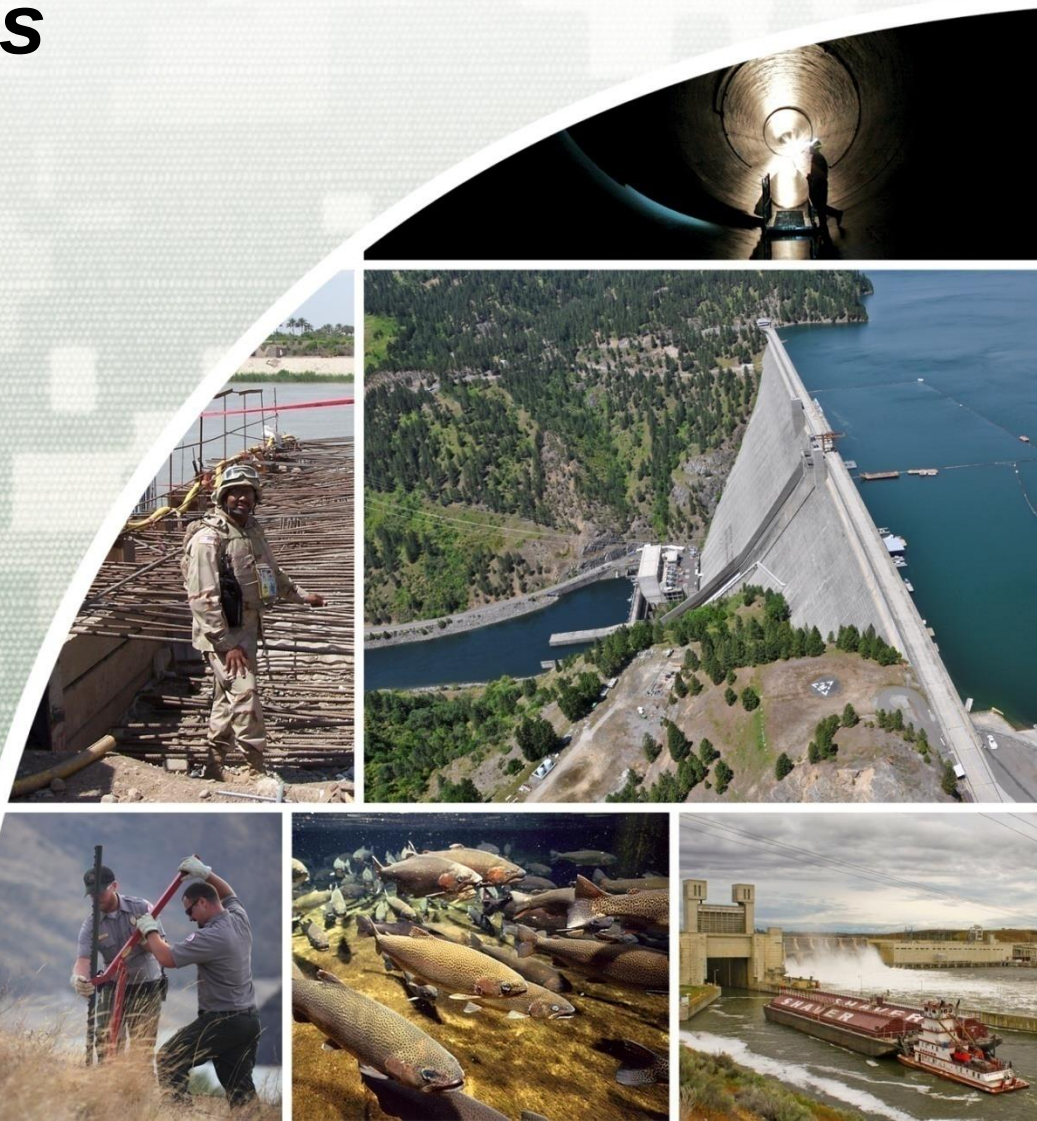
Lower Granite and Little Goose
Fish Ladder Temperature Improvement Systems

TMT YER

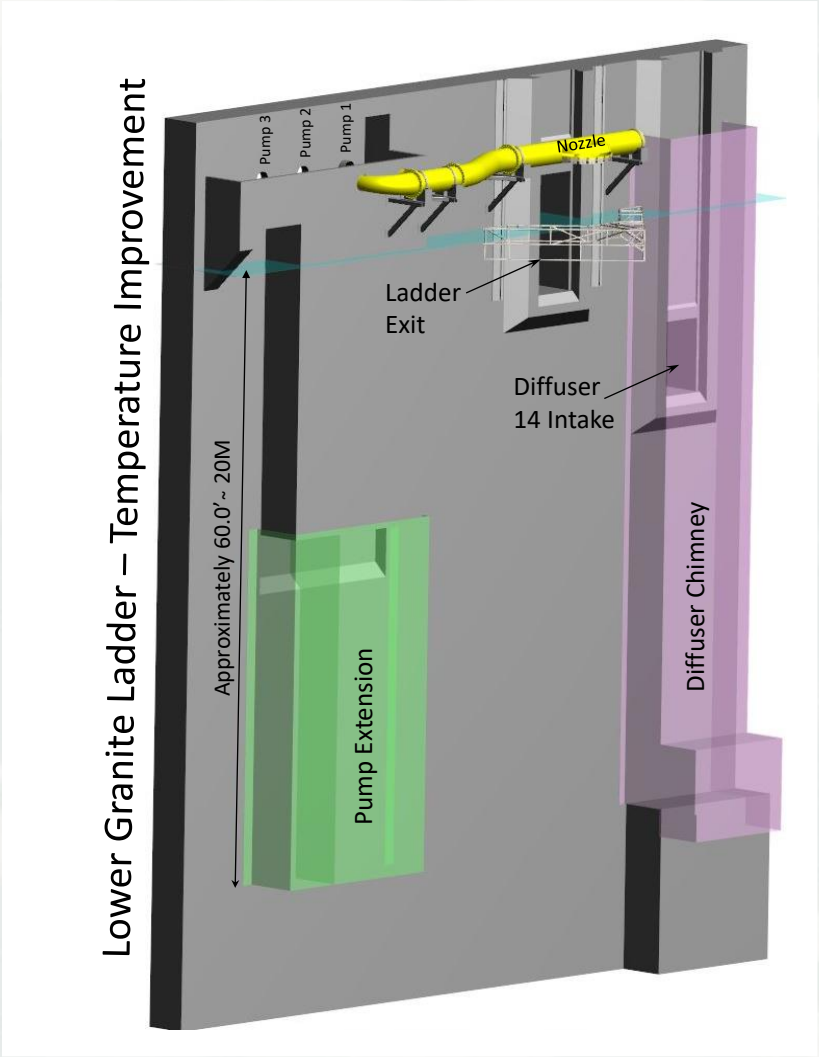
December 7, 2016



US Army Corps of Engineers
BUILDING STRONG®

Adult Fish Passage Route

Supplemental Water Intake Chimney – 70 ft.


Lower Granite Ladder – Temperature Improvement
Pump 3
Pump 2
Pump 1
Nozzle
Ladder
Exit
Diffuser
14 Intake
Approximately 60.0'~ 20M
Pump Extension
Diffuser Chimney

2016

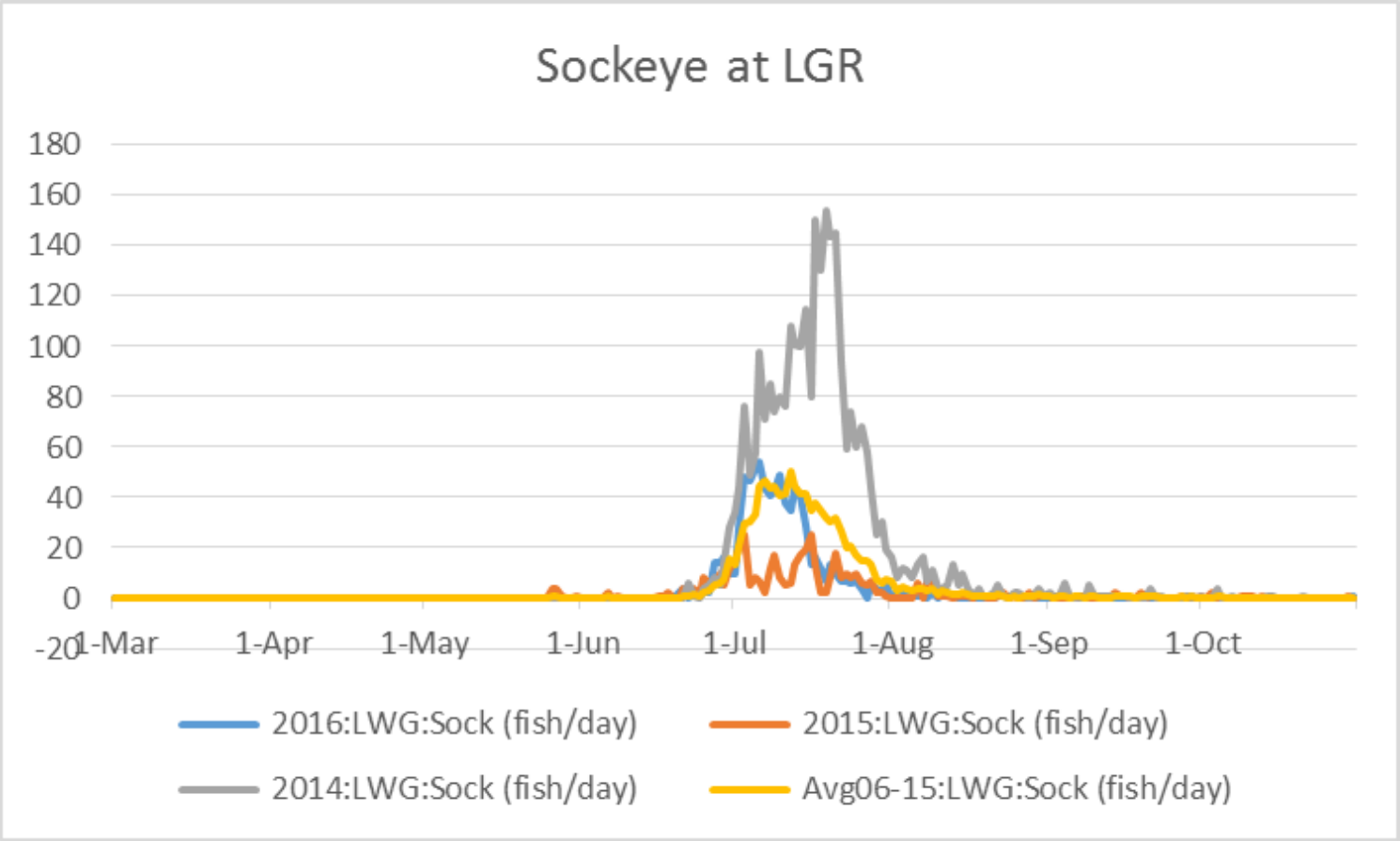
Turned ON : June 9
Turned OFF : September 8

No Passage Issues due to Water Temperature

Monitoring performed to understand fish distribution of fish exiting the ladder (ARIS acoustic camera)

-Sockeye appeared to stay within similar depth upon ladder exit moving out into forebay

-Fall Chinook appeared to move deeper upon exit from the ladder



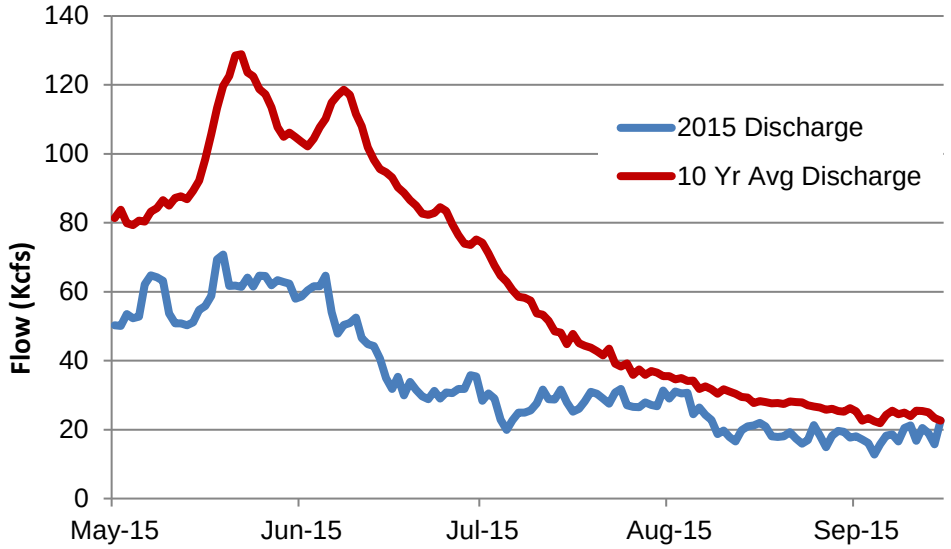
Justification for similar project at LGS

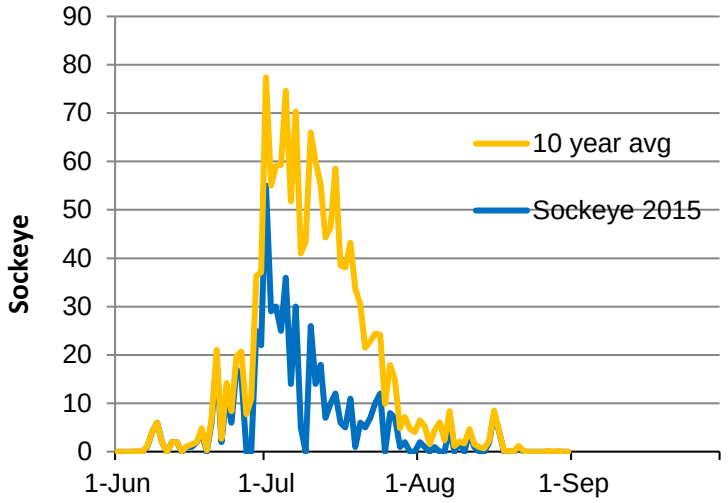
-Temperature blockage observed during 2015 for upstream bound sockeye

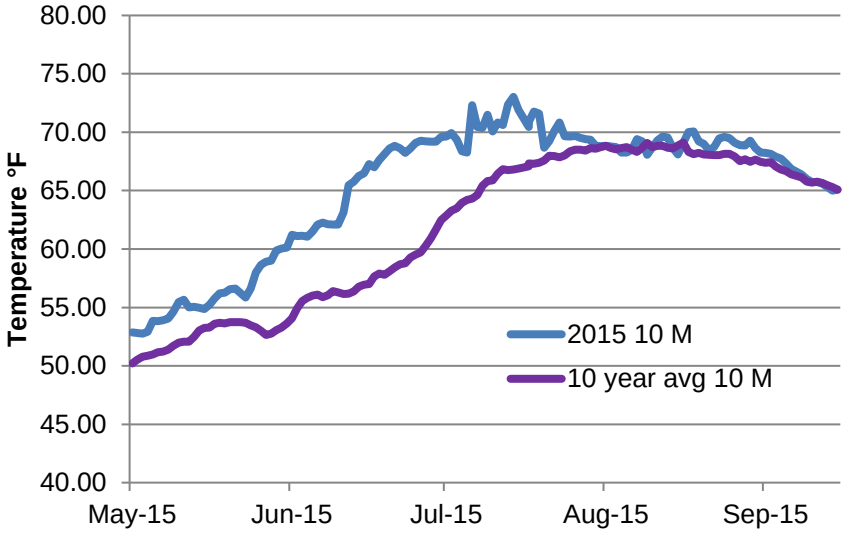
-Below 80 ft there is a cooler water layer that can provide a 2-4 degrees C benefit

-Similar total flow into ladder exit as LGR, with 25 cfs gravity fed from forebay into the control section of the fish ladder

PROBLEM in 2015 LGS







-Lower peak annual discharge

-Narrower period of adult sockeye peak movement with periods of delayed passage

- Higher water temperatures during May, June

HYPOTHESIS AFTER 2015

The temperature of water approaching Little Goose is very correlated with temperatures in the LGR dam tailrace which are regulated with flow augmentation from DWR dam

-IF 25 cfs of water from 80 ft deep in the forebay had been added to the ladder exit area in 2015:

1. there would have been a reduction from 32% to 16% for the amount of time water temperatures would have exceeded 68°F

2. there would have been no periods when water temperatures exceeded 72°F

3. there would have been no average hourly temperature differentials > 4°F

Little Goose 2016 Temporary Cooling Pump Operation

Pumps Turned ON : July 1
Pumps Turned OFF: September 9

Hobo brand thermistors were used to monitor the ladder exit area in 2016 (Hourly readings)

Data was uploaded weekly to the FPC website


Power
Generation
800 274 0336
Rental Power
cumminsnorthwest.com


Pump 1
Pump 2

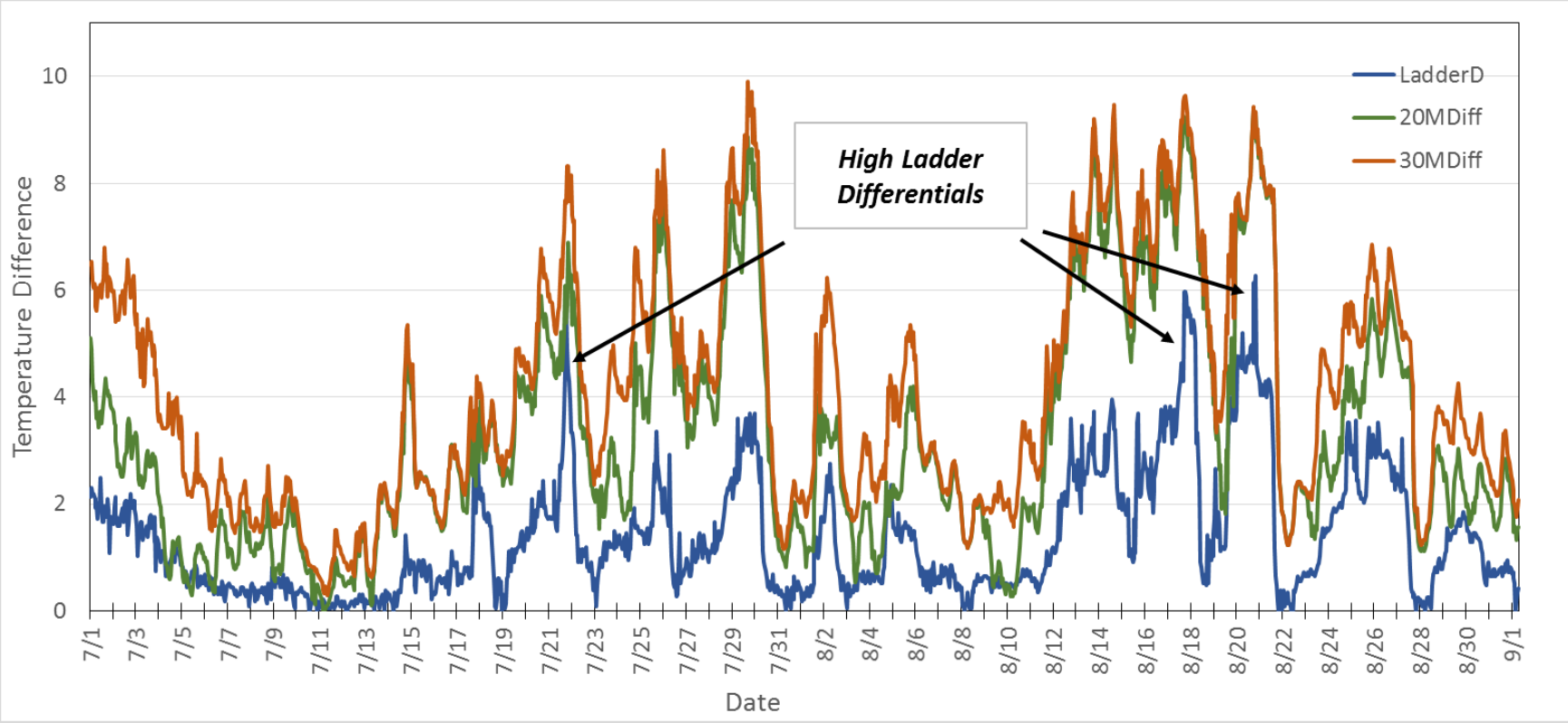
2016 Forebay Temperature Possible Benefits

Date of first day avg water temp exceeded 68°F = July 4
Date of last day avg water temp exceeded 68°F = August 29
Number of days daily avg water temps exceeded 68°= 15 days
Maximum daily temperature was 69.1 on August 4

VERSUS 2015

Date of first day avg water temp exceeded 68°F = June 20
Date of last day avg water temp exceeded 68°F = Sept 2
Number of days daily avg water temps exceeded 68°= 58 days
Maximum daily temperature was 71.9 on July 14

Little Goose 2016



Because differential was not a primary determinant for successful passage during 2016, perhaps differential becomes most important the greater you exceed a species preferred water temperature threshold

CAVEATS

- Rental pumps in 2016 could operate no deeper than 66 ft in the forebay

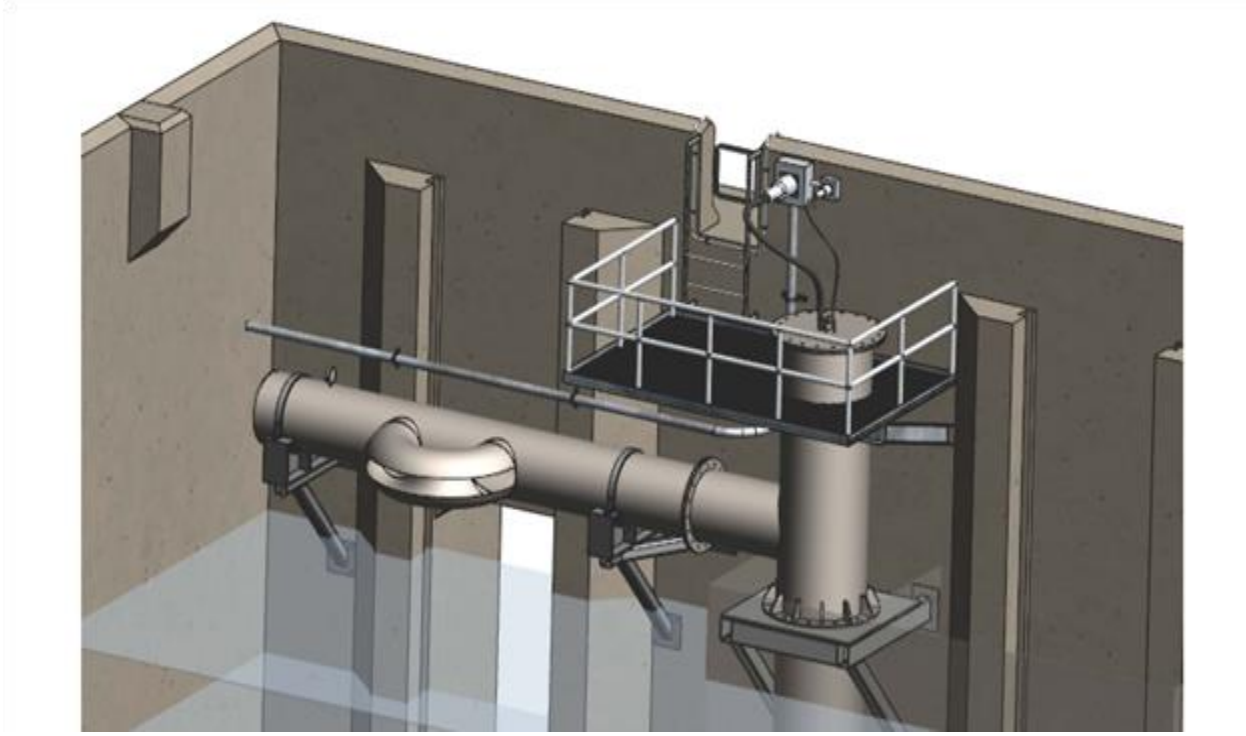
- Permanent system will better perform due to depth of pump at 80 ft will reach the coolest forebay water

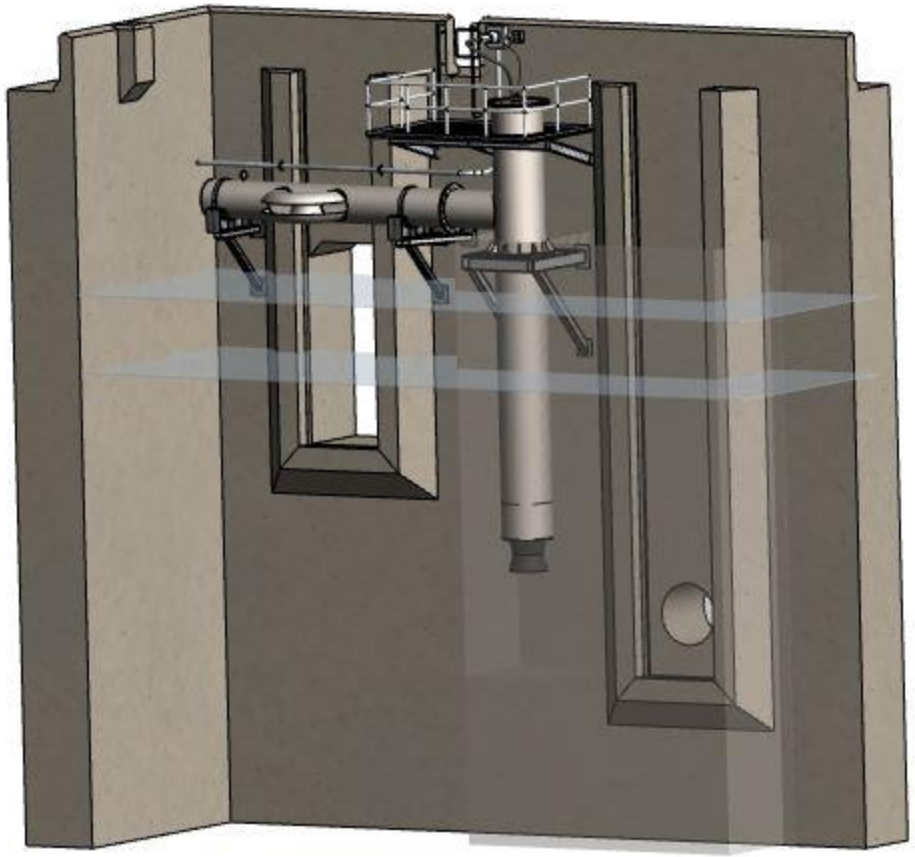
- Volume of permanent system will be same as temporary (25 cfs /~12,000 gallons)

2018 Permanent System

- Installation in January 2018

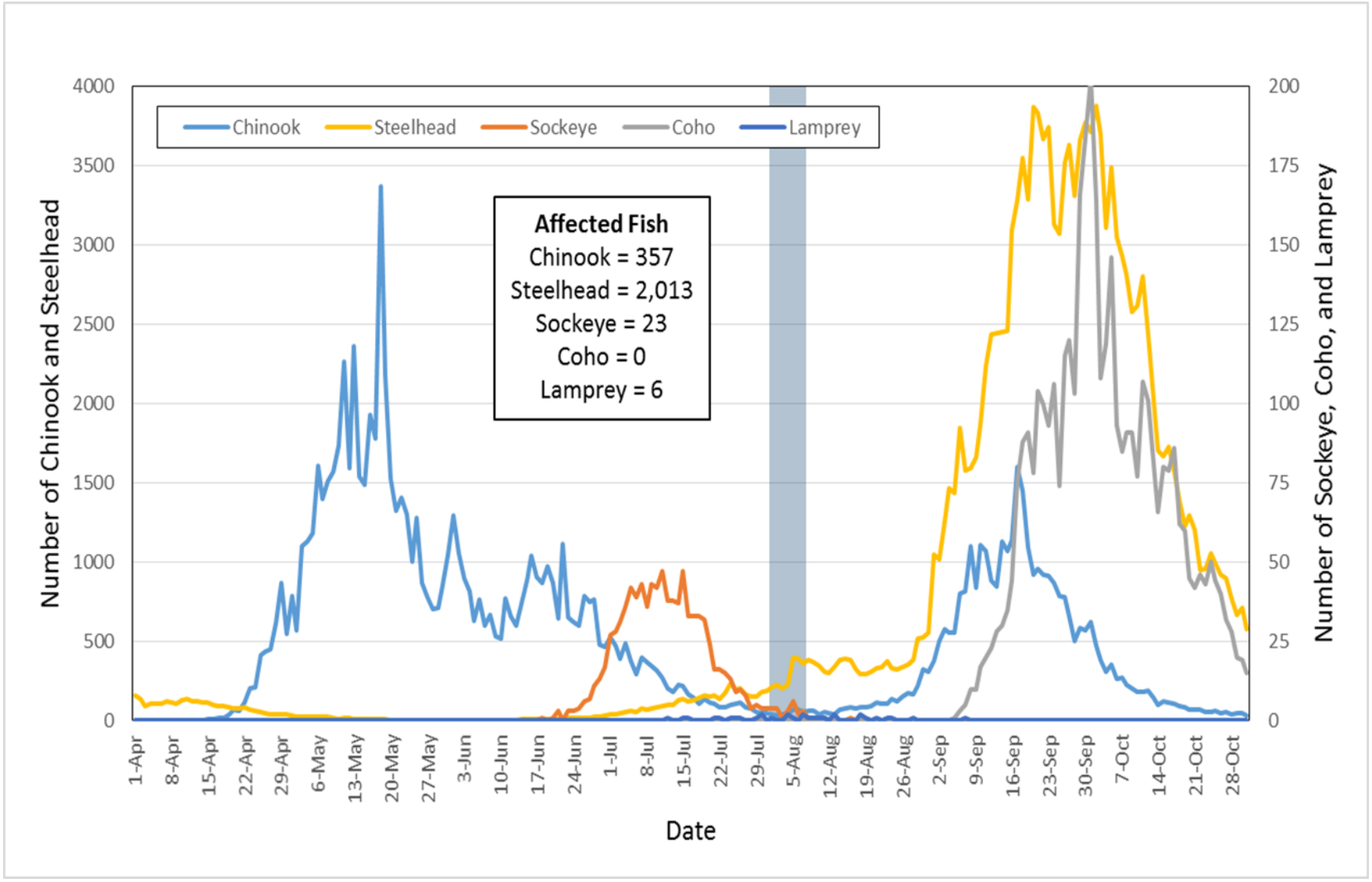
- For 2017 another temporary system
  - Utilize new permanent axial pump at 80 ft depth
  - Utilize a generator again to provide power for the pump






QUESTIONS ??

BUILDING STRONG®


Chinook
Steelhead
Sockeye
Coho
Lamprey
Affected Fish
Chinook = 357
Steelhead = 2,013
Sockeye = 23
Coho = 0
Lamprey = 6
Number of Chinook and Steelhead
Number of Sockeye, Coho, and Lamprey
Date
4000
3500
3000
2500
2000
1500
1000
500
0
200
175
150
125
100
75
50
25
0
1-Apr
8-Apr
15-Apr
22-Apr
29-Apr
6-May
13-May
20-May
27-May
3-Jun
10-Jun
17-Jun
24-Jun
1-Jul
8-Jul
15-Jul
22-Jul
29-Jul
5-Aug
12-Aug
19-Aug
26-Aug
2-Sep
9-Sep
16-Sep
23-Sep
30-Sep
7-Oct
14-Oct
21-Oct
28-Oct