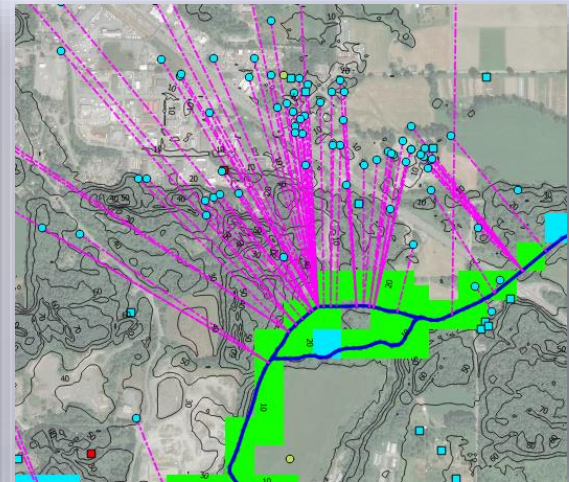




Ministry of Forests, Lands, Natural Resource Operations  
and Rural Development

# Update on Water Shortages in Koksilah Watershed



*Pat Lapcevic and Cali Melnechenko*

*Presentation to:*

*Cowichan Watershed Board July 29<sup>th</sup>, 2019*



## Outline

- Regional/Provincial Drought response
- Monitoring
- Koksilah Watershed Update





# Drought Indicator Summary

**Table 3: Drought Indicators Criteria Summary**

		Timing of Use	
		Early Season (Jan-May)	Seasonal (June-Oct)
<b>Indicator</b>	<b>Core Indicators</b>	Basin Snow Measures Seasonal Volume Runoff Forecasts	7-Day Average Streamflow 30 Day Percent of Average Precipitation
	<b>Supplemental Indicators</b>	Aquifer Levels Individual Indicator Hydrometric Station Results Multi-Year Trends Reservoir Inflows Wildfire Danger Class Ratings	

**Table 4: Core Indicator Thresholds**

	Level 1 (Green)	Level 2 (Yellow)	Level 3 (Orange)	Level 4 (Red)
Basin Snow Measures±	>80%	80-65% of normal	<65% of normal	
Seasonal Volume Runoff Forecasts	>80%	80-61% of normal	60-45% of normal	<45% of normal
30 Day % of Average Precipitation ¥	>80%	80-51% of average	50-25% of average	<25% of average
7-Day Average Stream flow	>25 percentile	11-25 percentiles	6-10 percentiles	<6 percentiles

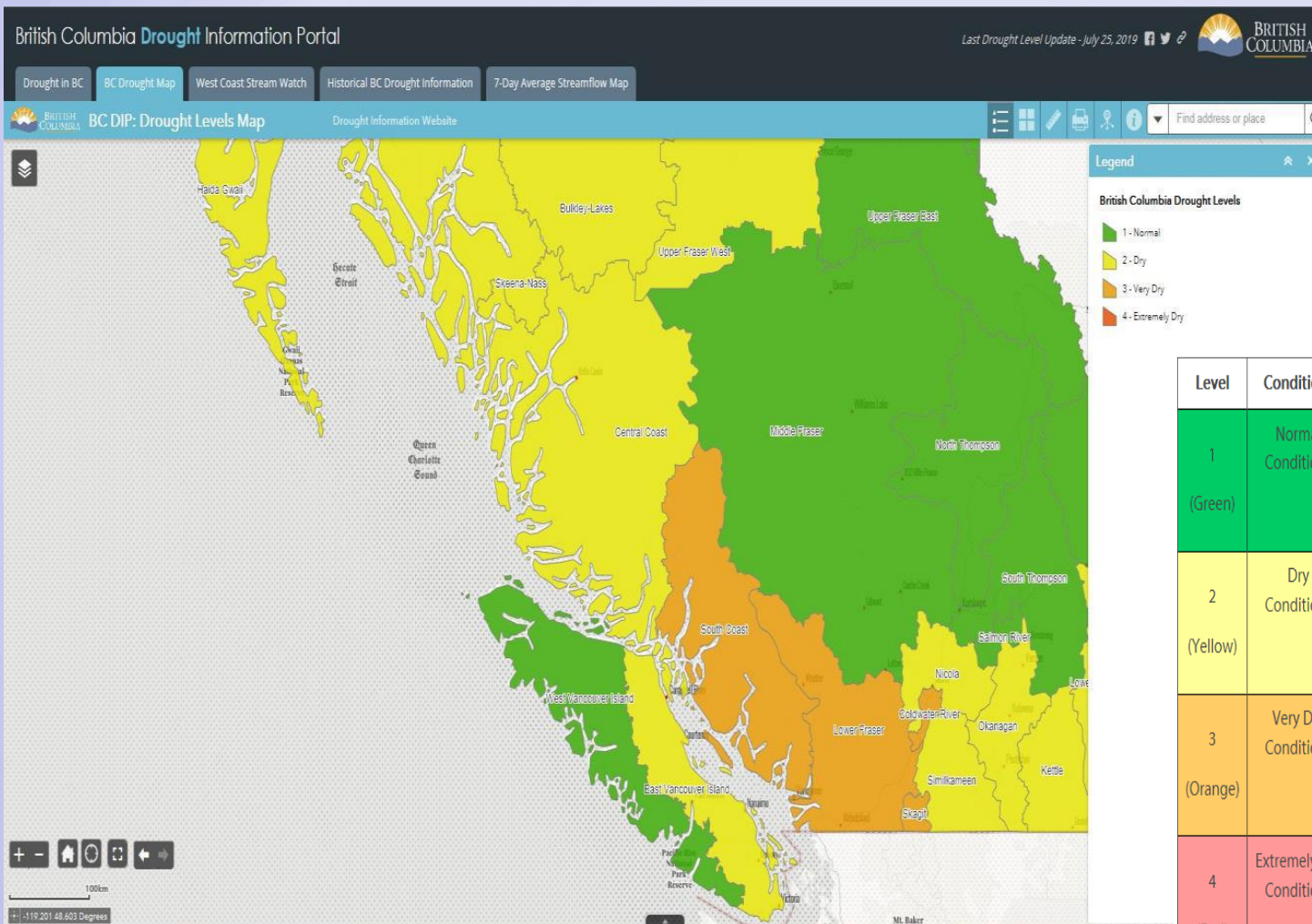


## **Tools: Determining Drought Levels**

- Canada Water Survey Real-Time Hydrometric Data Map
- Agriculture & Agri-Food Canada Drought Watch
- Water Stewardship - Hydrometric Stations
- Community Water Supply Monitoring (reservoir levels)
- Ecosystems – EFN & CEFT Monitoring
- BC Snow Station Interactive Map
- Provincial Groundwater Observation Well Network
- River Forecast Centre:
  - CLEVER Model 10-day Forecast
  - COFFEE Model 5-Day Forecast



# Drought Levels (July 25, 2019)



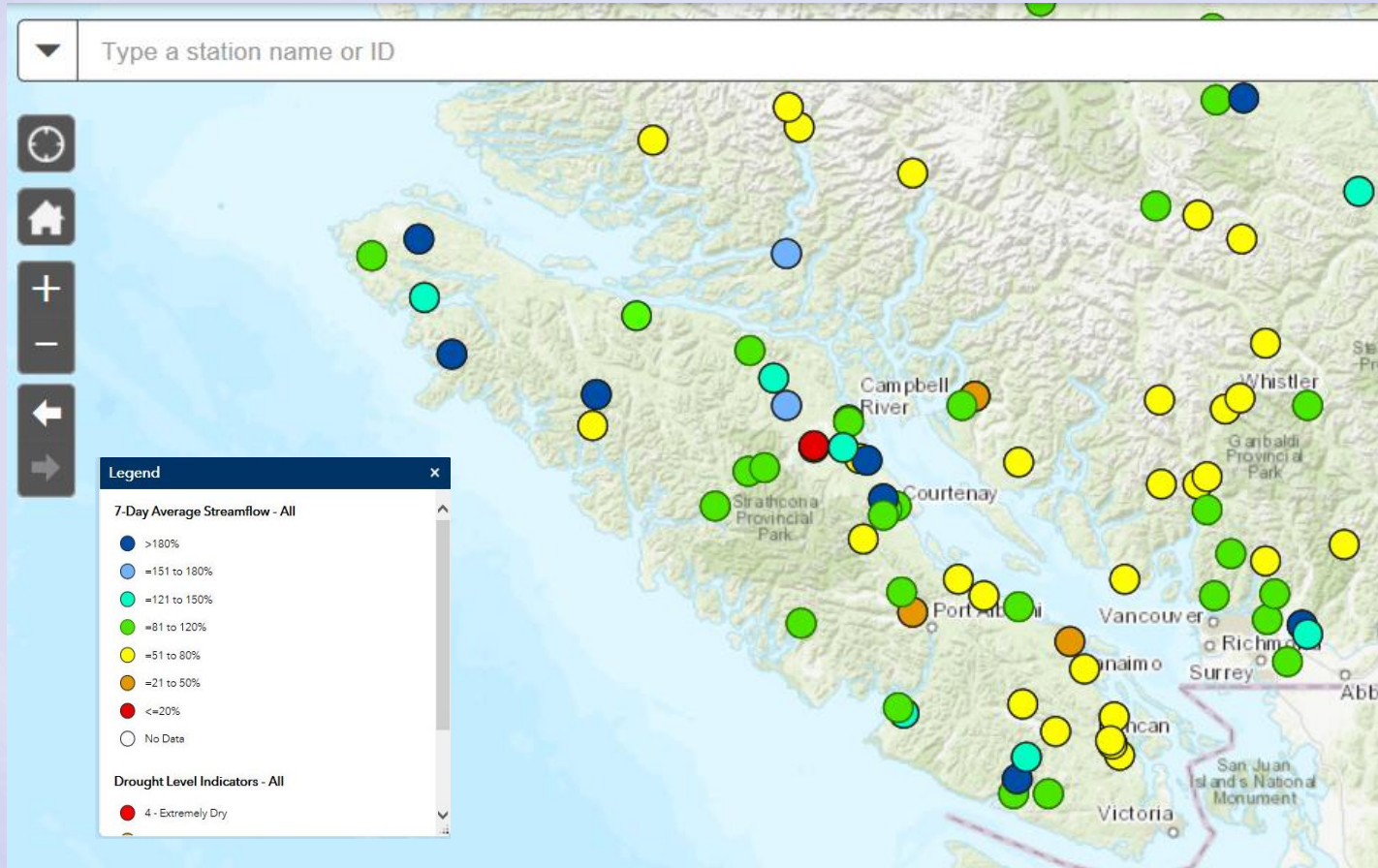
Drought Classification

Level	Conditions	Significance	Objective
1 (Green)	Normal Conditions	There is sufficient water to meet human and ecosystem needs	Preparedness
2 (Yellow)	Dry Conditions	First indications of a potential water supply problem	Voluntary conservation
3 (Orange)	Very Dry Conditions	Potentially serious ecosystem or socio-economic impacts are possible	Voluntary conservation and restrictions
4 (Red)	Extremely Dry Conditions	Water supply insufficient to meet socio-economic and ecosystem needs	Voluntary conservation, restrictions and regulatory action as necessary



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## 7 Day Average Streamflow (July 25, 2019)



### BC Drought Information Portal:

<https://www2.gov.bc.ca/gov/content/environment/air-land-water/water/drought-flooding-dikes-dams/drought-information>



# 2019 Flow Monitoring Program

## Stream Watch List:

- At risk of severe low flows due to considerable user demand, and of significant ecological or fisheries value:

Koksilah River

Chemainus River

French Creek

Black Creek

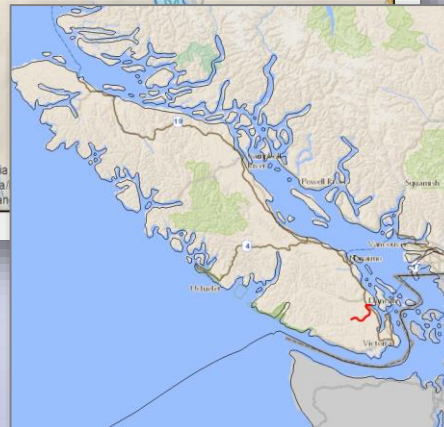
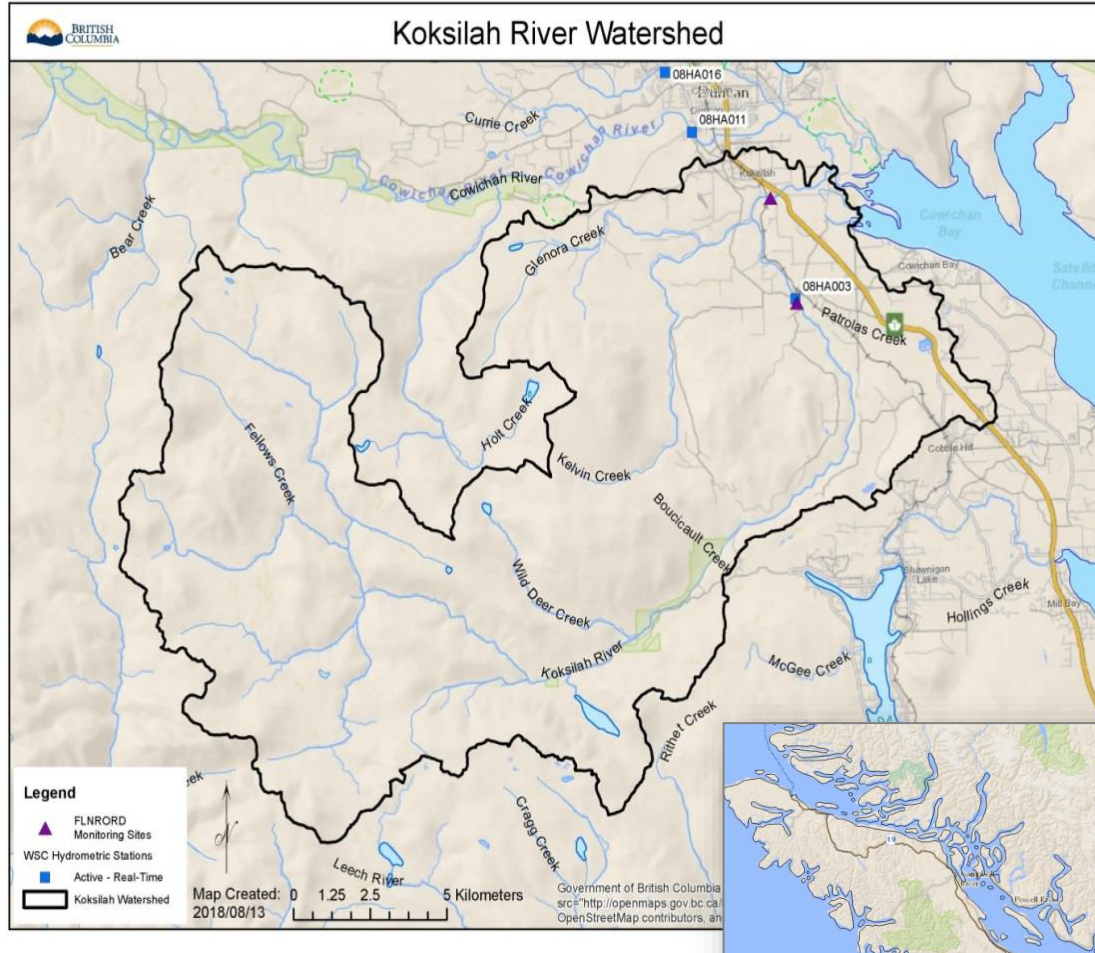
Fulford Creek

Millstone River

Tsolum River



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- Rain-dominated watershed
- No storage structure
- Historical low summer flows & high water temperatures
- Habitat for anadromous salmon, steelhead, trout
- Traditional use of fish, wildlife and water by local First Nations
- High domestic, agricultural run-of-river and groundwater demands in the middle and lower watershed
  - 170 SW licences
  - 77 GW licences/applications
  - 1328 registered wells





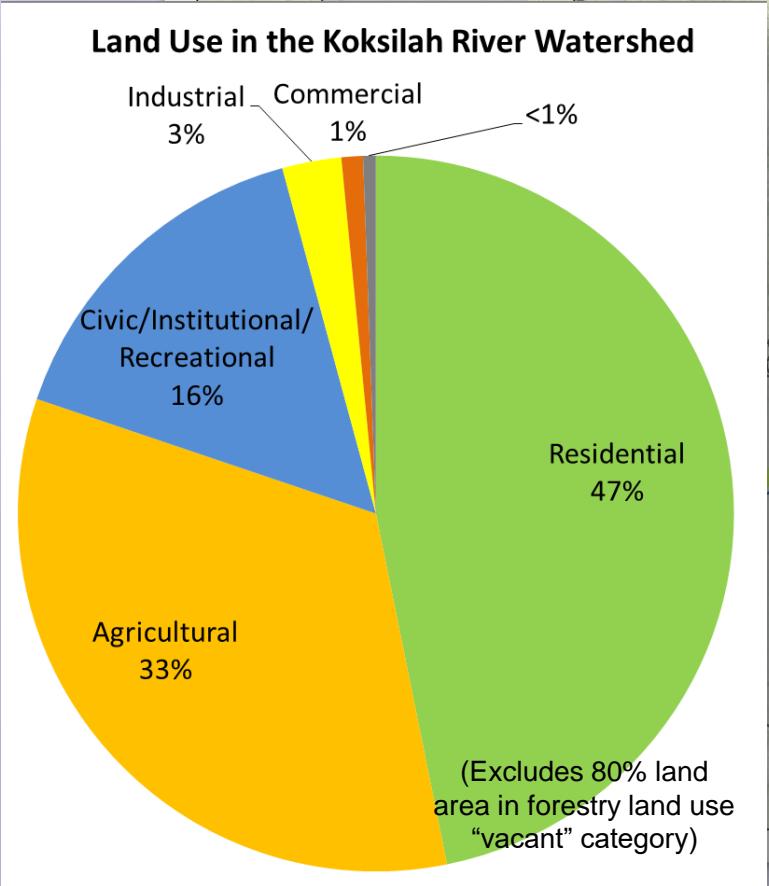
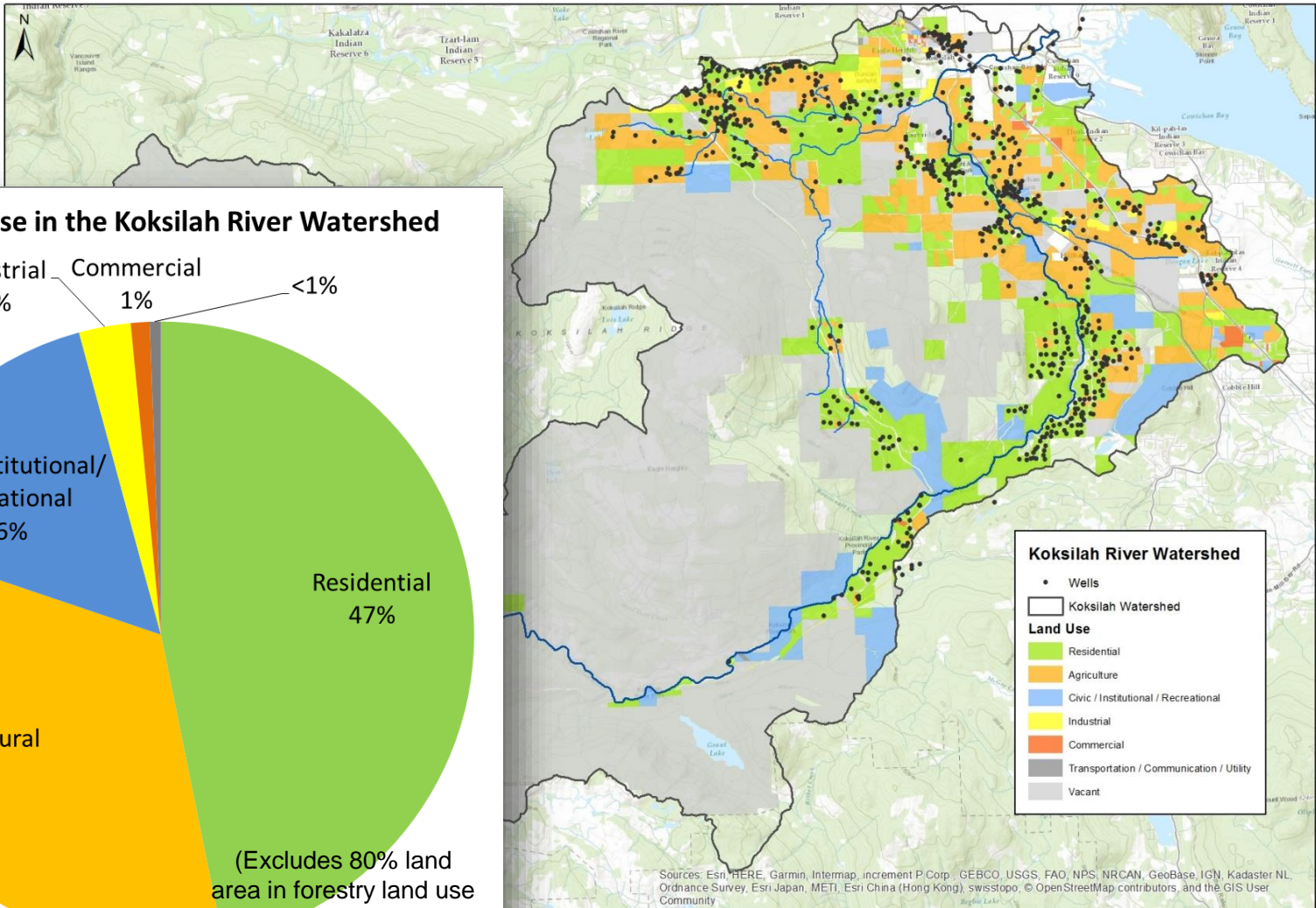
## Cumulative impacts in Koksilah Basin

- Climate change resulting in increased length of dry season, reduced snow pack
- Forestry and change in land use (e.g. high road density affecting natural hydrologic function)
- Urban development
- Industrial and commercial activities (quarries, pollution discharges)
- Agricultural impacts on surface and groundwater quality (e.g. phosphorus, nitrate)
- Significant declines in populations of salmonid species (steelhead, coho, chinook, rainbow trout)

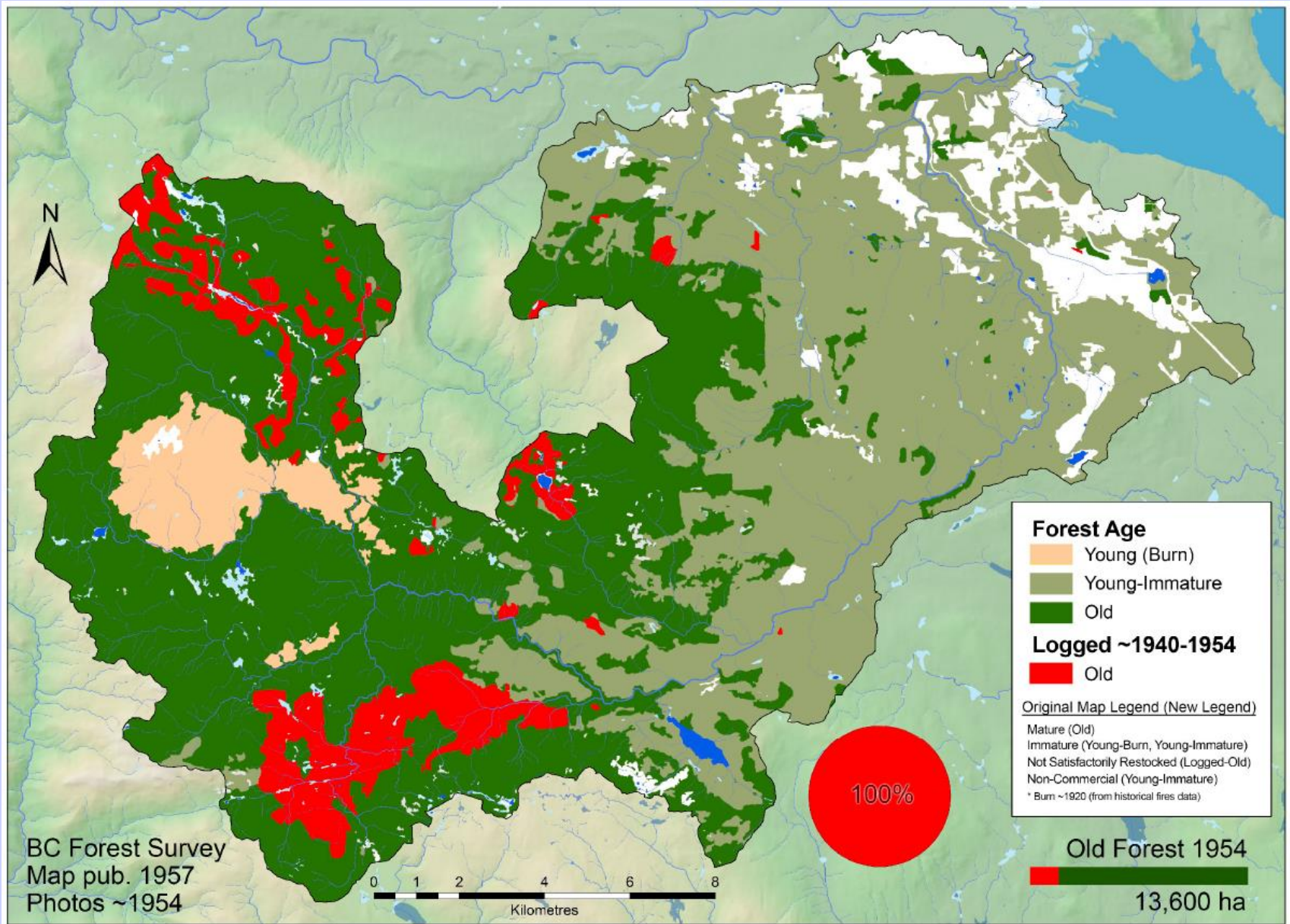




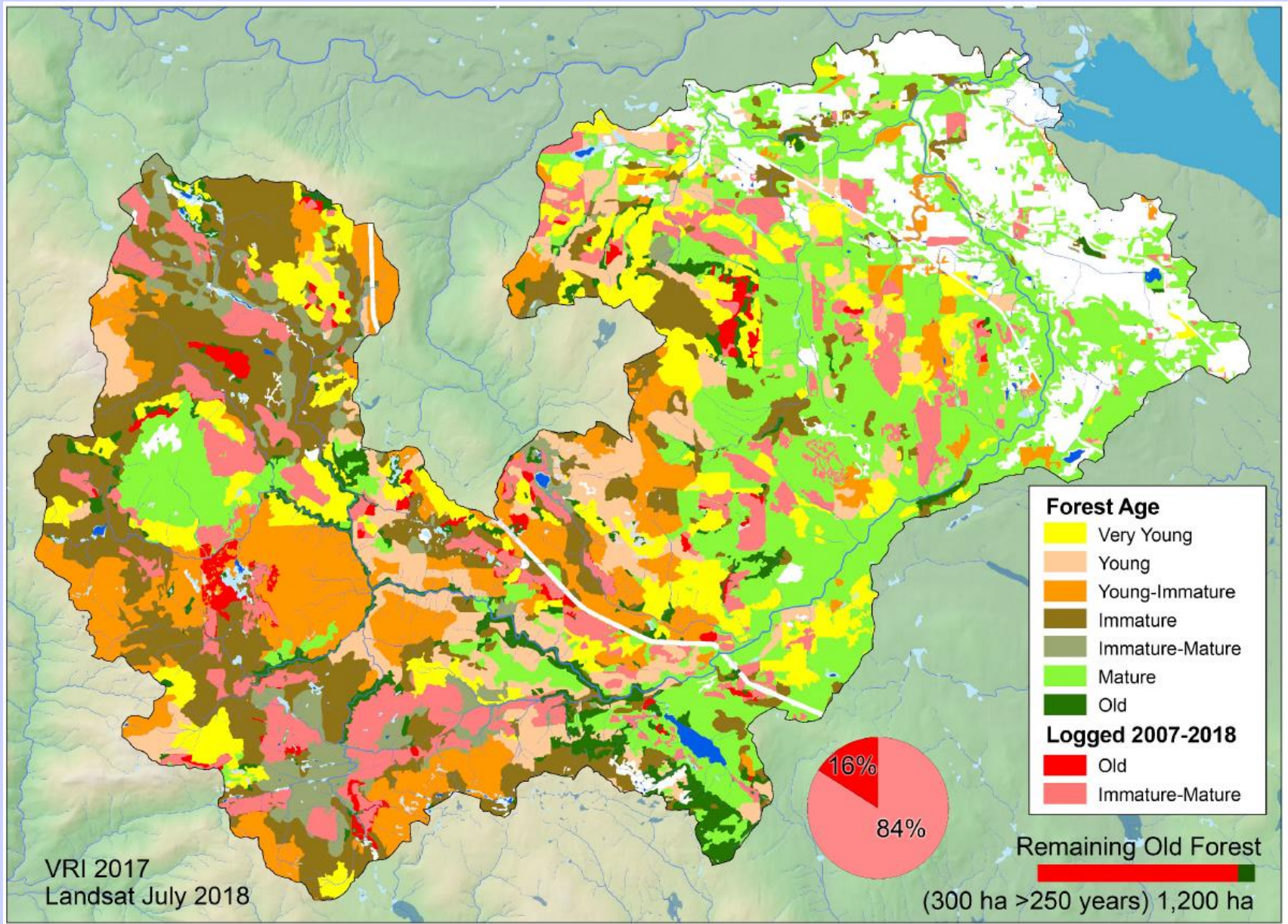
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Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, © OpenStreetMap contributors, and the GIS User Community



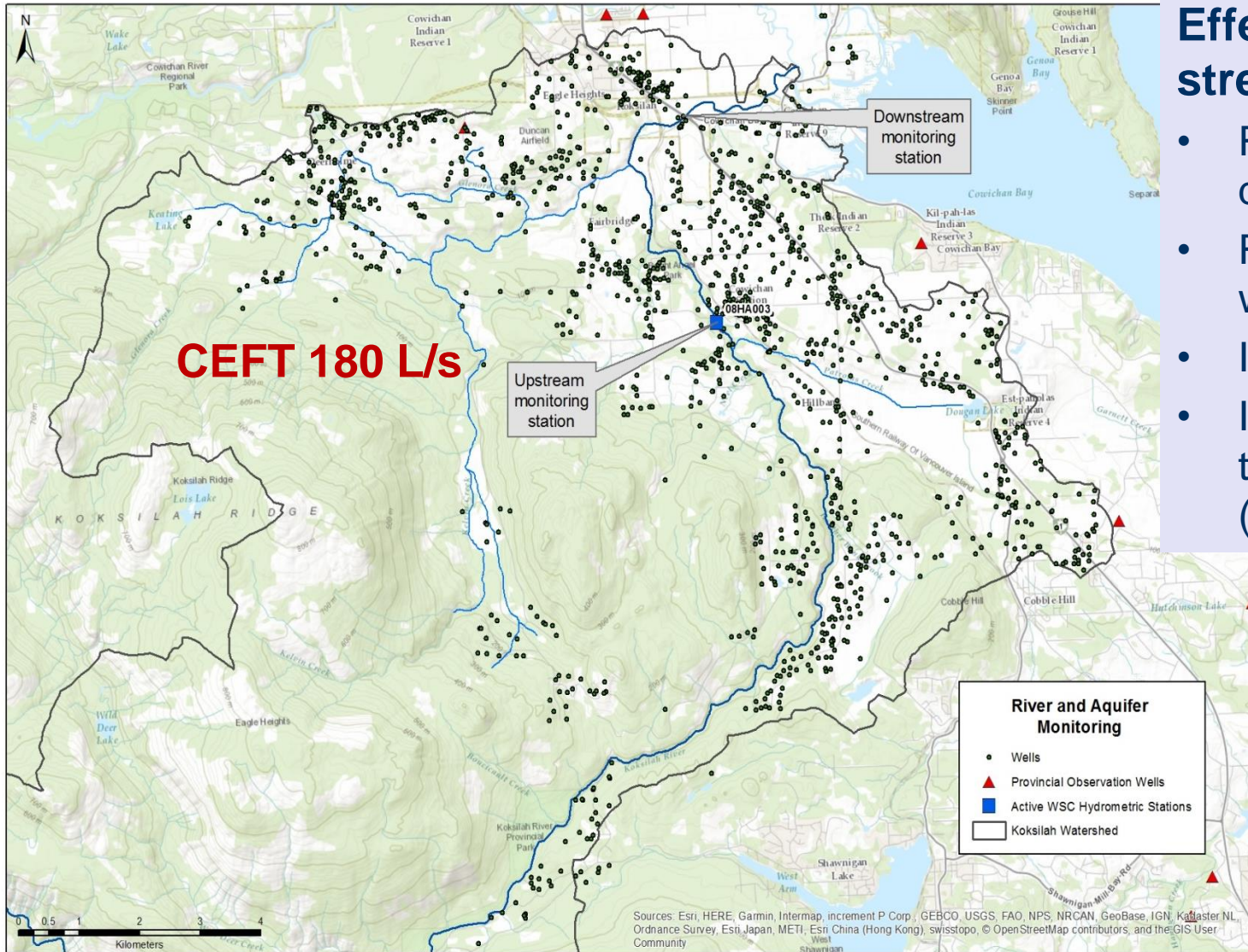
Credit: Doyle-Yamaguchi & Pritchard. Koksilah ecosystem-based conservation plan.  
Cowichan Station Area Assn. (2019, In Progress)



Credit: Doyle-Yamaguchi & Pritchard. Koksilah ecosystem-based conservation plan.  
Cowichan Station Area Assn. (2019, In Progress)



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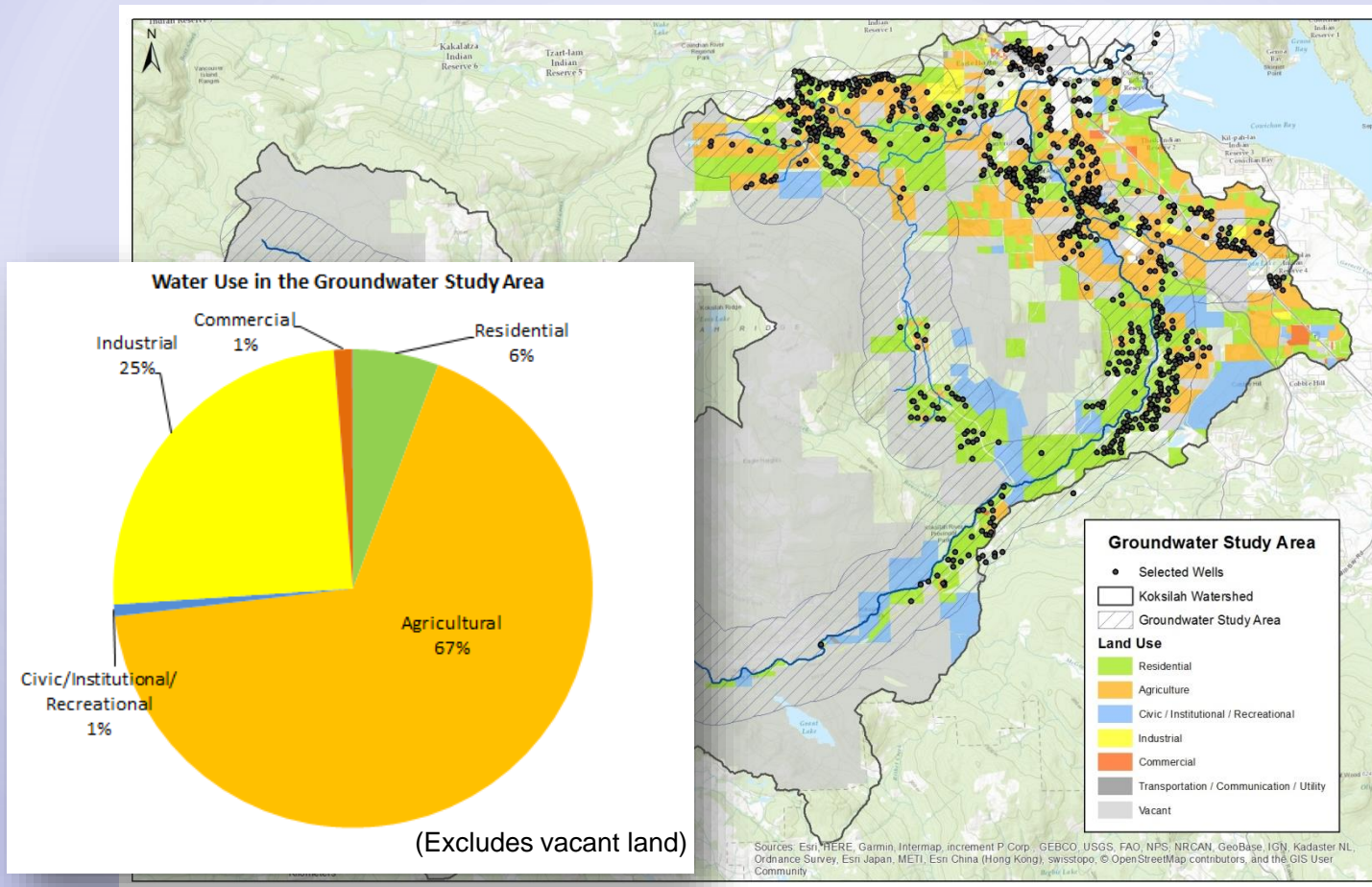
## Effects of low stream flow:

- Reduced water depth over riffles
- Reduced channel width
- Isolated pools
- Increased water temperatures (thermal stress)



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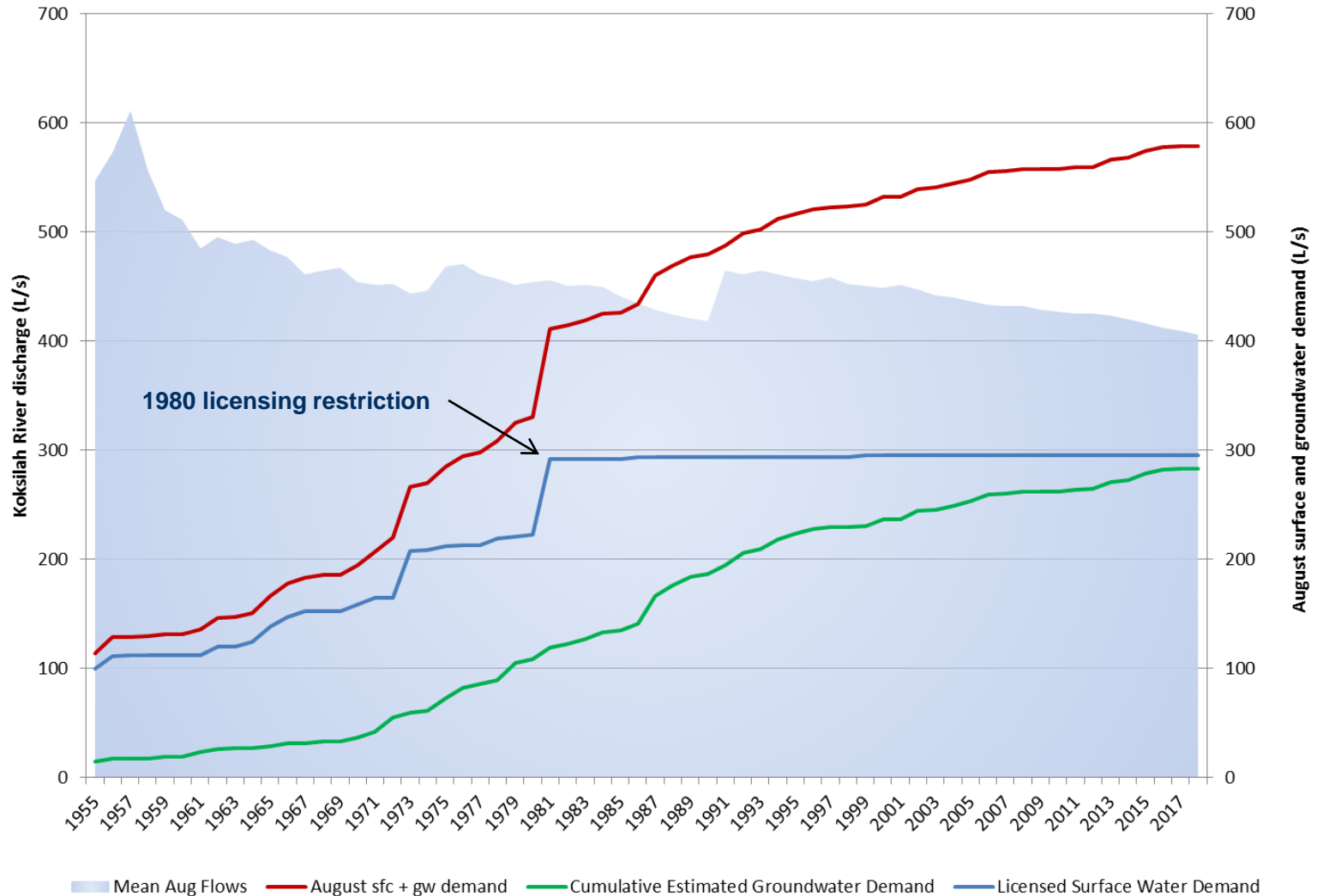
- ## Groundwater Use by Sector – 2018 Analysis
- 858 wells within 1 km of Koksilah and main tributaries
  - 28 water systems (93% groundwater)





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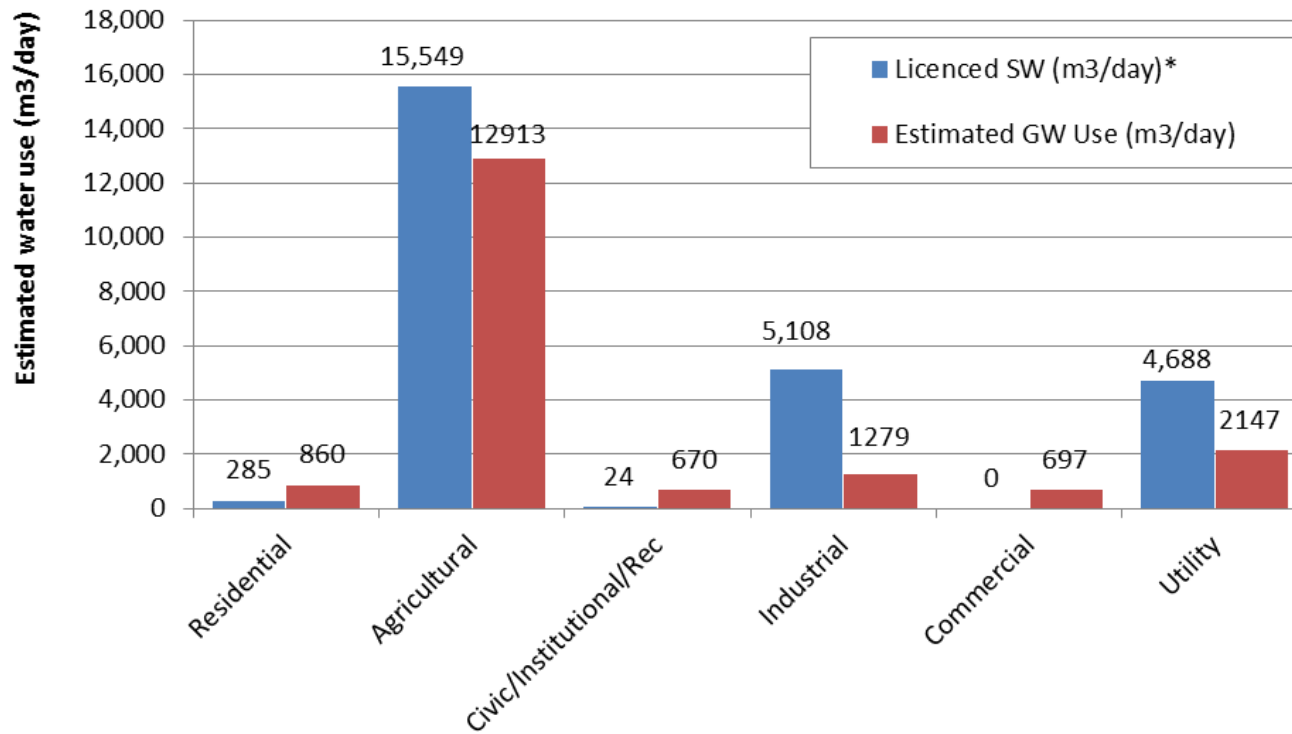
## Koksilah River Median August Discharge vs Water Demand (1955-2018)





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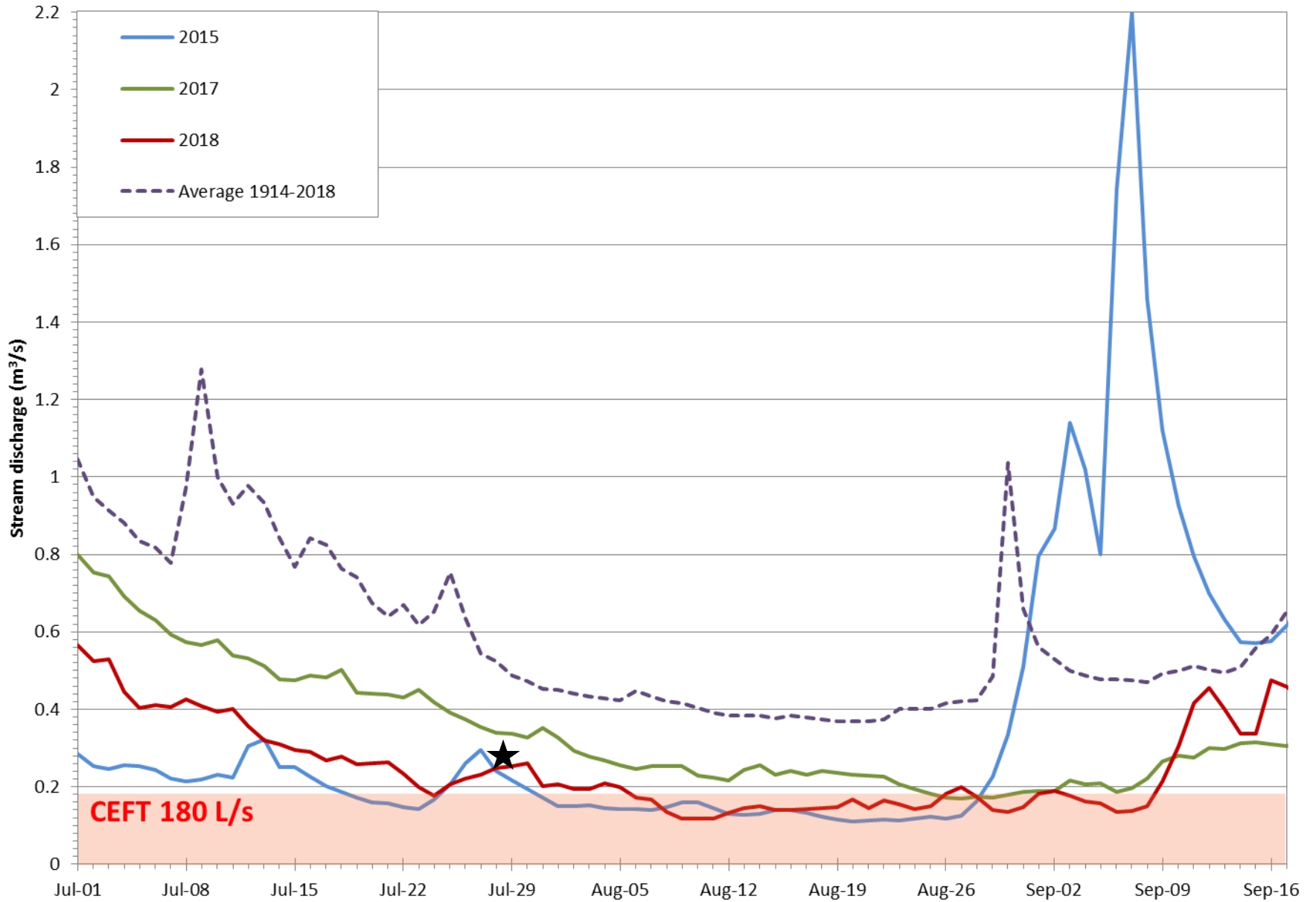
## Daily estimated water use by purpose in the Koksilah watershed



\* Daily demand for August. Does not include non-consumptive purposes.



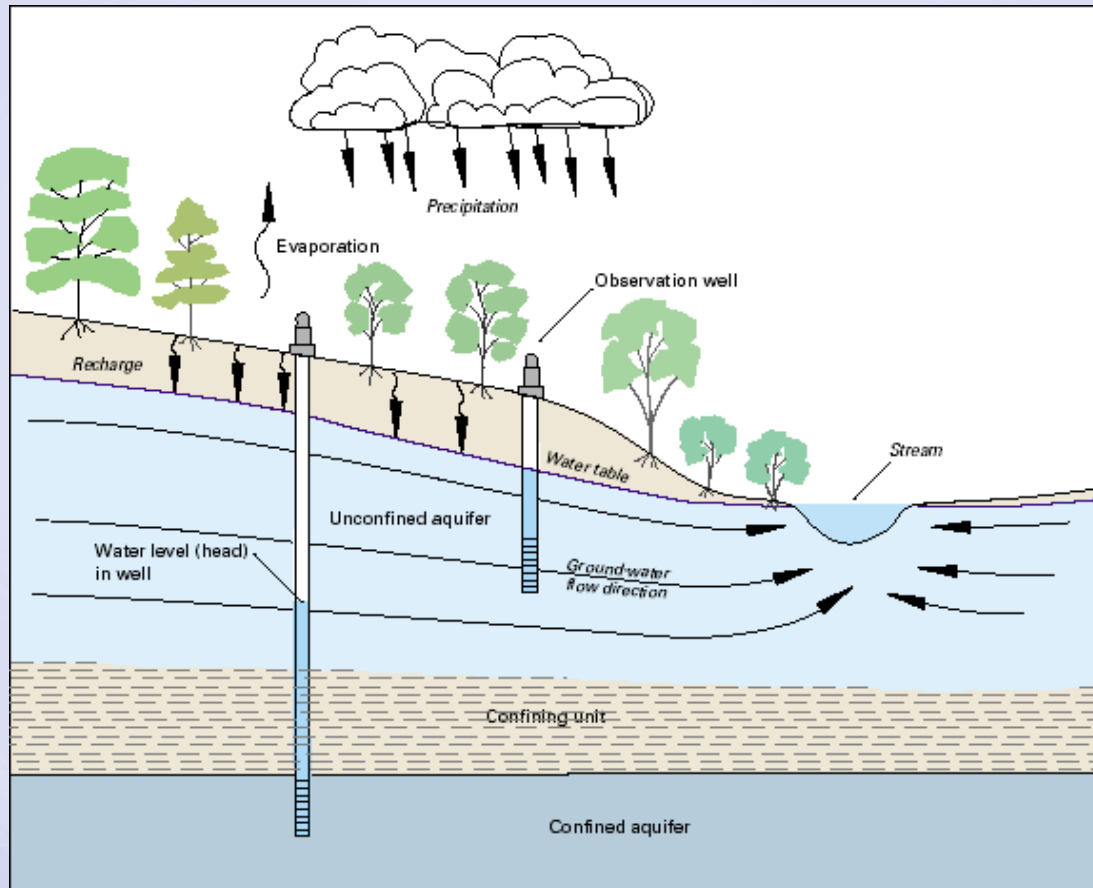
# Discharge Koksilah River at Cowichan Station (08HA003)





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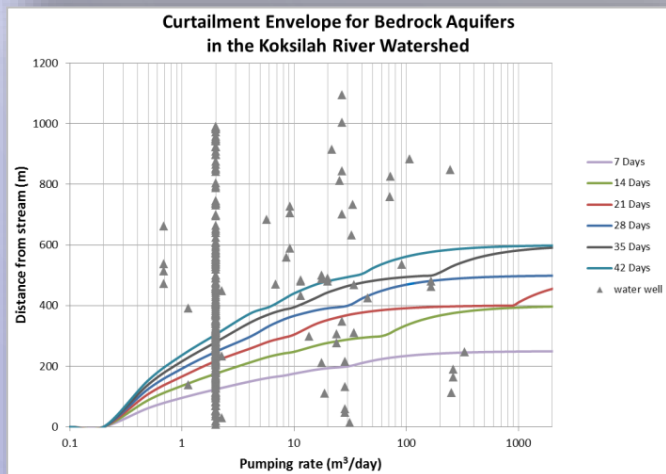
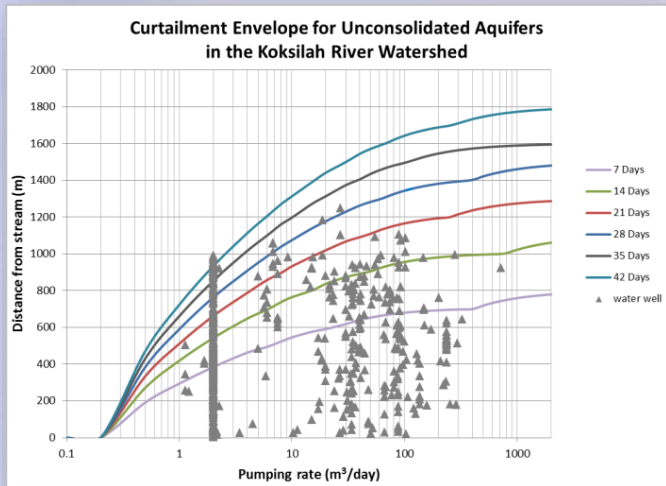
## Impacts to the environment – hydraulic connectivity



Credit - USGS



## Groundwater Curtailment Model



- Compile data on aquifer properties
  - Transmissivity and storativity values based on previous studies for similar aquifer types (e.g., Foster and Allen, 2014; Carmichael, 2014)
  - Affect pumping response and lag time
- Determine remaining model inputs
  - Curtailment period, minimum flow
- Calculate curtailment envelope
  - Spreadsheet: Baye and Rathfelder (ENV)
- Merge surface and groundwater datasets to determine priority rank (FITFIR)



# What are we protecting?

## Water Users

*Licensed or regulated users under the Water Sustainability Act including:*

- *Community Water Supplies*
- *Industrial and commercial water users*
- *Agricultural users*
- *Domestic Users*
- *Groundwater Users*

## Balancing Interests



## Ecosystems

*Environmental Flow Needs of systems:*

- *through voluntary conservation (Levels 2, 3 & 4).*

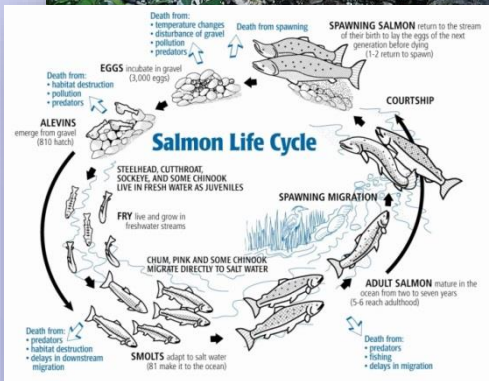
**&**

*Critical Environmental Flow Threshold (CEFT)*

- *Through targeted messaging (maximum conservation) and/or*
- *Temporary Protection Orders*
  - *Section 87 WSA*
  - *Section 88 WSA*



## WSA & Aquatic Ecosystems



### Environmental Flow Needs (EFN)

- Volume and timing of water flow required for the proper function of the aquatic ecosystem of the stream (all aquatic life)
- Considered in decisions related to water licensing from a stream or hydraulically connected aquifer (WSA S. 15)

### Critical Environmental Flow Threshold (CEFT)

- Volume of water flow in a stream below which significant or irreversible harm to the aquatic ecosystem of the stream is likely to occur – biological red line for fish

### Temporary Protection Orders

- A significant water shortage can be declared if flows in a stream fall below a CEFT (S. 86(1))

### Critical environmental flow protection order

- Water users may be required to stop diversion to prevent significant and irreversible harm, based on FITFIR priority date (S. 87)\*

### Fish population protection order

- Survival of a fish population is threatened; more flexible- used to regulate the *rate, timing, or type of water use* from a stream or hydraulically connected aquifer, not FITFIR based (S. 88)\*

\*Diversion of 250 L/d for essential household use permitted



## Management Actions 2017-2019



A water sustainability plan may be required for the users of the Koksilah watershed if drought continues. (File photo)

### Government sends letter urging conservation to users in Koksilah watershed

Water sustainability plan may be required

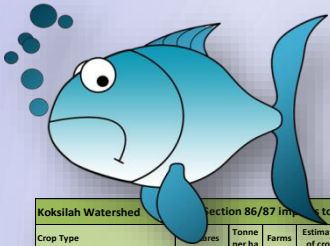
ROBERT BARRON / Jun. 14, 2019 12:00 p.m. / LOCAL NEWS / NEWS

While many in the Valley are focused on low water levels in Cowichan Lake and Cowichan River, the situation for residents who depend on water from the Koksilah watershed could be even worse.

- Letters:
  - Initial letters (all watersheds of concern)
  - Voluntary reduction letters
  - Licensees and inferred groundwater users
- Community meetings, e-bulletins, drought portal
- Direct communication
- Inspected river for active pumping and unauthorized diversions
- Flow monitoring
  - Koksilah, upper and lower watershed
  - Chemainus, upper and lower watershed



## Management Actions 2018



Koksilah Watershed Section 86/87 impacts to agriculture for entire watershed						8/29/2018	
Crop Type	Acres	Tonne per ha	Farms	Estimated value of crop/tonne	Total annual value of crop	Percent loss to shutdown	Value of loss for complete shutdown
Grass Forage Ha	802.8	11		\$ 220.00	\$ 1,942,776.00	20%	\$ 388,555.20
Field Corn Ha	124.9	48		\$ 50.00	\$ 299,760.00	10%	\$ 29,976.00
Market Veg HA	10.4			\$ 37,000.00	\$ 384,800.00	20%	\$ 76,960.00
Fruit Hectare	60.1			\$ 12,761.00	\$ 766,936.10	50%	\$ 383,468.05
Nursery/Tree containers	3.1			\$ 50,000.00	\$ 155,000.00	100%	\$ 155,000.00
Potential Crop Loss							\$ 1,033,959.35
Estimated Area Impacted						21%	\$ 217,131.44

Koksilah Curtailment Section 86/87 impacts to agriculture in curtailment zone						8/29/2018
Impact to Livestock				Pumps and tanks	Days required	
Dairy farms	10	\$	17,472.00			\$ 174,720.00
Poultry farms	4	\$	8,800.00			\$ 35,200.00
Delivered water loads/day	24	\$	190.00	32		\$ 145,920.00
Poultry production loss	4	\$	10,000.00			\$ 40,000.00
Milk production loss	10					
Total Impact to livestock						
Total Impacts to WSA Order						



- Data gathering/analysis for FITFIR list- licenced users (surface water and groundwater), and inferred unlicensed groundwater users
  - “Inferred”- who is using groundwater? How much? What might their priority date be?
- Modelled groundwater curtailment envelope
- Analyzed economic impact of issuing curtailment orders to agriculture community
  - Sec 86/87 (FITFIR): > \$4,000,000
  - Sec 88 (exclude livestock): \$217,131
  - Includes crop loss (potentially permanent), livestock culls for a four week curtailment period
- Developed draft briefing notes for the Minister with both Sec 86/87 and Sec 88 as options



## New and ongoing activities



- Expanding groundwater monitoring network:
  - 2 new observation wells drilled (Feb 2019)
  - 2 more planned for future; monitoring collaboration with regional government (CVRD)
- Two more flow monitoring stations added in Koksilah and Chemainus rivers
- Water Sustainability Plan scoping (working with Cowichan Tribes, CVRD, Cowichan Watershed Board)
- Groundwater curtailment model refinements
  - Include results from Western Water's hydraulic connectivity assessment





## Conclusions

- Hydrologic function within Koksilah basin affected by land use, water demand and climate change
- July-August streamflow below CEFT observed over successive years
- Determining groundwater influence on surface flows is complex
- Need to involve community to evaluate and address cumulative impacts while balancing ecologic values and economic impacts





# Ministry of Forests, Lands, Natural Resource Operations and Rural Development

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Jenny Fraser

John Baldwin

Jordan Rosenfeld

Klaus Rathfelder

Kyle Murray

Larry Barr

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