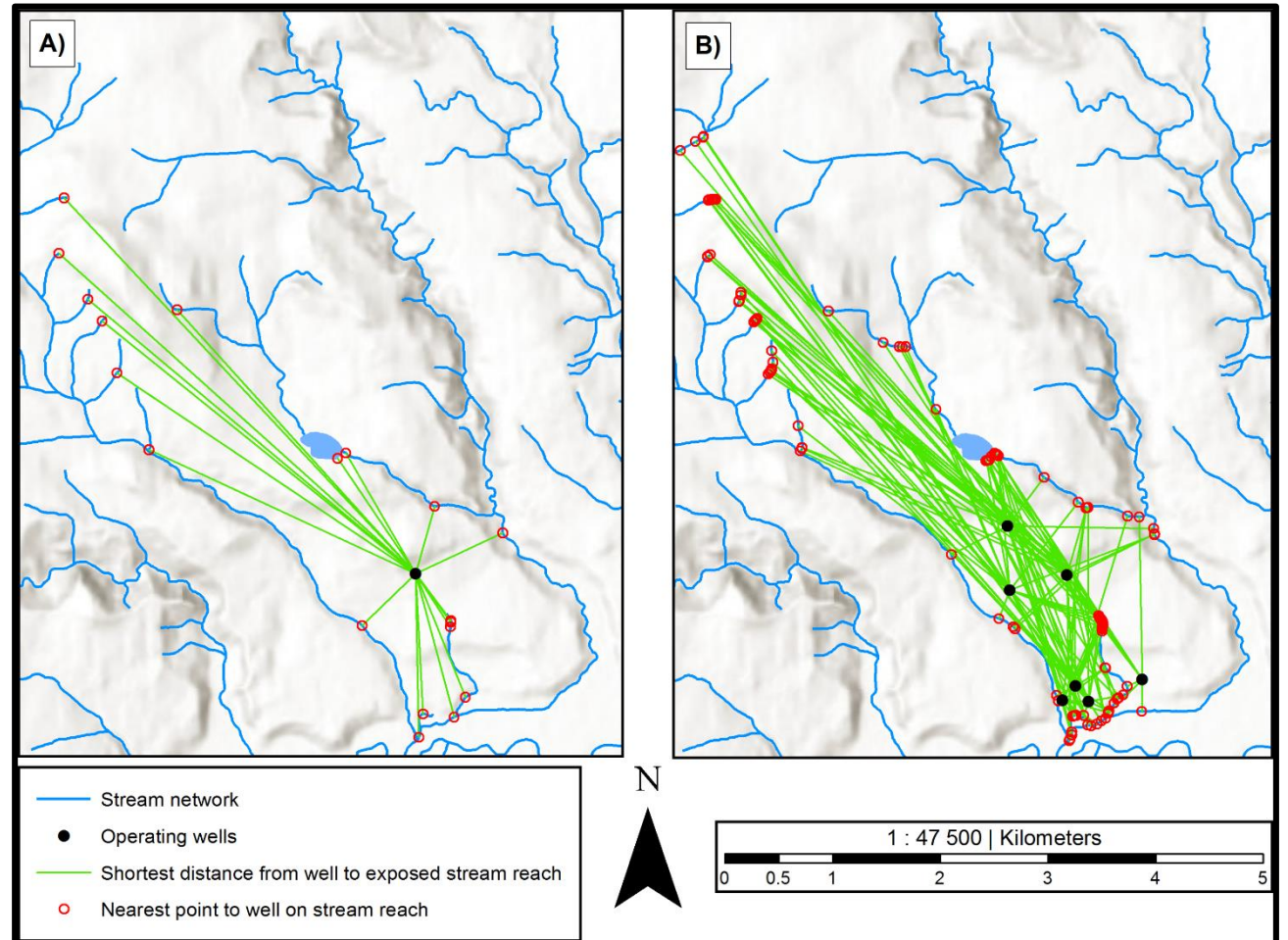
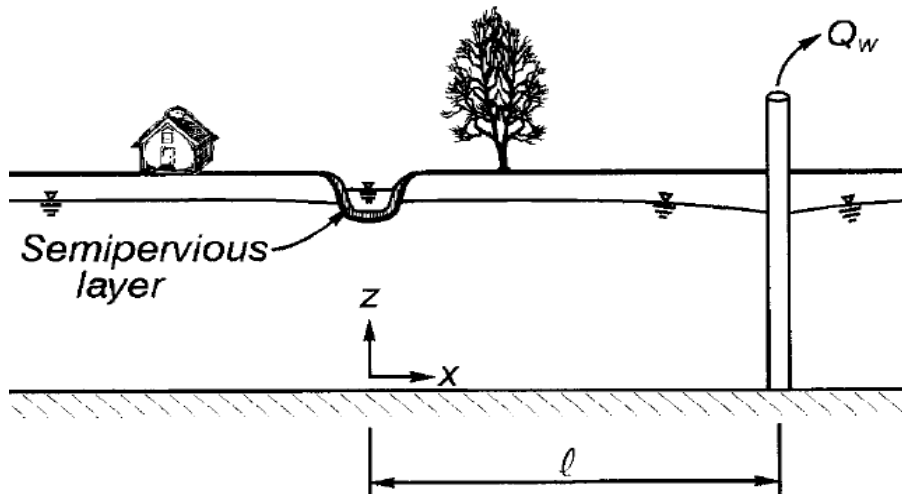
Stanford
Water in the West

**The Nature
Conservancy** 

How do we quantify streamflow depletion?

Can't measure directly – so we need models!

Analytical Models for one well and one stream



And models need data...

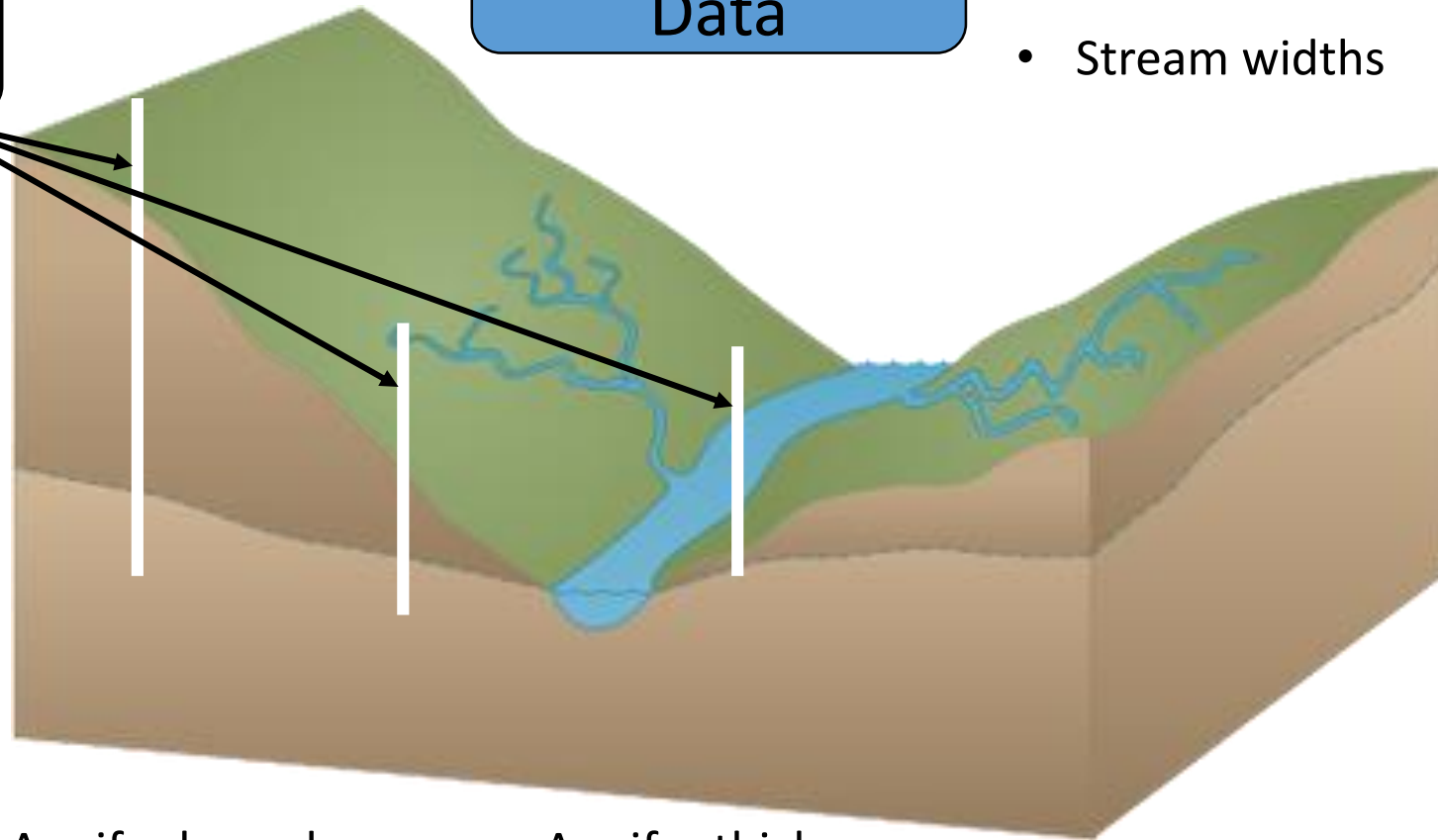
Well Data

- Well locations
- Screen depths
- Pumping rates
- Operation dates
- Operation schedules

Surface Water Data

- Stream network
- Flow rates
- Stream widths

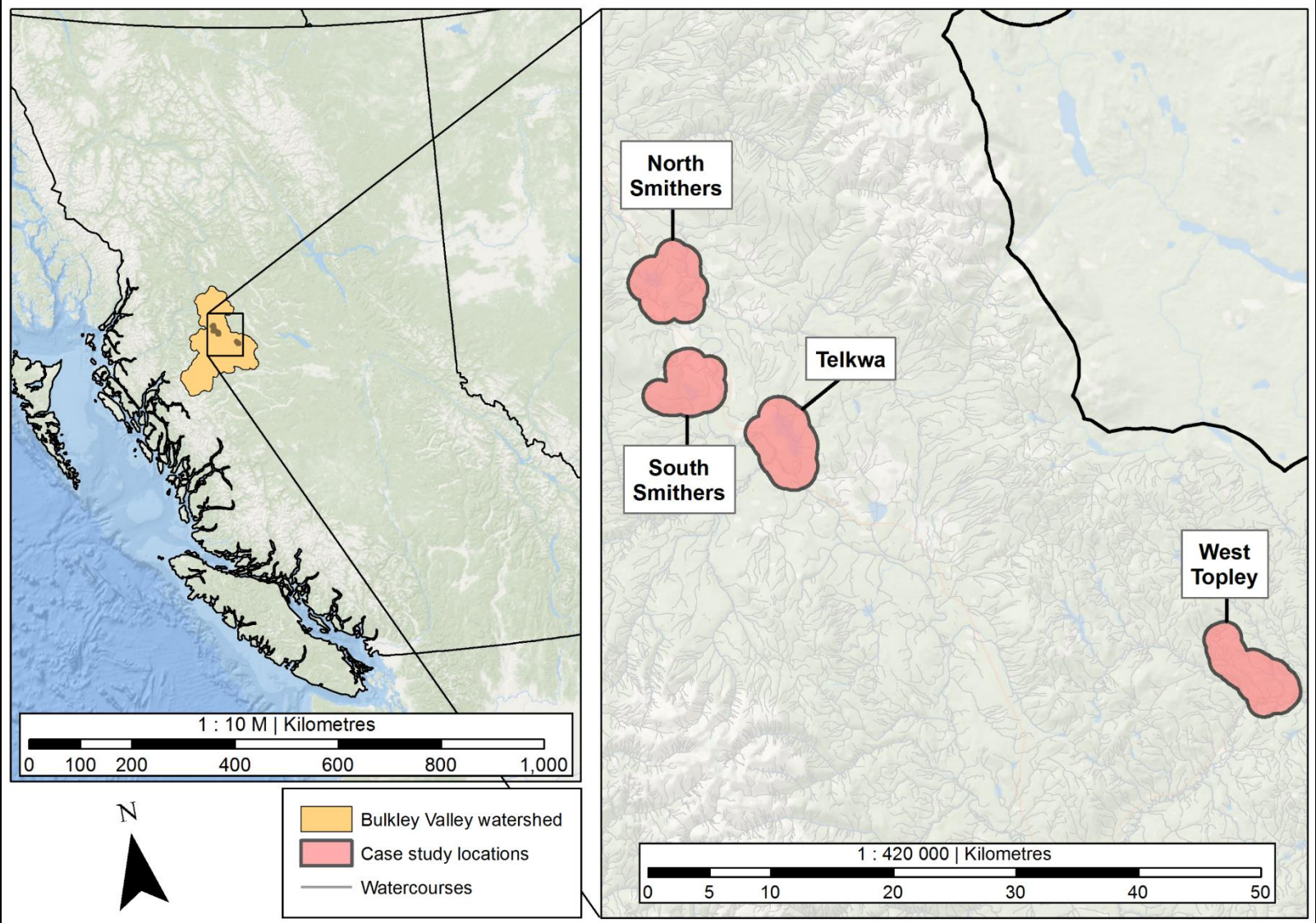
- Streambed properties
- Streambed penetration



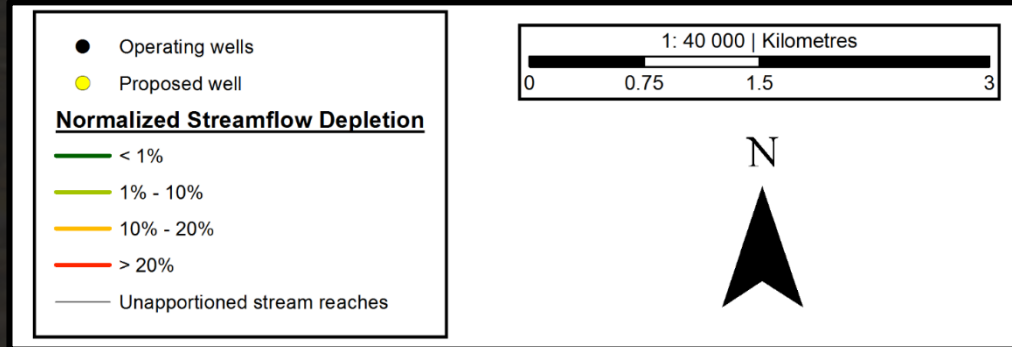
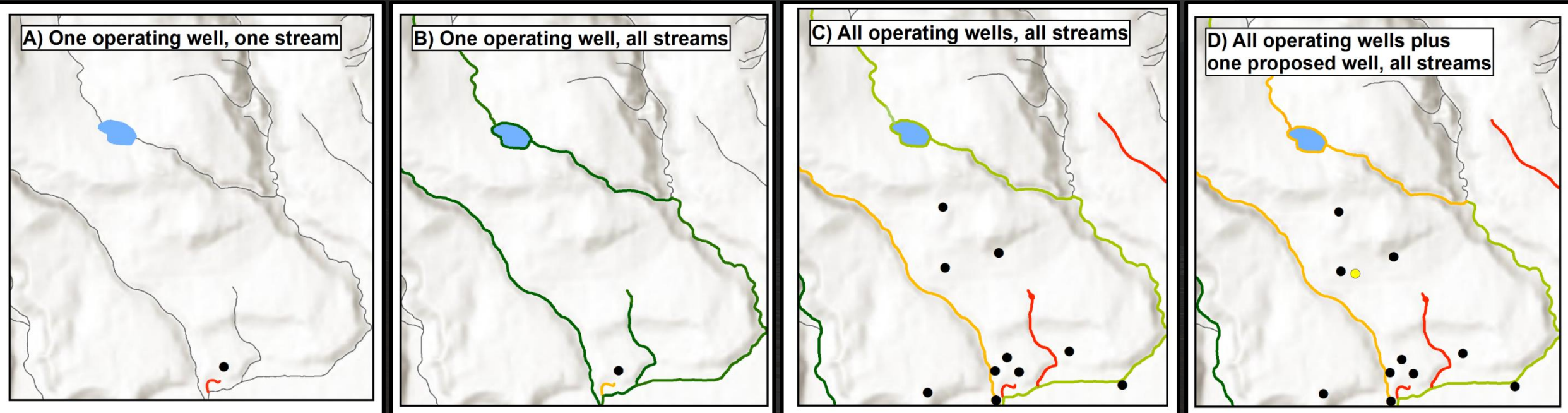
- Aquifer boundary
- Porosity
- Permeability
- Hydraulic conductivity
- Aquifer thickness
- Transmissivity
- Storativity

Aquifer Data

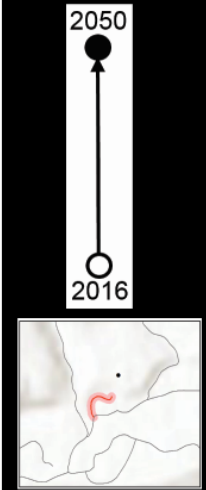
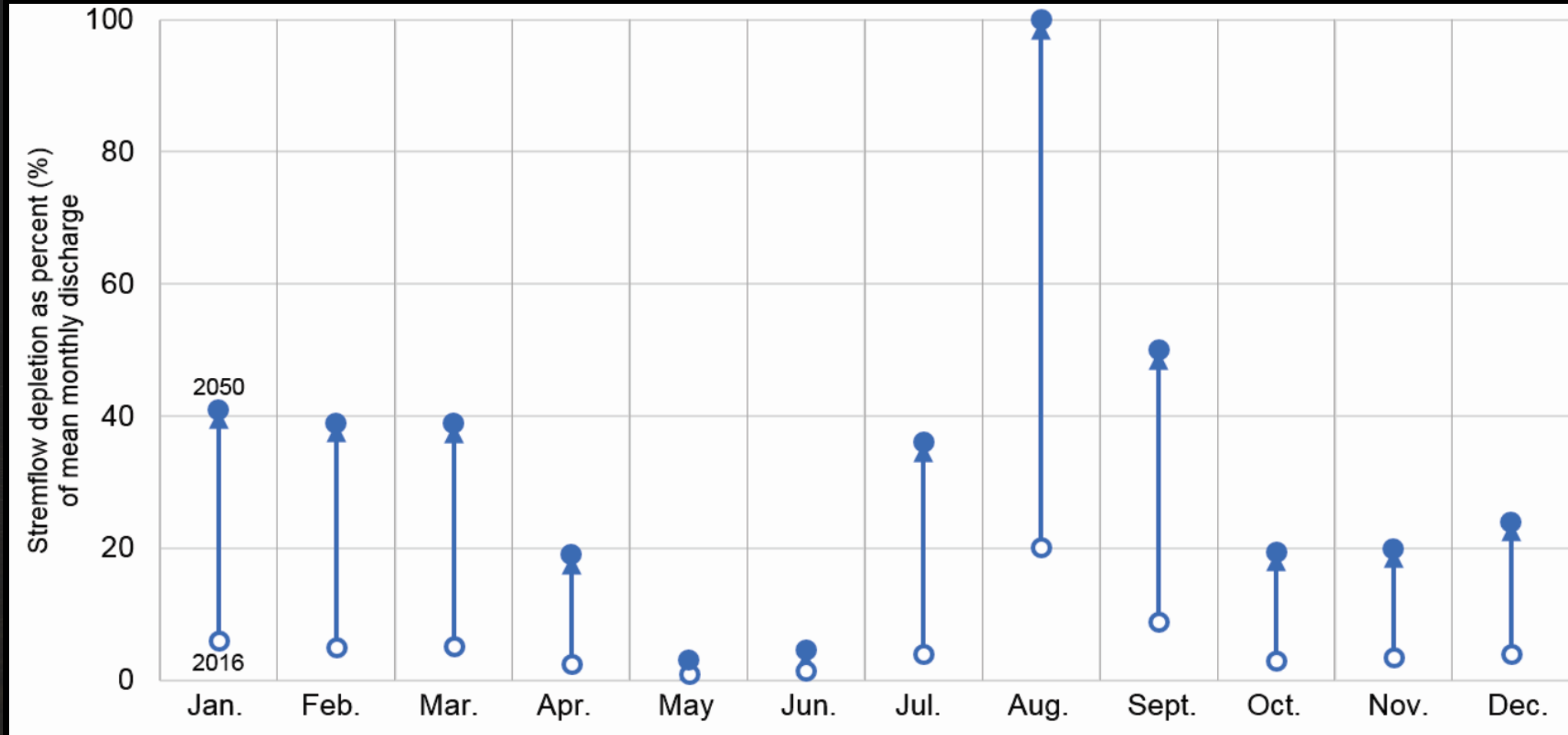
Case Study: Bulkley Valley, British Columbia, Canada



Streamflow depletion with increasing complexity



Streamflow depletion in different seasons to mid-century

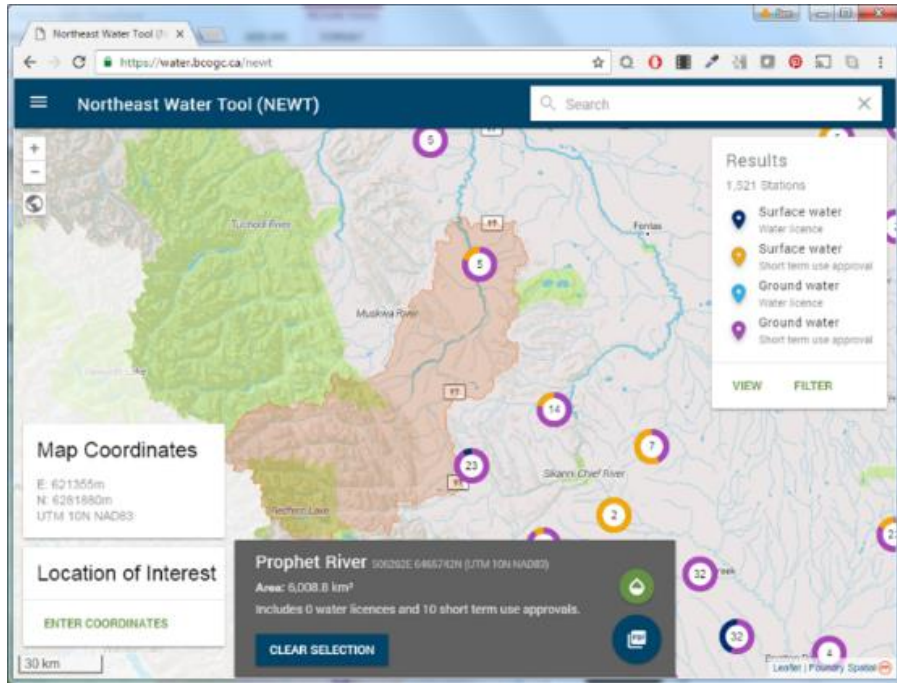


YES, THERE ARE HUGE
UNCERTAINTIES ABOUT THIS
BROKEN BACK BUT...

we also know enough to develop tools
and understanding to robustly,
adaptively manage this broken back



Making these new tools available for everyone...



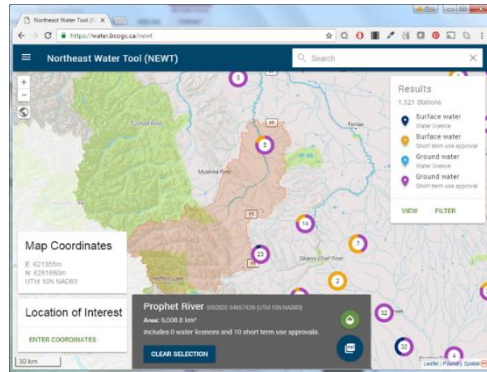
Water tool usage statistics, Jan-Mar 2017

Region	Users	Reports Produced	Access Model
Peace, BC	629	1521	Open
Skeena, BC	189	227	Open
Omineca, BC	148	226	Open
Foothills, AB	11	11	Paid
Cariboo, BC	162	193	Open

User-friendly, open-source data with limited user-control is critical for transparent decision making... and has reduced water-related conflicts.

New Tools

+ New laws




= better protection and management



Try current generation BC water tools at tables:

<http://www.bcwatertool.ca/>



BC
WATER TOOL


Access information about natural water availability, existing water users, and monitoring data using easy to use, map based tools.

Northeast Water Tool (NEWT)

The Northeast Water Tool (NEWT) is the BC Oil and Gas Commission's newly updated award-winning hydrology decision support tool for northeast BC. It includes information on natural water supply, existing water rights, and environmental flow needs of rivers, lakes and streams.

GO

Next generation tools with groundwater pumping in a series of papers on: <http://www.groundwaterscienceandsustainability.org/>



GROUNDWATER SCIENCE + SUSTAINABILITY
RESEARCH GROUP // TOM GLEESON // UVIC

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