Henry M. Jackson
HYDROELECTRIC PROJECT

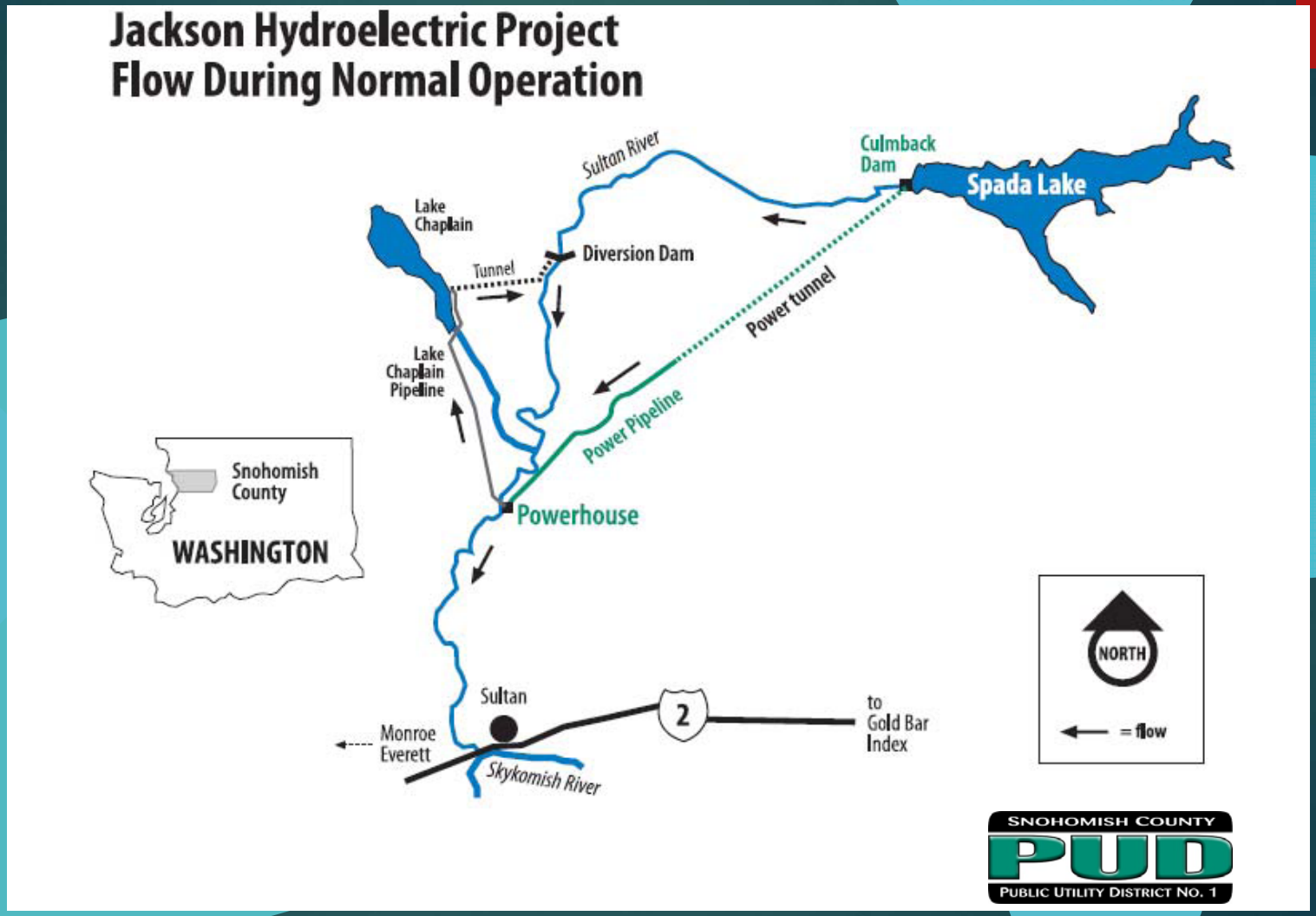
Jackson Project, Dam Safety & EAP Update – Online Training 2020

Narrated By: Scott Spahr, PE
Manager Generation Engineering

Overview

- How the Project Works
- How Culmback Dam was built
- How we make sure it is safe
- What we would do if something went wrong

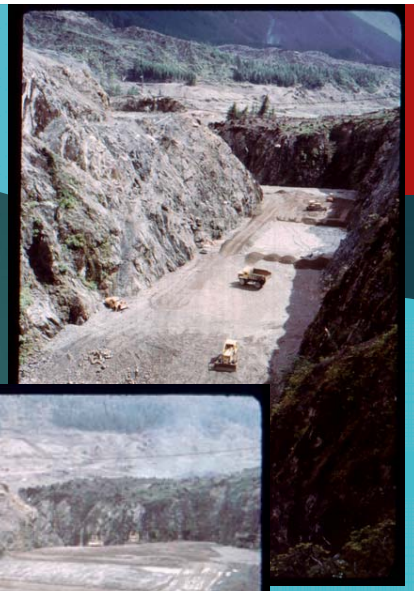
JACKSON PROJECT – OVERVIEW



Spada Lake and Culmback Dam

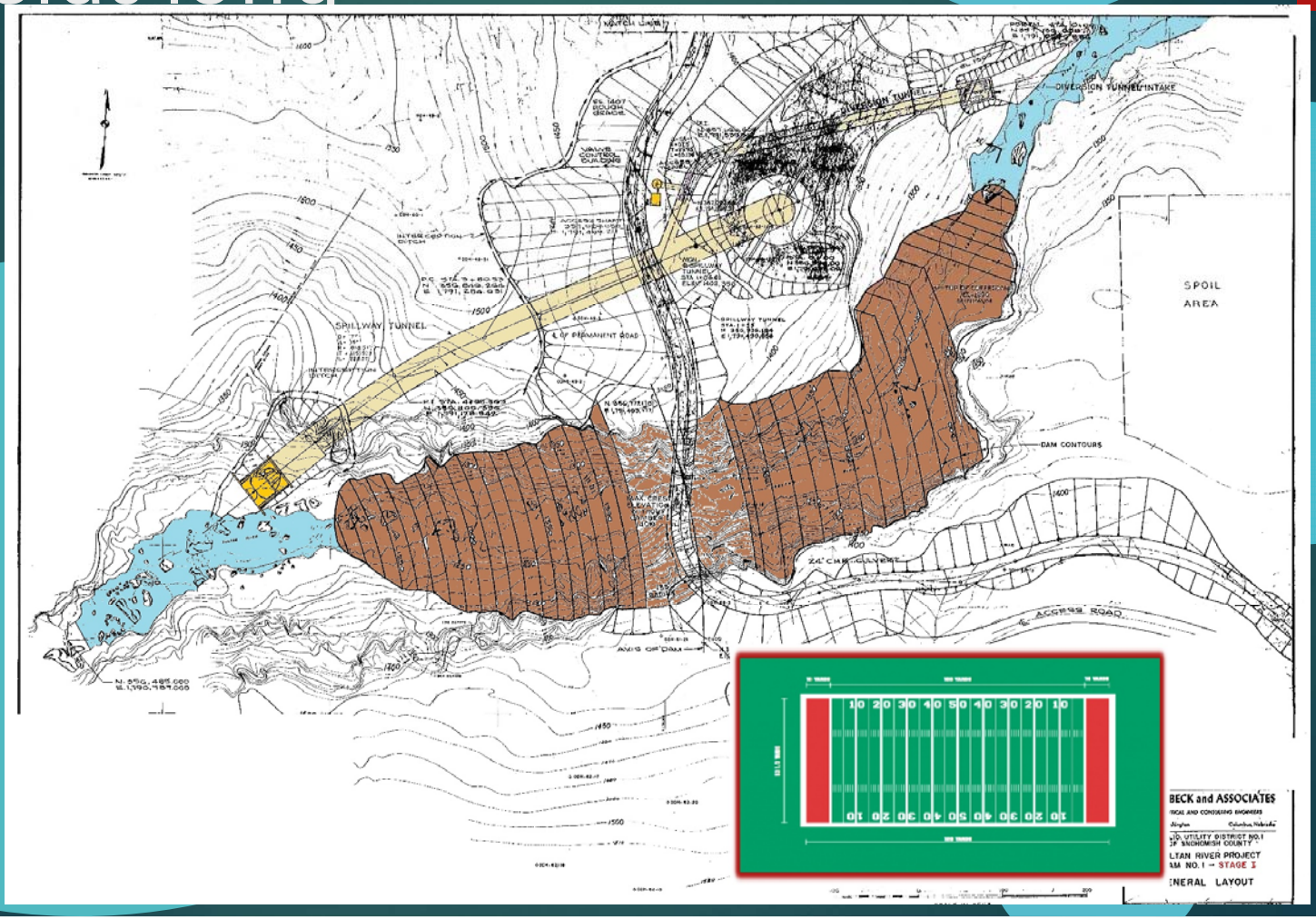
- **Earth fill - clay core**
  - 262 ft high
  - 640 ft across
- Stage I completed in 1964, Stage II completed in 1984
  - 55-years of operation

Stage I – Culmback Dam

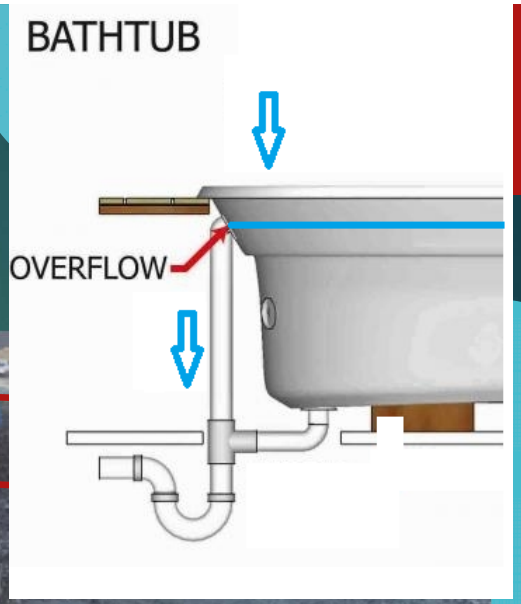


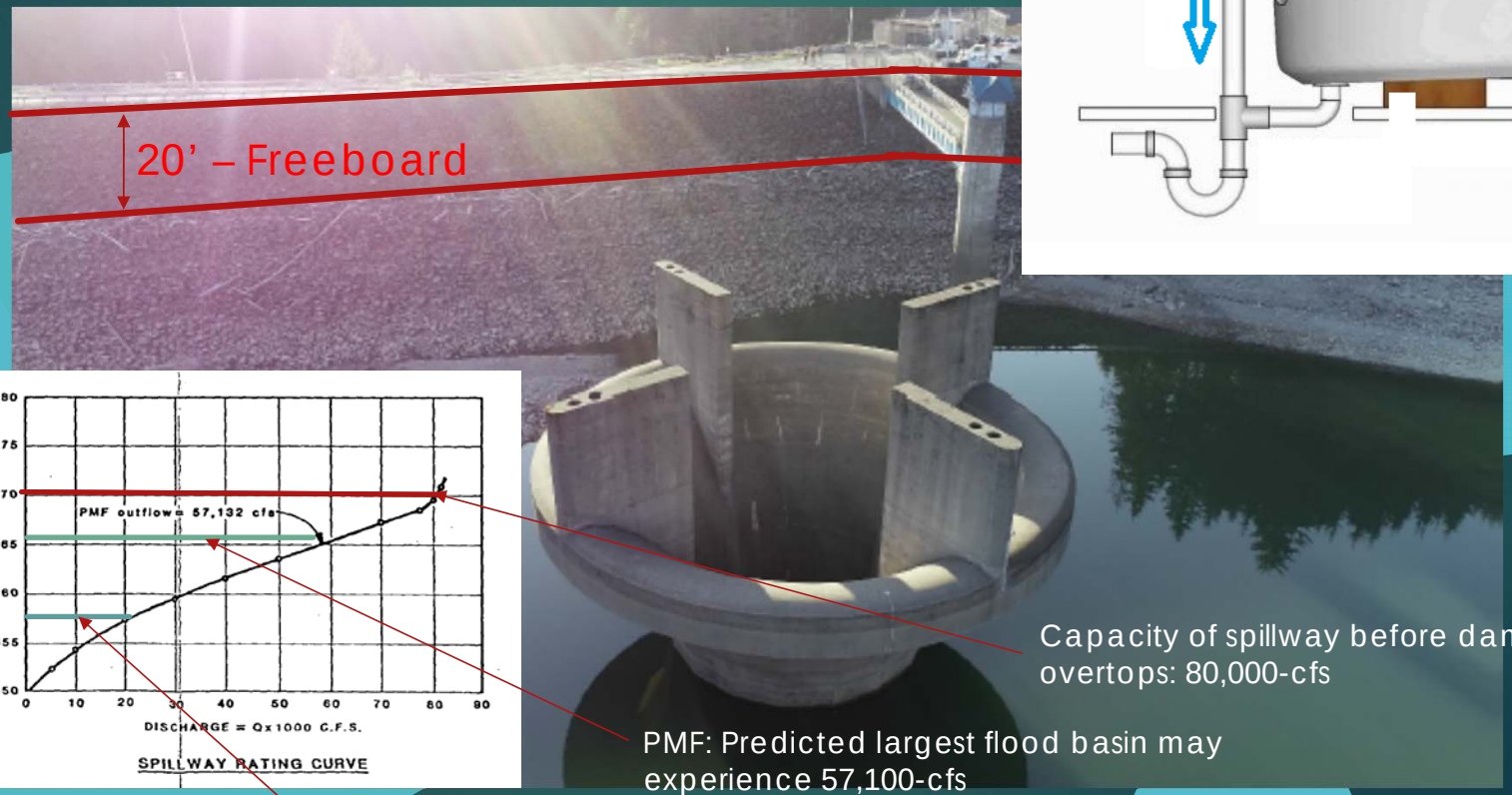
Filled a very narrow bedrock canyon

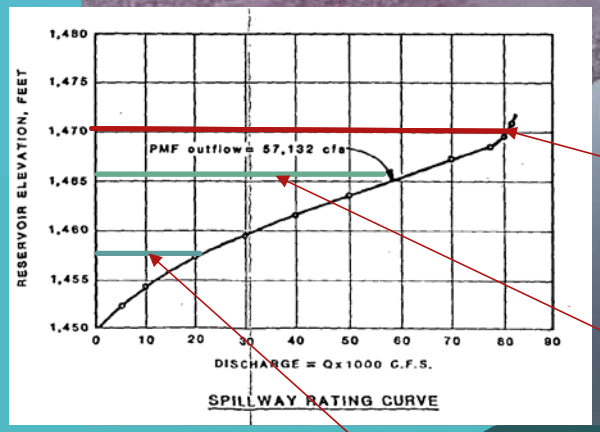
Stage I – About 3 football fields long



Morning Glory Spillway







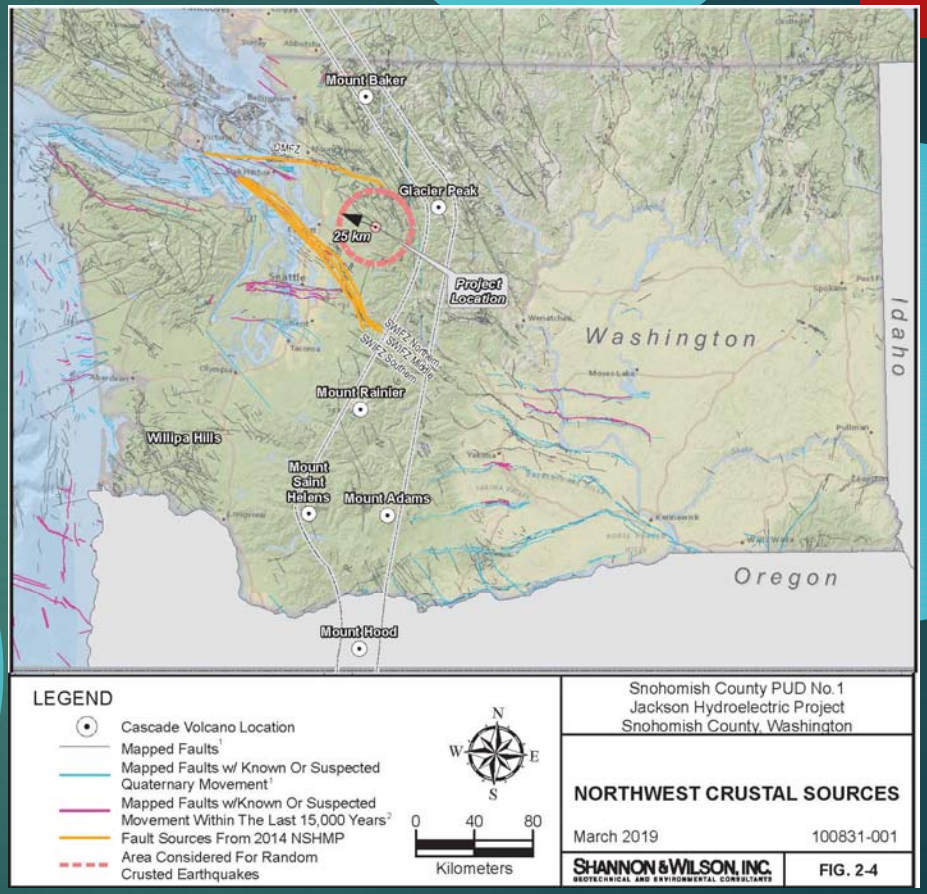
Capacity of spillway before dam overtops: 80,000-cfs

PMF: Predicted largest flood basin may experience 57,100-cfs

Largest spill 17,000-cfs (Nov 1990)

Maximum Credible Earthquake

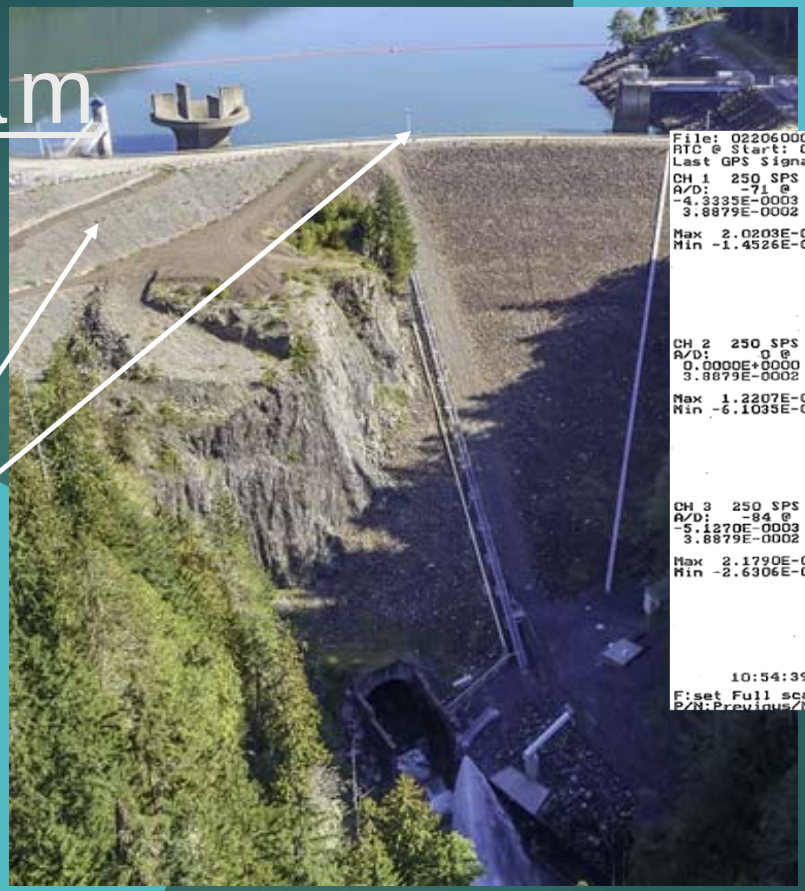
- Based on **local crustal faults** (~13 km, ~7.5 Richter) **Cascadia has less impact
- Culmback Stability re-evaluated in 2010
- Morning Glory Stability re-evaluated in 2018-19

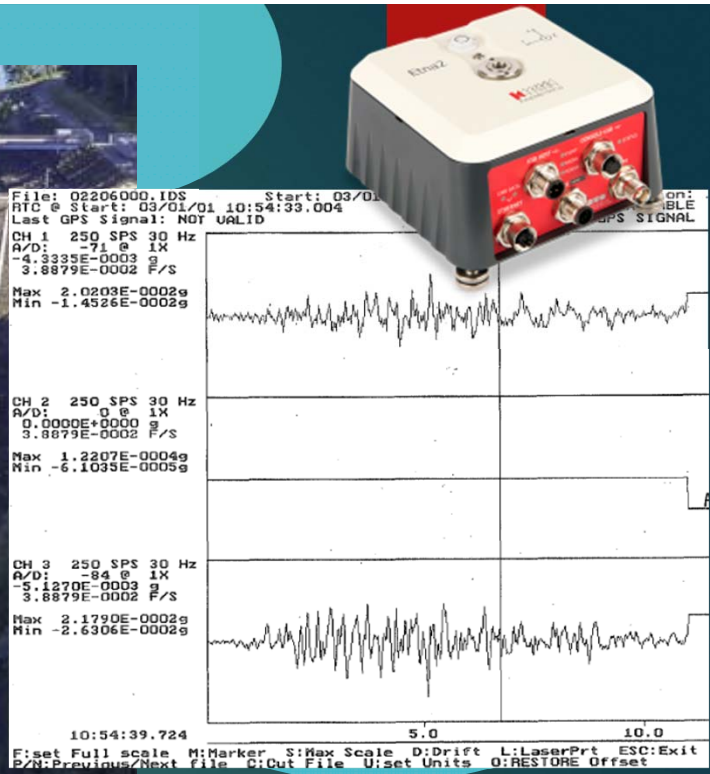


Project Inspections

* Real-time alarm monitoring and cameras 24x7
* Daily/Monthly Inspections by staff
* FERC Staff (annually)
* Independent Consultants (5 years)

Culmback Dam



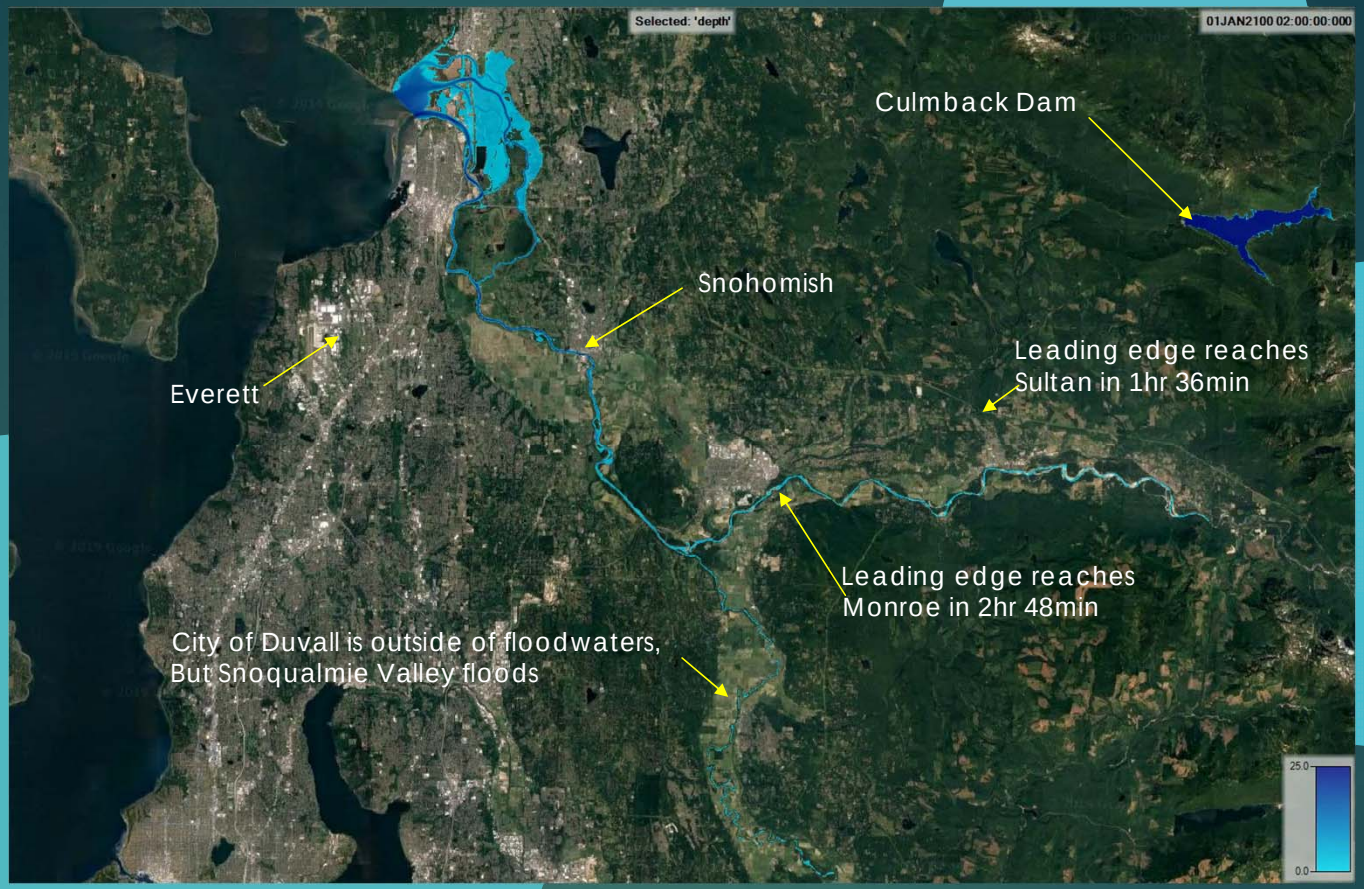


- **EAP/SMP Features**
  - Lake Level Changes
  - Rainfall Gauge
  - Seismic Sensors
  - Piezometers
  - Toe Alarm
  - Stream Gage

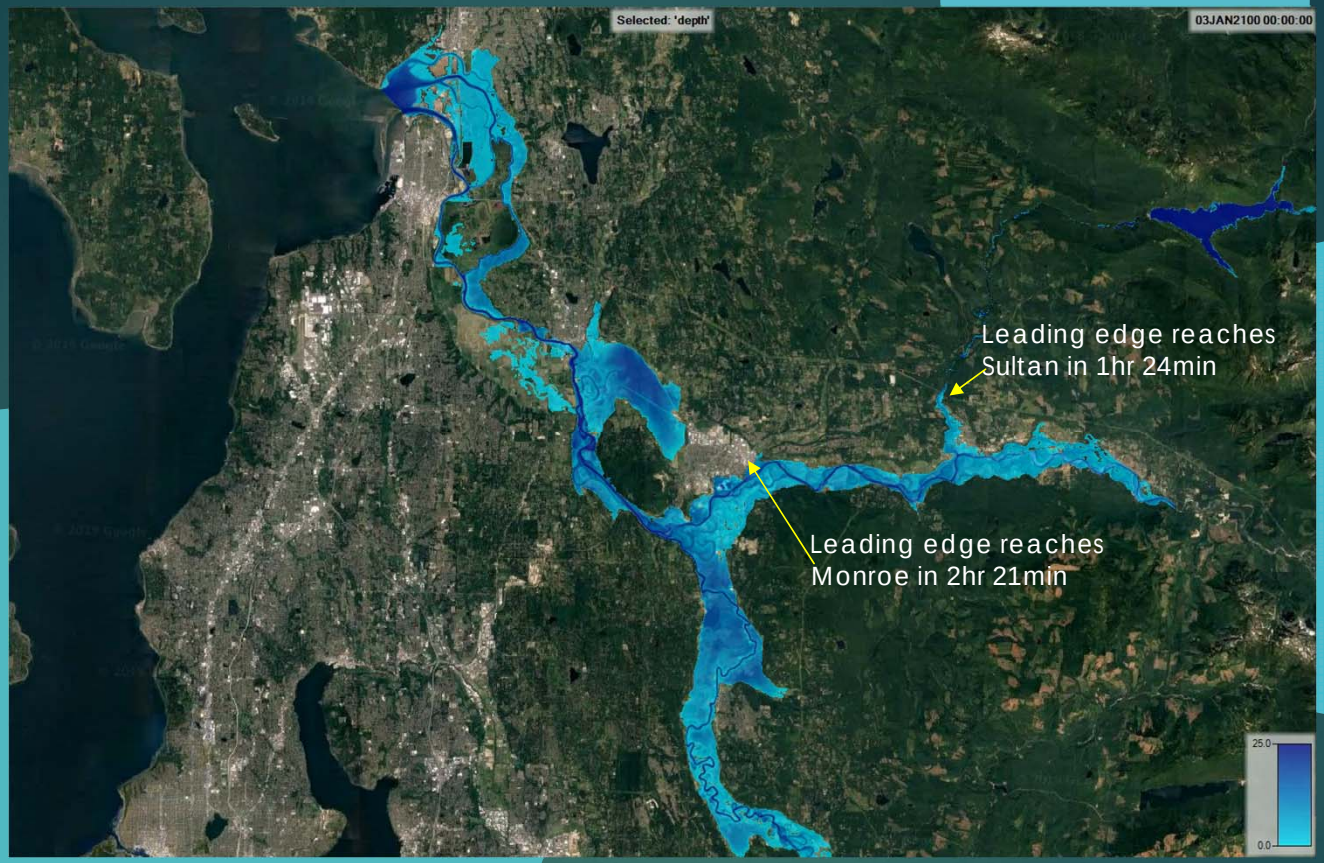
Alarm sent, read following earthquake felt by staff

What happens if the dam fails?

- The animation on the next slide shows the spread of water, and depths associated with a sudden dam failure. It represents a ‘sunny day’ failure.
- This animation and the times associated assume a complete loss of the dam structure virtually instantaneously. This is virtually impossible.
- However, this is a tool to see how destructive the event would be and reinforces that any warnings should be followed up on immediately.



- This animation shows the predicted effect of a sudden failure of Culmback Dam with the downstream area in a fair weather condition

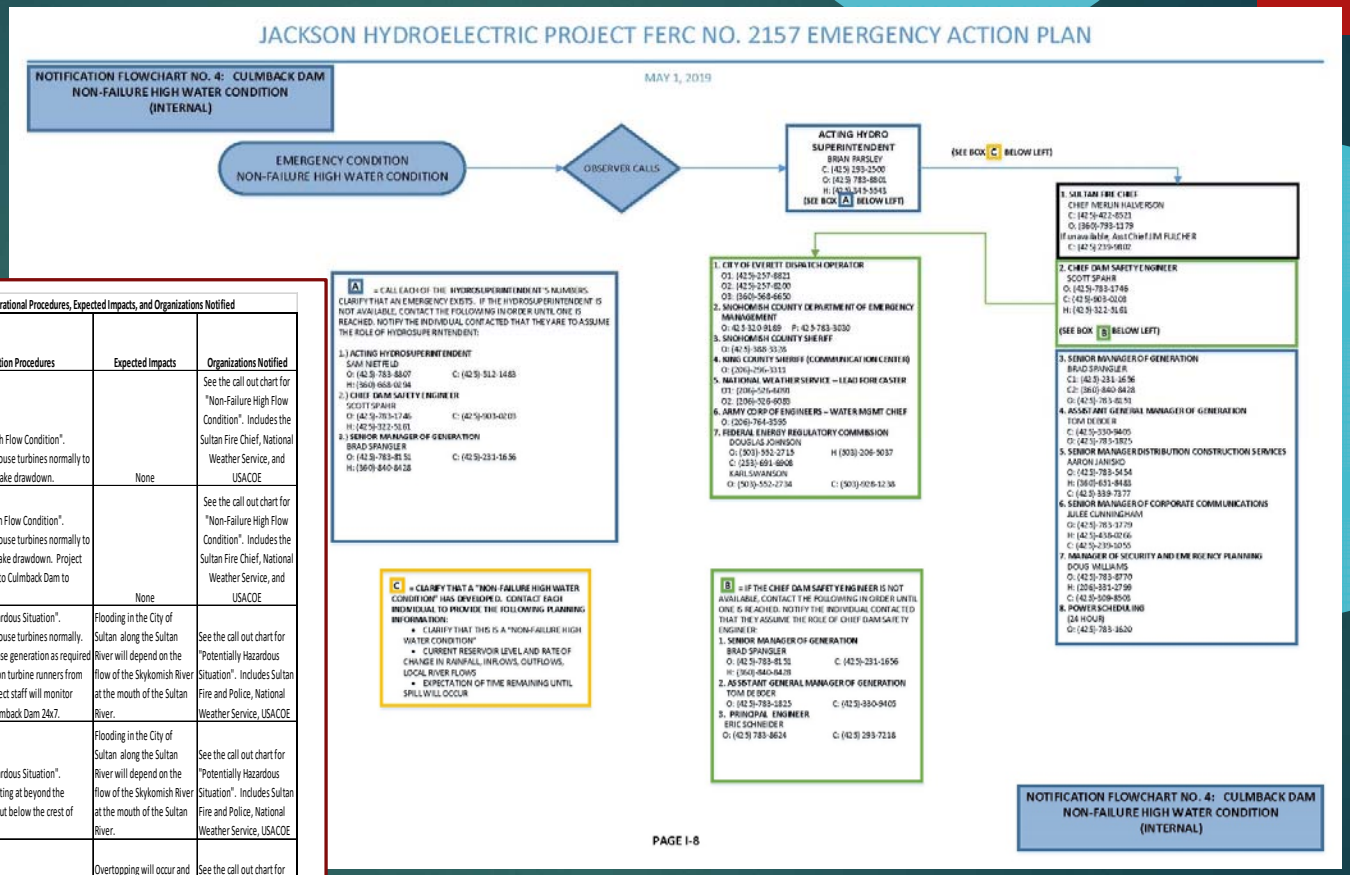


- This animation shows the predicted effect of a sudden failure of Culmback Dam with the downstream area **already** in a 100-year flood condition

How do we alert people of issues?

- The call-outs which follow indicate who is contacted if there is an issue at Culmback Dam.
- All of the calls initiate with an observer contacting the on-call operator (after hours) or the powerhouse (work hours).

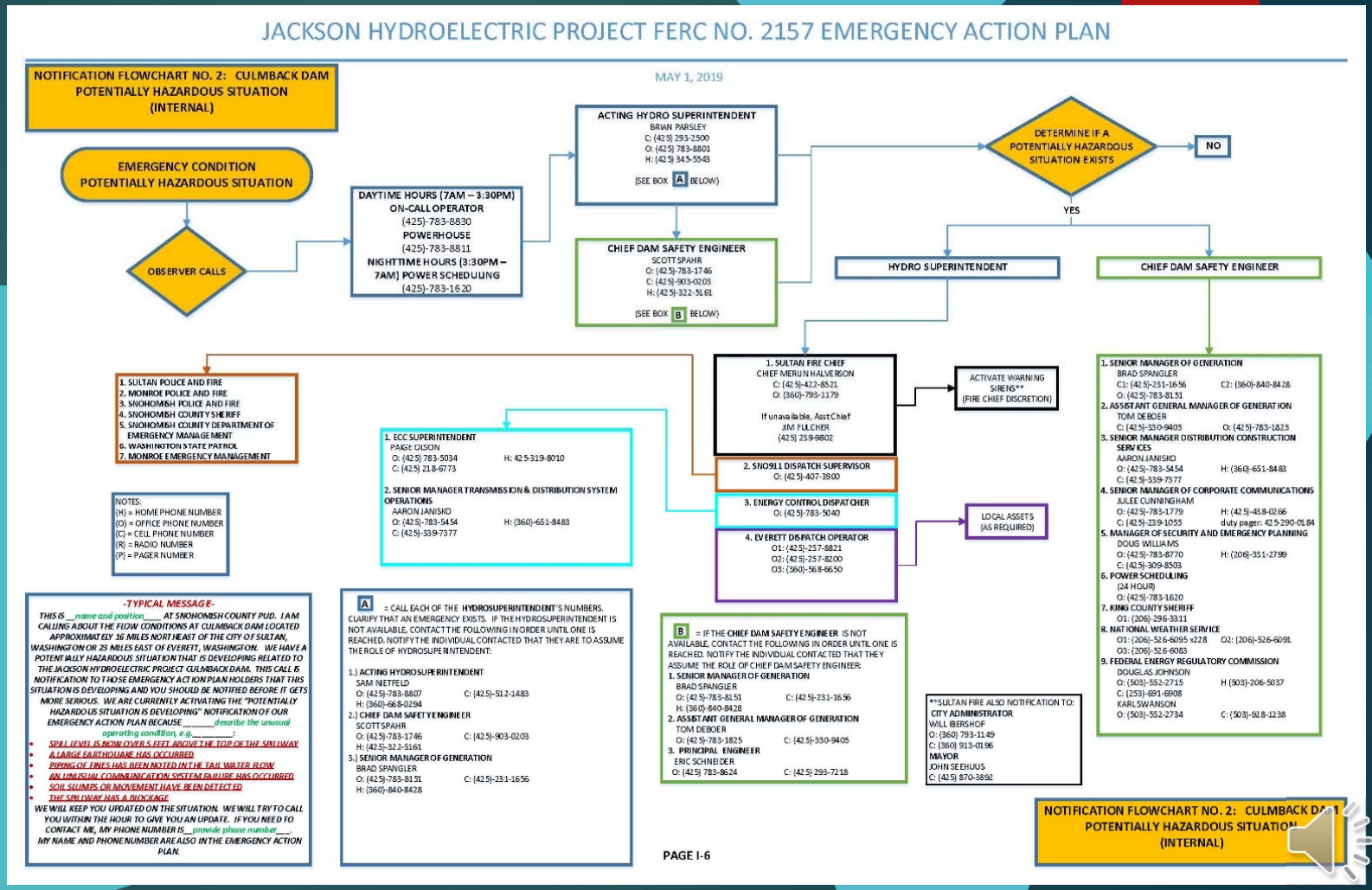
- If a morning glory spill is about to occur



Culmback Dam Outflows Correlated to Operational Procedures, Expected Impacts, and Organizations Notified

Spillway Flow (cfs)	Height over Spillway Crest (ft)	Operation Procedures	Expected Impacts	Organizations Notified
< 3,200	< 2.4	"Non-Failure High Flow Condition". Operate powerhouse turbines normally to facilitate Spada Lake drawdown.	None	See the call out chart for "Non-Failure High Flow Condition". Includes the Sultan Fire Chief, National Weather Service, and USACOE
3,200 to 10,166	2.4 to 5.0	"Non Failure High Flow Condition". Operate powerhouse turbines normally to facilitate Spada lake drawdown. Project staff dispatched to Culmback Dam to monitor 24x7.	None	See the call out chart for "Non-Failure High Flow Condition". Includes the Sultan Fire Chief, National Weather Service, and USACOE
10,166 to 57,780	5.0 to 15.1	"Potentially Hazardous Situation". Operate powerhouse turbines normally. However, decrease generation as required to keep the Pelton turbine runners from inundating. Project staff will monitor conditions at Culmback Dam 24x7.	Flooding in the City of Sultan along the Sultan River will depend on the flow of the Skykomish River at the mouth of the Sultan River.	See the call out chart for "Potentially Hazardous Situation". Includes Sultan Fire and Police, National Weather Service, USACOE
57,680 to 89,786	15.1 to 20.0	"Potentially Hazardous Situation". Spillway is operating at beyond the calculated PMF but below the crest of Culmback Dam.	Flooding in the City of Sultan along the Sultan River will depend on the flow of the Skykomish River at the mouth of the Sultan River.	See the call out chart for "Potentially Hazardous Situation". Includes Sultan Fire and Police, National Weather Service, USACOE
> 89,786	> 20.0	"Failure is Imminent or Has Occurred". Spada Lake elevation is higher than the Culmback Dam crest.	Overtopping will occur and erosion of the down stream slope of the dam is highly likely followed by dam failure.	See the call out chart for "Failure is Imminent or Has Occurred". Includes Sultan Fire and Police, National Weather Service, USACOE

- large earthquakes in Snohomish County
- abnormal reservoir high water levels - unusual spill condition
- spillway blockage
- piping, soil boils, or slumps in the downstream face of Culmback Dam
- movement or settlement of the dam
- communication system failure
- human threats



Failure has occurred, is occurring, or is about to occur.

JACKSON HYDROELECTRIC PROJECT FERC NO. 2157 EMERGENCY ACTION PLAN

MAY 1, 2019

NOTIFICATION FLOWCHART NO. 1: CULMBACK DAM FAILURE IS IMMINENT OR HAS OCCURRED (INTERNAL)

EMERGENCY CONDITION FAILURE IS IMMINENT OR HAS OCCURRED

RADIO OR SCADA ALARM

DAYTIME HOURS (7AM – 3:30PM)
ON-CALL OPERATOR
(425)-783-8830
POWERHOUSE
(425)-783-8811
NIGHTTIME HOURS (3:30PM – 7AM) POWER SCHEDULING
(425)-783-1620

VERIFY ALARM

ACTIVATE WARNING SIRENS**

ACTING HYDRO SUPERINTENDENT
BRIAN PARSLEY
C: (425) 293-2500
O: (425) 783-8801
H: (425) 345-5543
(SEE BOX A BELOW)

1. SULTAN FIRE CHIEF
CHIEF MERLIN HALVERSON
C: (425) 422-8521
O: (360)-793-1179

If unavailable, Asst Chief
JIM FULCHER
(425) 239-9802

2. SNO911 DISPATCH SUPERVISOR
O: (425)-407-3900

3. CHIEF DAM SAFETY ENGINEER
SCOTT SPAHR
O: (425)-783-1746
C: (425)-903-0203
H: (425)-322-5161
(SEE BOX B BELOW)

4. ENERGY CONTROL DISPATCHER
O: (425)-783-5040

5. EVERETT DISPATCH OPERATOR
O1: (425)-257-8821 (cell dispatch)
O2: (425)-257-8200 (main)
O3: (360)-568-6650 (microwave)
O4: (863) 200-1161 (satellite)

LOCAL ASSETS

1. SULTAN POLICE AND FIRE
2. MONROE POLICE AND FIRE
3. SNOHOMISH POLICE AND FIRE
4. SNOHOMISH COUNTY SHERIFF
5. SNOHOMISH COUNTY DEPARTMENT OF EMERGENCY MANAGEMENT
6. WASHINGTON STATE PATROL
7. MONROE EMERGENCY MANAGEMENT

1. ECC SUPERINTENDENT
PAIGE OLSON
O: (425) 783-5034 H: 425-319-8010
C: (425) 218-6773

2. SENIOR MANAGER TRANSMISSION & DISTRIBUTION SYSTEM OPERATIONS
AARON JANISKO
O: (425)-783-5454 H: (360)-651-8483
C: (425)-339-7377

1. SENIOR MANAGER OF GENERATION
BRAD SPANGLER
C1: (425)-231-1656 C2: (360)-840-8428
O: (425)-783-8151
2. ASSISTANT GENERAL MANAGER OF GENERATION
TOM DEBOER
O: (425)-783-1825 C: (425)-330-9405
3. NATIONAL WEATHER SERVICE
O1: (206)-526-6091 O2: (206)-526-6083
4. US ARMY CORP OF ENGINEERS
O1: (206)-764-6702 O2: (206)-877-3495
5. KING COUNTY SHERIFF
O1: (206)-296-3311
6. SNOHOMISH COUNTY ROAD MAINTENANCE
STEVE FLUDE
O: (425)-388-7508 C: (425)-359-0903
7. WASHINGTON STATE DEPARTMENT OF TRANSPORTATION (MONROE)
CECIL RENCH
O1: (425)-239-9820 O2: (206)-440-4490
8. PUGET SOUND ENERGY (PSE) DISPATCH CENTER
O1: (425) 885-4544 O2: (800)-462-1360
9. BONNEVILLE POWER ADMINISTRATION (BPA) DISPATCHER
O1: (800)-392-0816 O2: (360)-418-2281
10. BURLINGTON NORTHERN COMMAND CENTER
O: (800)-832-5452
11. SEATTLE CITY LIGHT
SYSTEMS CONTROL CENTER
O1: (206)-706-0203 O2: (206)-706-0204
12. US FOREST SERVICE
FOREST SUPERVISOR
O1: (425)-783-6010 O2: (425)-315-2091
13. GENERAL MANAGER
JOHN HAARLOW
O: (425)-783-8100 C: (425)-319-4200
14. SENIOR MANAGER OF CORPORATE COMMUNICATIONS
JULEE CUNNINGHAM
O: (425)-783-1779 H: (425)-438-0266
C: (425)-239-1055 duty pager: 425-290-0184
15. MANAGER OF SECURITY AND EMERGENCY PLANNING
DOUG WILLIAMS
O: (425)-783-8770 H: (206)-331-2799
C: (425)-309-8503
16. POWER SCHEDULING
(24 HOUR)
O: (425)-783-1620
17. FEDERAL ENERGY REGULATORY COMMISSION
DOUGLAS JOHNSON
O: (503)-552-2715 H (503)-206-5037
C: (253)-691-6908
KARL SWANSON
O: (503)-552-2734 C: (503)-928-1238

NOTES:
(H) = HOME PHONE NUMBER
(O) = OFFICE PHONE NUMBER
(C) = CELL PHONE NUMBER
(R) = RADIO NUMBER
(P) = PAGER NUMBER

-TYPICAL MESSAGE-

THIS IS __name and position____ AT SNOHOMISH COUNTY PUD. WE HAVE AN EMERGENCY CONDITION AT JACKSON HYDROELECTRIC PROJECT'S CULMBACK DAM LOCATED APPROXIMATELY 16 MILES NORTHEAST OF THE CITY OF SULTAN, WASHINGTON OR 23 MILES EAST OF EVERETT, WASHINGTON. WE ARE CURRENTLY ACTIVATING THE FAILURE IS IMMINENT OR HAS OCCURRED NOTIFICATION OF OUR EMERGENCY ACTION PLAN BECAUSE:_____ explain why, e.g._____

- *DAM FAILURE HAS OCCURRED OR IS OCCURRING*
- *WATER LEVELS ARE CLOSE TO THE TOP OF THE DAM*
- *A SINKHOLE HAS APPEARED ON THE DAM*

PLEASE REFERENCE YOUR COPY OF CULMBACK DAM EMERGENCY ACTION PLAN AND THE ENCLOSED INUNDATION MAPS, WHICH APPLY TO YOUR JURISDICTION.

WE WILL KEEP YOU UPDATED ON THE SITUATION, WHETHER THE SITUATION IS RESOLVED OR GETS WORSE. WE WILL TRY TO CALL YOU WITHIN THE HOUR TO GIVE YOU AN UPDATE. IF YOU NEED TO CONTACT ME, MY PHONE NUMBER IS__provide phone number____. MY NAME AND PHONE NUMBER ARE ALSO IN THE EAP

A = CALL EACH OF THE **HYDROSUPERINTENDENT'S** NUMBERS. CLARIFY THAT AN EMERGENCY EXISTS. IF THE HYDROSUPERINTENDENT IS NOT AVAILABLE, CONTACT THE FOLLOWING IN ORDER UNTIL ONE IS REACHED. NOTIFY THE INDIVIDUAL CONTACTED THAT THEY ARE TO ASSUME THE ROLE OF HYDROSUPERINTENDENT:

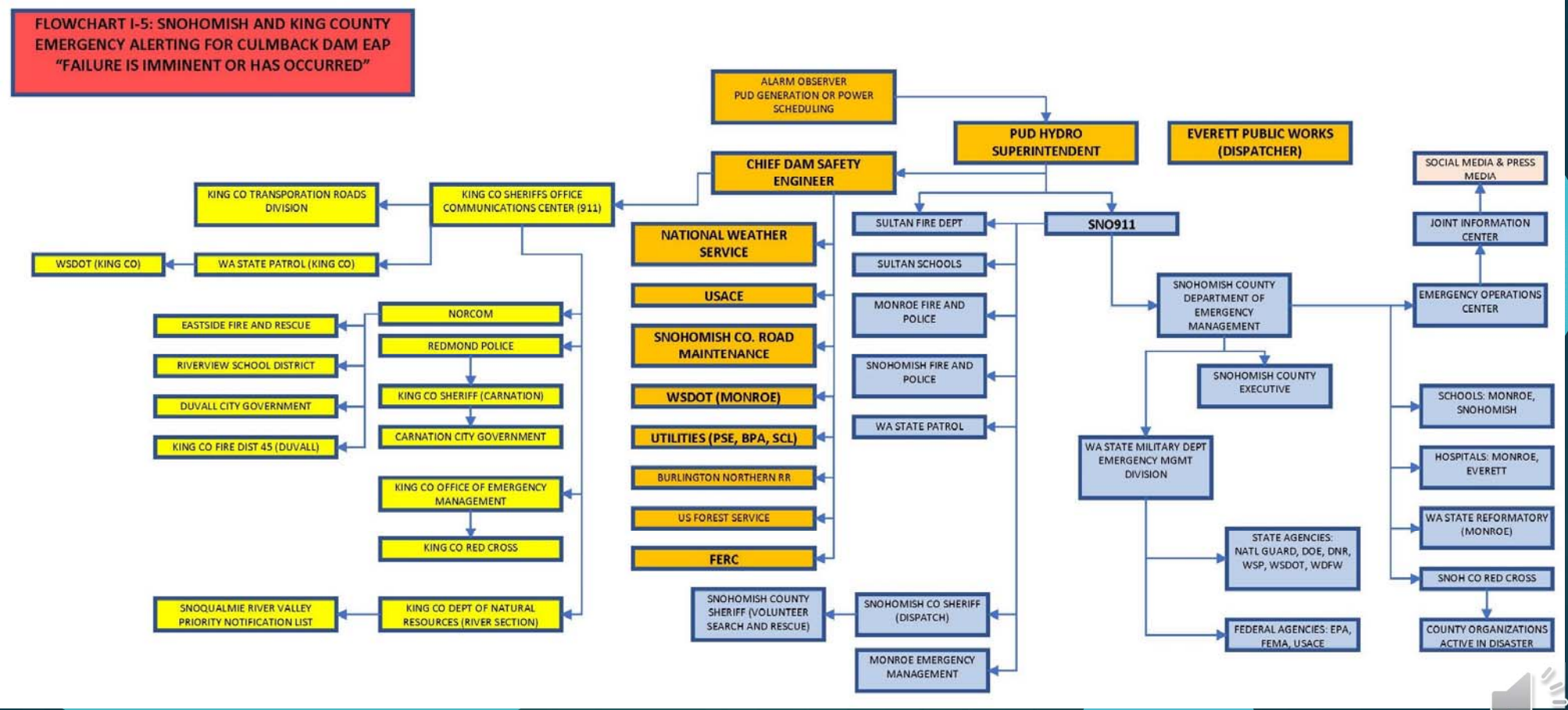
1.) **ACTING HYDROSUPERINTENDENT**
SAM NIETFELD
O: (425)-783-8807 C: (425)-512-1483
H: (360)-668-0294
2.) **CHIEF DAM SAFETY ENGINEER**
SCOTT SPAHR
O: (425)-783-1746 C: (425)-903-0203
H: (425)-322-5161
3.) **SENIOR MANAGER OF GENERATION**
BRAD SPANGLER
O: (425)-783-8151 C: (425)-231-1656
H: (360)-840-8428

B = IF THE **CHIEF DAM SAFETY ENGINEER** IS NOT AVAILABLE, CONTACT THE FOLLOWING IN ORDER UNTIL ONE IS REACHED. NOTIFY THE INDIVIDUAL CONTACTED THAT THEY ASSUME THE ROLE OF CHIEF DAM SAFETY ENGINEER:
1.) **SENIOR MANAGER OF GENERATION**
BRAD SPANGLER
O: (425)-783-8151 C: (425)-231-1656
H: (360)-840-8428
2.) **ASSISTANT GENERAL MANAGER OF GENERATION**
TOM DEBOER
O: (425)-783-1825 C: (425)-330-9405
3.) **PRINCIPAL ENGINEER**
ERIC SCHNEIDER
O: (425) 783-8624 C: (425) 293-7218

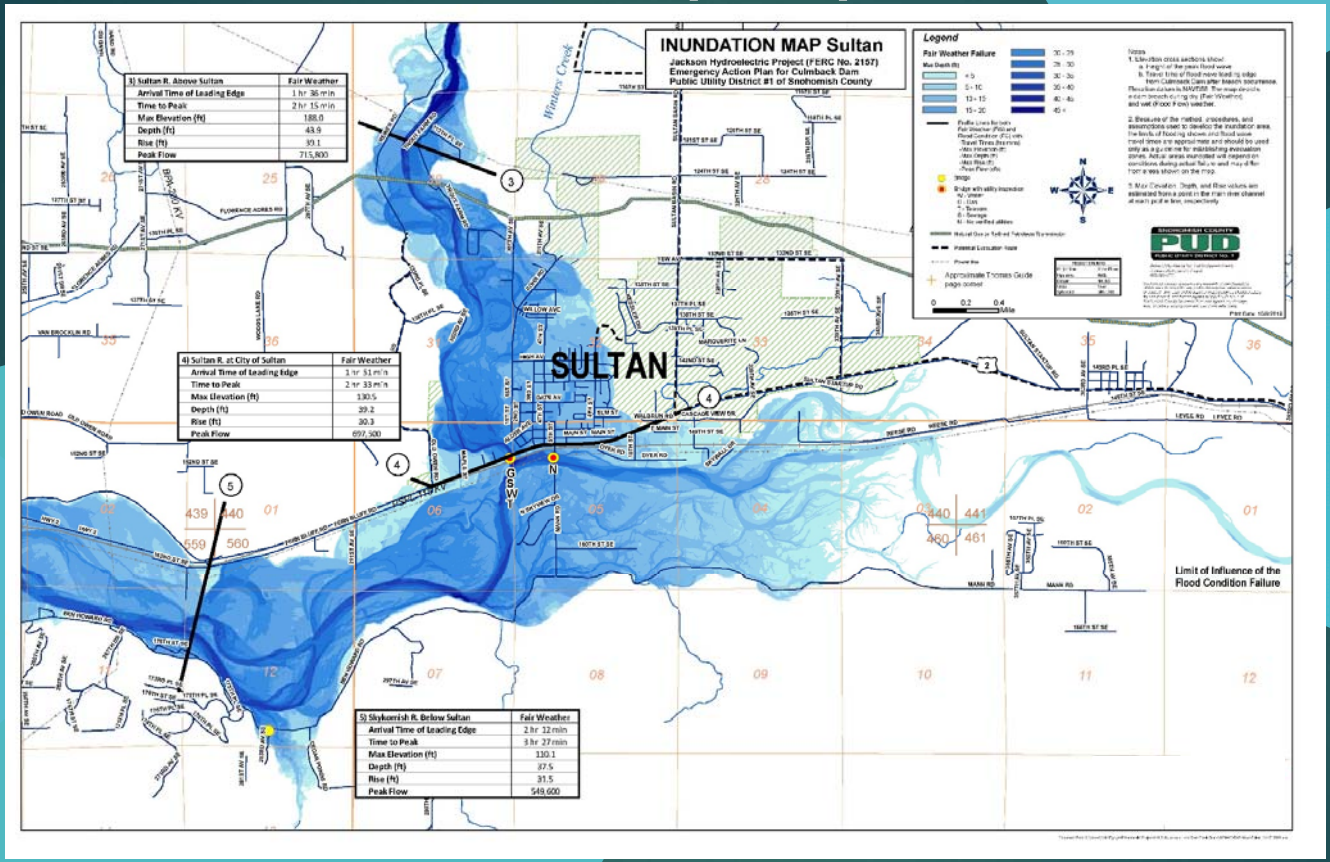
**SULTAN FIRE ALSO NOTIFICATION TO:
CITY ADMINISTRATOR
WILL IBERSHOF
O: (360) 793-1149
C: (360) 913-0196
MAYOR
JOHN SEEHUUS
C: (425) 870-3892

NOTIFICATION FLOWCHART NO. 1: CULMBACK DAM FAILURE IS IMMINENT OR HAS OCCURRED (INTERNAL)

Communication beyond the PUD



Inundation Map Update



- The inundation maps were recently updated as the result of new hydraulic modeling, and represent depth in a graduated color scheme.

Summary

- Culmback Dam provides essential public services (water and electricity) to Snohomish County.
- The dam is well-built, maintained and monitored.
- Because of the consequence of failure, it is important to know what to do in an emergency. Quick action is key, and it is better to over-communicate.
- What I need from you: Please review that you have a current copy of the Culmback Dam Emergency Action Plan. Make sure it has accurate contact information for your agency, and that anyone who would be responding to an emergency has reviewed.

Questions and Feedback

- We would welcome any questions or feedback:

  Eric Schneider

  (425) 293-7218

  easchneider@snopud.com

  or

  Scott Spahr

  (425) 903-0203

  sdspahr@snopud.com

  ** Particularly let me know about inaccurate contact information, or a lack of EAP copies.