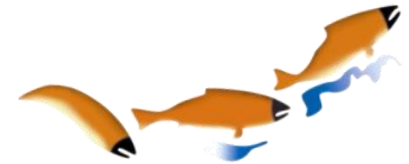




# RECONNECTING FLOODPLAIN ECOSYSTEMS



*What we have learned.  
Monitoring results to date  
Upcoming projects*



**Kari Alex**

**SOSCP forum February 20<sup>th</sup>, 2019**



# VALLEY CHANGES

Okanagan Outlet dam

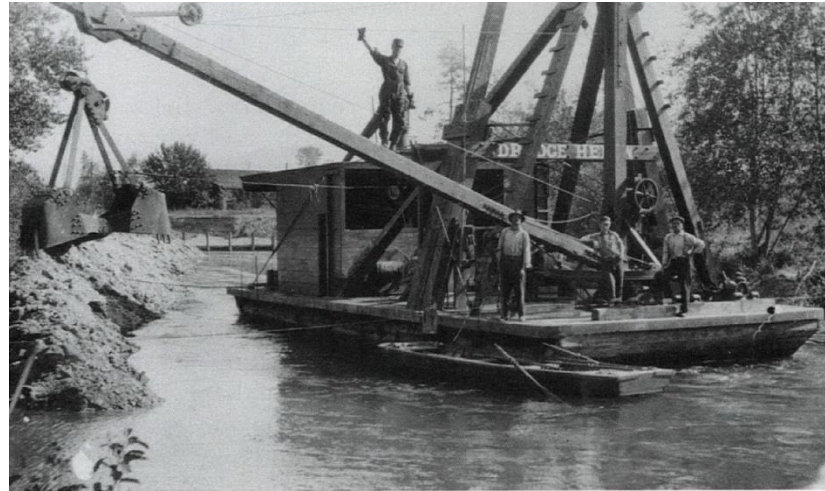
Flood control, navigation & irrigation

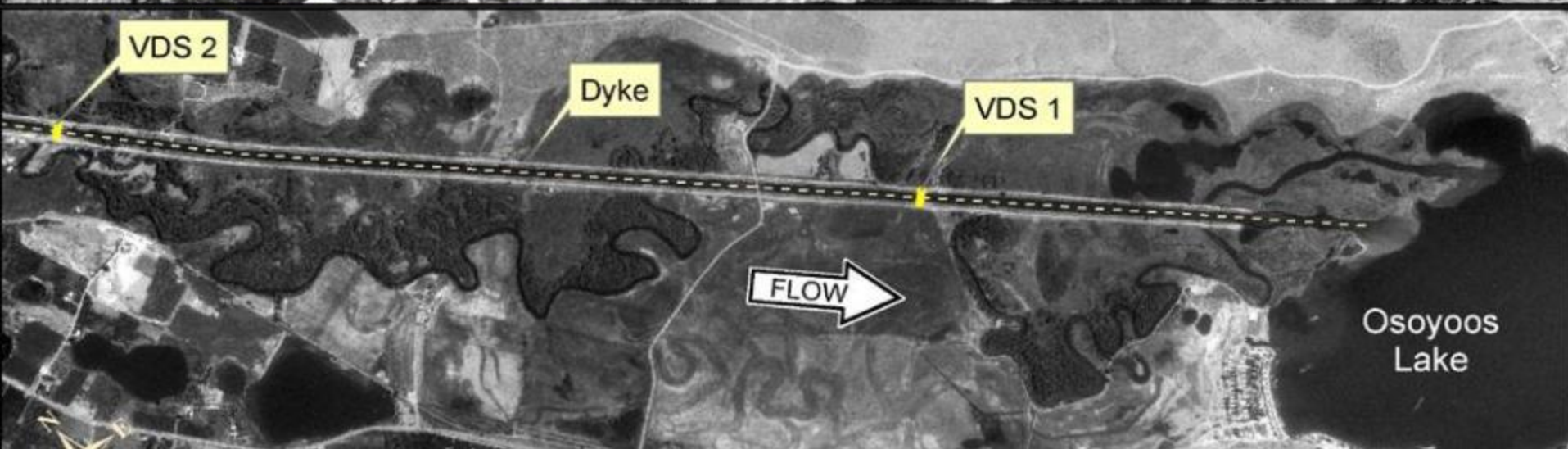
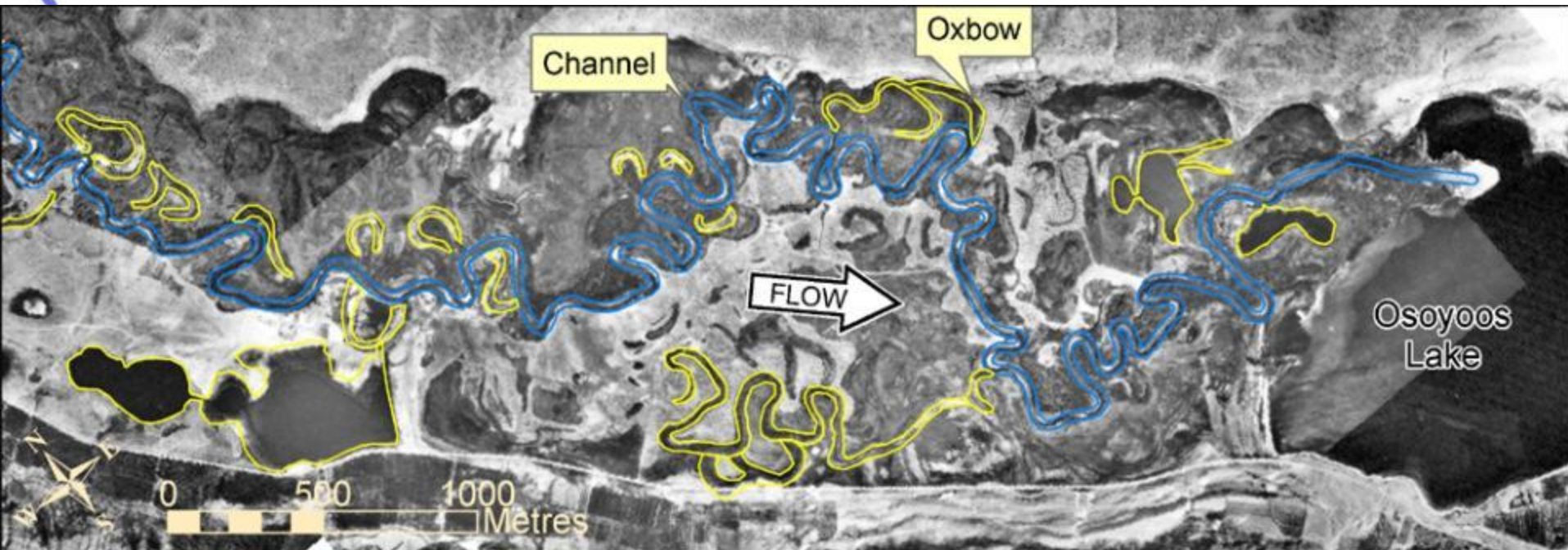
- dams,
- dredging &
- channelization

Skaha Outlet dam

McIntyre Dam

Osoyoos Lake







# VALLEY CHANGES



## *q̓awsitk<sup>w</sup> (OKANAGAN RIVER) - CANADA*

- 1 of BC most endangered River



### *HABITAT LOSS*

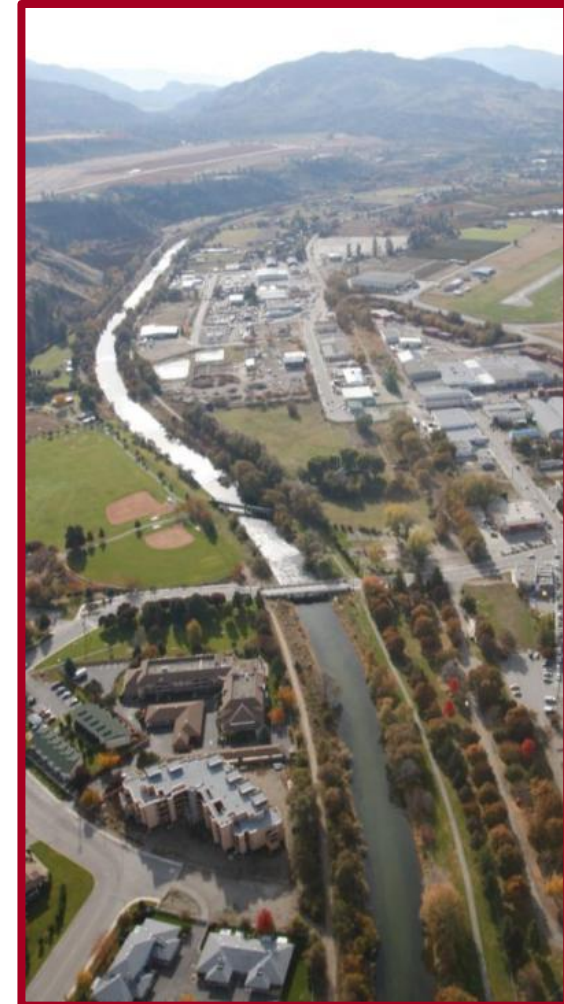
- 84% River = channelized
- 50% River length = lost
- 90% Riparian vegetation = lost
- Instream diversity = lost
- Connection floodplain = lost
- Native species = declined
- Exotic species = allowed to colonized



NATURAL: 3 km



SEMI-NATURAL: 2 km



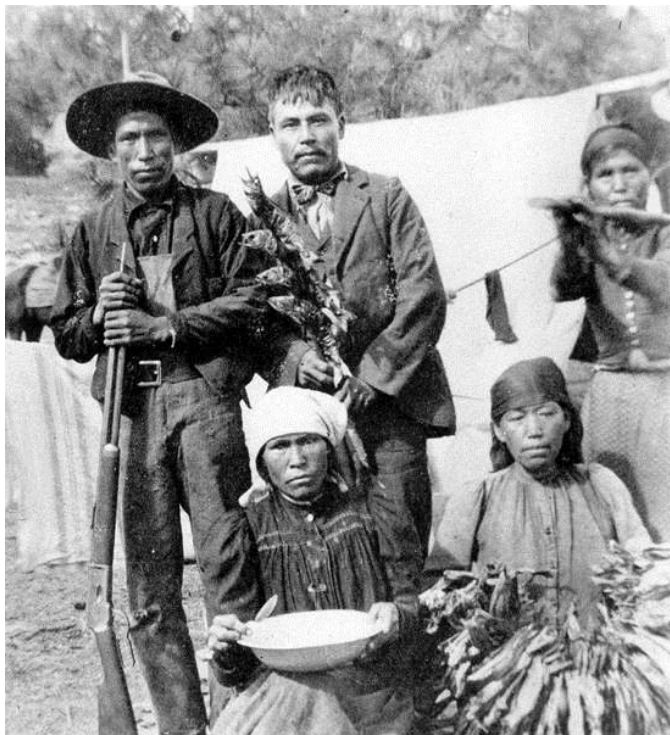
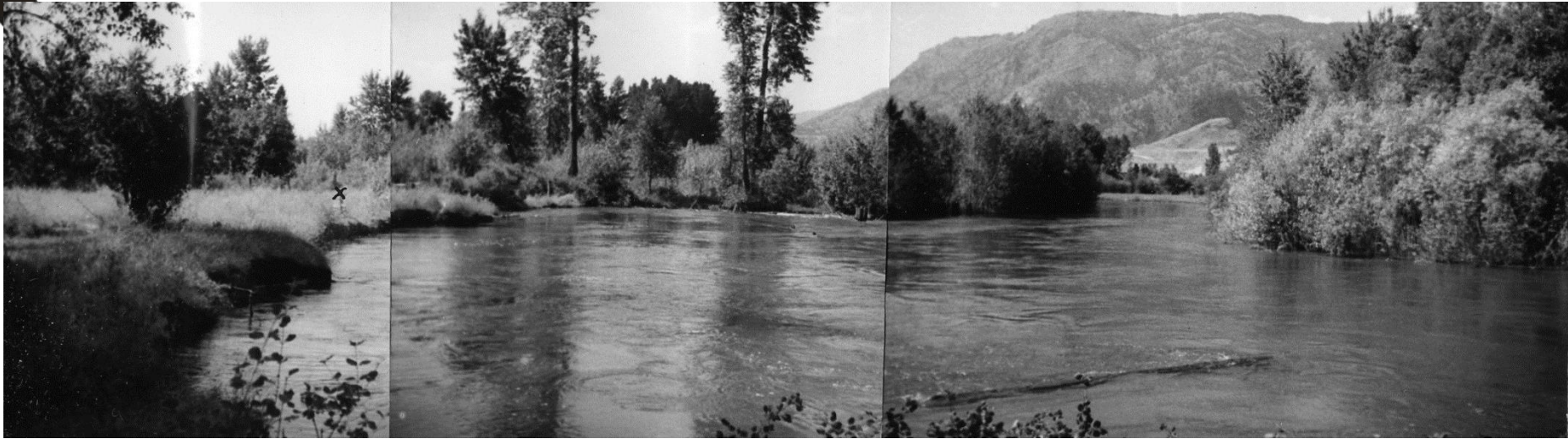
CHANNELIZED: 30 km

# VALLEY CHANGES





# VALLEY CHANGES



*qawsitk<sup>w</sup> (PENTICTON CHANNEL)*

# VALLEY CHANGES



Sockeye - rebounding

Chinook – rare

Steelhead – rare

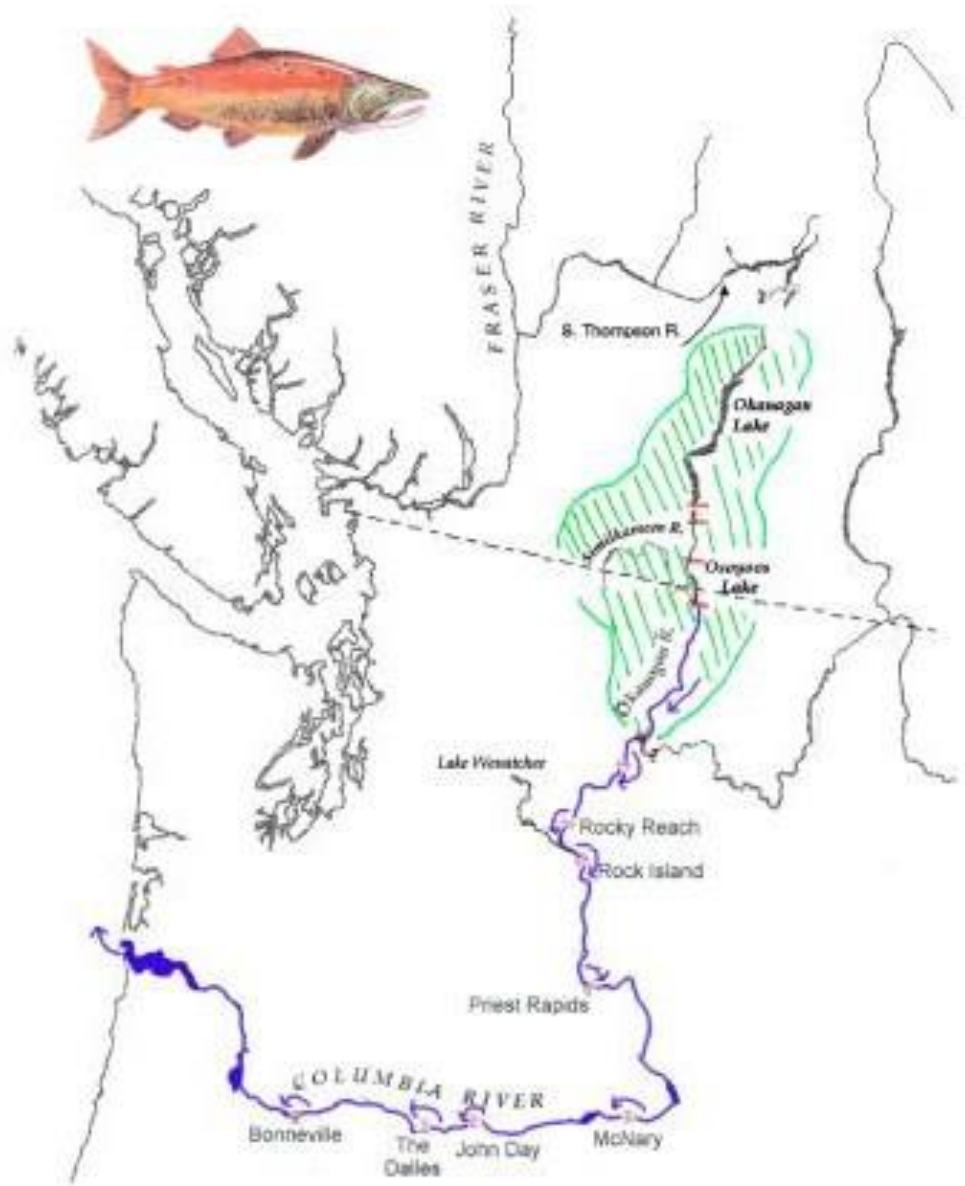
Coho – extirpated

Chum – extirpated

Lamprey- extirpated

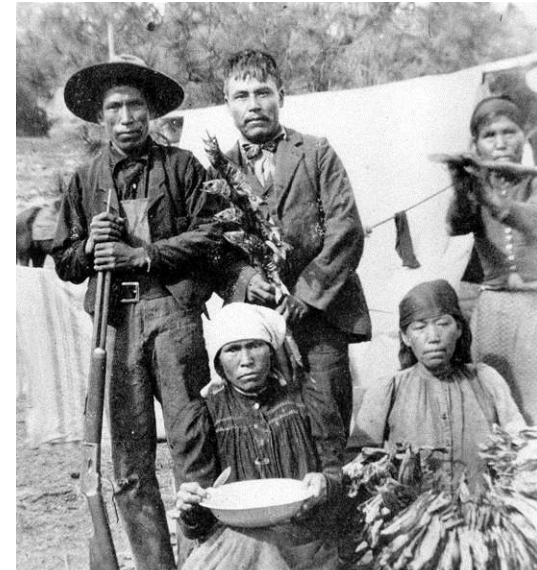
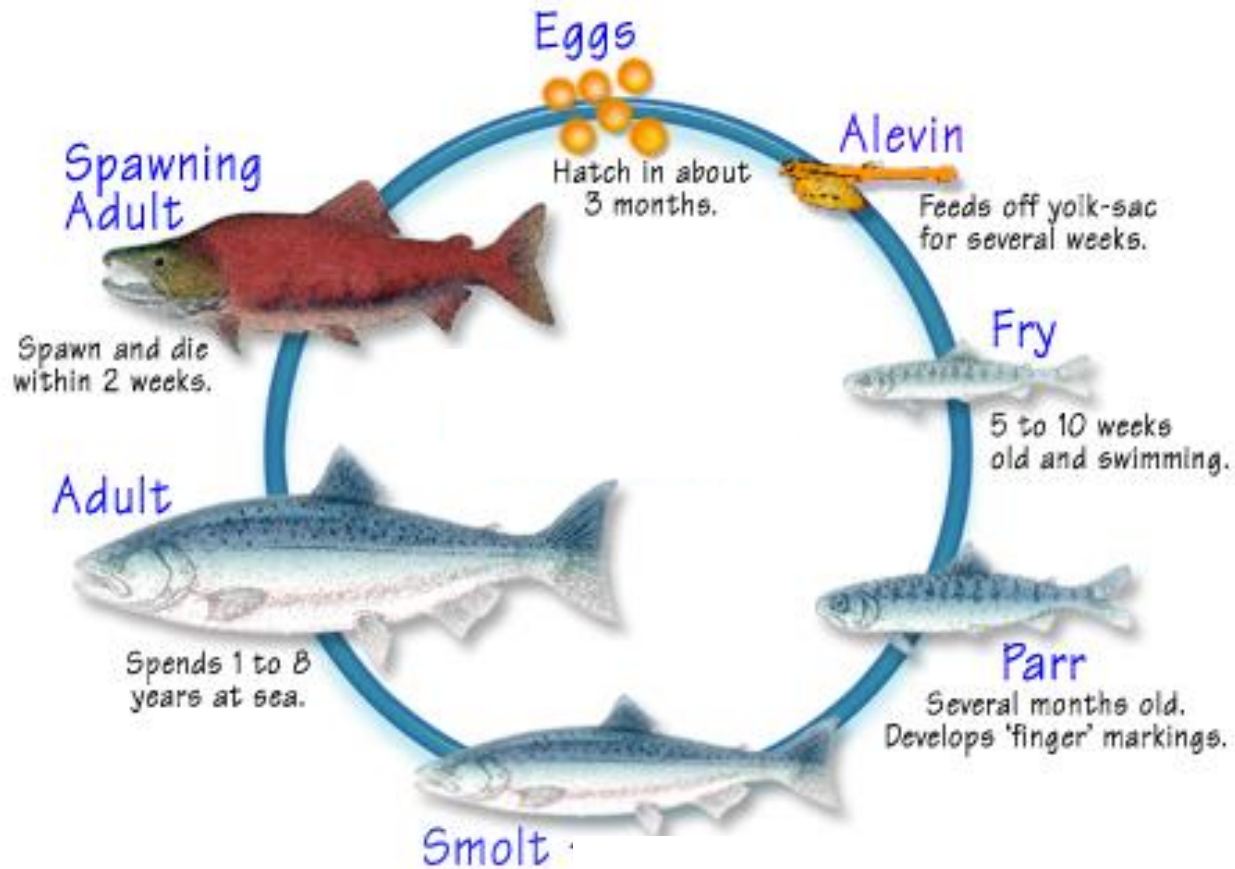
Kokanee – declined

Rainbow Trout – declined





# Salmon life cycle



# VALLEY CHANGES



- Lake Whitefish (1894)
- Largemouth bass (1909)
- Lake trout (1909)
- Carp (1915)
- Eastern brook trout (1924)
- Black Bullhead (1941)
- Tench (1941)
- Smallmouth bass (1960s?)
- Yellow Perch (1975)
- Black Crappie –(1985)
- Bluegill (2001)
- Pumpkinseed (???)
- Brown bullhead (???)
- Mysis shrimp (1966)
- Eurasian Milfoil (1972)

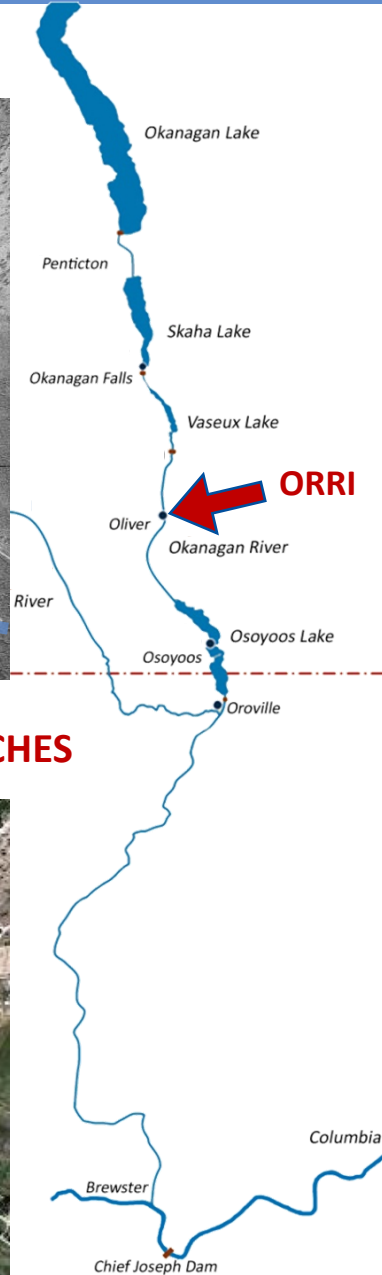
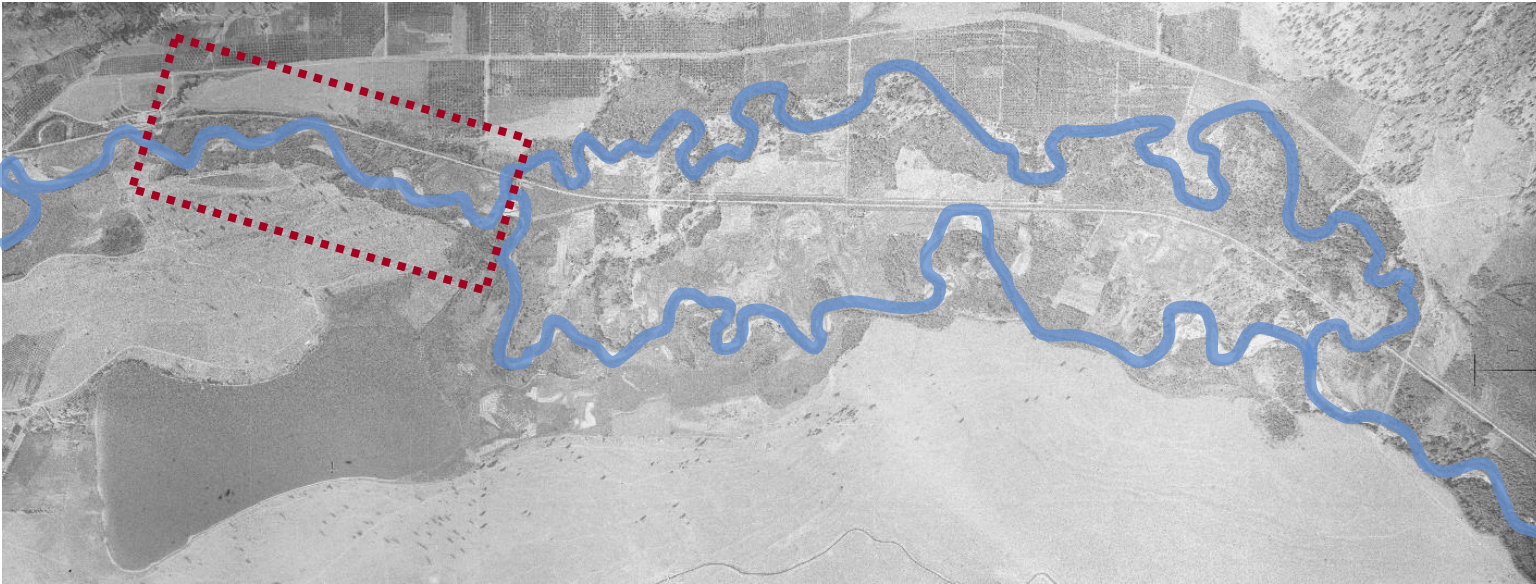




# OKANAGAN RIVER RESTORATION INITIATIVE



1910



PHASE I

PHASE II

1950

NATURAL & SEMI-NATURAL REACHES



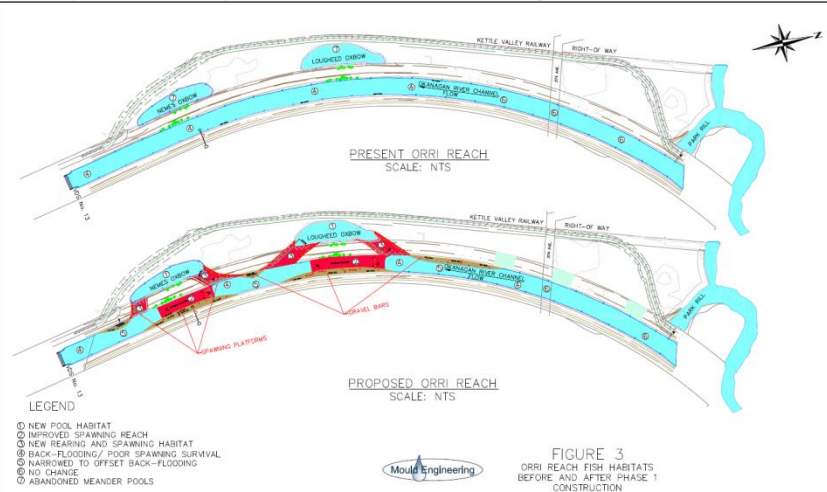


# OKANAGAN RIVER RESTORATION INITIATIVE



**2000-2008**

plans, permits, designs, funds



**2009-2018**

monitoring & adaptive management



**2008-2009** construction works



# OKANAGAN RIVER RESTORATION INITIATIVE



## ***DUAL CHANNEL***

- 1.2 km dyke set back
- 0.5 km river re-meandered
- 2 old oxbows reconnected



# OKANAGAN RIVER RESTORATION INITIATIVE



**Phase I Reconnected Isolated Oxbows  
(2009)**



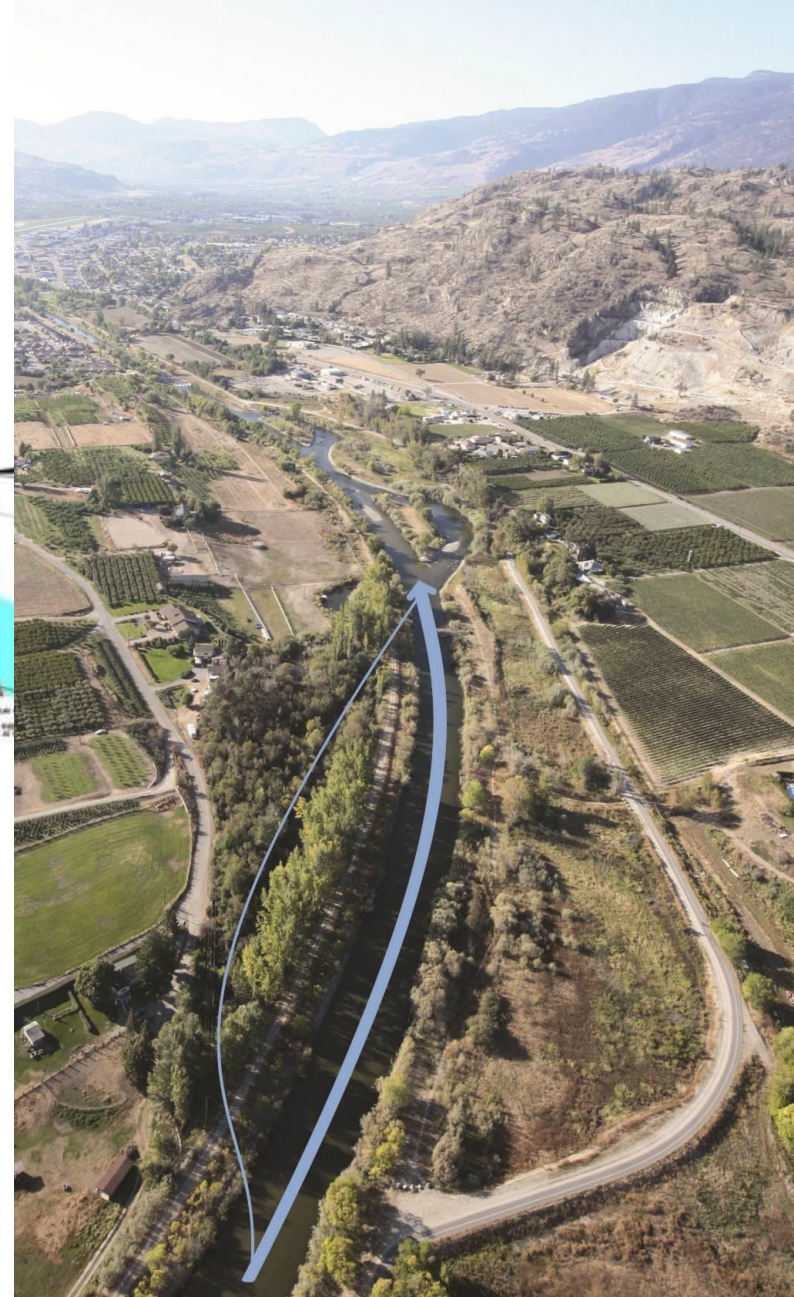
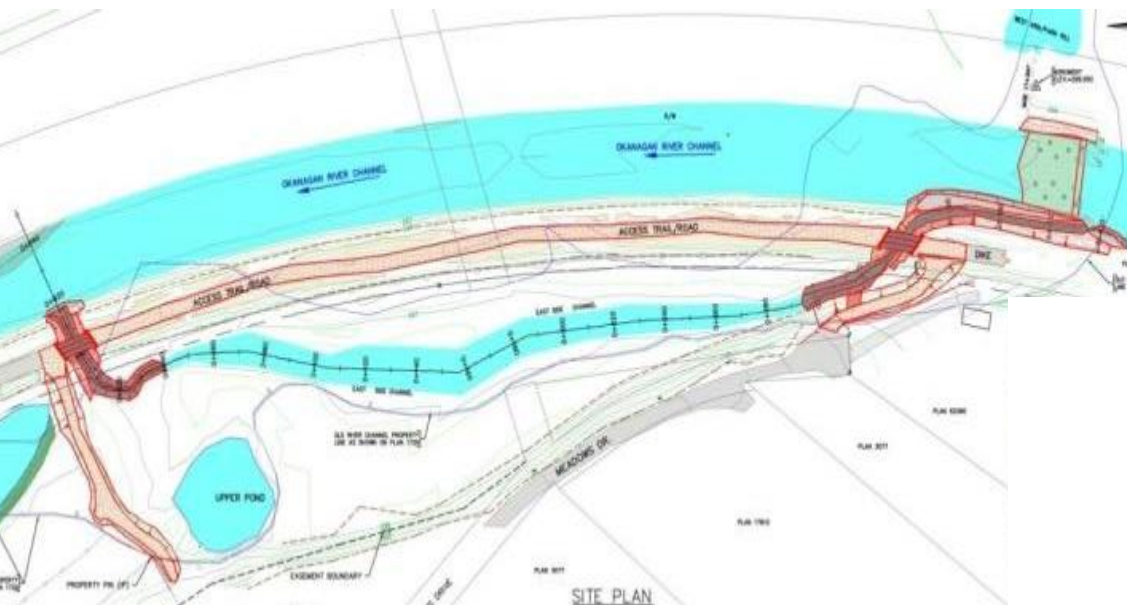
**Created Amphibian Ponds  
(2014)**

**Phase I Dike Setback & Reactivated  
Floodplain (2008)**

# ORRI – PHASE II



Reconnection of small natural side channel  
(historic river pathway)  
immediately upstream Phase I





# ORRI – PHASE II



**2013** construction





# ORRI – PHASE II



## *HABITAT REFUGE*

- Phase II side channel acted as a water quality refuge during high turbidity events
- No Chinook documented pre-treatment but observed in Phase I
- Trout observed in Phase II side channel (spring)

*2014-2018* monitoring,  
adaptive management





# ORRI – PHASE II



## *PHASE II*

- gravel deposited in approach channel creating blockage (high freshet years)
- scoping options to increase flow in side channel and reduce deposition in approach





# ORRI – PHASE II



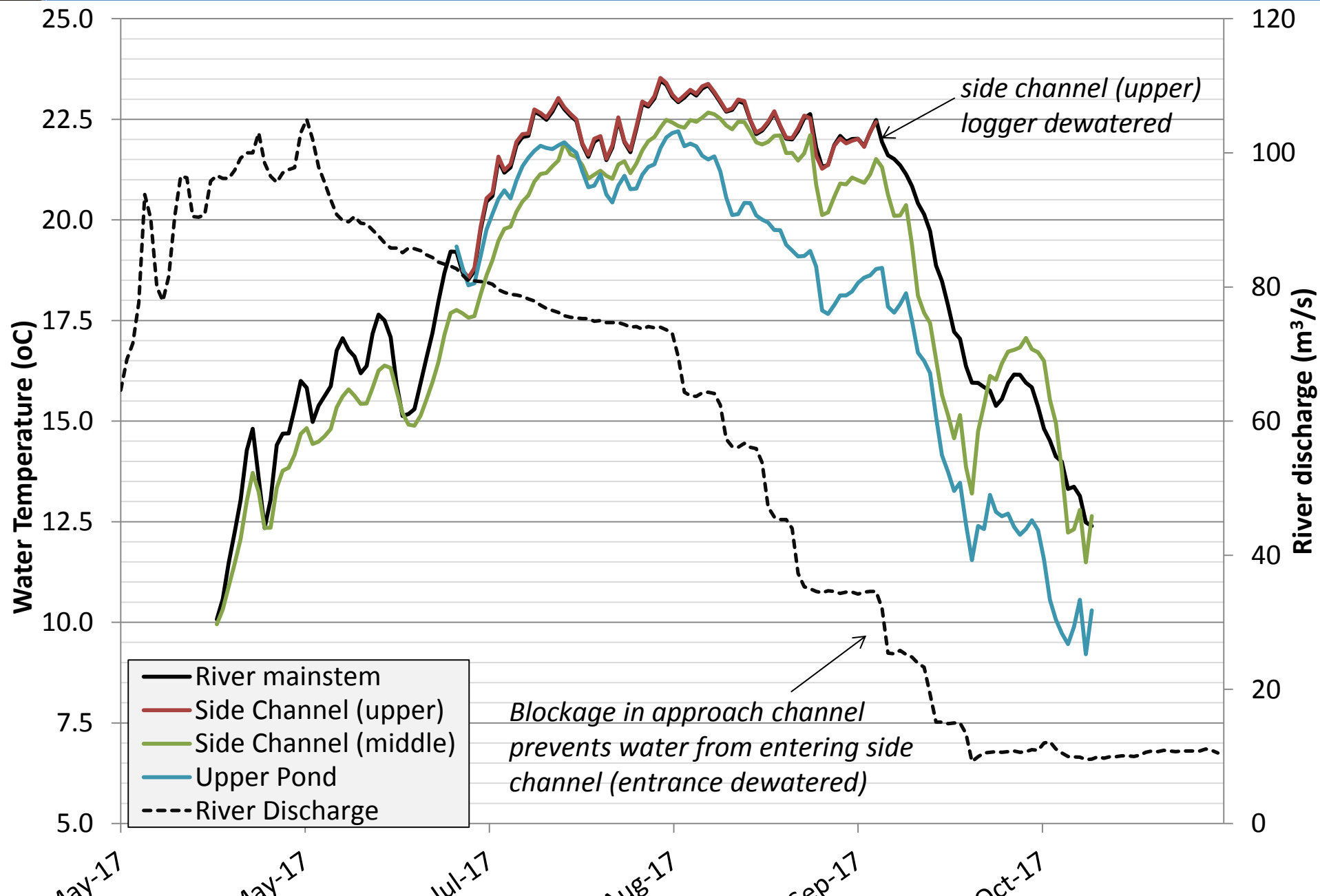
## *PHASE II*

- the side channel was inundated during high flows ( $30 \text{ m}^3/\text{s}$ )





# ORRI – PHASE II



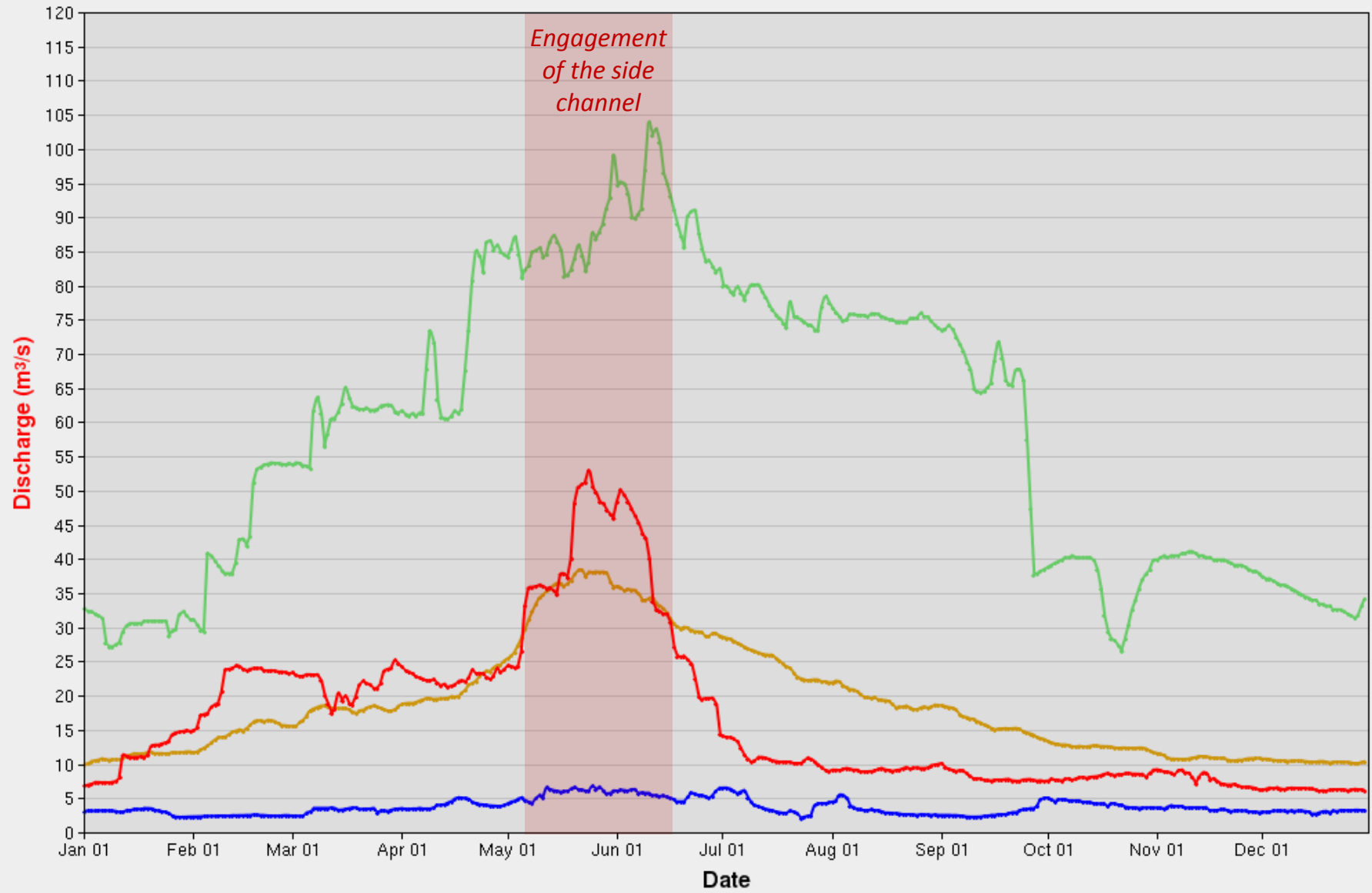


# ORRI – PHASE II



— 2015 Data — Maximum — Minimum — Mean

## EXAMPLE OF A MEDIAN FLOW YEAR



# CHINOOK SALMON



- Chinook emerge March or April and are poor swimmers (Everest & Chapman 1972)
- Chinook rearing in incised channelized reaches lacking complexity is impacted as juveniles are displaced downstream in high flows, highlighting the importance of off-channel rearing areas (Jefferys et al. 2008)



# CHINOOK SALMON



- After emergence stay in the Okanagan to feed before smolting to the ocean
- Ephemeral floodplain habitat provide ideal conditions for growth of phytoplankton with low velocity; high clarity and temperature (Ahernn et al 2006).
- Feeding success is greater in floodplain than the river for juvenile chinook (Sommer et al 2001).





# LOUGHEED FLOODPLAIN



2004 - BEFORE



**disconnected floodplain**  
(hayfield/infrastructure)

2008 - BEFORE



**disconnected floodplain**  
(hayfield)

2010 - AFTER



**re-connected floodplain**  
(called "Lougheed")

2016 - AFTER



**re-connected floodplain**  
(enhanced overtime)



# LOUGHEED FLOODPLAIN



2011 & 2016 (85 m<sup>3</sup>/s)



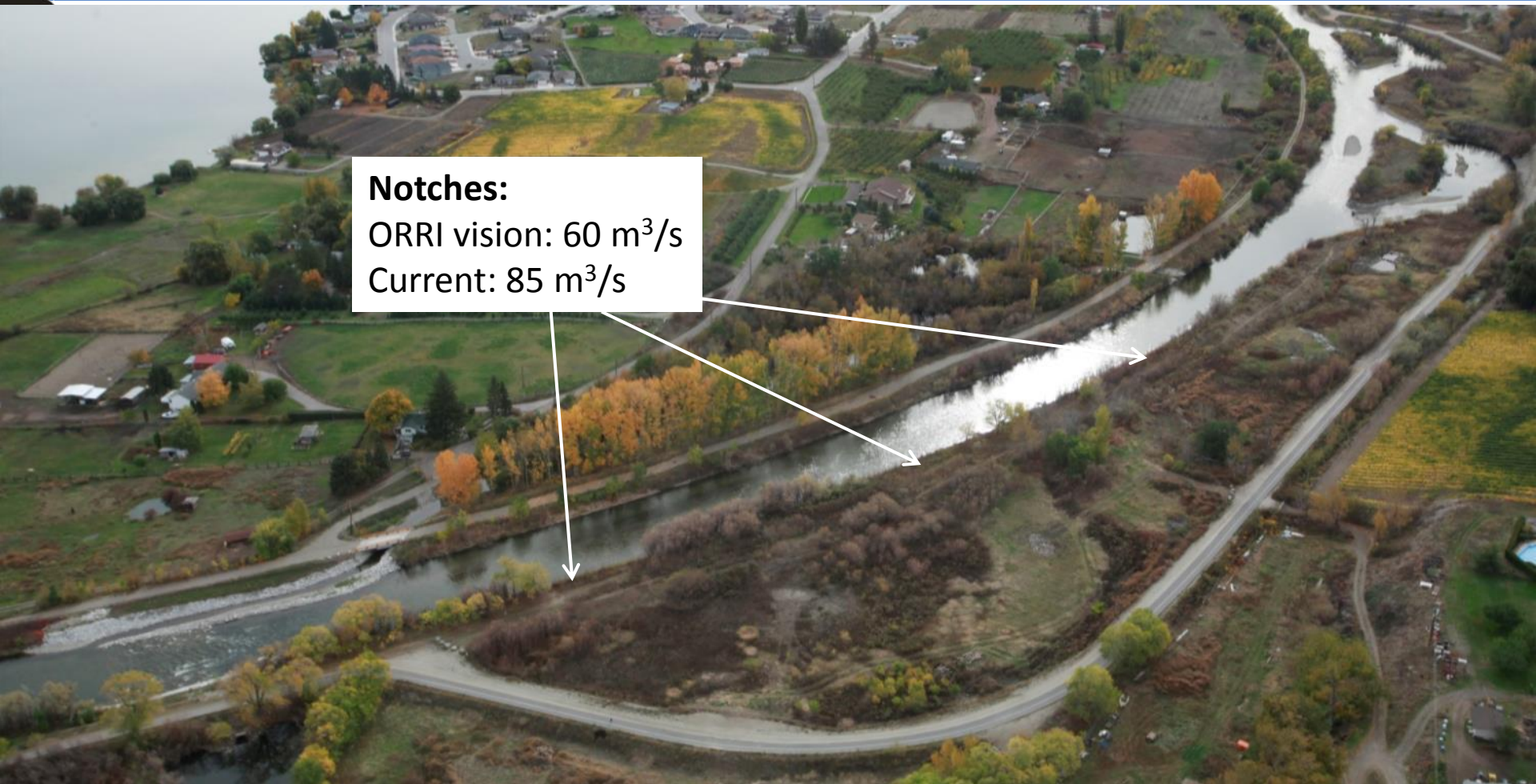
Areas inundated in 2016 at peak flow (85 m<sup>3</sup>/s)



Areas also inundated in 2011 at 85 m<sup>3</sup>/s (but with debris at VDS 13)



# LOUGHEED FLOODPLAIN



## Notches:

ORRI vision:  $60 \text{ m}^3/\text{s}$

Current:  $85 \text{ m}^3/\text{s}$

## Target species:

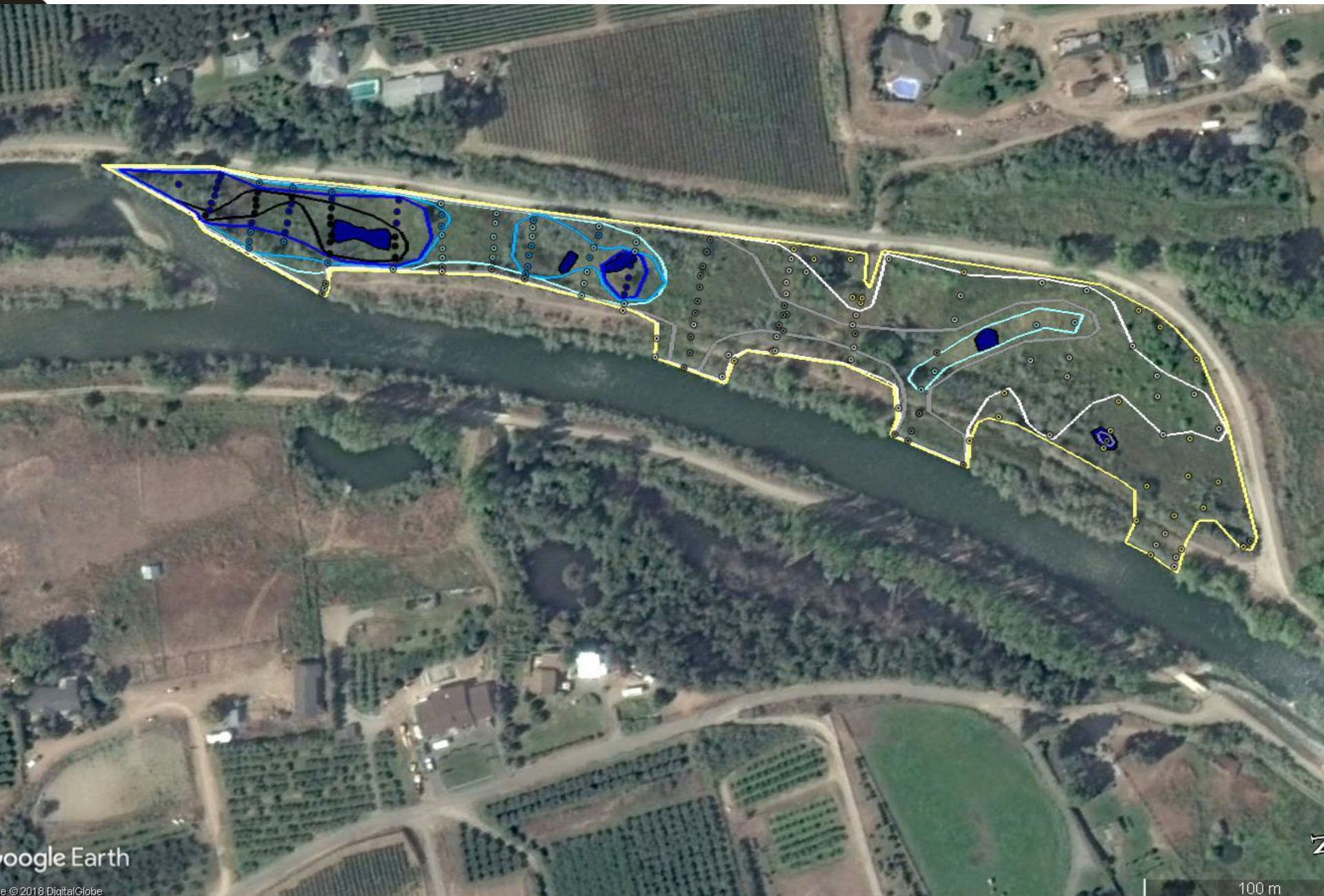
- Yellow-breasted Chat
- Great Basin Spadefoot & Tiger Salamander
- juvenile Chinook (rearing)

## Goals:

- Enhance long term floodplain & riparian habitats for local indigenous species (incl. SAR).
- Provide a diversity of habitats as found in Cottonwood Ecosystems of southern Interior.



# LOUGHEED FLOODPLAIN





# LOUGHEED FLOODPLAIN



55 m<sup>3</sup>/s  
(Q<sub>50%</sub>)



70 m<sup>3</sup>/s  
(Q<sub>30%</sub>)



85 m<sup>3</sup>/s  
(Q<sub>10%</sub>)



# LOUGHEED FLOODPLAIN



## ***GOALS 2018:***

- Create a Cottonwood meadow.
- inundated at spring flows
- drain completely for no stranding of indigenous fish
- OUTCOMES TBC



# SPAWNING BEDS in PENTICTON



## 1909 NATURAL RIVER & FEATURES



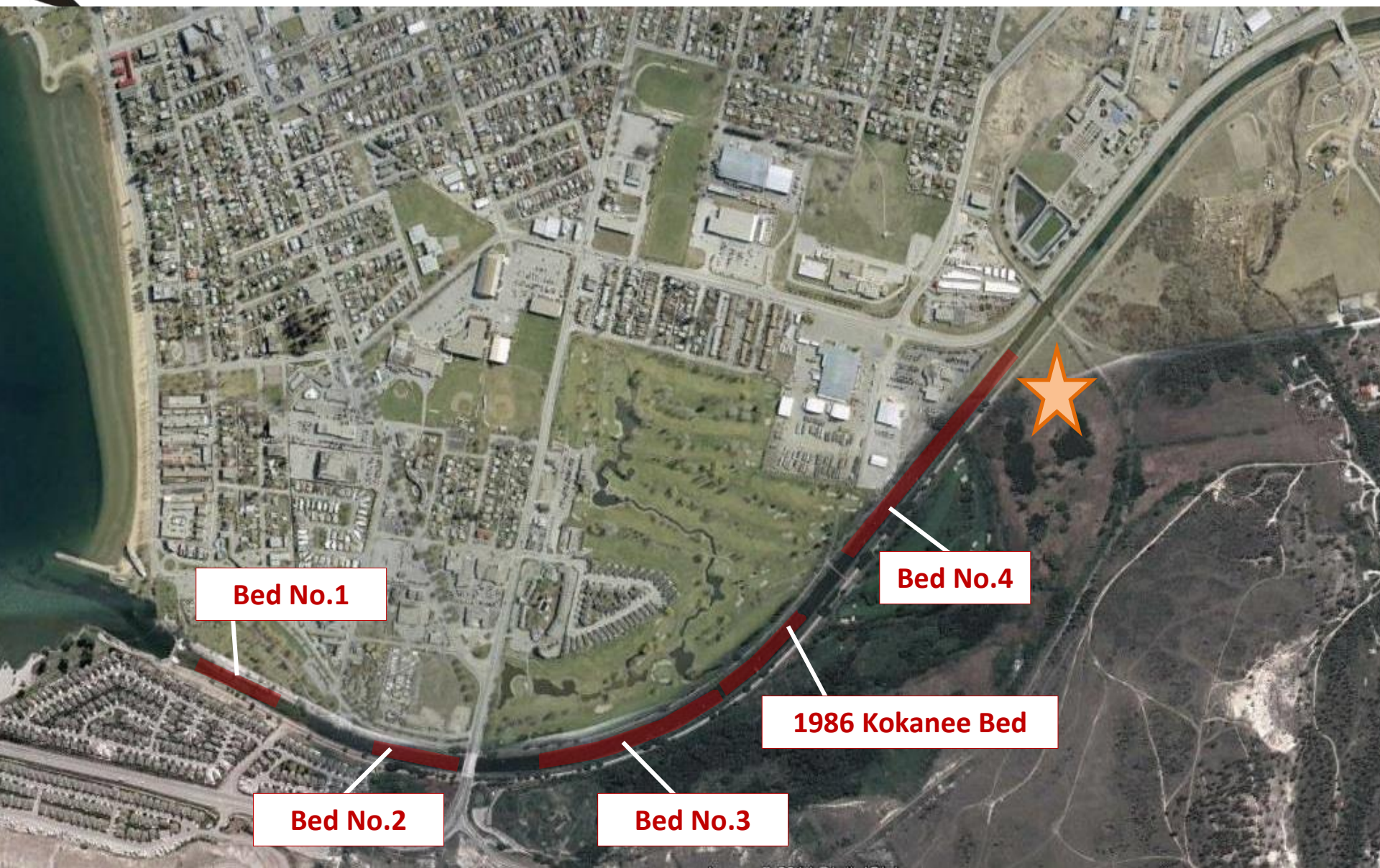
## 1950's HABITAT LOST



## 2014-NOW SPAWNING BEDS



# SPAWNING BEDS in PENTICTON



**Bed No.1**

**Bed No.4**

**1986 Kokanee Bed**

**Bed No.2**

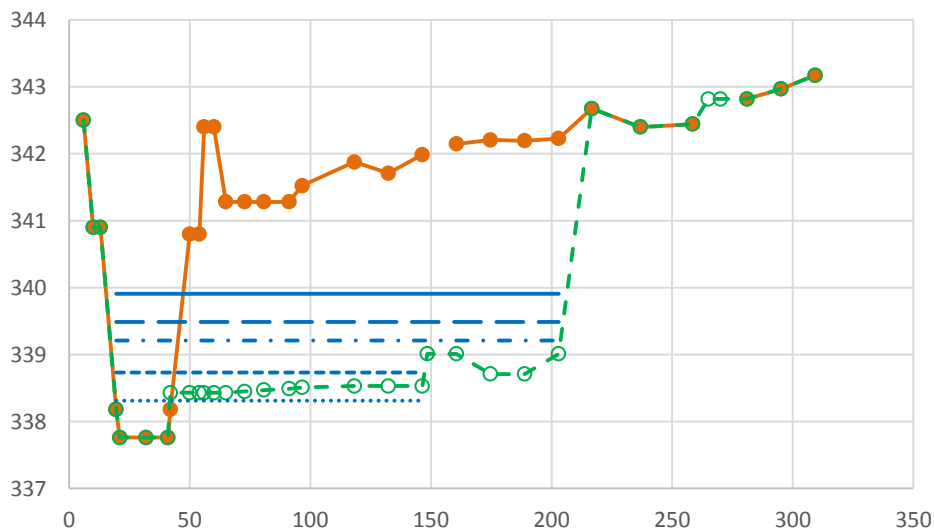
**Bed No.3**



## GOALS:

- Restore floodplain habitats,
- create Chinook rearing pond,
- restore fish-free floodplain, and
- riparian habitat for aquatic wildlife.

Pond cross section



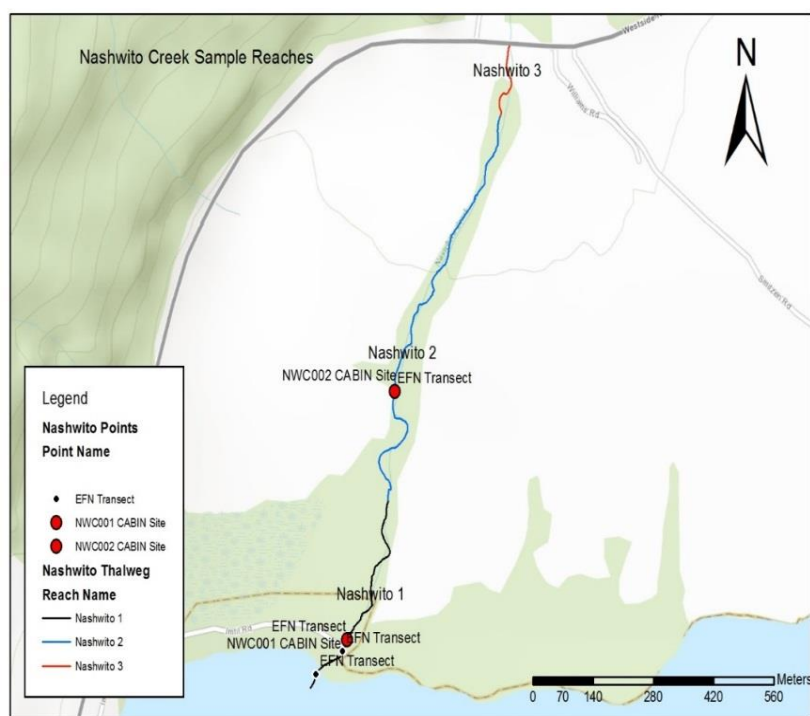
# ENVIRONMENTAL FLOW NEEDS



## ENVIRONMENTAL FLOW NEEDS

**(EFN):** volume and timing of stream flow required for proper functioning of the aquatic ecosystem.

	Duration	Time Period	Original EFN Target (cms)
Fry / Smolt emmigration	7 day	Apr 1 - Apr 30	1.120
Flushing Flows	1 day	Apr 15 - June 30	4.480
Migration / Spawning - large rainbow	30 day	May 1 - June 30	1.591
Freshet rampdown	7 day	June 15 - July 7	0.448
Rearing - rainbow	30 day	July 1 - Oct 31	0.336
Migration - kokanee	7 day	Aug 22 - Oct 21	0.224
Spawning - kokanee	30 day	Aug 22 - Oct 21	0.224
Incubation	30 day	Oct 15 - March 31	0.224



# THANK YOU - LIM LIMPT



## ***ks p'el'k'stim***

*“Balancing indigenous knowledge and western science to manage, protect and restore indigenous fisheries resources and aquatic habitat with the Okanagan Territory”*



**For more info: Kari**

ONA Fisheries Department

[kalex@syilx.org](mailto:kalex@syilx.org); 1-866-662-9609

# THANK YOU - LIM LIMPT



Jeffers, C.A., J.J Opperman, P.B. Moyle. 2008. Ephemeral floodplain habitats provide best growth conditions for juvenile Chinook Salmon in a California river. *Environ. Biol. Fish.* 83:449-458.

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Sommer, T.R, M.L. Nobriga, W.C. Harrell, W. Batham, and W.J. Kimmerer. 2001. Floodplain rearing of juvenile chinook salmon: evidence of enhanced growth and survival. *Can. J. Fish. Aquat. Sci.* 58:325-333.

Everest, F. H and Chapman D.W. 1972. Habitat selection and special interaction by juvenile Chinook salmon and steelhead trout in two Idaho streams. *J. Fish. Res. Board Canada.* 29: 91-100.