

July 11, 2024

# **SPIRIT LAKE OUTFLOW SAFETY IMPROVEMENT PROJECT**

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Virtual Public Meeting No. 1



# Opening Remarks



# TODAY'S AGENDA

- **Introductions**
- **Why Are We Here?**
  - History of the Spirit Lake Outflow Tunnel and the Mount St. Helens National Volcanic Monument
  - Current status of the outflow tunnel
  - Purpose of this meeting: Stakeholder Engagement
- **Studies, Collaboration and Planning Efforts to Date**
  - NASEM Recommendation for Enhanced Outreach
- **Initial Identification of Stakeholder Values**
- **Engineering Feasibility Analysis**
  - Army Corps Studies
  - Ongoing Outflow Options Evaluations
- **What Comes Next?**
  - Continued Stakeholder Engagement
  - Stakeholder Questionnaire
  - NEPA Scoping





# Leader's Intent Statement

*Gifford Pinchot National Forest Supervisor Johanna Kovarik*



Stewarding for public safety and the outstanding geologic, ecologic, and cultural resources, of the Mount St. Helens National Volcanic Monument is an essential part of our work on the Gifford Pinchot National Forest. Improving the safety, integrity, and function of the Spirit Lake Outflow after 40 years of operation is a critical part of that work. The agency investment of assembling current information about Mount St. Helens, Spirit Lake and the Toutle-Cowlitz River System, as well as seeking public and stakeholder values regarding this dynamic system is crucial as the Forest Service begins environmental analysis for the Spirit Lake Outflow Safety Improvement Project.

The Spirit Lake Outflow Engineering Feasibility Analysis, Tribal Consultation and Collaboration, and Stakeholder Engagement are all essential components that will provide a firm foundation for the team to develop alternatives for a resilient Spirit Lake Outflow that considers the values and needs of the people and the ecological system of the Toutle/ Cowlitz River drainages and Mount St. Helens.

The alternatives will be informed by:

- Government to Government Consultation with the Tribes,
- An integrated effort in identifying concerns, issues, and values from the community as well as adjacent management and regulatory agency missions, and
- Identification of potential Spirit Lake Outflow options as informed by an Engineering Feasibility Analysis.

As we strive to gain public input, the team looks forward to engaging with those interested in being a part of exploring a resilient solution to managing the outflow from Spirit Lake.



# Dan Tormey, PhD, PG

- Nationally recognized NEPA expert
- Success at innovative outreach programs involving detailed stakeholder mapping, monitoring, contingency planning, and training
- USDA Forest Service National Monument experience: NASEM Science Advisory Board for Giant Sequoia National Monument in California where he helped develop their management plan
- Long-term work in the IUCN's Geoheritage Specialist Group with a focus on volcanic heritage and best practices for managing protected areas worldwide
- Research focus on large sector collapse and debris flow in the Andes Mountains that included recommended management activities for similar volcanoes



## Guidelines for geoconservation in protected and conserved areas

Crofts, R., Gordon, J.E., Briha, J., Gray, M., Gunn, J., Larwood, J., Santucci, V.L., Tormey, D., and Worboys, G.L.

Craig Groves, Series Editor



## World Heritage Volcanoes

Classification, gap analysis, and recommendations for future listings

Thomas J. Casadevall, Daniel Tormey and Jessica Roberts



# Mark Havekost, PE

- Detailed understanding of the geotechnical aspects of tunnels, dams, water conveyance systems, and hydropower projects.
- National expert in design of water conveyance tunnels.
- Served as an outside technical reviewer for the ACOE's internal design of the Spirit Lake Tunnel repairs.
- Expertise in the identification, evaluation, and mitigation of geohazards.
- Geotechnical and underground design lead for the evaluation, risk assessment, conceptual design, and cost estimating of a new low level outlet at Oroville Dam as part of DWR's Comprehensive Needs Assessment of the Oroville facility following the spillway incident.
- Core technical team member for Potential Failure Mode Analyses (PFMA)/Dam Safety Evaluation for the dams and outlet works on Puget Sound Energy's Lower and Upper Baker Hydroelectric Projects.

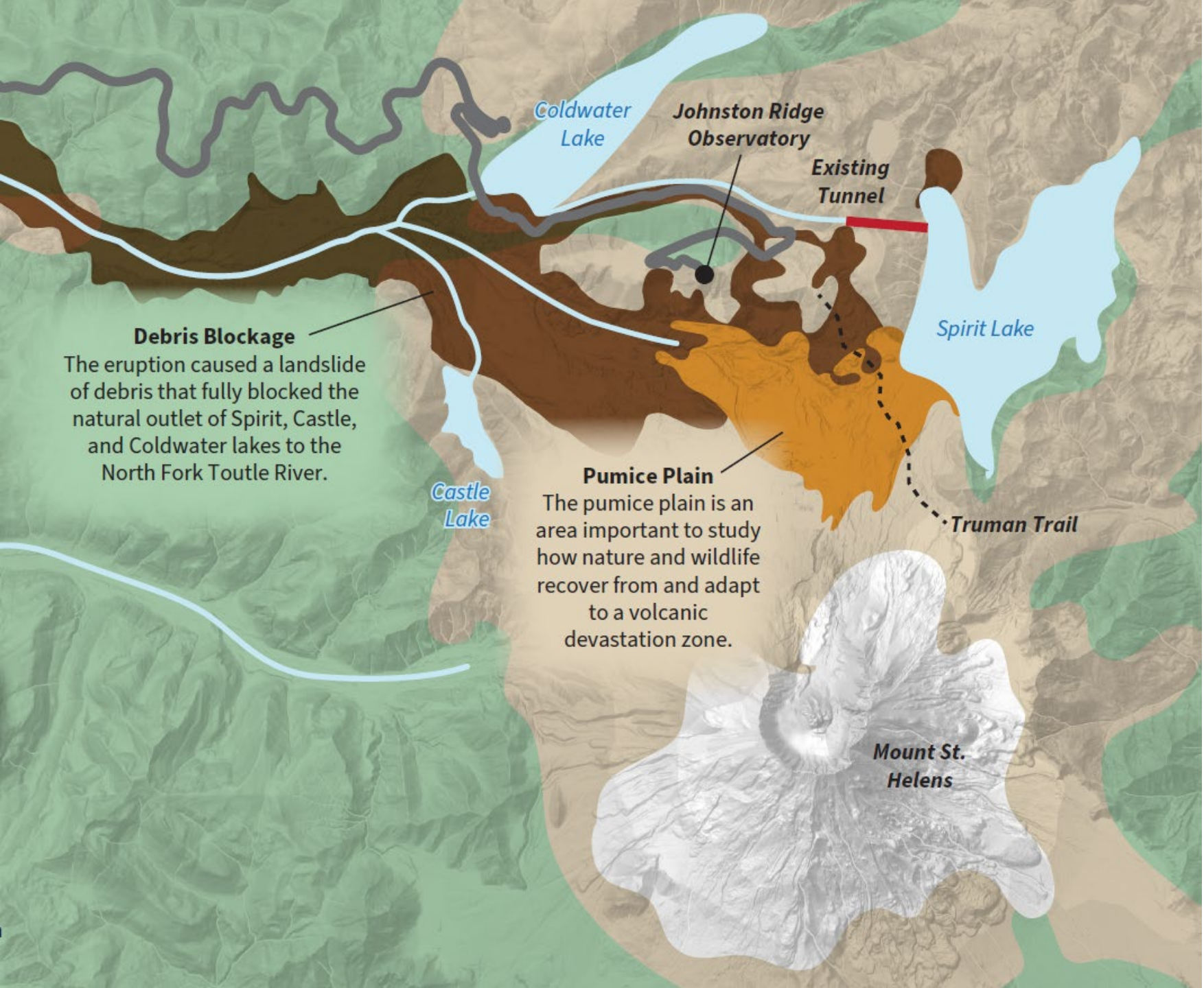




# Why are we here today?



# Mount St. Helens Volcano and Spirit Lake



**Debris Blockage**  
The eruption caused a landslide of debris that fully blocked the natural outlet of Spirit, Castle, and Coldwater lakes to the North Fork Toutle River.

**Pumice Plain**  
The pumice plain is an area important to study how nature and wildlife recover from and adapt to a volcanic devastation zone.

# History of the Spirit Lake Outflow Tunnel



**1980:** Mount St. Helens erupts, causing widespread damage and loss of 57 lives. Blast debris blocks the outlet to Spirit Lake, and the lake can no longer drain.



**1982:** Impounded waters of Spirit Lake rise dangerously and FEMA fears a catastrophic flood from a potential breach of the debris blockage is imminent. The US Army Corps of Engineers (Army Corps) deploys barge-mounted pumps to remove water from the lake.



**1989:** The Army Corps builds a sediment retention structure on the North Fork Toutle River to counteract ongoing sedimentation in the area's rivers by slowing the flow of water to allow debris to settle rather than be carried downstream.



**1995 & 1996:** Major tunnel repairs are required for two consecutive years. During these efforts, Spirit Lake is unable to discharge. Rising water levels approach the maximum safe operating levels where pressure on the natural debris blockage increases, and creates concern about potential future tunnel failure and the downstream consequences.

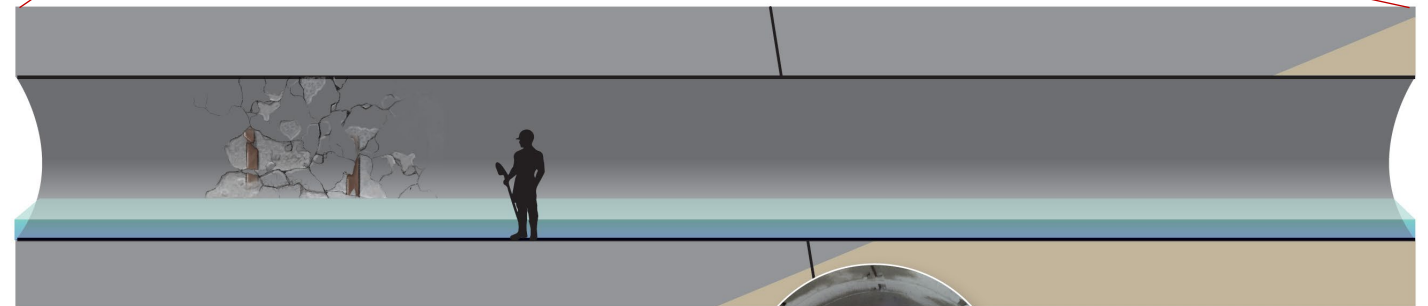


**2016:** Major tunnel repairs noted during annual inspections are addressed. As in 1995 and 1996, Spirit Lake water levels approach maximum safe operating levels while repairs are underway.



**2021:** The U.S. Forest Service (USFS), Gifford Pinchot National Forest is seeking a long-term solution to managing Spirit Lake water levels. As the responsible agency, the Forest Service must address the consequences of the aging tunnel, and a single lake outlet.

**1985:** A tunnel is bored through Harry's Ridge to create a new outlet for Spirit Lake water. This addresses the immediate dangers of the lake overflow release of the debris block downstream communities



**1995/1996:** Large sections of shotcrete had pulled away from the tunnel walls and the floor had heaved and cracked. Some supportive ribs had buckled.



**2015/2016:** Significant floor heave from high ground pressure reduced the tunnel diameter from 11 feet to 7 feet, restricting flow capacity.

May 7, 2015

The Honorable Tom Tidwell  
Chief  
U.S. Forest Service  
1400 Independence Ave. S.W.  
Washington, D.C. 20250

The Honorable Jo-Ellen Darcy  
Assistant Secretary of the Army (Civil Works)  
U.S. Army Corps of Engineers  
108 Army Pentagon  
Washington, D.C. 20310-0108

The Honorable Suzette Kimball  
Director (Acting)  
U.S. Geological Survey  
12201 Sunrise Valley Drive  
Reston, VA 20192

Dear Chief Tidwell, Assistant Secretary Darcy, and Director Kimball:

We write with serious concern regarding the state of the Spirit Lake Tunnel, located on the Gifford Pinchot National Forest in our home state of Washington. We understand that the tunnel is in significant need of renovation and repair and we wish to ensure federal agencies are doing everything in their power to prevent a structural failure, including communicating their needs to Congress. Complete failure of this tunnel in the shadow of Mount St. Helens could be catastrophic to Washington state on multiple levels.

While the tunnel is located on land managed by the U.S. Forest Service (USFS) and is operated and maintained by the USFS, it was constructed by the U.S. Army Corps of Engineers (Army Corps). Using funds provided by the USFS, the Army Corps has provided inspection and repair work on the tunnel throughout its existence, and the U.S. Geological Survey (USGS) has monitored seismic activity in the region at the Cascades Volcano Observatory.

## Spirit Lake tunnel operating again

Andre Stepankowsky andre@tdn.com Mar 15, 2016 0

SALE! SUBSCRIBE FOR \$1/MO.



## Failure of Wash. volcano runoff could be catastrophic

Kyle Iboshi KGW Staff

Published 7:20 p.m. ET May 14, 2015



Spirit Lake Tunnel Kyle Iboshi. KGW

# Purpose of the Project and this Meeting

## Public Safety



*The primary purpose of the Spirit Lake Outflow Safety Improvement Project is to manage and maintain infrastructure to maintain water levels and have redundancy in the protections. Should the lake levels rise and breach the debris blockage, the downstream communities in the Toutle River and Columbia River systems would be endangered. USFS has a responsibility to prevent this event.*



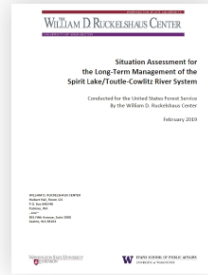
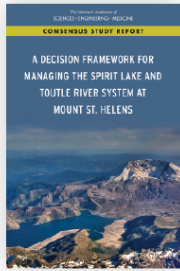
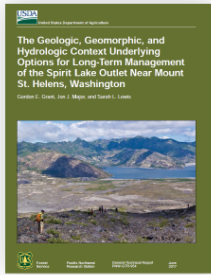
## Enhanced Outreach Process

USFS recognizes the various resources and stakeholder values in the Mount St. Helens area and Toutle River system. A primary reason for the enhanced outreach process is to build in additional time to engage with stakeholders and incorporate their input into the engineering and options design process before beginning formal NEPA compliance.



# Collaboration and Planning Efforts So Far...

The Spirit Lake and Mount St. Helens area has been the subject of extensive research efforts focusing on understanding the unique geological and ecological aspects of the region as well as identifying and collaborating with a diverse array of stakeholders whose interests and communities are impacted by tunnel management decisions.



**2017:** The **USFS Pacific Northwest Research Station** publishes a semiquantitative risk assessment that explores the three principal regional hazards (floods, earthquakes, and eruptions) as they relate to the Spirit Lake debris blockage and potential tunnel solutions.

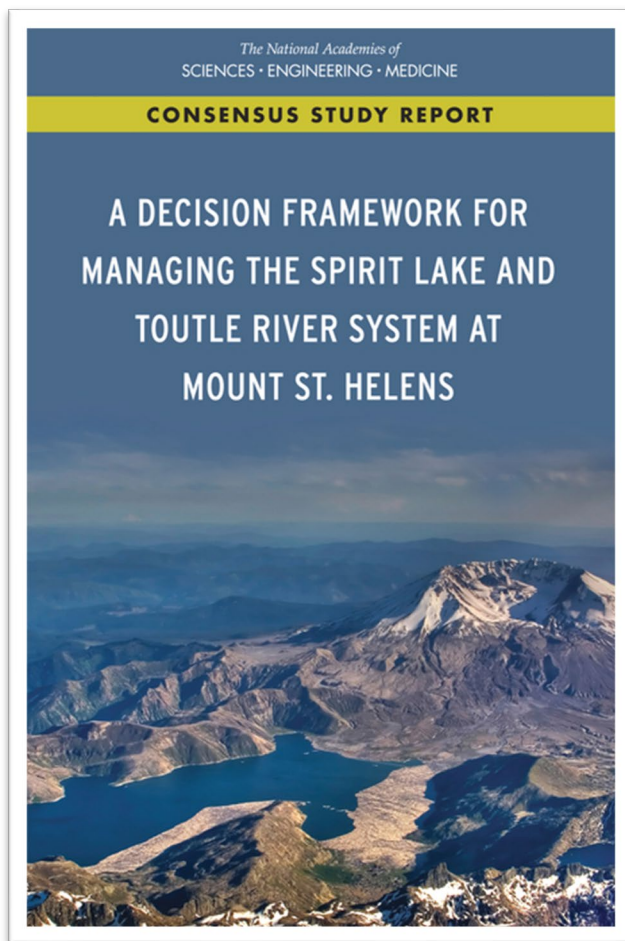
**2018:** Inspections of the outflow tunnel indicate a need for millions of dollars in repairs to avoid failure. The **National Academies of Sciences, Engineering, and Medicine (NASEM)** publishes a comprehensive report proposing decision-making processes to address the long-term safety and management issues related to the Spirit Lake tunnel and the Toutle River system.

**2019:** The USFS commissions the **William D. Ruckelshaus Center** to draft a Situation Assessment for the “Long-Term Management of the Spirit Lake/Toutle-Cowlitz River System”. Interviews are conducted with stakeholders from public, private, tribal, and nonprofit entities. Common themes and sub-themes are identified in values and preferences for how to manage the challenging system.

**2020:** USFS completes the NEPA process for the **Spirit Lake Tunnel Intake Gate Replacement and Geotechnical Drilling Project**. This Project is separate from the Spirit Lake Outflow Safety Project. The Tunnel and Gate replacement project is a maintenance and safety project and includes repairing the tunnel inlet, building temporary roads to the work area, and conducting geotechnical drilling. This work is currently underway and scheduled for completion in 2027.

**2021-2024:** USFS conducts stakeholder engagement in parallel with engineering feasibility analysis of potential outflow options prior to beginning the NEPA compliance process. Based on the NASEM Report recommendations, the **Spirit Lake, Toutle/Cowlitz River Collaborative** was created as a system-level entity to lead a collaborative multi-agency, multi-jurisdictional effort with the goal of addressing sediment management and risks associated with catastrophic flood in the Spirit Lake and Toutle/Cowlitz River system.

# Decision Support in a Controversial Setting of Geoheritage, Biodiversity, and Cultural Values

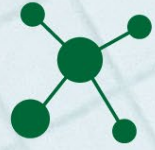


- **US National Academy of Sciences and Medicine (NASEM)** conducted an extensive study about managing the Spirit Lake and Toutle River system and recommended **multi-criteria decision analysis** as the essential tool.
- The Ruckelshaus Center Situation Assessment of key issues and stakeholder values. Led to the development of the Spirit Lake/Toutle-Cowlitz Rivers Collaborative (“**the Collaborative**”)
- The USFS and Catalyst are conducting **Enhanced Outreach** to put these studies into practice, including Engineering Feasibility Analysis to support outflow options development and the upcoming NEPA analysis

# Multi-Criteria Decision Analysis: Balancing Science, Engineering Feasibility, Stakeholder Values



- Provide a firm foundation for agency decisionmakers to develop a Proposed Action and draft alternatives for a resilient Spirit Lake Outflow solution.
- Integrated effort including public and stakeholder values and adjacent management and regulatory agency missions identified for Public Participation.
- Balance scientific values, engineering objectives and constraints, and input from interested parties, agency, and government



### Stakeholder Engagement

USFS will engage stakeholder groups to seek input on potential outflow options. This will be done through working group sessions, questionnaires, and videos/presentations.



### Outflow Options Development

Outflow options development plays a key role in the NEPA process. All feasible outflow options will be considered in formulation of draft alternatives for NEPA.



### Engineering Feasibility Analysis

USFS is developing an Engineering Feasibility Assessment during the stakeholder engagement phase to capture stakeholder input and carry potential outflow options forward into the design phase.

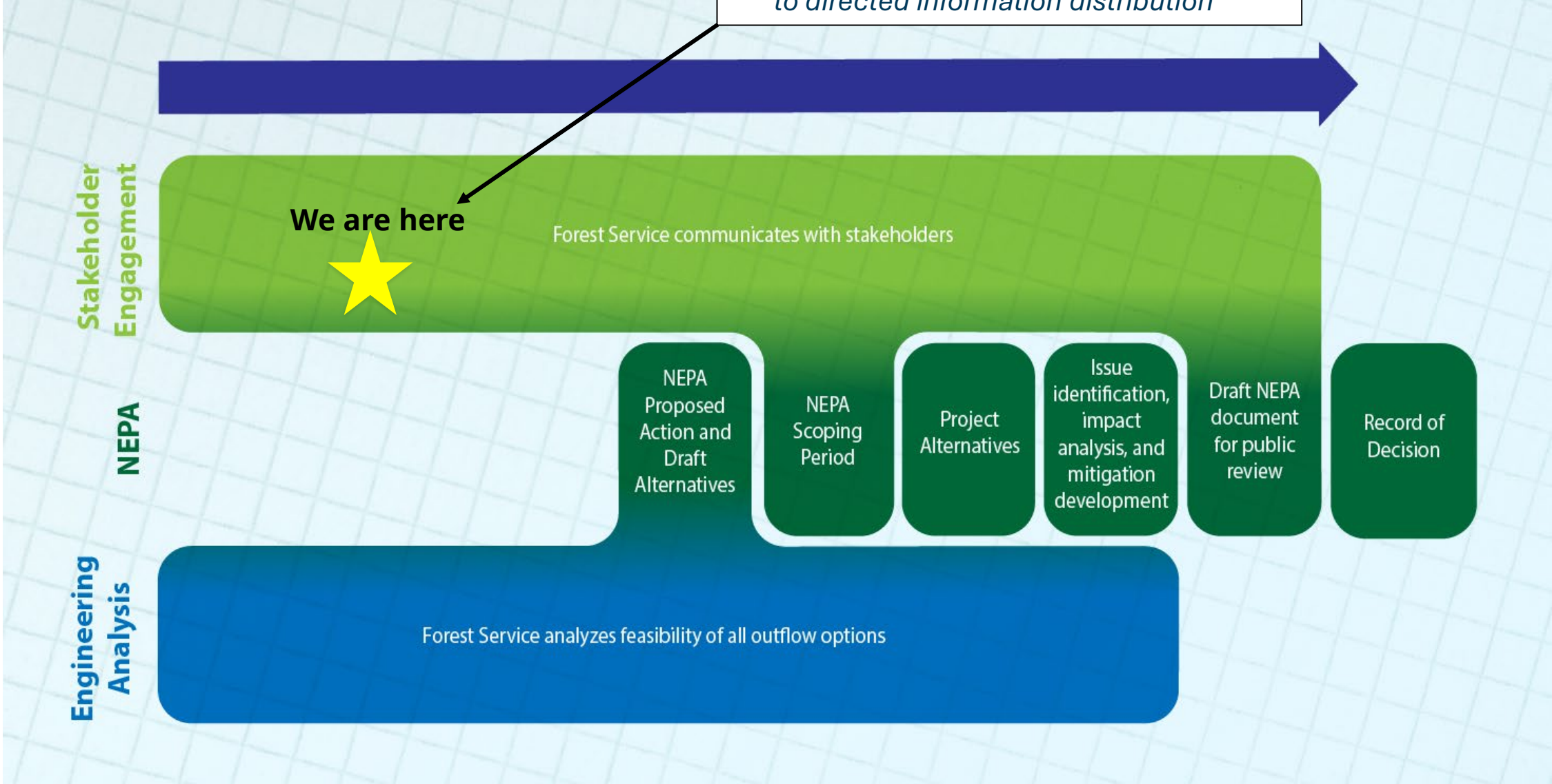


# The Enhanced Outreach Process

In the years and months leading up to NEPA, USFS and the local Collaborative Group have hosted many discussions, identified values, and explored ideas and solutions. This is an iterative process which relies on continued engagement with stakeholders. All these efforts will inform later NEPA compliance documentation.

# The Process and Timeline

**Enhanced Outreach:**  
*NASEM recommends dialogue in addition to directed information distribution*



# A SPECIAL PLACE

## Balancing Research, Nature, Economy, Heritage, and Recreation in the Spirit Lake Ecosystem

Spirit Lake and Mount St. Helens have value to many diverse stakeholders. While Spirit Lake is the focal point of the Project Area, its management plays a role in the Toutle River, Cowlitz River, and Columbia River systems. Valued resources include:

- Public Safety
- Cultural Resources – Mount St. Helens is a listed Traditional Cultural Property due to the sacred significance of the volcano to tribes
- Sediment and flood control downstream of Spirit Lake
- Recreation
- Decades-long research projects on the Monument, particularly on the pumice plain
- Fish and wildlife habitat
- Local Economy – tourists and visitors come from around the world



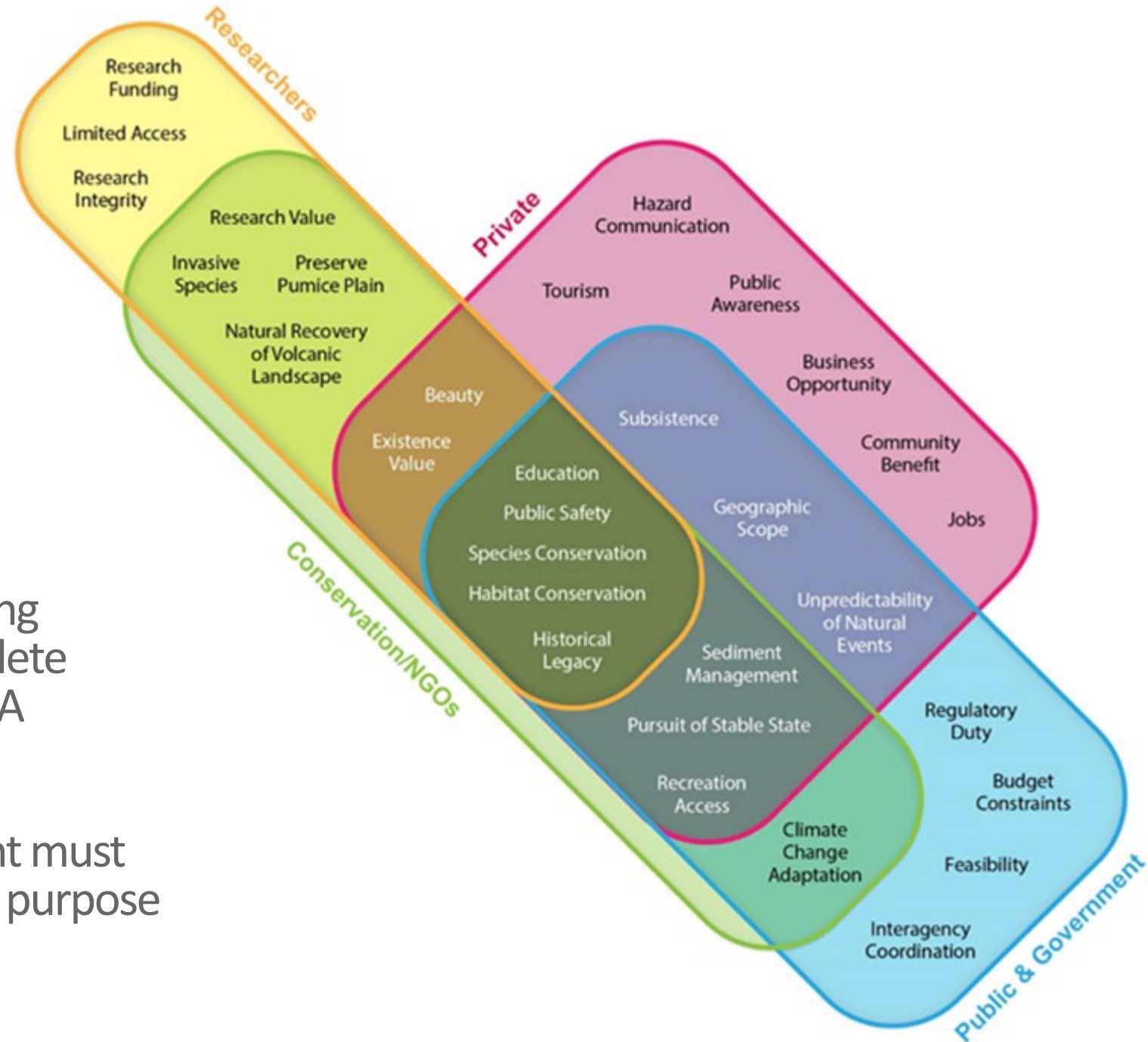
# Issues and Values Mapping Exercise

## Types of Stakeholders

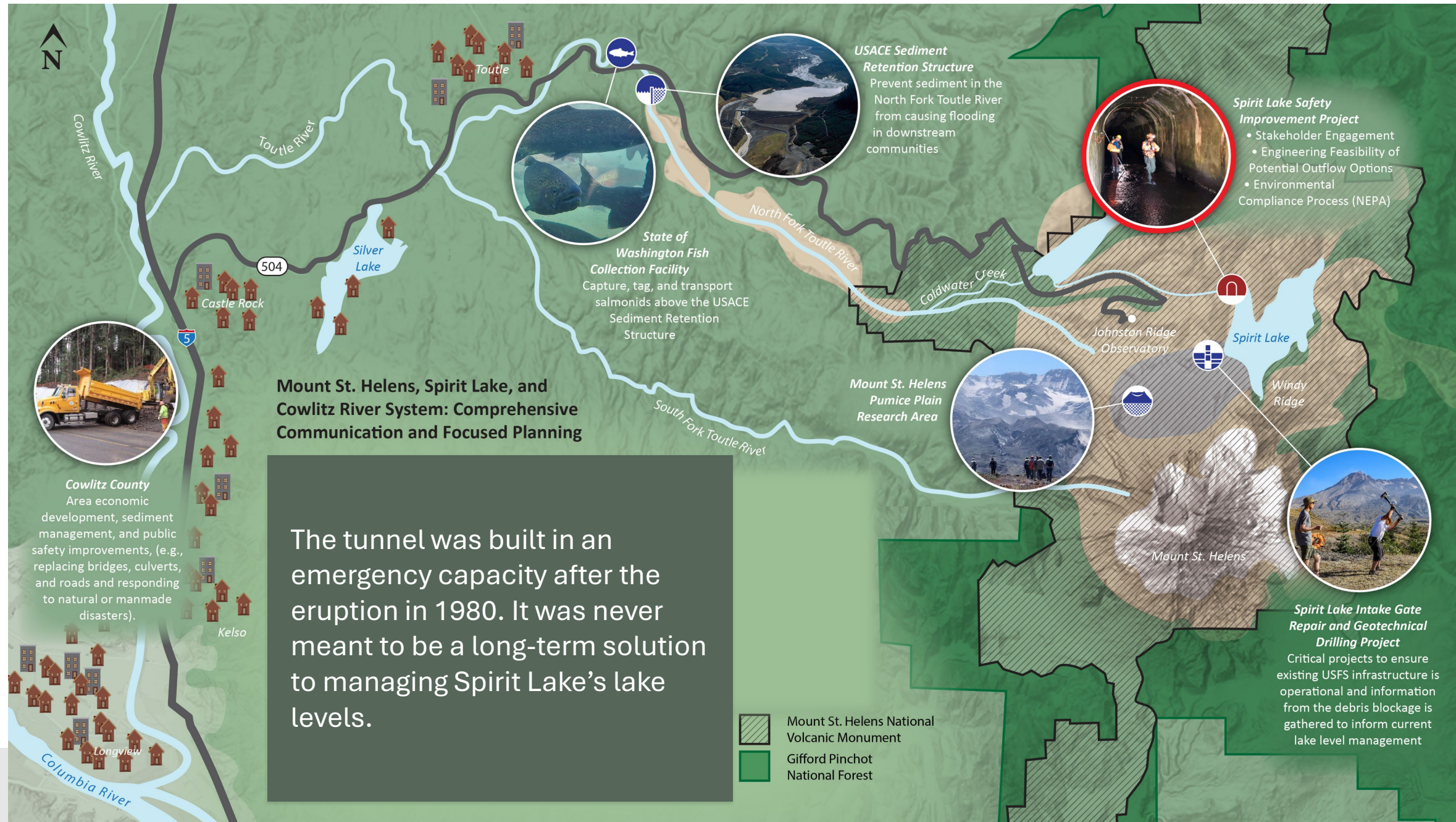
- Private
- Public/Government
- Research/Academia, and
- Conservation/NGOs

Issues and values overlap to varying degrees: from no overlap to complete overlap. These will inform the NEPA “Purpose and Need” statement.

NEPA Purpose and Need statement must also include Forest’s management purpose



# The Collaborative and Current Enhanced Outreach: Shared goals, different geography and timeline



# NASEM Recommended Next Steps

## Development of Alternatives

- “Common mistake is to construct alternatives from too narrow of a set of possible options”
- Screening level analysis recommended first, in dialogue and using the project objectives

## NASEM alternatives

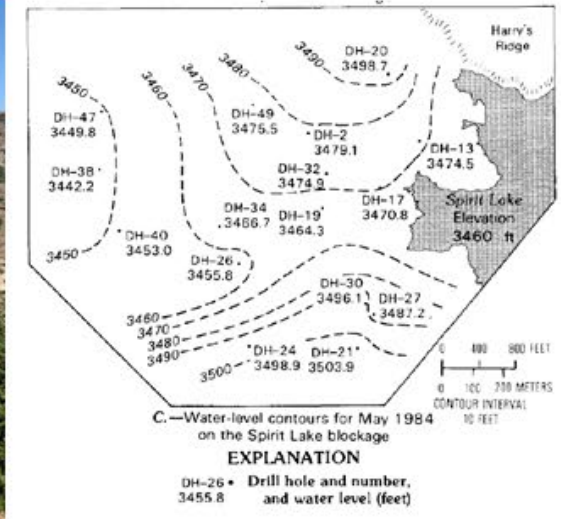
- Rehabilitate tunnel
- Covered conduit
- Open channel
- Alternative drainage tunnel
- Pumping station (and on standby)

## Decision consequences and tradeoffs (i.e., NEPA)



# Engineering Feasibility Analysis Overview

## Identifying and Analyzing Outflow Improvement Options





US Army Corps  
of Engineers  
Portland District



## Spirit Lake Outflow Reconnaissance Study Draft Report

# Army Corps of Engineers *Outflow Reconnaissance Study*



- Army Corps Reconnaissance Study draft issued April 2021
- USFS and consultant engineering team conducted initial review and worked with ACOE
- Further mapped out proposed Feasibility Study in light of the Reconnaissance Study
- Aug/Sept 2021: 5-day field evaluation

# Step I – Army Corps Reconnaissance Study Options

## Lake Level Management Measures

*“Measures may be rearranged into alternatives that are different from the five described in this report. The descriptions of the five alternatives, and their effects, may serve as a basis for reformulating [additional] alternatives.” (Recon Report, April 30, 2021)*

- New open channel across debris blockage (partial and full drain)
- New buried conduit across debris blockage as redundant outlet
- New permanent pumping station as redundant outlet
- Major rehabilitation of outlet and tunnel
- Alternative outlet tunnel

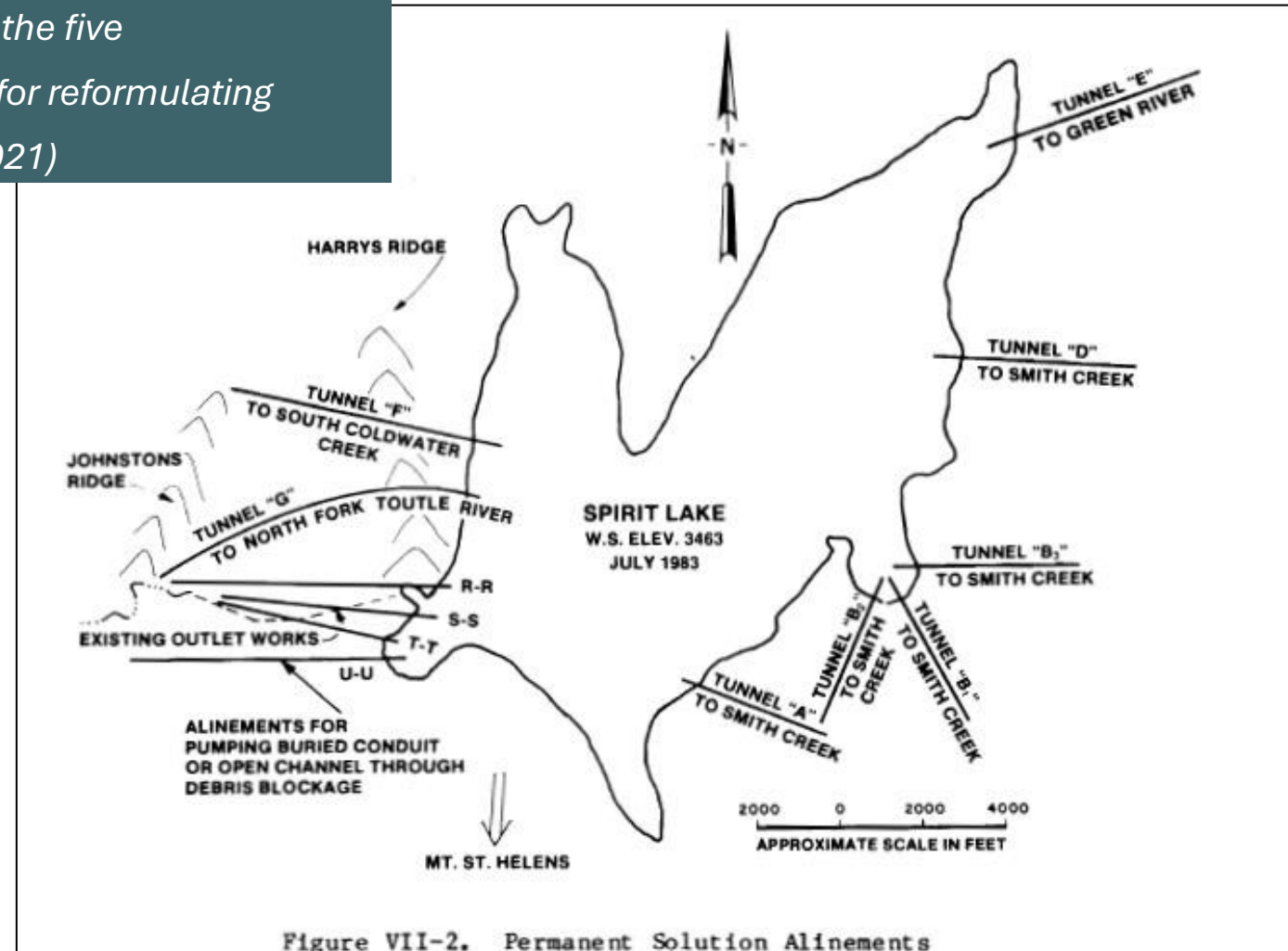
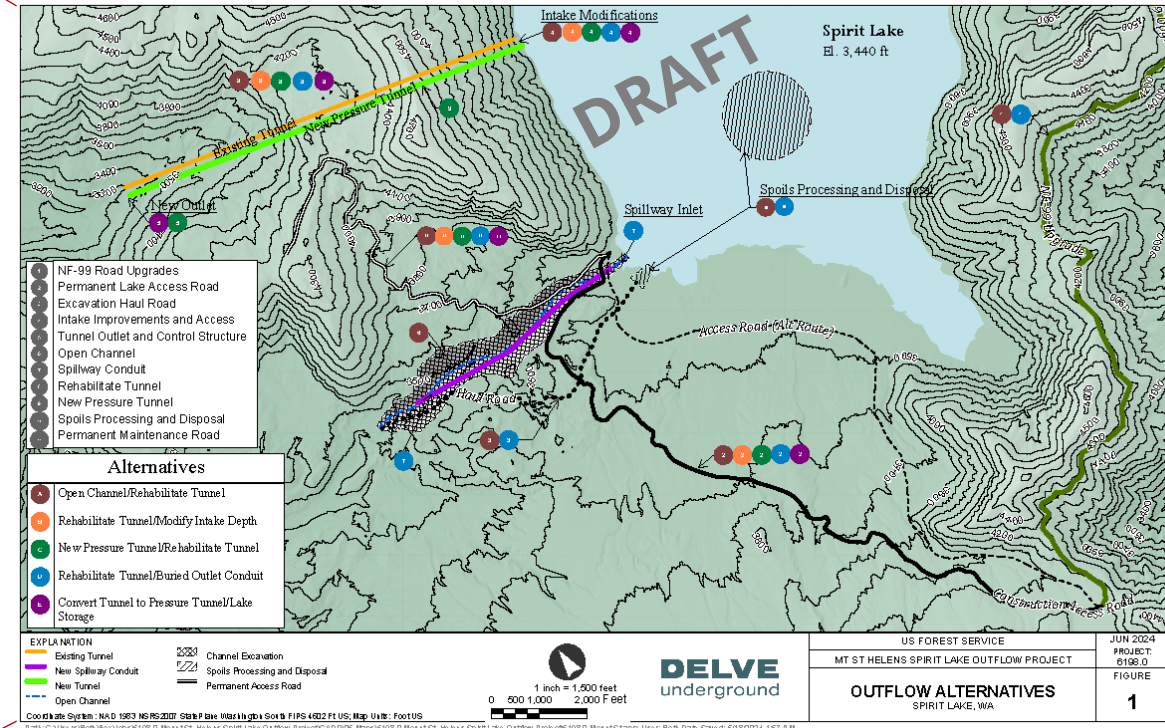


Figure VII-2. Permanent Solution Alignments

# Step 2: Reconfigure and Add Options

Option	Primary Lake Level Control Measure	Redundant Lake Level Control Measure
1	Open channel outlet which releases water when lake levels are above El. 3,440 ft	Existing outlet tunnel serves as a redundant, back-up outlet
2	Open channel outlet that drains Spirit Lake	<b>Upgrade existing outlet tunnel and modify intake depth.</b>
3	Upgrade existing outlet tunnel structure through shear zones	Permanent pumping station
4	<b>New pressure tunnel through rock to the west</b>	Existing tunnel lining repair and reinforcement in shear zones
5	Complete repairs of the JKL shear zone	Buried conduit within the debris blockage sized to function as a passive emergency spillway
6	<b>Convert existing outlet tunnel to a pressure tunnel</b>	<b>Lake storage buffer due to revisited evaluation of max safe lake level</b>



# Additional Engineering Evaluations

- Feasibility of permanent access road alignment from Johnson Ridge down to the blockage area
- Blockage stability assessment
- Technical feasibility of a new pressure tunnel or conversion of existing tunnel into a pressurized system
- Range of hydraulic load demands that influence channel performance and slope stabilization measures for lake drain and shallow buried outlet measures

# Step 3: Feasibility and Risk Analysis Categories for Each Option

- Implementation
- Geohazards
- Hydraulic Performance
- Environmental
- Constructability
- Resiliency



# Your Role!



## Ask Questions

This is not a one-way street. Please let us know your questions about the project and enhanced outreach process.



## Stay Involved

This is a prelude to NEPA, which will include more stakeholder involvement. We ask you stay involved in the enhanced outreach and NEPA process.



## Offer Input

Your input is the key reason we are doing this enhanced outreach and stakeholder engagement. Please let us know your thoughts on key issues and options.



## Work the Process

There are numerous stakeholder values to account for in the design/options process. We will do our best to balance all. Let the process do its job.



# What's Coming Next?

**Virtual Public Meeting No. 2**  
(to include a more in-depth description of  
Engineering Options)

(July 24, 2024)



**Stakeholder Questionnaire**

(available after July 24 meeting)



**NEPA In-Person Public Scoping Meeting**

(August/September 2024)



# About the Questionnaire

Complete by **August 30, 2024**.

Send to [sm.fs.spiritlake@usda.gov](mailto:sm.fs.spiritlake@usda.gov)

We will compile and synthesize the results, which will assist with the engineering feasibility/design and options development process.



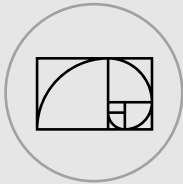
## Brief Profile on Respondent

How many times per year do you visit Mount St. Helens? Primary reason for visiting?



## Values

Which issues are most important to you: risk of failure of the Spirit Lake blockage; recreational use and access; ecosystem restoration, academic research of post-volcanic eruption recovery; Local economic and tourism restoration; sediment management downstream from Spirit Lake?



## Project Components

Which aspects of the Project are most important to you: cost, footprint, longevity, duration?



## Disturbance Minimization

Which resources are you most concerned about the Project impacting? What are your recommendations for minimizing potential disturbances and impacts?

# Stay Informed! Follow us on Social Media and Join our Mailing List

We will periodically release additional information throughout the engineering and alternatives process. Stay tuned for future infographics on the potential alternatives.



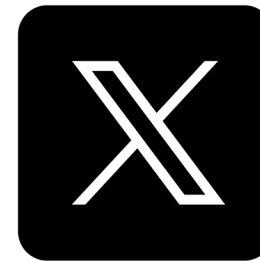
Spirit Lake Outflow Safety Improvement Project Webpage:

<https://www.fs.usda.gov/detailfull/giffordpinchot/landmanagement/?cid=FSEPRD488792>



Facebook:

<https://www.facebook.com/GiffordPinchot>



Twitter/X:

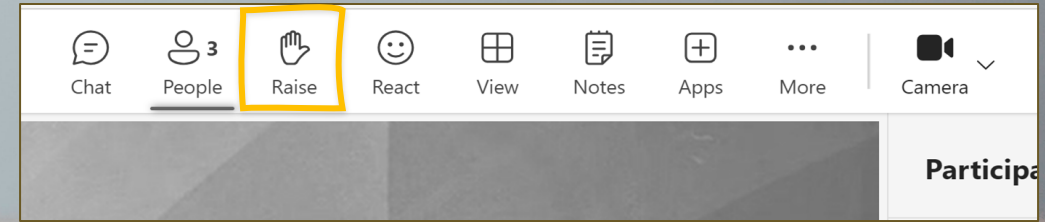
@GPNF



**Thank you!**

# Questions or comments? Let's talk.

## Raise your hand in Teams!

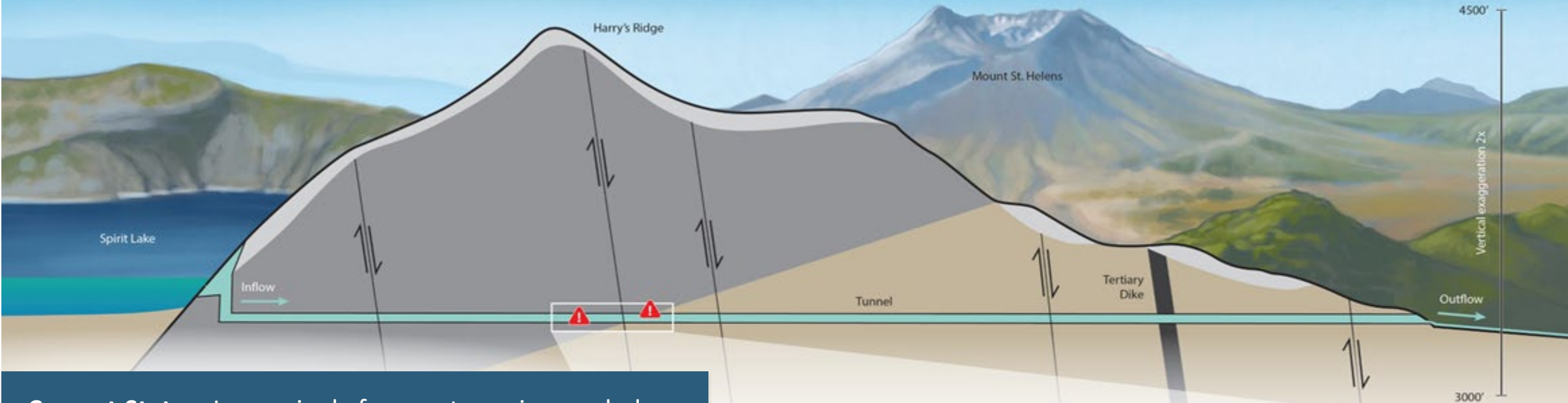


Spirit Lake Outflow Safety Improvement Project Webpage:

<https://www.fs.usda.gov/detailfull/giffordpinchot/landmanagement/?cid=FSEPRD488792>

**Extra slides**

# URGENT NEED TO ACT: Deferred maintenance and local geological stress have increased the risk of tunnel failure

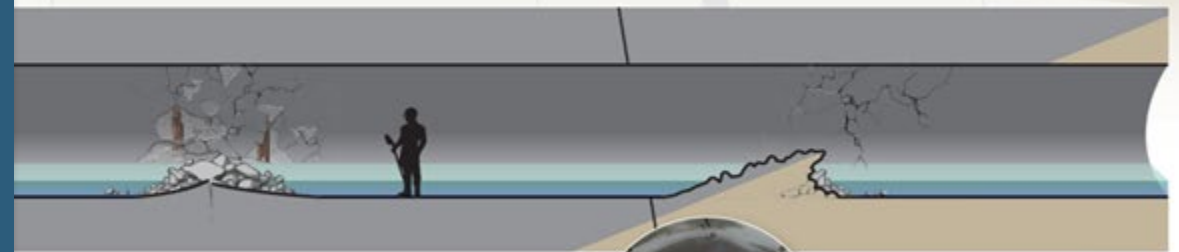


**Current Status:** Increasingly frequent repairs needed.

**The Tunnel Is No Longer Operating Optimally:**

Geologically active areas have compromised the tunnel. The tunnel has cracked, heaved, and buckled in places.

**Increasing Probability of Tunnel Failure:** Eventually the tunnel will fail or require lengthy closures that could result in lake level rises that put 50,000 downstream residents at risk.



**1995/1996:**  
Large sections of shotcrete had pulled away from the tunnel walls and the floor had heaved and cracked. Some supportive ribs had buckled.



**2015/2016:**  
Significant floor heave from high ground pressure reduced the tunnel diameter from 11 feet to 7 feet, restricting flow capacity.

Predominantly tuff
  Predominantly basalt/andesite
  Overburden and debris avalanche
 

 Shear zone or normal fault