Jun 21st, 10:50 AM - 11:10 AM

Successful downstream passage of juvenile salmonids at a run-of-river hydro project in the Pacific Northwest

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Portland General Electric

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See next page for additional authors

Presenter Information
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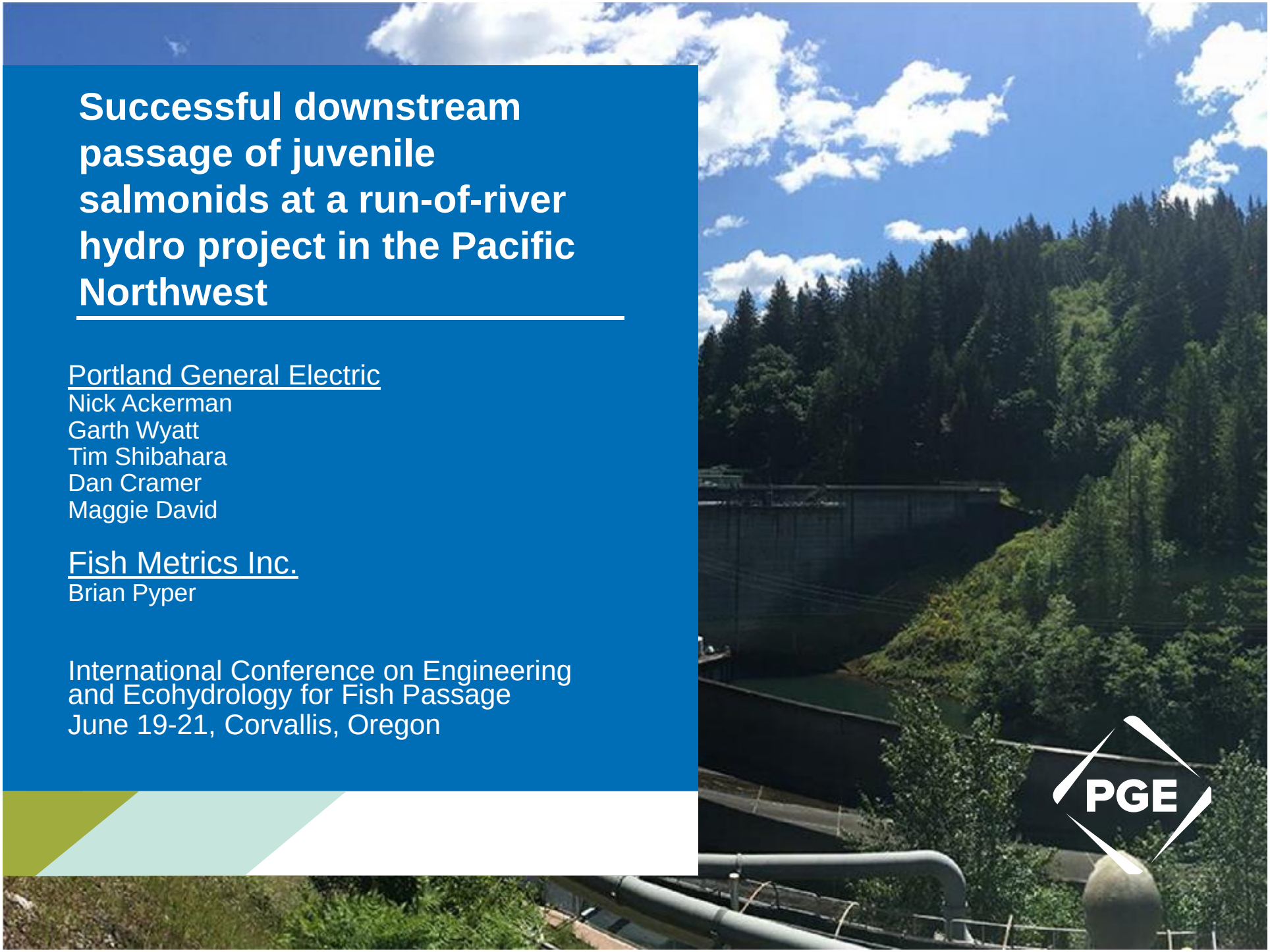
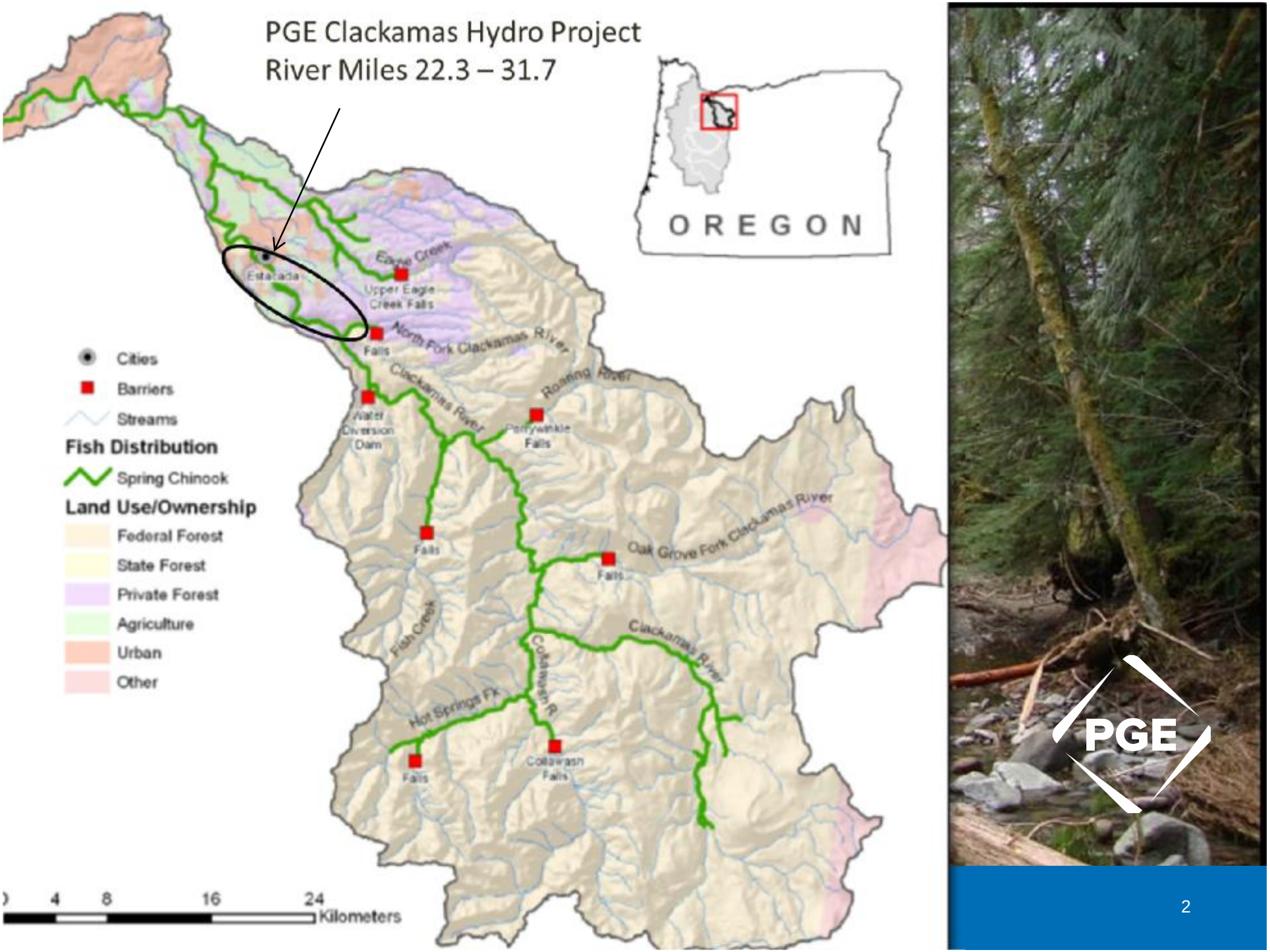
Fish Metrics Inc.
Brian Pyper

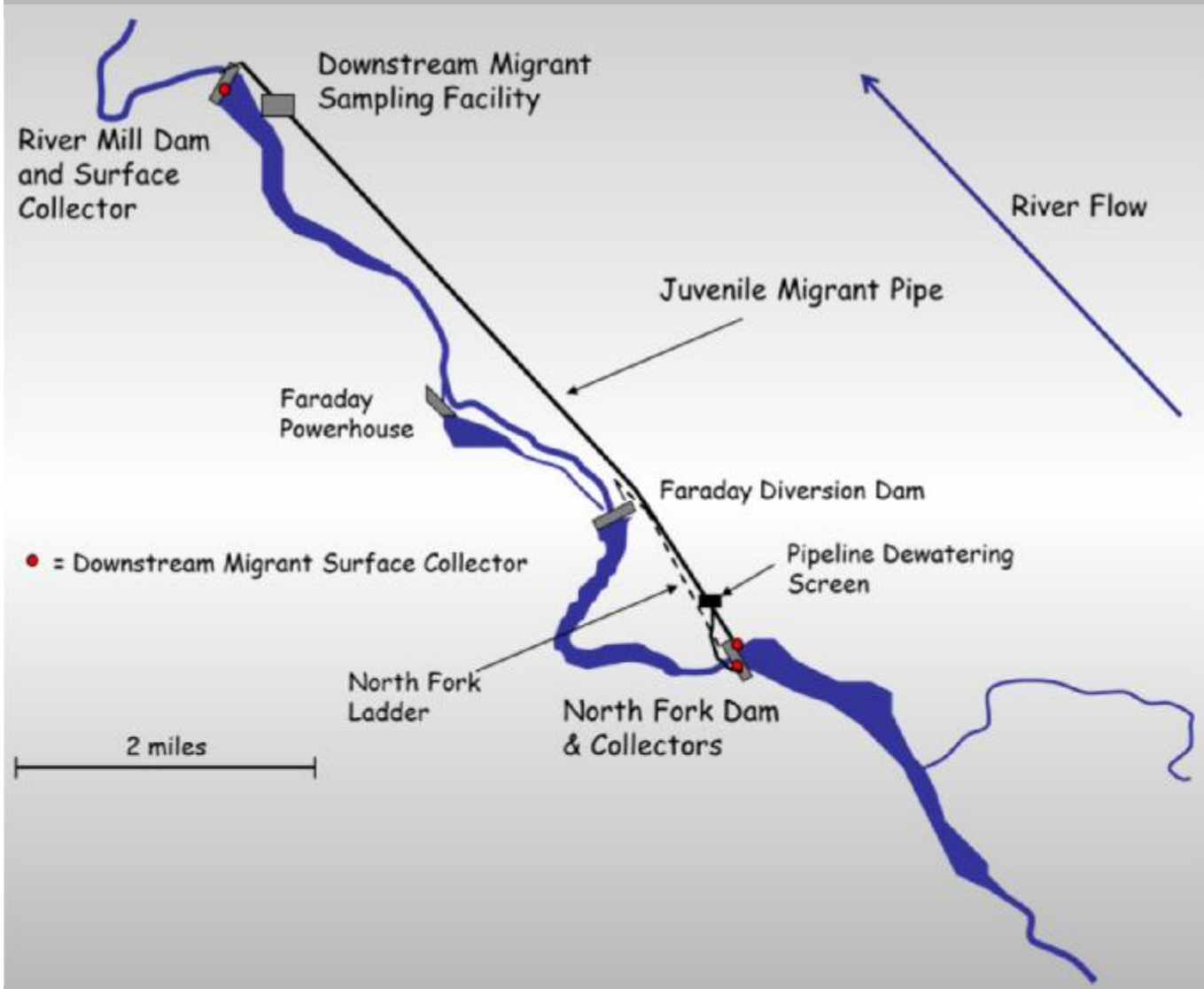
International Conference on Engineering and Ecohydrology for Fish Passage
June 19-21, Corvallis, Oregon




PGE Clackamas Hydro Project
River Miles 22.3 – 31.7
OREGON
Estacada
Eagle Creek
Upper Eagle Creek Falls
North Fork Clackamas River
Falls
Clackamas River
Water Diversion Dam
Roaring River
Pennywinkle Falls
Falls
Oak Grove Fork Clackamas River
Falls
Clackamas River
Fish Creek
Collawash R
Hot Springs Fk
Falls
Collawash Falls
Cities
Barriers
Streams
Fish Distribution
Spring Chinook
Land Use/Ownership
Federal Forest
State Forest
Private Forest
Agriculture
Urban
Other
0 4 8 16 24
Kilometers

PGE

Clackamas River Hydro Project



Run-of-River Project
127 MW Capacity

3 Dam Complex

Built 1906 – 1958

Mean Daily flow =
1,454 cfs or
41 cubic meter/s (cms)

FERC License Issued in 2010

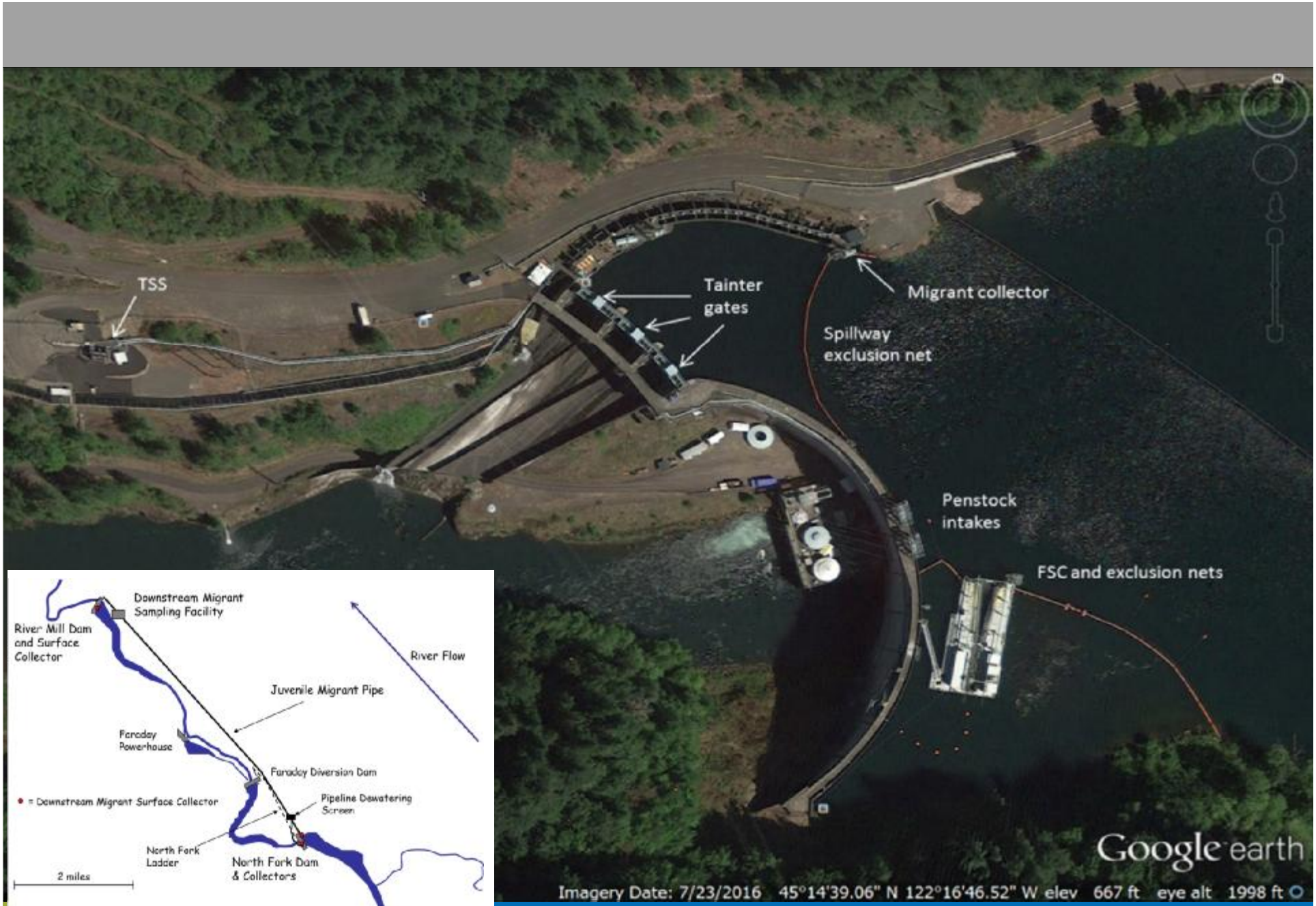
Major Downstream Passage <u>Improvements Include:</u>

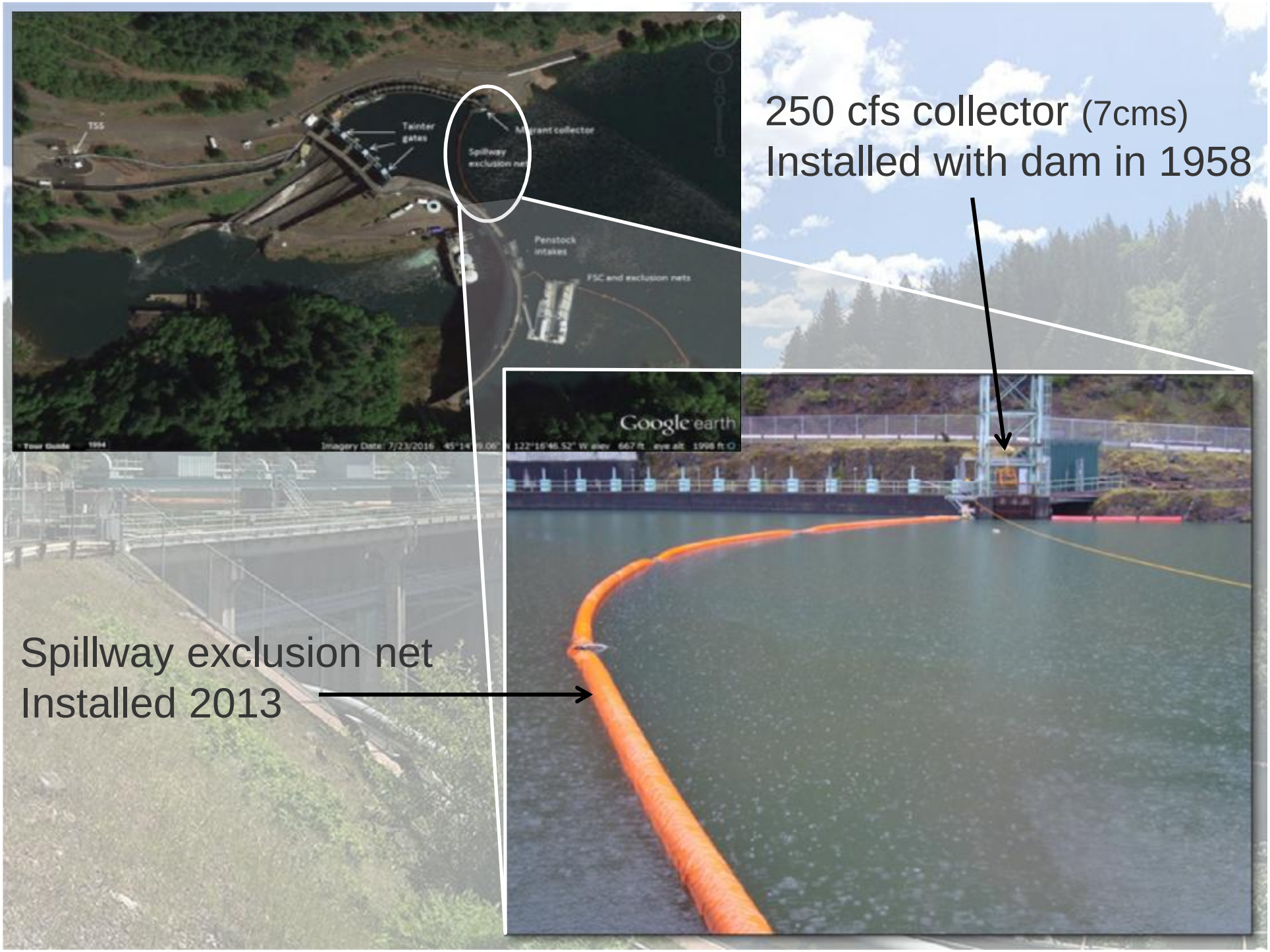
North Fork Floating Collector

North Fork Spillway Exclusion Net

River Mill Collector

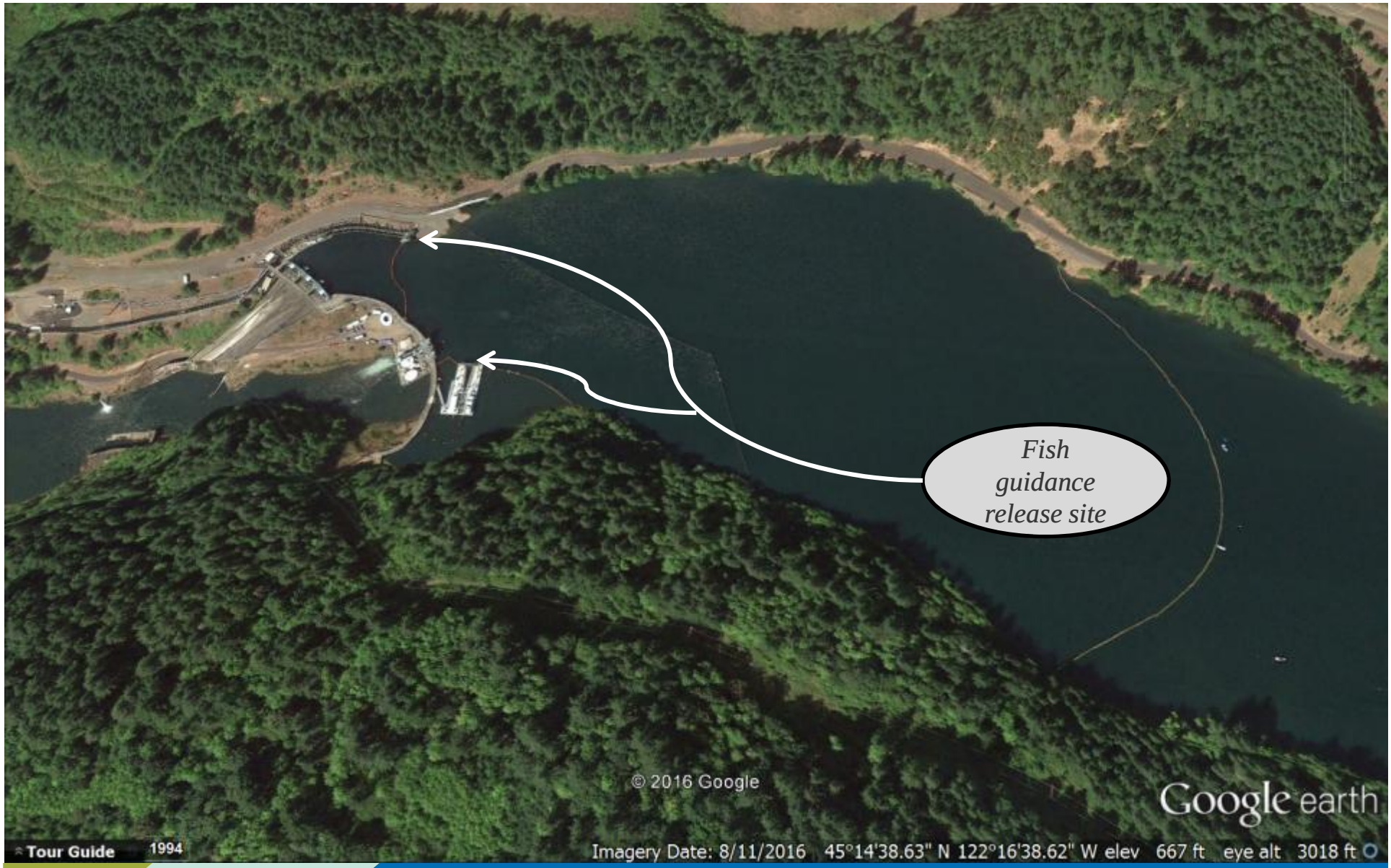
Extension of Downstream Migrant Pipeline/Sampling Facility


TSS
Tainter gates
Migrant collector
Spillway exclusion net
Penstock intakes
FSC and exclusion nets
Google earth
Imagery Date: 7/23/2016 45°14'39.06" N 122°16'46.52" W elev 667 ft eye alt 1998 ft
Downstream Migrant Sampling Facility
River Mill Dam and Surface Collector
River Flow
Juvenile Migrant Pipe
Faraday Powerhouse
Faraday Diversion Dam
= Downstream Migrant Surface Collector
Pipeline Dewatering Screen
North Fork Ladder
North Fork Dam & Collectors
2 miles


250 cfs collector (7cms)
Installed with dam in 1958
Spillway exclusion net
Installed 2013
TSS
Tainter gates
Spillway exclusion net
Penstock intakes
FSC and exclusion nets
Google earth

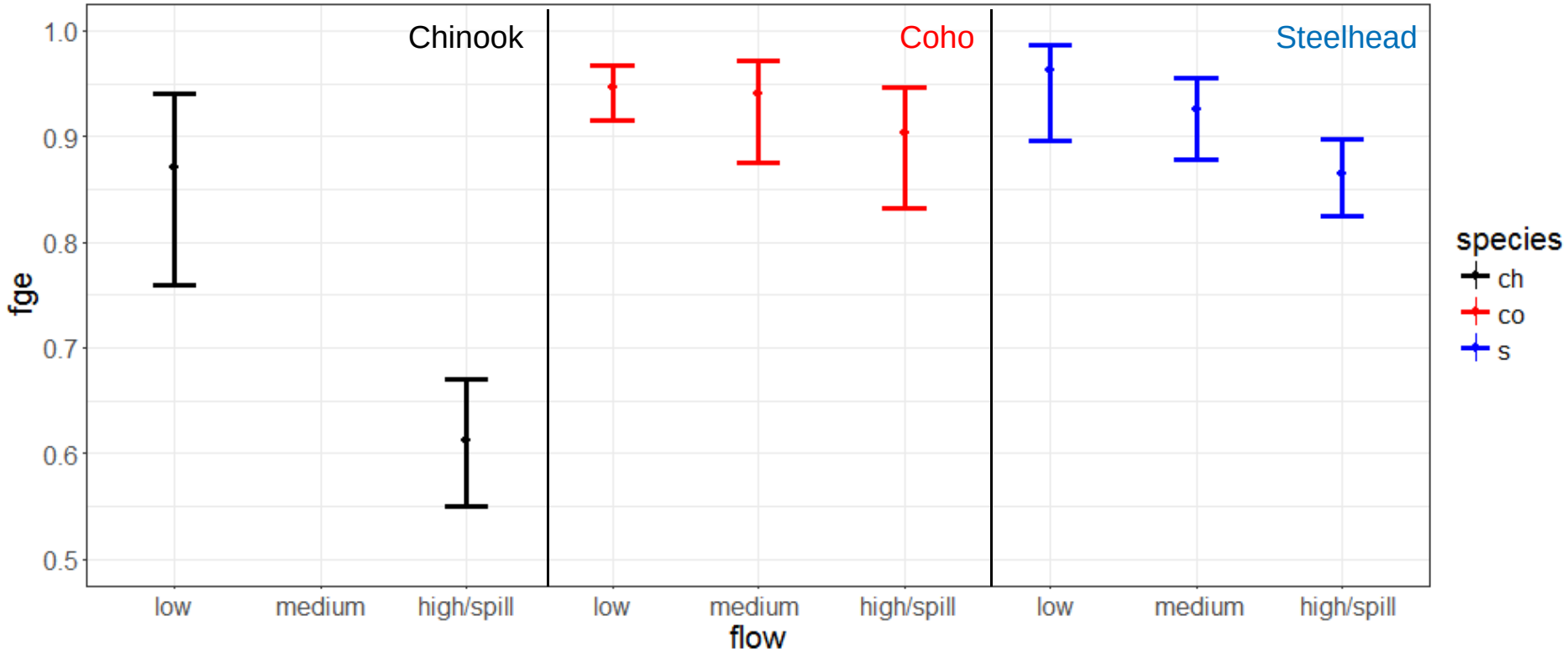
North Fork surface collector commissioned in 2015
1,000 cfs attraction flow (28 cms)

North Fork Fish Guidance Evaluation



North Fork Fish Guidance Evaluation

Species	Release Groups	Released	Collected	FGE	95% CI	% FSC
Chinook[1]	1	55	48	0.87	0.76 – 0.94	92%
Coho	5	455	429	0.94	0.92 – 0.96	75%
Steelhead	3	266	249	0.94	0.90 – 0.96	60%

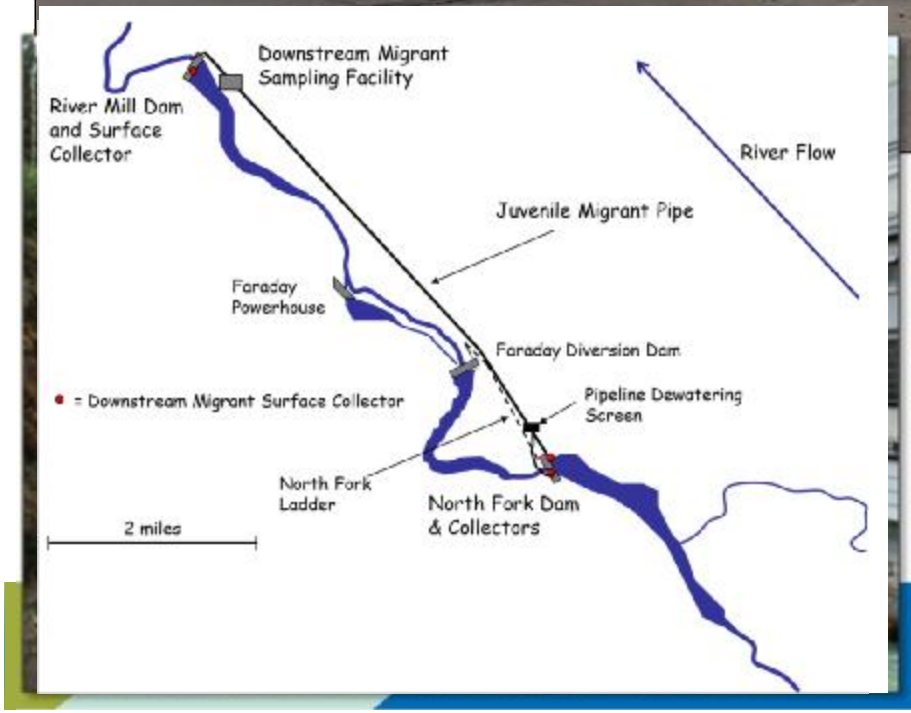


Juvenile Migrant Pipeline

Pipeline Length: 7.1 miles
Diameter: 18 inches
Flow: 7 cfs
Water Travel Time: ~ 90 min.

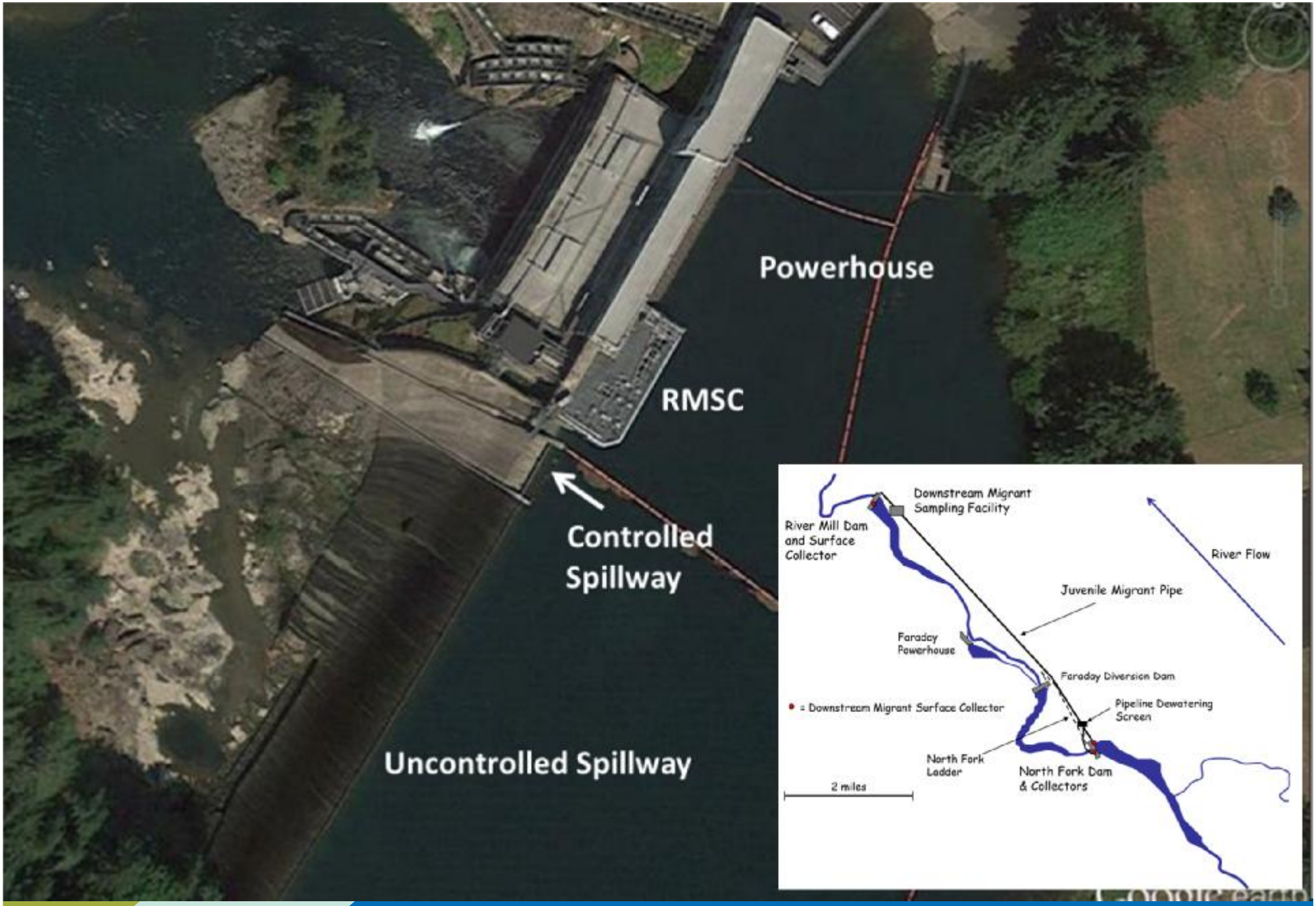
Juvenile Migrant Sampling Facility

- Timer based sampling
- Daily enumeration by species and life stage
- Collection of fish for evaluations
- PIT detection array

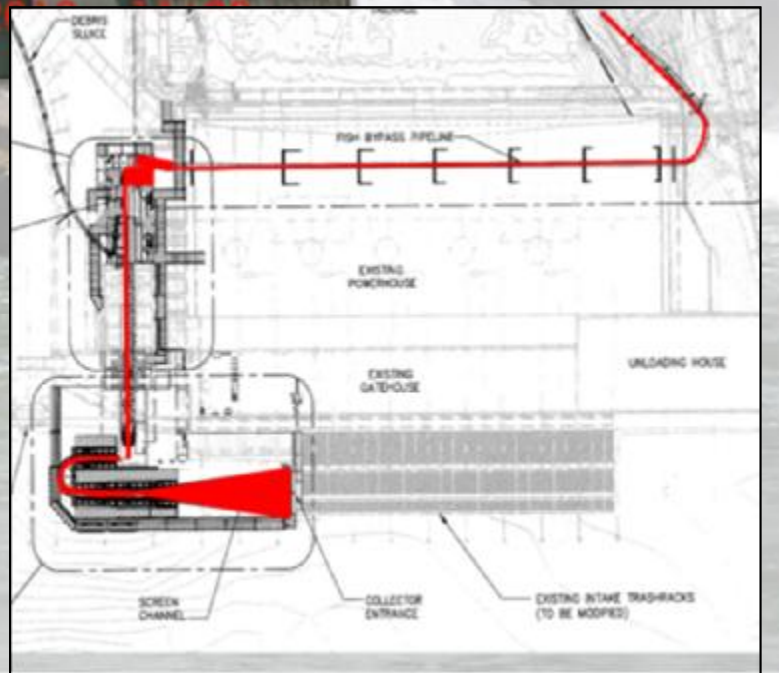


Juvenile Pipeline Evaluation - 2016

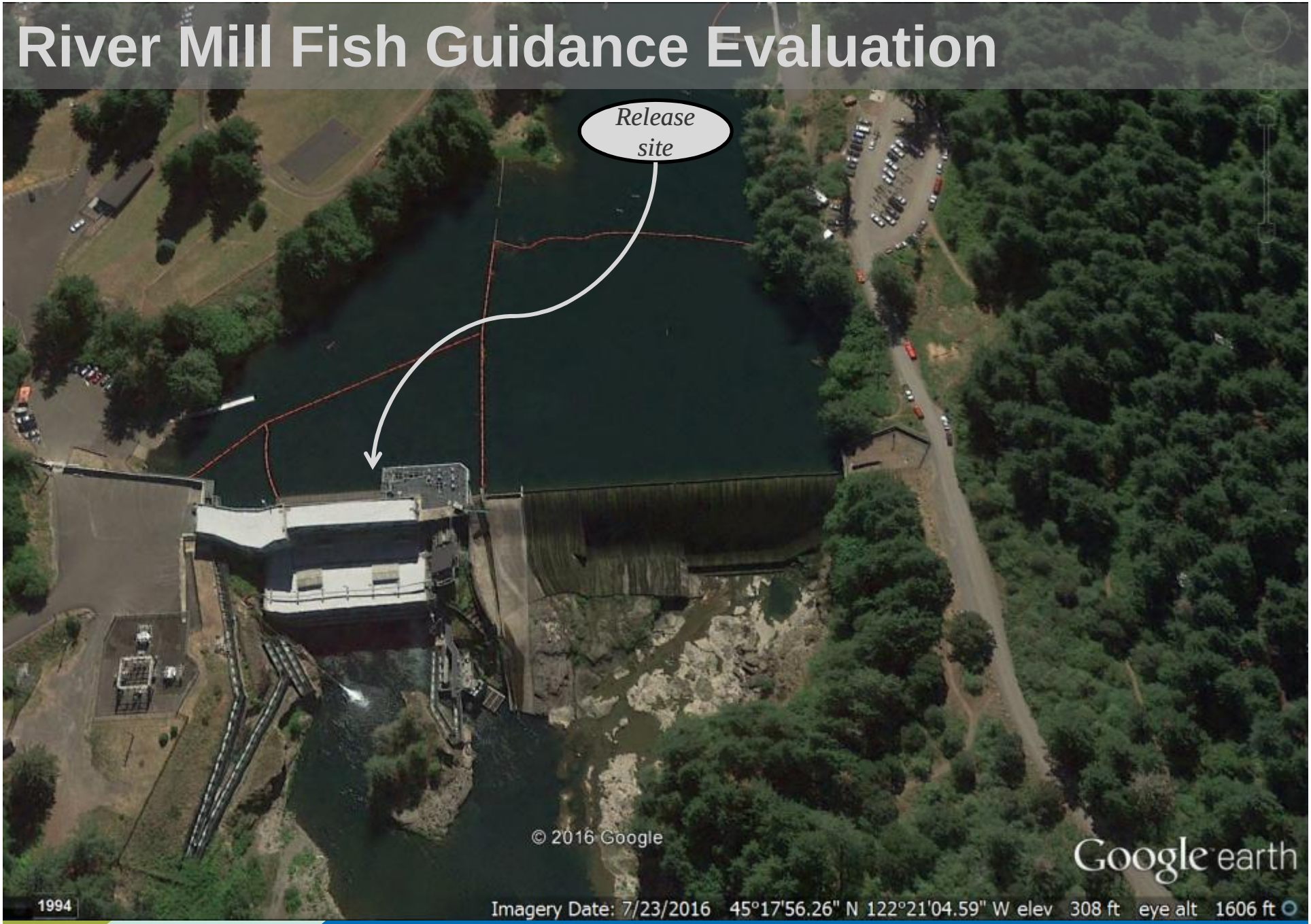
Species	N	Injury	Mortality	Median Travel Time (h)
Coho	137	0.7%	0.0%	2.6 - 4.7
Steelhead	195	0.5%	0.0%	1.9 – 2.0


Powerhouse
RMSC
Controlled Spillway
Uncontrolled Spillway
Downstream Migrant Sampling Facility
River Mill Dam and Surface Collector
River Flow
Juvenile Migrant Pipe
Faraday Powerhouse
Faraday Diversion Dam
= Downstream Migrant Surface Collector
Pipeline Dewatering Screen
North Fork Ladder
North Fork Dam & Collectors
2 miles

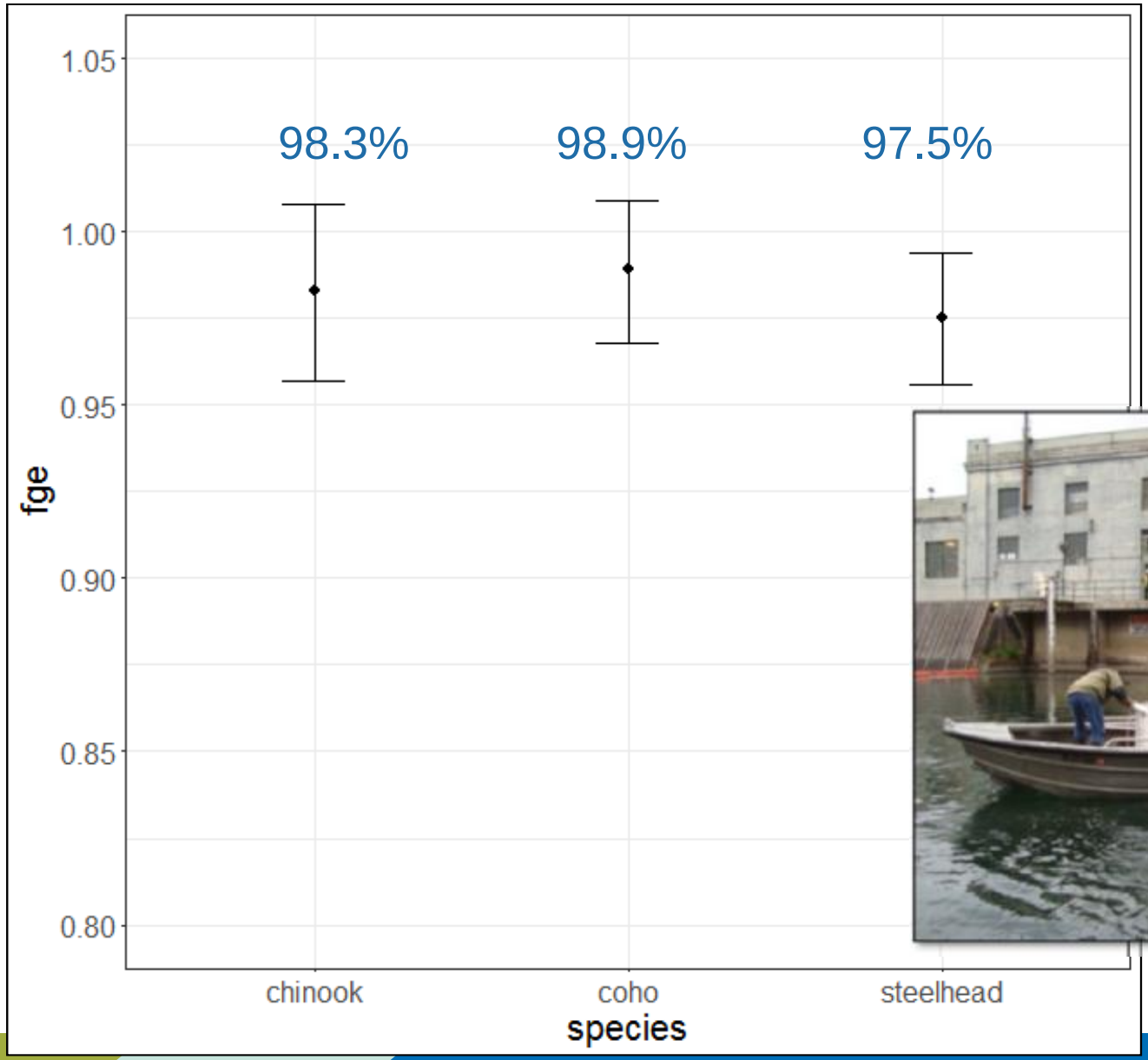
River Mill surface collector
Commissioned in 2012
500 cfs attraction flow tied to PH



River Mill Fish Guidance Evaluation

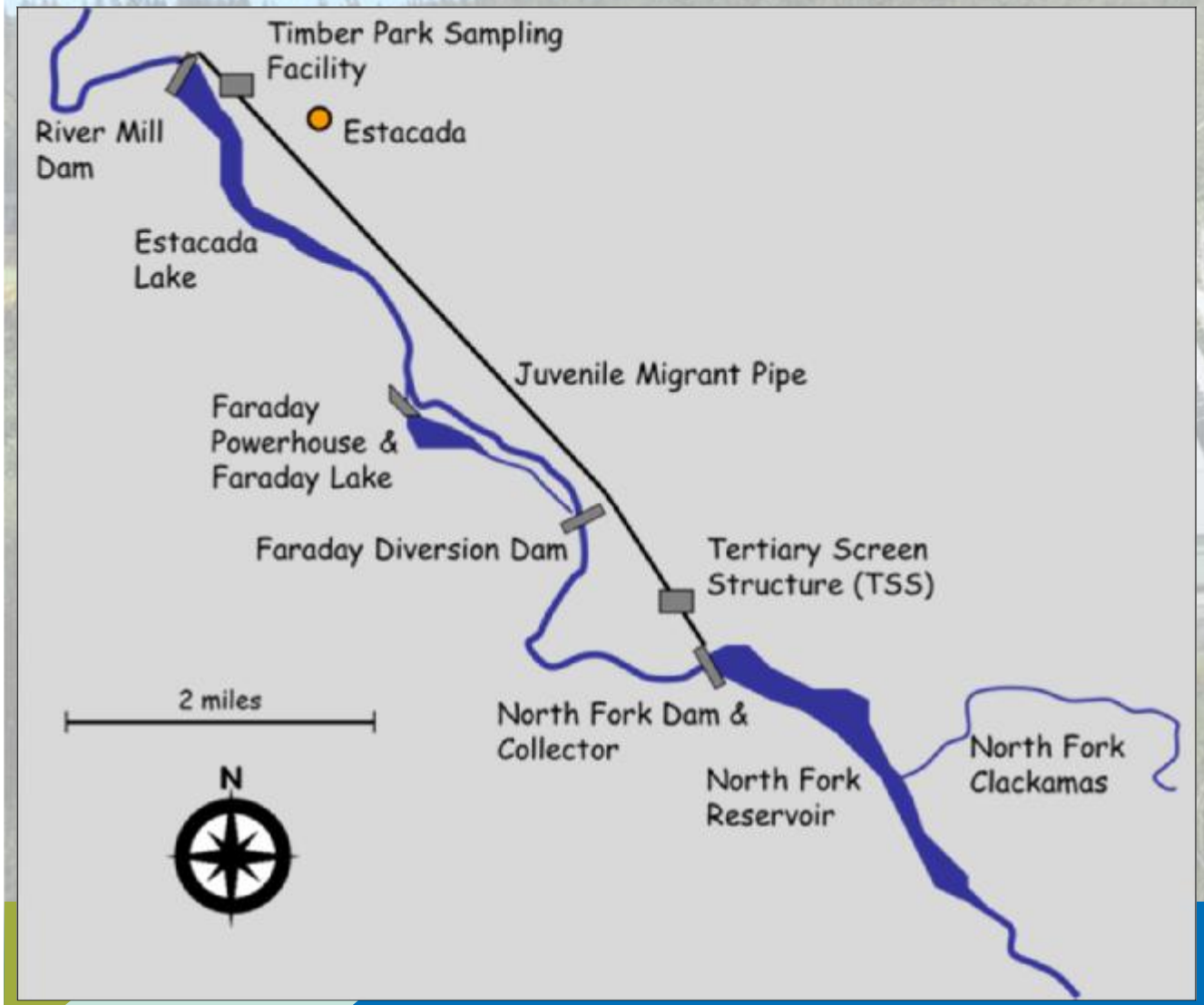


River Mill Fish Guidance Evaluation



Project-Wide Passage (2016)

Species	Combined North Fork and River Mill Detections		
	d	Est	95% CI
Coho	382	95.3%	92.7-97.0%
Steelhead	254	95.5%	92.3-97.4%



Conclusions

North Fork

High guidance (>85%) all flows tested for coho & steelhead

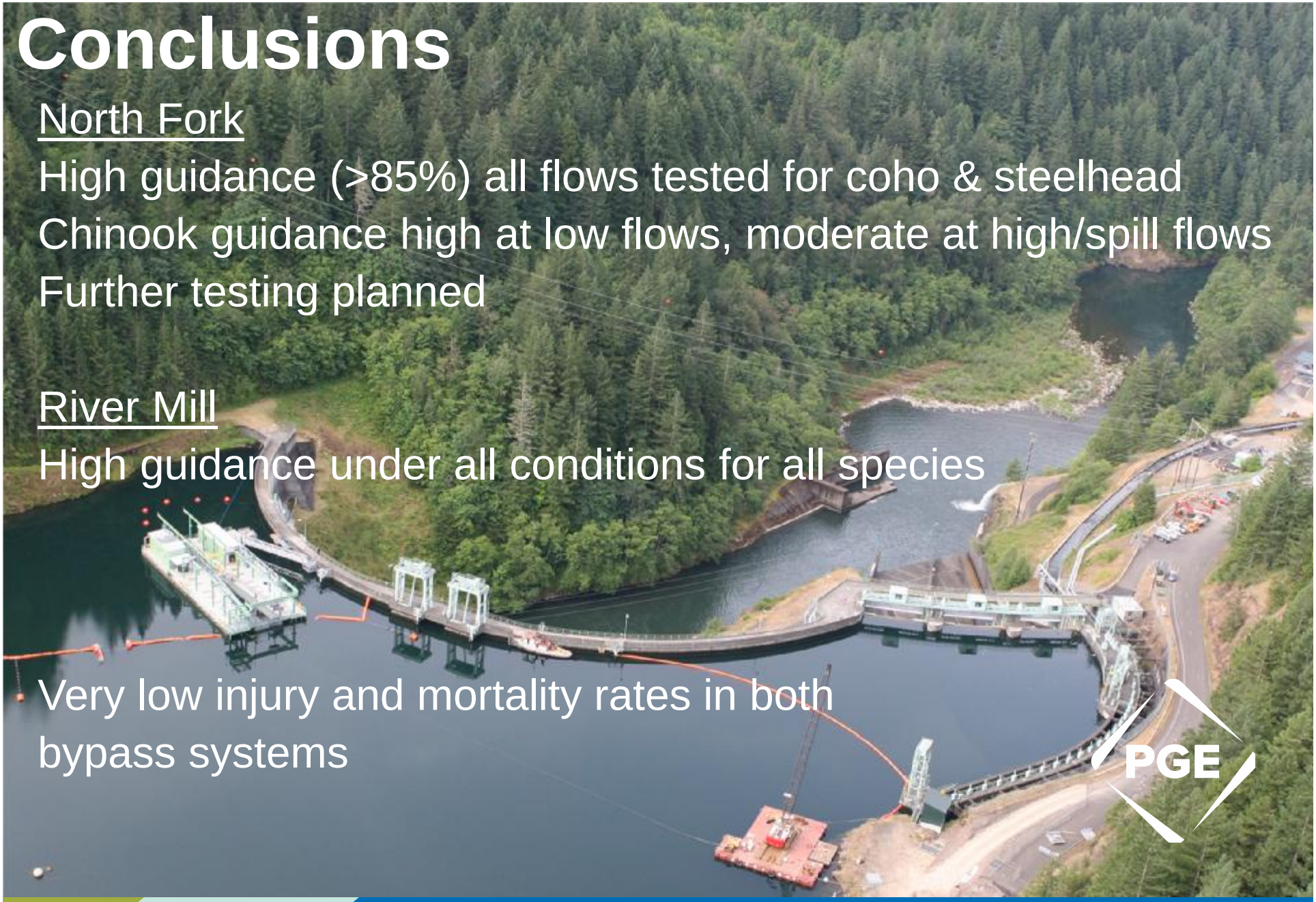
Chinook guidance high at low flows, moderate at high/spill flows

Further testing planned

River Mill

High guidance under all conditions for all species

- Very low injury and mortality rates in both bypass systems



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Sean Flak - PGE Engineer
Peter Christensen - R2 Resource Consultants
Doug Cramer - Retired PGE Biologist
John Esler – PGE License Manager
Resource Agencies
Countless other design engineers, vendors, and construction contractors

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