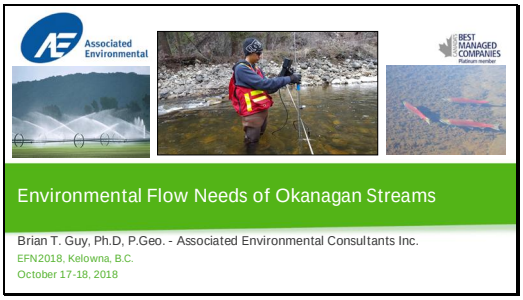
Slide 1

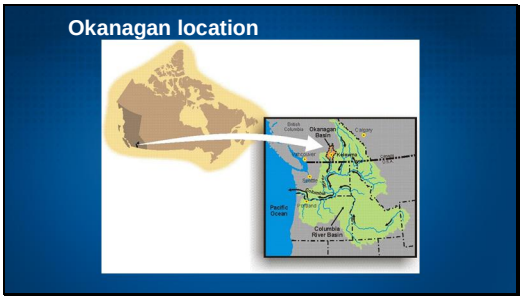


- The Environmental Flow Needs (or EFN) project I'm going to talk about in the next few minutes is an example of a great partnership between a First Nation organization and other governments; one in which the First Nations partner is leading the science side of a complex, highly technical project.
- My role was to lead Phase 1 of the project a couple of years ago, and I'm currently assisting in bringing Phase 2 to a successful conclusion.
- The scope of the project is largely scientific (the first two phases are entirely scientific).
- The project is intended to develop credible, science-based EFNs for the Okanagan streams, and these EFNs would then be used to inform decision-making.

Slide 2

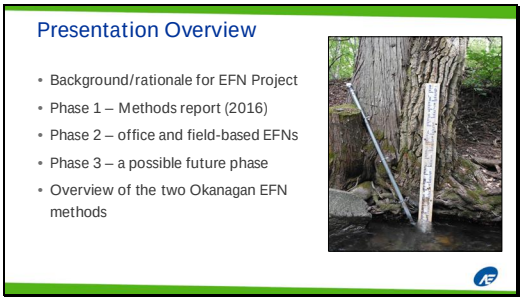
- Only my name is listed on the title slide but the project has several partners.
- The Okanagan Nation Alliance is the tribal organization representing the 7 individual Bands comprising the Okanagan Nation. The ONA was part of the leadership team for Phase 1 and is leading the scientific and technical work in Phase 2 of the project.
- The Okanagan Basin Water Board is a key convenor – they've assembled a lot of the funding for the Okanagan EFN project and provide project management.
- The province of B.C. is a key partner on the project – as a member of the Steering Committee, and providing the benefit of the Province's lengthy history with habitat suitability curves, fish and fish habitat assessment methods, and EFN-setting, and finally,
- Several consultants have contributed to various components of the work.

Slide 3



- Here's where the Okanagan Basin is located.
- About 400 km east of Vancouver
- It's a tributary of the Columbia River, the fourth largest river in North America.

Slide 4



- The presentation will provide a summary of a multi-phase project – the goal of which is to establish Environmental Flow Needs (EFNs) in Okanagan streams.
- I'll start with a bit of background – the drivers for the Okanagan EFN project
- Then I'll talk about Phase 1 of the project - which involved the development of appropriate office-based and field-based methods for EFN-setting in the Okanagan.
- And Phase 2 (which is currently underway) and involves application of these methods to some of the high priority streams in the area
- I won't say much about Phase 3 (a possible future phase) – which could involve developing an approach to interpreting and applying the technically-derived EFNs in decision-making.
- I'll introduce the office-based and the field based EFN-setting methods in use in the project.

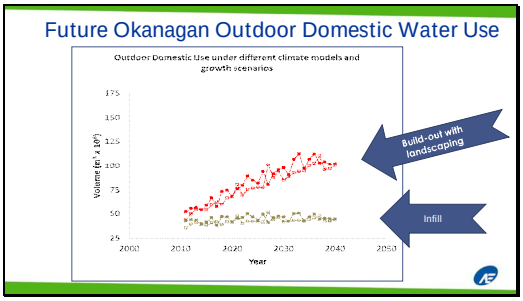
Slide 5

- Farmers need water, and so do fish.
- As the climate changes and the Okanagan population continues to grow, water conflicts are increasing.
- Droughts are getting worse and more frequent, as are floods.
- Meanwhile, fish habitat loss continues.

Slide 6

- With a changing climate, summers are starting earlier and lasting longer, they are getting hotter and they are generally getting drier.
- What do these three influencing factors mean for irrigation?
- Answer: water demand is increasing

Slide 7



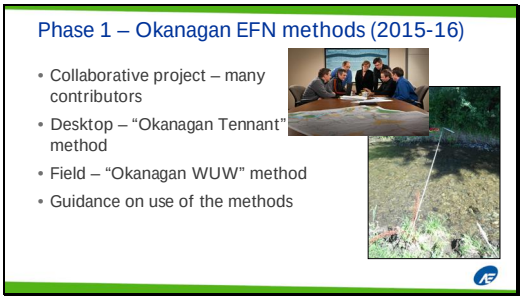
- Here are some estimates of future outdoor domestic water use in the Okanagan with two different land use scenarios.
- The business-as-usual scenario in red is all upwards - reflecting a combination of population growth and climate change increasing the water demand.

Slide 8

- The other big driver is the new Water Sustainability Act (WSA), which became law on Feb 29, 2016.
- The WSA gives the province the ability to restrict water withdrawals when flows drop below the Environmental Flow Needs in a stream, and allows them to completely stop water withdrawals when flows drop below the Critical Environmental Flow Threshold (CEFT).
- The EFN is the water flow needed to sustain the aquatic ecosystem;
- and the CEFT is the critical flow below which there is no more habitat, so going below that flow is really dire for fish. Its equivalent to the Permanent Wilting Point in agriculture.
- In order to regulate within the new WSA, provincial regulators have to know what the EFNs and CEFT are in each stream for which a licence is applied for.
- In 2015 the Okanagan Basin Water Board, the Okanagan Nation Alliance, and the Province began a multi-phase study to develop Okanagan-relevant methods for determining EFNs in the Okanagan.
- Many other EFN studies have been completed in the Okanagan, but for various reasons, they all had limitations that limited their usefulness – so I won't dwell much on

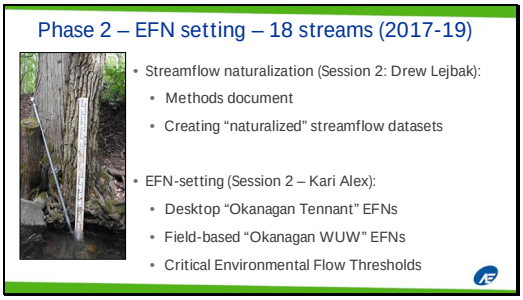
these previous studies – except to mention that this project is not the first attempt to determine EFNs in the Okanagan.

Slide 9



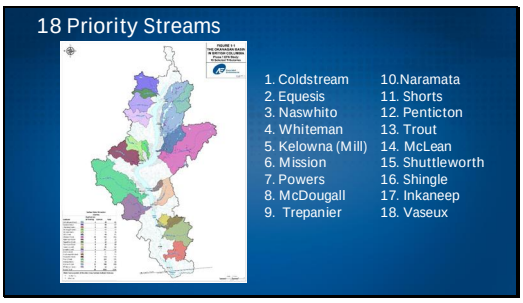
- A very important element of Phase 1 of the project was its collaborative nature.
- It was led by the Okanagan Basin Water Board, but many agencies contributed, and the consultants chosen for the work were a broad and diverse group.
- Phase 1 of the project produced a desktop EFN setting method for use in low-risk situations, and a field-based EFN setting method for determining EFNs in more complex cases (for example where there are very high fisheries values or lots of storage and diversions for municipal or agricultural use).
- The desktop method is a customized form of the well accepted B.C. Modified Tennant Method, and is referred to as the "Okanagan Tennant method".
- The field-based method is a modified form of the well known Weighted Usable Width (WUW) method previously applied in the Okanagan, and is known as the "Okanagan WUW method".
- The Phase 1 report described these methods, and also provided guidance on applying the methods,
- and information relevant to EFN-setting for each of 19 tributaries designated as "high priority" by the project leaders.

Slide 10



- Phase 2 work is underway, and has included several components, all of which will be described in greater detail in presentations in Session 2 of the conference:
- Development of a suite of methods for estimating and accounting for the human influence on streamflows to create "naturalized" streamflow datasets for use with the Okanagan Tennant method.
- Creation of "natural" streamflow datasets for each of the "high priority" tributaries.
- Drew Lejbak will describe the streamflow naturalization process more detail in Session 2.
- Development of EFNs using the desktop Okanagan Tennant method for all the high priority tributaries.
- Collection of biological and hydrological data, followed by application of the Okanagan WUW method for the "high priority" streams.
- Setting Critical Environmental Flow Thresholds to assist with managing water use reductions during times of scarcity.
- All of the Okanagan Tennant and Okanagan WUW work, including setting CEFTs, will be discussed by Kari Alex of the Okanagan Nation Alliance in Session 2.
- In addition, the EFN investigative work generates a lot of data, and in Session 2, Natasha Neumann will discuss the challenges of data management related to the project.

Slide 11



Here's a map showing the locations of the 18 priority tributaries within the Okanagan Basin.

Slide 12

Phase 3 – Practical Application of EFNs

- Not scoped yet
- Possible ideas:
  - A committee (as contemplated by WSA) to inform the provincial decision-makers
  - Method of restricting diversions when flow is less than EFN but greater than CEFT

- Phase 3 (future): if it proceeds - will involve developing an approach to interpreting and applying the technically-derived EFNs in decision-making.
- For example, would the province establish a committee of First Nations or others as contemplated by the WSA to assist with decision-making in high risk situations?
- Or, would the province develop a consistent approach to restricting water diversions in years where flows are less than the EFNs but greater than the Critical Environmental Flow Threshold?

Slide 13

Okanagan Tennant method – some definitions

Naturalized Streamflow
Streamflow in the absence of flow regulation

Residual (Net) Streamflow
Streamflow that remains after storage and diversions (this is reality)

"Maximum Licensed" Streamflow
Residual streamflow assuming maximum use of water licences

- To apply the Okanagan Tennant method we need to know the naturalized flow, the residual flow, and streamflow under a hypothetical maximum licensed use scenario.

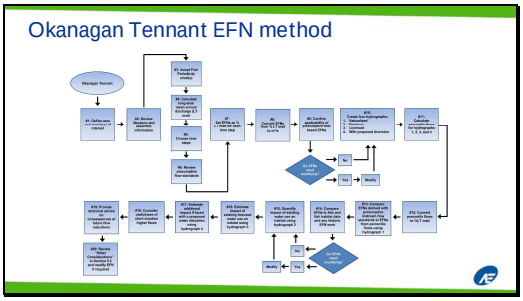
Slide 14

Okanagan Tennant EFN method

- Create 3 hydrographs:
  - For natural conditions
  - For current conditions
  - For maximum licensed conditions
- Set EFNs as median flow for the month or week of interest, or the presumptive instream flow standard

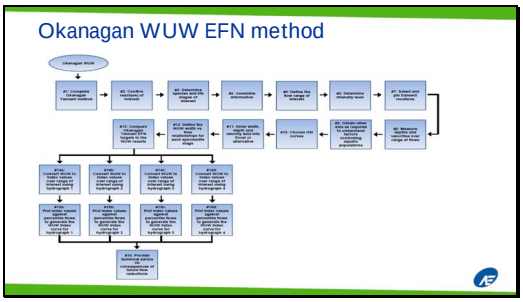
- The Okanagan Tennant method is a desktop method that relies only on streamflow information – but is customized to Okanagan flow conditions, and the fish periodicity of Okanagan fish species.
- You first create 3 hydrographs (one for natural flows, one for actual flows, and one hypothetical hydrograph that assumes that all licensed withdrawals are occurring.
- Then you set the EFN as the lower of the median flow for the month or week of interest, or the presumptive instream flow standard, which is a value estimated from a meta-analysis of many studies of flow needs in similar habitats in B.C.
- The Phase 1 report provides a detailed step by step guide to using the method.

Slide 15



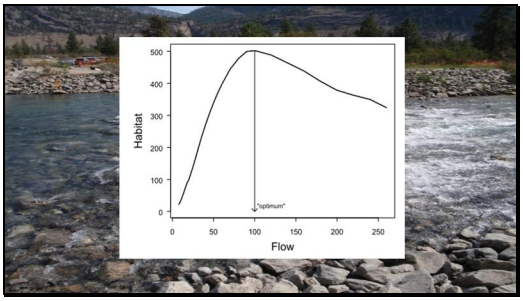
- This graphic shows the step by step process for completing the Okanagan Tennant method.
- I won't go into it here, but in a subsequent presentation in Session 2, Kari Alex of the ONA will describe the process and give an example of its application.

Slide 16



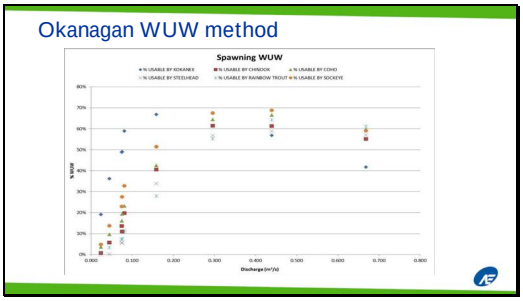
- Here's the flowchart describing the steps to apply the Okanagan WUW method.
- I won't describe the process here.
- In a subsequent presentation in Session 2, Kari Alex from ONA will describe the process and give an example of its application.

Slide 17



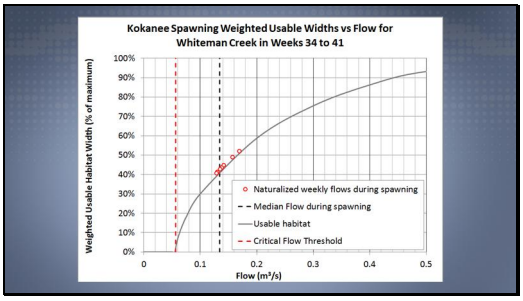
- The WUW method provides a way to relate fish habitat to streamflow on a customized stream-by-stream basis, and come up with a diagram like this one.
- You get here by choosing the right transect locations at which to measure depth and velocity across the stream, and then …
- For one flow level, determining the Weighted Useable Width using the right HSI (Habitat Suitability Index) curve
- The HSI curve is a curve that describes habitat usefulness as functions of depth and velocity – and there are different HSI curves for difference fish species and life stages.
- You repeat this for several different flows and end up with a relationship between Weighted Useable Width and flow (like the one shown here) …
- which can then be used to identify the CEFT and the EFN
- Then, finally, using different HSI curves for each species and each life stage, you can determine these WUW vs flow relationships for each fish species and life stage present in the stream.
- The ONA is leading this work.

Slide 18



- This slide shows what these curves look like when you combine 6 different species of fish onto one slide.
- This one is specifically for the spawning part of the life cycle.

Slide 19

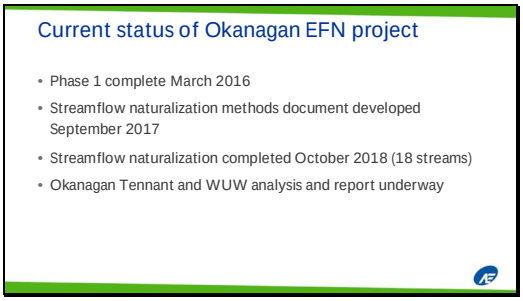


- If you separate it out by species and life stage on a particular creek, you have something like this – for Kokanee spawning in Whiteman Creek from mid-August through the end of September.
- There's lots of great information contained on this plot: the median flow, the CEFT, and the WUW vs flow relationship.
- Fish production in the Okanagan watershed is naturally constrained during the late summer and early fall. The plot shows that under natural conditions in a typical year, (see vertical line representing median flow) fall spawning fish are restricted to about 50% of the total available habitat. This means that there is no surplus water available for human use during this period without an impact to fish productivity.

Here's some more background on the Okanagan:
In a typical year, flow conditions in managed Okanagan watersheds vary from one watershed to another with three distinct scenarios:

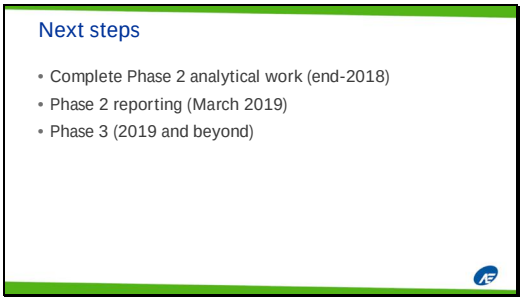
- Late summer water use is not offset by storage releases - so fish production is reduced because water extraction results in lower habitat availability. When streamflow approaches critical flow levels, voluntary or regulatory water use restrictions will be required.
- Late summer water use is offset by releases from upstream storage - so streamflow remains at natural levels.
- Late summer streamflow is augmented by storage releases. In these watersheds, flows are maintained above natural levels on a regular basis and more habitat is available and fish production is higher than would occur in natural conditions.

Slide 20



Here is the current status of the project.

Slide 21



- Next steps
  - •Complete Phase 2 analyses
  - •Phase 2 reporting (by end of March 2019)
  - •Phase 3 (a possible future phase - 2019 and beyond)