Using GIS to Effectively Communicate Hazard Information to the Public

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Snohomish County Department of Emergency Management

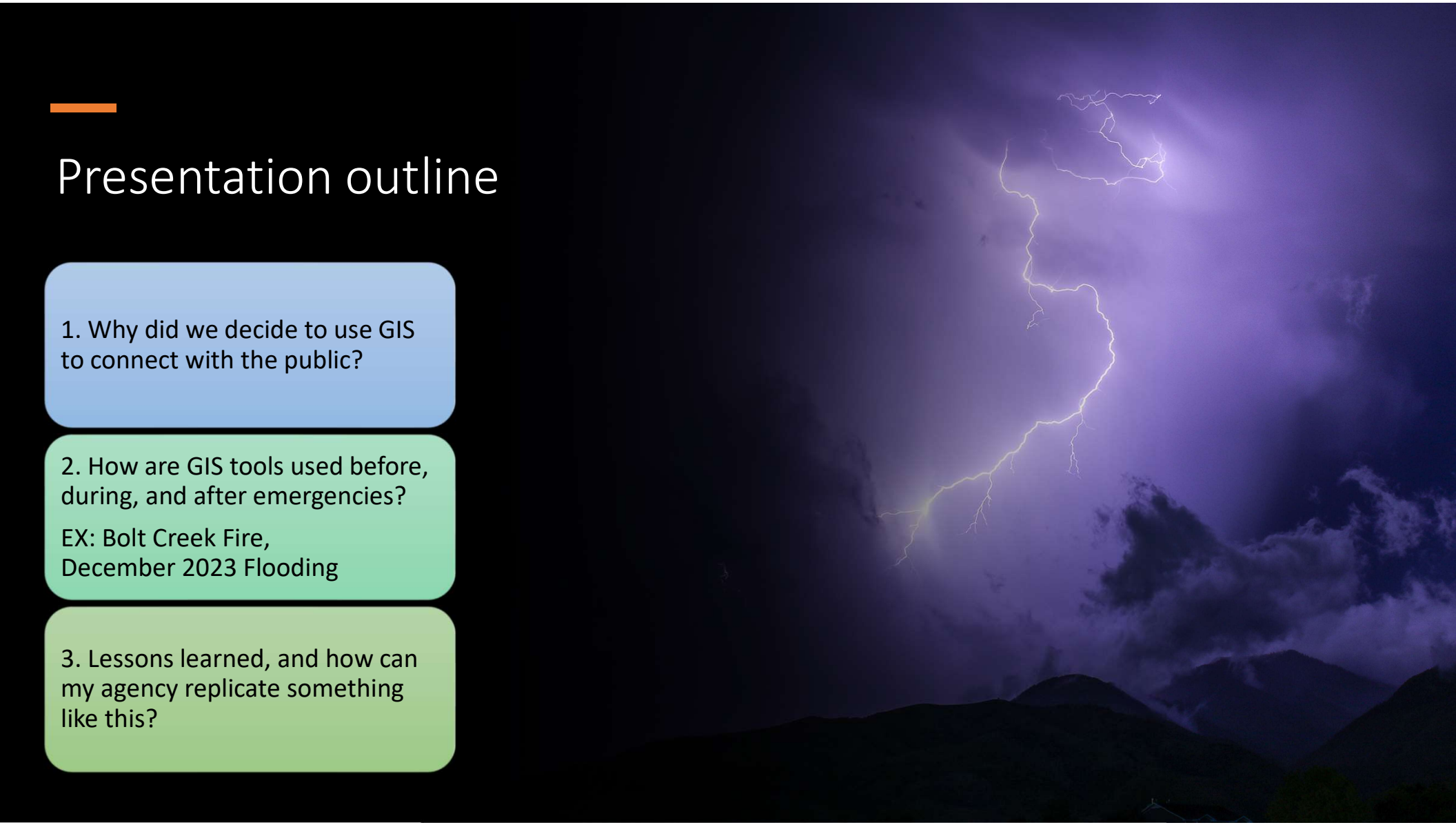
Presentation outline

1. Why did we decide to use GIS to connect with the public?

2. How are GIS tools used before, during, and after emergencies?

   EX: Bolt Creek Fire,
   December 2023 Flooding

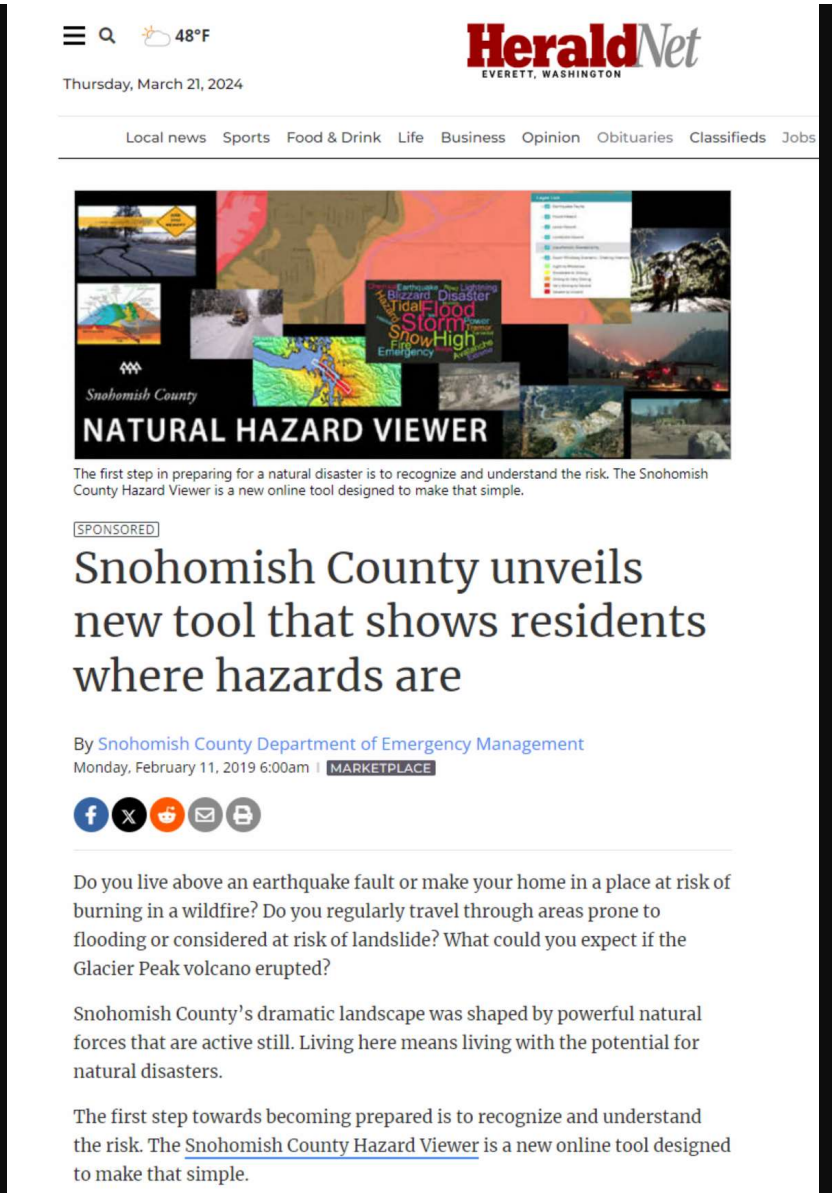
3. Lessons learned, and how can my agency replicate something like this?



Part 1: Why did we decide to use GIS to connect with the public?

It started with an idea

- In 2019, PIO Scott North worked with County IT and DEM staff to represent natural hazards from the Hazards Mitigation Plan as an ArcGIS Story Map
- Interactive content makes hazards (even more) personal
  - Plans were in place to update the natural hazards viewer into an all-hazards viewer, but then…



48°F

HeraldNet
EVERETT, WASHINGTON

Thursday, March 21, 2024

Local news Sports Food & Drink Life Business Opinion Obituaries Classifieds Jobs

The first step in preparing for a natural disaster is to recognize and understand the risk. The Snohomish County Hazard Viewer is a new online tool designed to make that simple.

SPONSORED

Snohomish County unveils new tool that shows residents where hazards are

By Snohomish County Department of Emergency Management
Monday, February 11, 2019 6:00am | MARKETPLACE

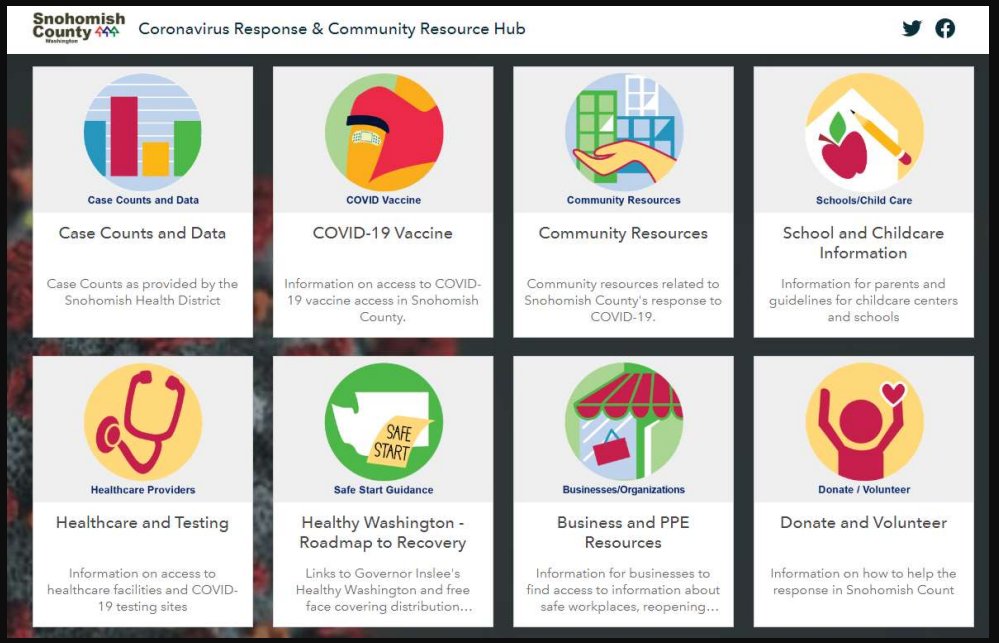
Do you live above an earthquake fault or make your home in a place at risk of burning in a wildfire? Do you regularly travel through areas prone to flooding or considered at risk of landslide? What could you expect if the Glacier Peak volcano erupted?

Snohomish County's dramatic landscape was shaped by powerful natural forces that are active still. Living here means living with the potential for natural disasters.

The first step towards becoming prepared is to recognize and understand the risk. The Snohomish County Hazard Viewer is a new online tool designed to make that simple.

Then, a GIS platform saw record engagement

- During Snohomish County's COVID-19 activation, the EOC GIS team deployed the Coronavirus Response template for public outreach
  - 2 million views in 2020/2021!
- There are other hazards in the county - 13 are identified in the Hazard Communications Plan
  - The Hazard Viewer is effective at conveying hazard information *before* an event
  - What if we had a hub site pre-deployed with crucial information in multiple languages that we can readily drive traffic to *during* an emergency?



Outreach products streamlined

- The Snohomish County Hazard Viewer 2.0 launched in 2023
  - A comprehensive location for hazard information *before* an emergency occurs
- The Snohomish County Public Safety Hub was launched in 2022 to a literal trial-by-fire
  - A comprehensive location for hazard information *during* an emergency
  - Becomes a known location for recovery and information gathering *after* an emergency as well
- Both products are designed, managed, and updated in-house and in real time with a PIO-GIS partnership

The result:

https://snoco.org/hazards

The result:

https://snoco.org/safety

Snohomish County

Snohomish County Public Safety Hub

For information on sheltering, evacuations, real-time response, and more

Search...

How will you hear about an emergency?

Prepare yourself for an emergency by signing up for Snohomish County Emergency Alerts and reverse 911.

Click on the image to subscribe to emergency alerts.

Click Here to sign up for Community Alerts and Smart911

The following pages will be updated as conditions dictate

Cold Weather Shelters

Find a Cold Weather Shelter

Wildfire

Wildfire evacuations and information

Cooling Centers

Find a cooling center

Flooding

View river gauges and other resources

Smoke

Find a clean air shelter

Hazardous Material Emergencies

HazMat spills and response

Dam Emergency

Dam overtopping or failure

Other Emergencies

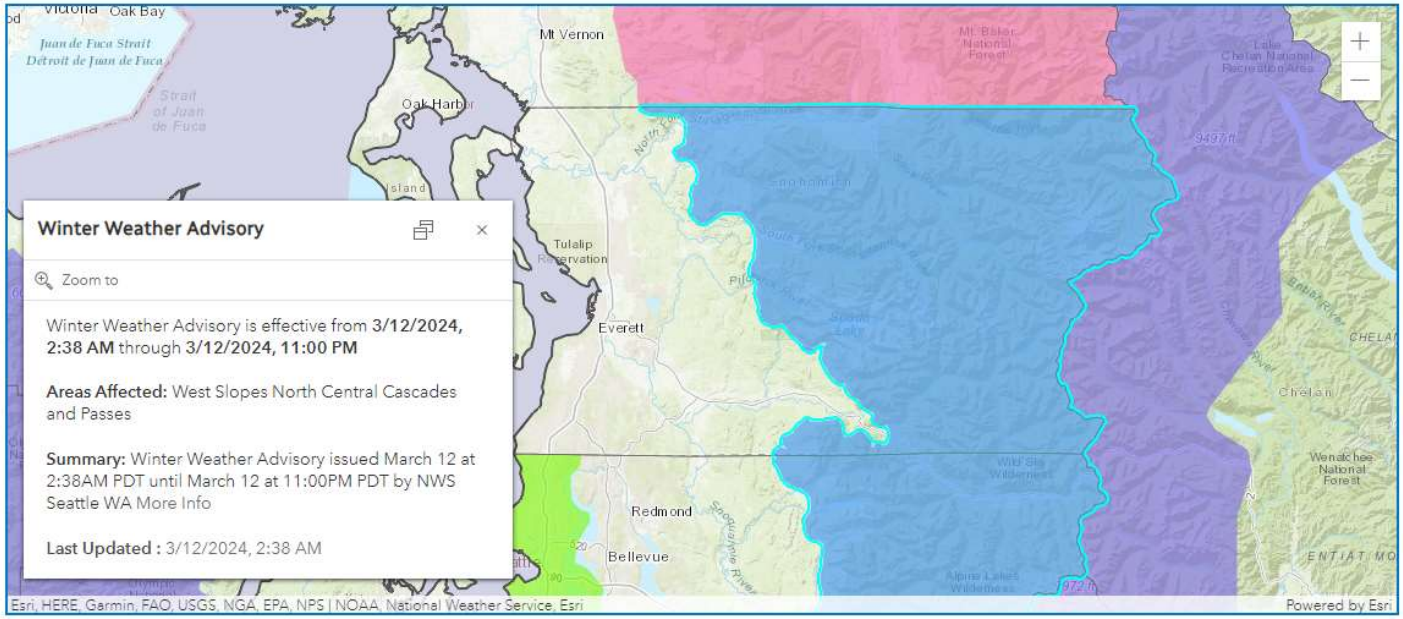
For other public safety hazards

National Weather Service Alerts

Click on the colored shapes in the map below to see NWS alerts for the area indicated.

Check the map below for advisories, warnings, and other notices from the National Weather Service

National Weather Service Weather Watch



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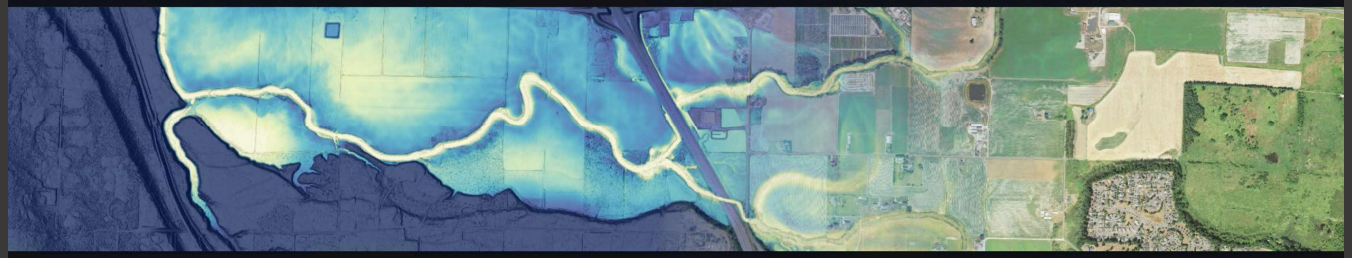
Contact: 425-388-5060

Snohomish County Hazard Viewer

Find hazards in your community | Read more about hazards | Prepare now for hazards



Identify hazards in your community

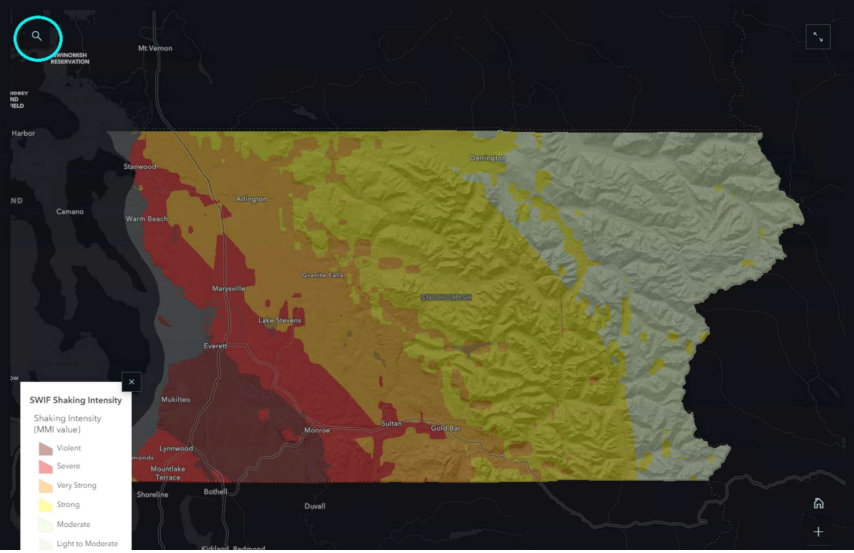
Use the following maps to search for a location and find nearby hazards that could affect your community

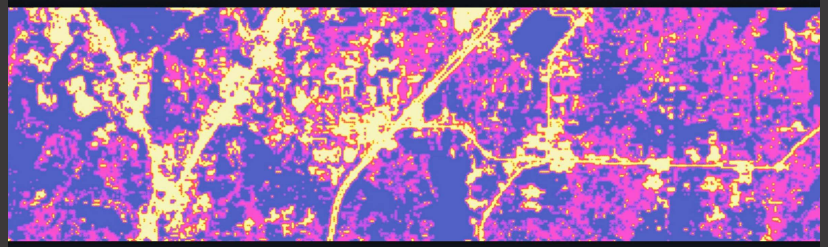
Snohomish County Department of Emergency Management

Using the viewer | Earthquake hazards | Severe weather hazards | Flood hazards | Dam failure | Wildfire hazards | Mass earth movement | Glacier Peak volcano | Tsunami hazards | Explore all hazards

Using the viewer

To find hazards near an address or landmark, click on the search icon in the upper left corner to expand the search bar.





Hazards in Snohomish County

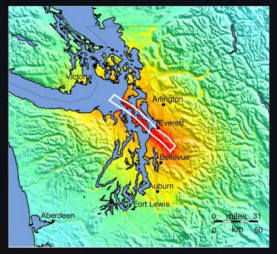
Scroll or use the navigation buttons to read about human-caused and natural hazards most likely to occur in Snohomish County.

Snohomish County Department of Emergency Management

People living in Snohomish County are exposed to a suite of human-caused and natural hazards. To lessen potential impacts, the County and its partners maintain and regularly update a Hazard Mitigation Plan. The last update was completed in 2020. Among other things, the work identified and ranked the community's biggest hazards using criteria that included expected severity, magnitude, frequency, the ability to prepare for onset and expected durations for worst-case and most-likely scenarios.

South Whidbey Island Fault earthquake scenario

The South Whidbey Island Fault has been studied extensively in recent years. This map represents the potential shaking intensity from a shallow Magnitude 7.4 event with an epicenter two miles northeast of Langley. Areas in Dark Red have the potential for the highest levels of shaking. Areas in Green will likely experience less shaking.



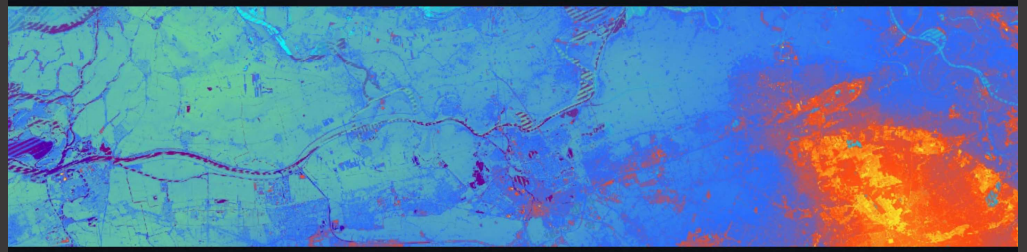
Such a quake likely would cause an estimated $12.8 billion damage in Snohomish County and leave more than 5,000 people in need of short-term shelter.

Additional information related to the South Whidbey Fault can be found **here**.

View the SWIF hazard map here

Liquefaction hazards

Liquefaction is a secondary effect of an earthquake. Hard shaking can cause some soil types to lose shear strength and behave as liquids. Structures built atop liquefaction zones – including buildings and road foundations – can lose their support and sink into what was previously solid ground. Water will sometimes come to the surface, bringing with it liquefied sand and creating sand boils, sometimes called "sand volcanoes."



Prepare for hazards

Use the links and resources on this page to prepare yourself and loved ones for a disaster. Learn about the risks, make a plan, build a kit.

Snohomish County Department of Emergency Management

Sign up for emergency alerts! | Create an emergency kit | Visit these websites

> *How can I prepare?*

Sign up for emergency alerts!

SnoCoAlerts is the county's early warning and notification system for delivering urgent emergency information, right to your cellphone. This robust system is relied upon by emergency managers and other first responders as one of the key tools to keep you informed during a disaster. Signing up for SnoCoAlerts is quick and easy.

The system is powered by Smart911. Your zip code and street address are used to tailor alerts for where you live. You can choose which hazards result in alerts. You also can add more alerts or update your contact methods at any time.

Even if you don't use a cellphone, you still should consider signing up. Through the Smart911 portal, you are given the option of securely providing critical information that can be shared with emergency responders. Among the data to consider providing:

- People living in your household.
- Phone numbers associated with your family.
- Pets, service animals, and livestock.
- Medical conditions and allergies.
- Medications and medical equipment.
- Property details, layout, and utility information.
- Access to vehicles, their descriptions.
- Your ability, or inability, to evacuate if necessary.
- Emergency contacts.

All of that information can assist emergency dispatchers in determining how best to get help to you and your family during an emergency.

Part 2: How are GIS tools used before, during, and after emergencies?

Ex 1: Bolt Creek Fire

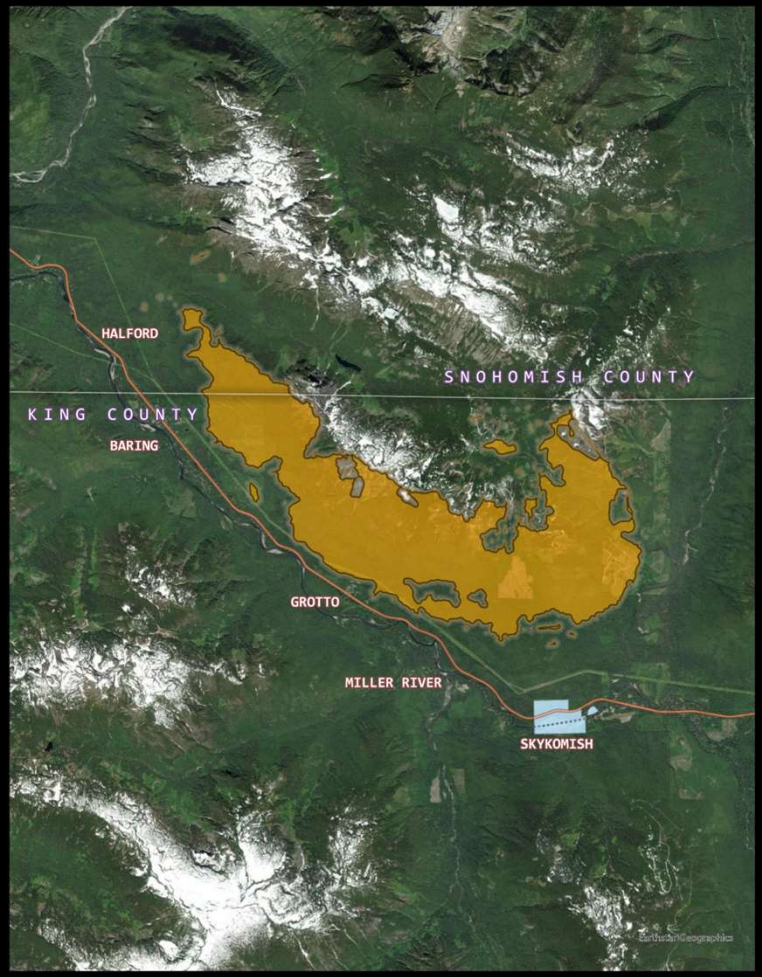
The first test – Bolt Creek Fire

- A fire was reported to 911 on Saturday, September 10th, 2022 at 5:15AM
- Fire began near a Forest Service Road in steep, rugged forest terrain
  - At the time the size was around 20 acres
- Conditions were ideal for a fire to spread quickly
  - A red flag warning was issued Friday, September 9th
  - Easterly winds (blowing west) 25-35 MPH
  - Above average temperatures for weeks with below average precipitation
- Sky Valley Fire, the responding agency in Snohomish County, decides to send evacuation messaging to nearby town of Index based on drone footage

EVERETT
MONROE
GOLD BAR
HIGHWAY 2
INDEX
SNOHOMISH COUNTY
CASCADE MOUNTAINS
KING COUNTY
SKYKOMISH
SEATTLE

Timeline of Events

- September 10th: A Wireless Emergency Alert (WEA) was sent out by 11:42 to residents around the town of Index ('Ready' Level 1 Alert)
- By 12:00 Snohomish County EOC activated, Public Safety Hub Wildfire page was published, with evacuation maps and road closure information going live at 13:24
  - Snohomish County PIO, King County PIO, Sky Valley Fire, multiple law enforcement agencies all post messages driving traffic to the hub
- September 11th, 14:00 a Type 3 IMT assumed Incident Command and sent messaging via InciWeb and Facebook, also linking our Hub for evacuation maps. The fire had grown to 7,600 acres
- September 13th, 08:00: a Type 2 IMT assumes Incident Command. Fire grows to 9,440 acres


HALFORD
SNOHOMISH COUNTY
KING COUNTY
BARING
GROTTO
MILLER RIVER
SKYKOMISH

HALFORD
SNOHOMISH COUNTY
KING COUNTY
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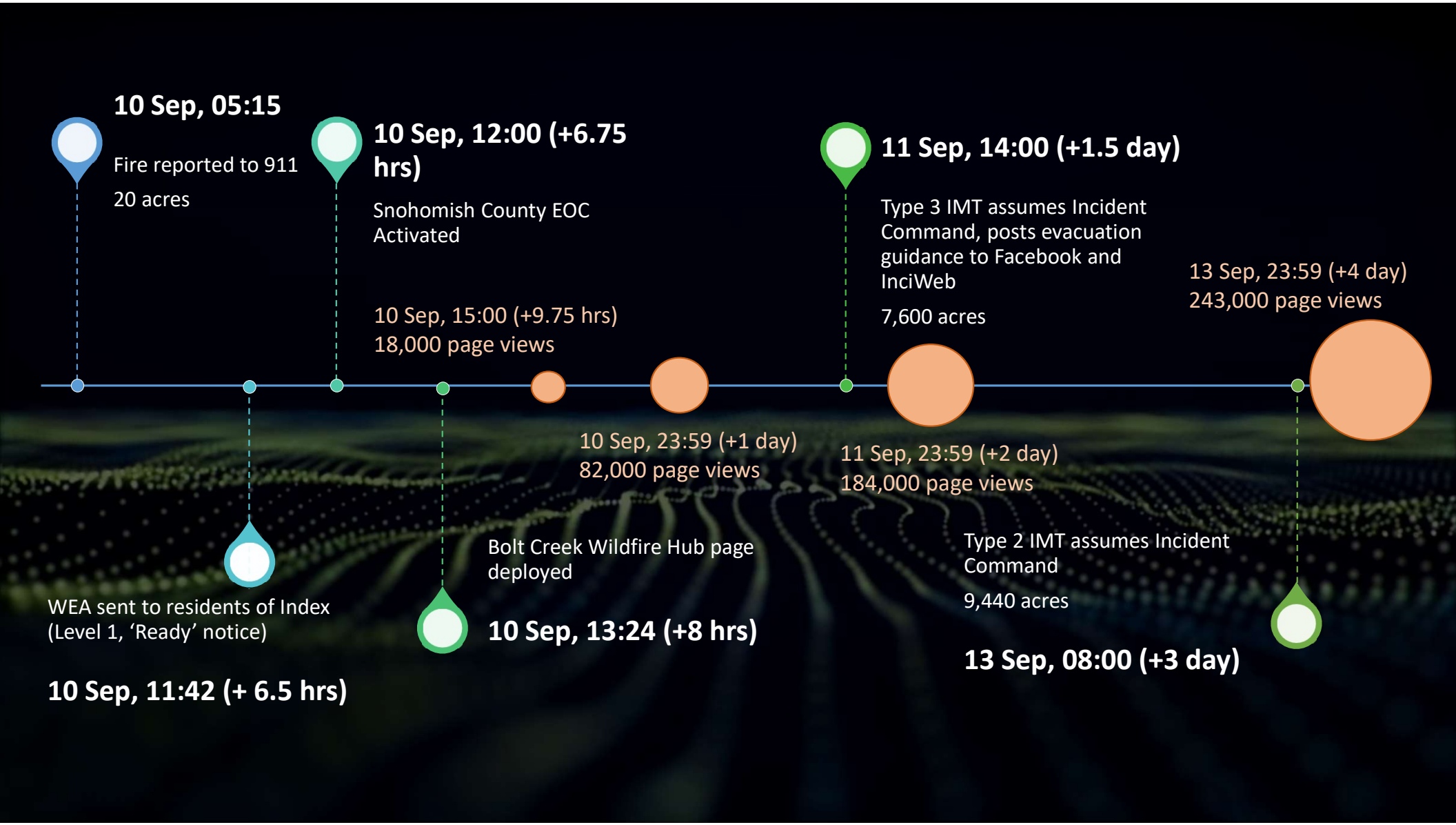
SKYKOMISH


10 Sep, 05:15
Fire reported to 911
20 acres
10 Sep, 12:00 (+6.75 hrs)
Snohomish County EOC Activated
10 Sep, 15:00 (+9.75 hrs)
18,000 page views
10 Sep, 23:59 (+1 day)
82,000 page views
11 Sep, 14:00 (+1.5 day)
Type 3 IMT assumes Incident Command, posts evacuation guidance to Facebook and InciWeb
7,600 acres
11 Sep, 23:59 (+2 day)
184,000 page views
13 Sep, 23:59 (+4 day)
243,000 page views
WEA sent to residents of Index (Level 1, 'Ready' notice)
10 Sep, 11:42 (+ 6.5 hrs)
Bolt Creek Wildfire Hub page deployed
10 Sep, 13:24 (+8 hrs)
Type 2 IMT assumes Incident Command
9,440 acres
13 Sep, 08:00 (+3 day)

Hub Content

- Basic event information
  - Start date, location, etc
  - Definitions for Levels 1, 2, 3 as well as “Ready, Set, Go!”
- Interactive map with evacuation zones, road closures, and shelter locations
  - Evac zones published daily to AGOL are easy to preserve for public records
- Static event summary maps
- General wildfire and smoke safety information
- Links to sign up for emergency alerts, social media and other resources

Usage details for the period:

September 10, 2022 - September 17, 2022

Custom Date Range

Set a Custom Date Range

Start Date: 9/10/2022

End Date: 9/17/2022

Update Report

Item Views this Period

262,985

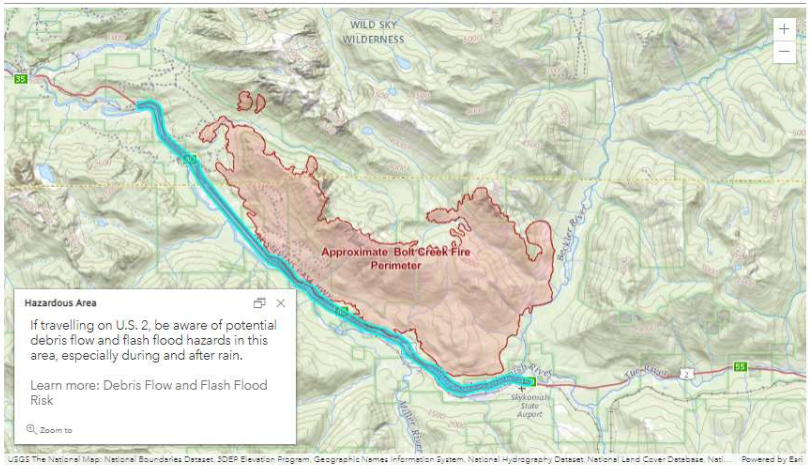
Avg Item Views Per Day

37,569.29

Usage Time Series

Video and Map Resources

Bolt Creek Fire Map



Click HERE for a full-page version of this map.

*Fire location data is an **estimate and is not guaranteed to be accurate** from a layer representing detectable thermal activity from VIIRS satellites for the last 7 days. VIIRS Thermal Hotspots and Fire Activity is a product of NASA's Land, Atmosphere Near real-time Capability for EOS (LANCE) Earth Observation Data, part of NASA's Earth Science Data.*

Soil Burn Severity	Acres	Percent
Unburned or Underburned	3,302	22%
Low Soil Burn Severity	5,921	40%
Moderate Soil Burn Severity	3,938	26%
High Soil Burn Severity	1,817	12%
Grand Total	14,978	100%

General Wildfire Information

Wildfires and Health

Smoke contains tiny particles that can get deep into your lungs and even enter your blood stream. Exposure to smoke has been linked to a range of serious health problems.

Breathing smoke is not good for anyone, but some groups of people are more at-risk for severe health effects. Those with pre-existing heart and lung conditions are especially sensitive to smoke. Go to the Department of Health Smoke From Fires FAQ for more information on who is more at-risk and steps you can take to stay safe.

Check Air Quality Forecasts

Go to the Puget Sound Clean Air Agency's website or follow them on Twitter for air quality forecasts and current conditions in Snohomish County.

Check the Air Quality Index (AQI) in your area. The AQI uses color coded categories to show when air quality is good, moderate, or unhealthy.

- An interactive map showing the current AQI in your area is available here.
- Flyers in multiple languages showing health recommendations for different AQI categories are available here.

Keep Your Indoor Air Clean

Pets

Air Quality Forecast

Puget Sound Clean Air Agency, WA | Official Website (pscleanair.gov)

Department of Ecology Smoke Forecast (wa.gov)

Washington Smoke Information (wasmoke.blogspot.com)

AirNow.gov

Resources

Bolt Creek Fire incident information :: InciWeb

Smoke From Fires :: Washington State Department of Health

Smoke from Fires Toolkit :: Washington State Department of Health

Wildfire Smoke | Puget Sound Clean Air Agency, WA (pscleanair.gov)

Protect Yourself from Wildfire Smoke | CDC

Wildfires and Indoor Air Quality (IAQ) | US EPA

Stay Informed with Social Media:

Tweets from @NWSSeattle

NWS Seattle @NWSSeattle · 23h

Through May 21st, it's probably no surprise that Seattle's off to a warm start. Average high was 71.4 and average low 51.5.

Both numbers are the warmest on record through May 21. How will the month end? We have a late week warmup followed by an uncertain weekend forecast

Tweets from @wsdot_traffic

WSDOT Traffic @wsdot_traffic · 35m

Update 8:13 AM : On I-5 southbound just north of NE 145th St there is a disabled vehicle blocking the HOV lane.

WSDOT Traffic

Tweets from @wspd7pio

Trooper Kelsey Harding @wspd7pio · May 12

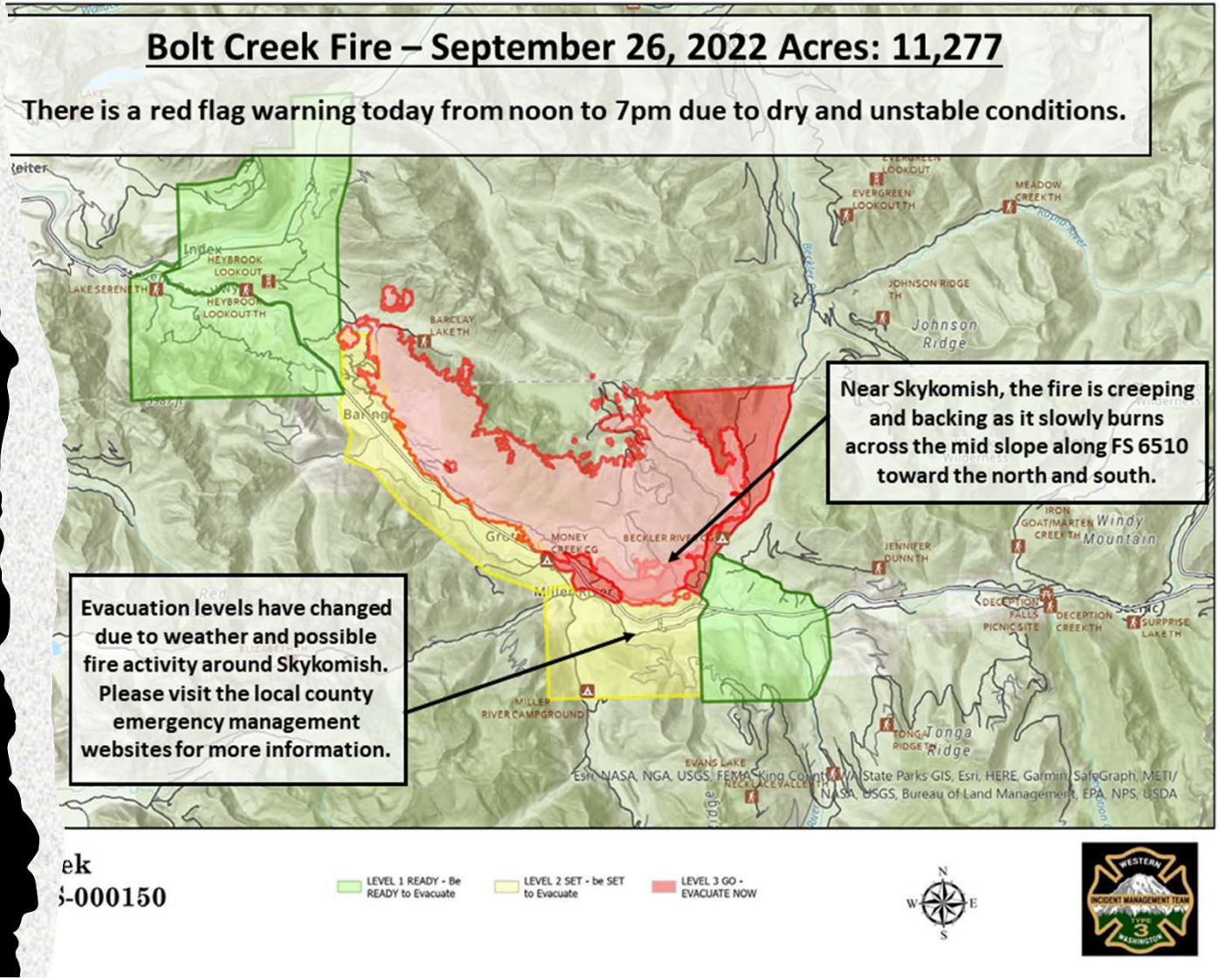
#Reminder for anyone who may still experiencing scam phone calls using a WSP phone number.

Trooper Kelsey H... @wsp... · Apr 25

#yourwsp has received calls from citizens advising they

Daily summary maps from the IMT inform the public quickly and predictably

Information



Role of GIS review:

- Before: the Snohomish County Hazard Viewer provides tips on living with smoke, familiarizes residents with the “Ready, Set, Go!” messaging, and provides proactive tips for establishing defensible space, etc
  - Interactive maps with WUI and fire risk
- During: the Snohomish County Public Safety Hub hosts near real-time event information, including evacuation areas and road closures in an interactive map as directly received from the ICP
  - Daily relevant information posted on the landing page with a date and time stamp
- After: Snohomish County Public Safety Hub, now familiar to most affected residents, hosts burn scar information, recovery information, etc

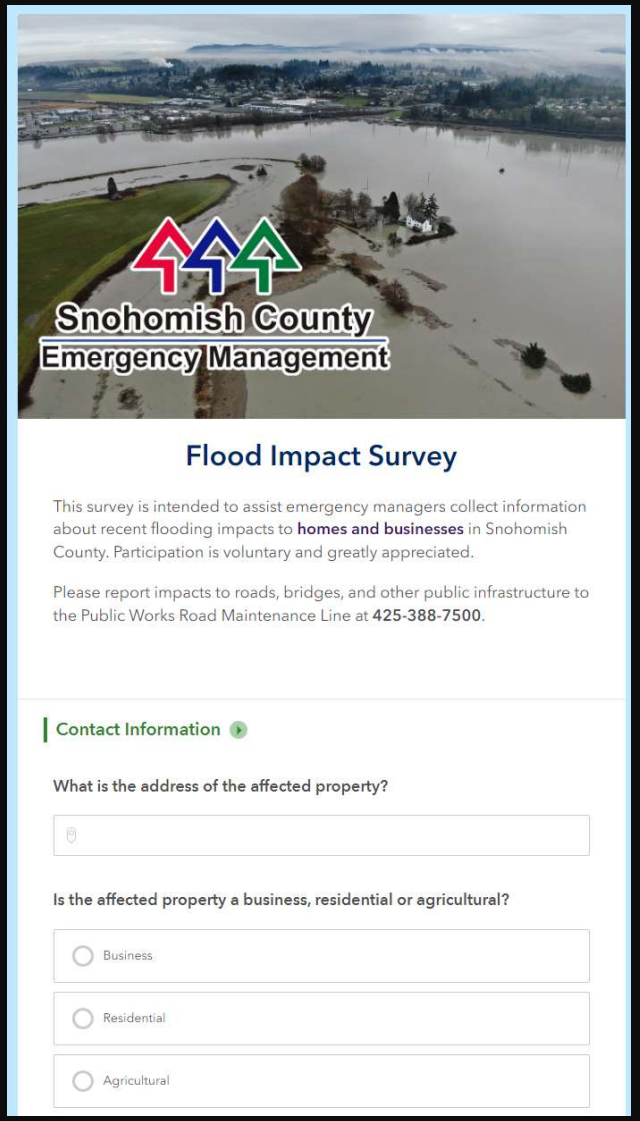
Example 2: December 2023 flooding

Event overview

- Occurred December 5-6, 2023. Areas of the county saw 6 inches of rain in 24 hours. Record high temps and snowmelt contributed to the hydrologic load
- The Stillaguamish exceeding meteorologists' expectation in keeping with the "flashy" nature of the river. Some of the steepest mountains in the state are in Snohomish County. It's only a few miles from the timberline to sea level. Any snow runoff from the nearby mountains can quickly change the dynamics of the river
- The Stillaguamish River reached 21.34 feet at Arlington Tuesday afternoon, setting a new record high - 7 feet above flood stage
- First major impacts seen near Arlington, Granite Falls, Gold Bar, Snohomish
- Most dramatic flooding occurred near Stanwood and Silvana early Wednesday morning

Hub Content

- Basic event & safety information
  - Start date, road closures, location, etc
  - Flood resources and contact information
  - Drone footage near real time (used by local and national news crews)
- A voluntary survey for reporting flood impacts to homes and businesses
- Interactive map with road closures, stream gauges, and NWS alerts
- Links to sign up for emergency alerts, social media and other resources



Snohomish County

Flooding

How will you learn about a flood event?

Prepare yourself for an emergency by signing up for Snohomish County Emergency Alerts and reverse 911.

Click on the image to subscribe to emergency alerts.

Click the image to sign up for Community Alerts and Smart911

March 6, 2024:

The US National Weather Service Seattle has no flood watches or warnings in effect for Snohomish County rivers, but that can change fast.

If you encounter water over roadways, please turn around. That's the safest choice for everyone. As little as 6 inches of moving water is deep enough to topple an adult or to reach the bottom of most passenger cars. A foot of water will float many vehicles, and two feet of rushing water has the force to sweep away vehicles, including sport utility vehicles and pick-up trucks.

Find all Weather Service watches and warnings for Snohomish County here: https://bit.ly/3uMfgsr

Welcome to the Snohomish County Department of Emergency Management's flood safety page!

To check current conditions and National Weather Service alerts and warnings, please scroll or jump to the map below. We encourage you to sign up for emergency alerts using the banner above. Otherwise, read on to learn about flood safety, to find useful resources, and to read about historic floods in Snohomish County.

Jump To -

Flooding is part of the ebb and flow of living here

Flooding is one of the most familiar natural hazards in Snohomish County.

More than 75,000 people here live and work in places where potentially devastating floods can occur. The major river basins – the Snohomish and Stillaguamish – on average flood every three to five years, often at the same time. Big creeks draining through south Everett, Mill Creek, Lynnwood and Bothell also bear watching.

Since 1962, the county has weathered 18 floods large enough to be presidentially declared disasters. The worst arrived during winter 1975, causing $42 million damage and the deaths of 3,500 head of livestock.

Flood season here typically begins in October and lasts into spring. The threat is greatest between late November and early February. That's when storms heading inland from the Pacific Ocean bring heavy rains and mild temperatures, often melting mountain snows and spurring rivers to jump over their banks.

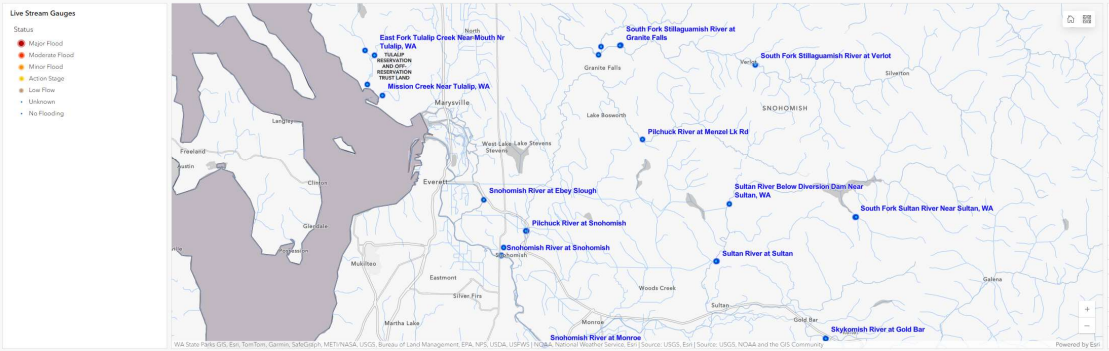
While heavy downpours can produce flash flooding, particularly in some urban neighborhoods and in wildfire burn scar areas, there usually is some warning that high water is coming. That means there is time to prepare.

Flooding and Road Closure Maps

Click on the map below for live river gauges, weather alerts from the National Weather Service, and Snohomish County road closures. Clicking on a gauge will show more information from each gauge, including estimated peak flow times and, if available, river level forecasts. Clicking a road or gauge from the lists on the right of the page will zoom to the selected road closure or river/stream gauge on the map. Road closure data is generally kept current during weekdays, and may be updated during large flood events.

River gauges from the United States Geological Survey and the National Weather Service are shown in real-time on this map. To view Snohomish County-operated river gauges, please visit the Snohomish County OneRain website.

Want to know the difference between a flood watch, flood warning, and other common flood terminology? Click here to jump to Flood Facts.



Current County Road Closures

Data source error

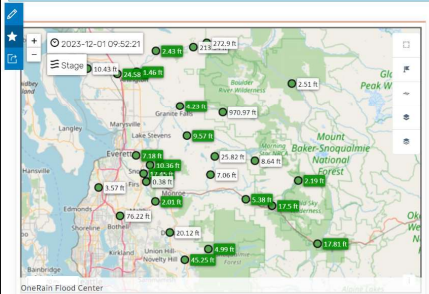
Click a road to zoom to the closure on the map

Live River Gauges

- Skykomish River Near Gold Bar, WA
- South Fork Sultan River Near Sultan, WA
- Mission Creek Near Tulalip, WA
- Sf Stillaguamish River Near Granite Falls, WA
- Pilchuck River Near Snohomish, WA
- East Fork Tulalip Creek Near Mouth Nr Tulalip, WA
- West Fork Tulalip Creek Near Tulalip, WA
- Snohomish River Near Monroe, WA

Click a gauge to zoom to it on the map

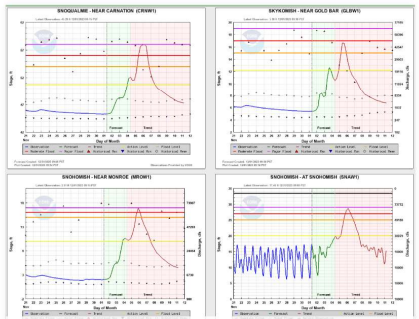
Additional map resources



Snohomish County OneRain Flood Center

The site is meant to serve as a "one stop" source for real-time river level and rainfall depth data in Snohomish County and the surrounding area, including county-operated guages not available in the map above.

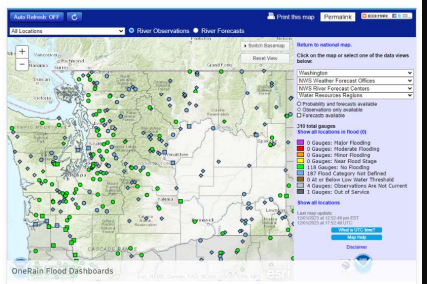
OneRain Map



Snohomish County OneRain Dashboard

Visit the OneRain Dashboard page to see at-a-glance forecasts for major rivers that can be set to refresh as often as every 30 seconds.

OneRain Dashboard



National Weather Service Advanced Hydrologic Prediction Service (AHPS)

AHPS is a web-based suite of accurate and information-rich forecast products. They display the magnitude and uncertainty of occurrence of floods from hours to days and months in advance.

Visit AHPS

Cleanup begins after damaging flood hit record level in Snohomish County

by Jeremy Harris, KOMO News Reporter | Wed, December 6th 2023

Flooding of the Stillaguamish River in Snohomish County on December 6, 2023. (Snohomish County Emergency Management)

SEATTLE — People who were affected by a record-setting flood in Arlington on Tuesday have started assessing the damage and cleaning up.

The Stillaguamish River flowed over its banks for around 24 hours starting Monday night, leaving some homes, businesses, and parks covered in water.

according to The Associated Press.

The region has experienced almost nonstop heavy rains since Friday.

"It just kept pounding," said Brent Bower, a senior service hydrologist in the National Weather Service's Seattle office.

The flooding has prompted several daring rescues. A Snohomish Regional Fire & Rescue crew found a man in a small aluminum boat without paddles or a headlamp Tuesday evening in the midst of raging floodwaters on the Skykomish River, which is known for its whitewater rafting. Rescuers were able to pluck the man as he scrambled near shore after a rope rescue attempt failed, according to an agency Facebook post.

Police Say Everyone Should Carry This New Safety Device

Floodwaters in Snohomish County highlight heavy rains that have blanketed parts of the Pacific Northwest. Snohomish County

Atmospheric river storms are common along the West Coast. They often look like fire hoses on weather radar.

Usage details for the period:

March 12, 2023 - March 12, 2024

Past 12 Months

Item Views this Period	Avg Item Views Per Day
19,912	54.40

Usage Time Series

Usage details for the period:

December 2, 2023 - December 9, 2023

Custom Date Range

Set a Custom Date Range

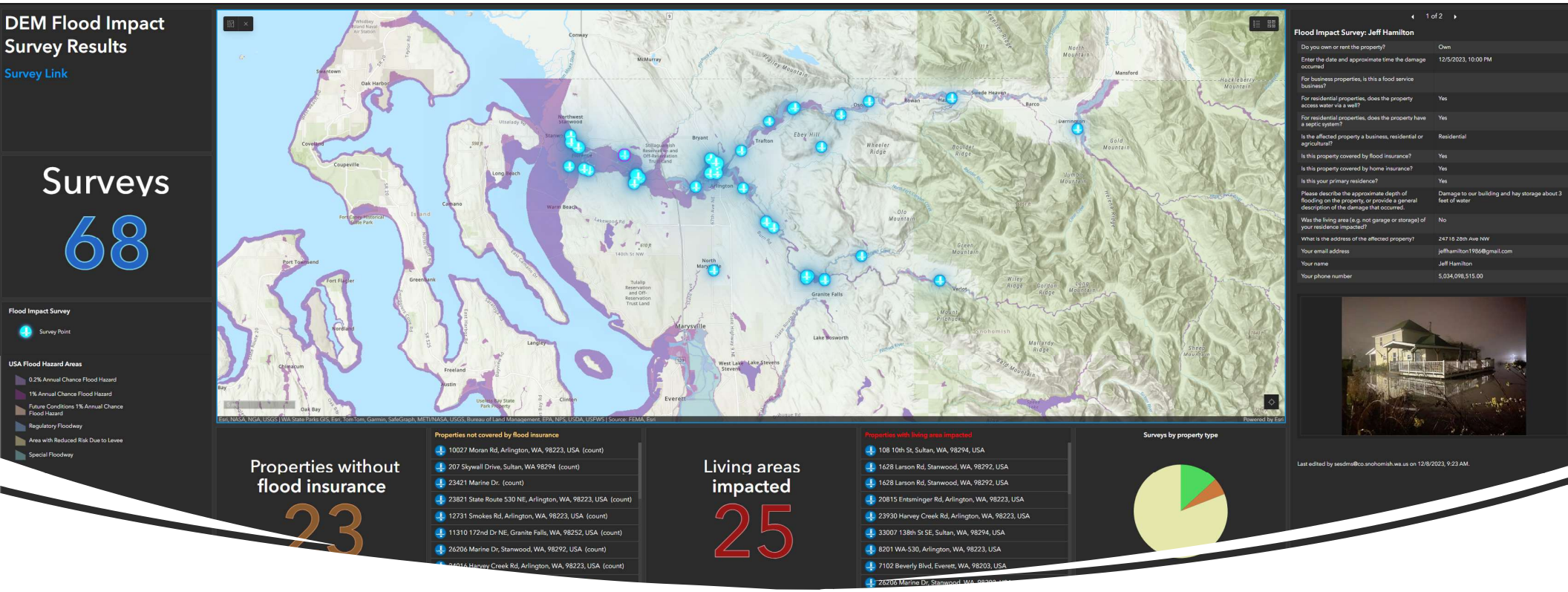
Start Date: 12/2/2023

End Date: 12/9/2023

Update Report

Item Views this Period	Avg Item Views Per Day
17,337	2,476.71

Usage Time Series



- Survey responses fueled dashboards useful for situational awareness in the EOC, reporting damage to the state, assisting public works determine waste material drop locations, etc

Role of GIS review:

- Before: the Snohomish County Hazard Viewer provides tips on living in flood areas, provides FEMA flood risk areas, and conveys safety information for encountering flooded roads, etc
  - Interactive maps show the flood risk near properties of interest
- During: the Snohomish County Public Safety Hub hosts near real-time event information, including evacuation areas and road closures in an interactive map
  - Also hosts links to stream gauges, hydrologic outlooks, NWS alerts, and more
  - Daily relevant information posted on the landing page with a date and time stamp
- After: Snohomish County Public Safety Hub hosts flooded property impact surveys for DEM

Part 3: Lessons learned, and how can my agency replicate something like this?

First, why are these products important?

People take immediate protective action when they receive an emergency alert

True

False

FALSE!

According to the late FEMA social psychologist Dr. Dennis Mileti, “while all the forest animals are running from the flames, people who get a warning DELAY taking protective action and instead waste time searching the net, watching TV, and talking with neighbors trying to decide what, if anything, to do about the fire”

People will generally not change this behavior in most emergencies (even time-sensitive emergencies)

A public safety Hub site gives an authoritative location for all necessary information to quickly provide all details to facilitate the decision process – don’t fight human instinct, help it along

A single source of agile, authoritative information

- People need an authoritative information source. Facebook and X (Twitter), etc. have login prompts, unreliable management, misinformation, etc
- First hours and days can be critical, and that is when the majority of web traffic occurs
- Our Bolt Creek Fire Hub page reached 18,000 views under 3 hours from publishing, ~184,000 in two days
  - ***66% of views from entire incident in first 72 hours***
- The hub can be edited by PIOs or GIS staff and changes deployed in seconds
- Shortened or vanity URLs can be used in WEA messages and social media to provide a direct link to the best source of updated event information
- A home for long form content if needed
  - If you can't say it in a tweet, you likely need a hub

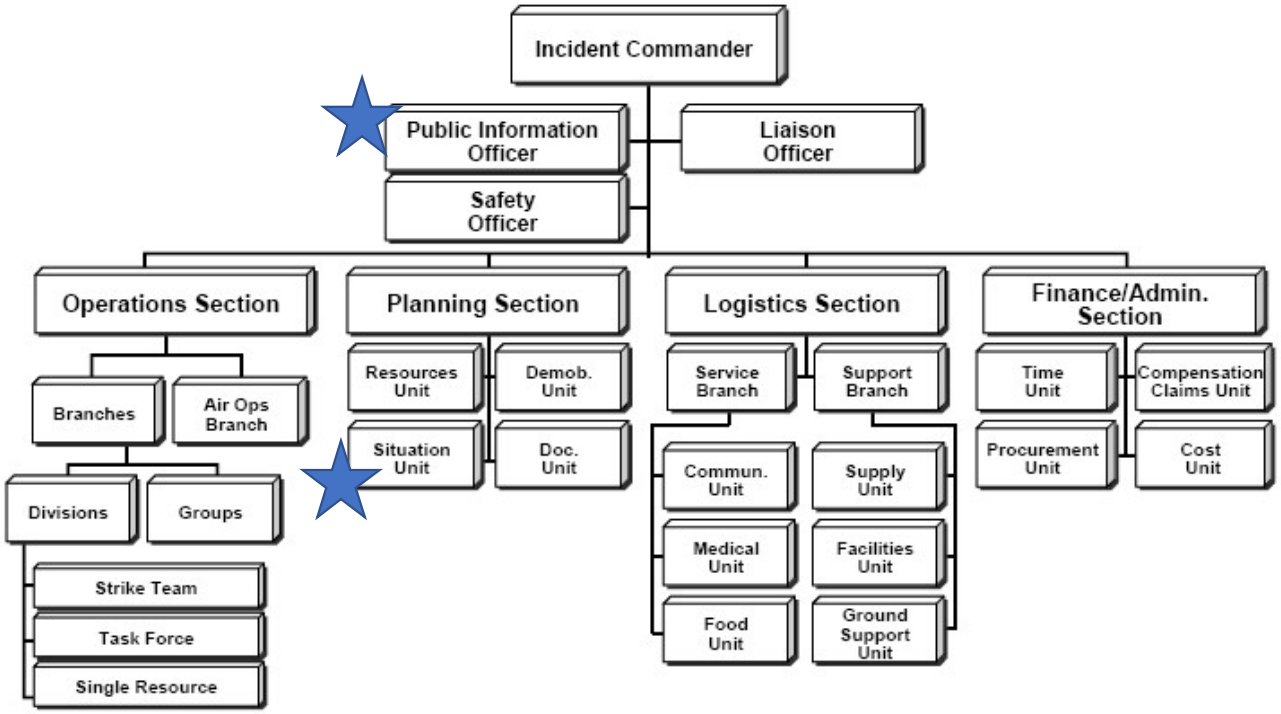
Best practice

- According to research agency CNA, one of the current best practices in social media crisis communications includes "**us[ing] social media to direct people towards landing pages and resources that could be useful, like fact sheets or interactive maps"**

    - Social media is not the best means for all types of information exchange. When information needs to be detailed, e.g., when addressing questions about public health measures, or needs to be interactive, e.g., interactive maps that track wildfires, it is best to use social media to guide community members towards a website, email address, or online form. This can be done through regular posting and with an automatic reply to direct messages

- White paper here

Role of GIS in the Incident Command System

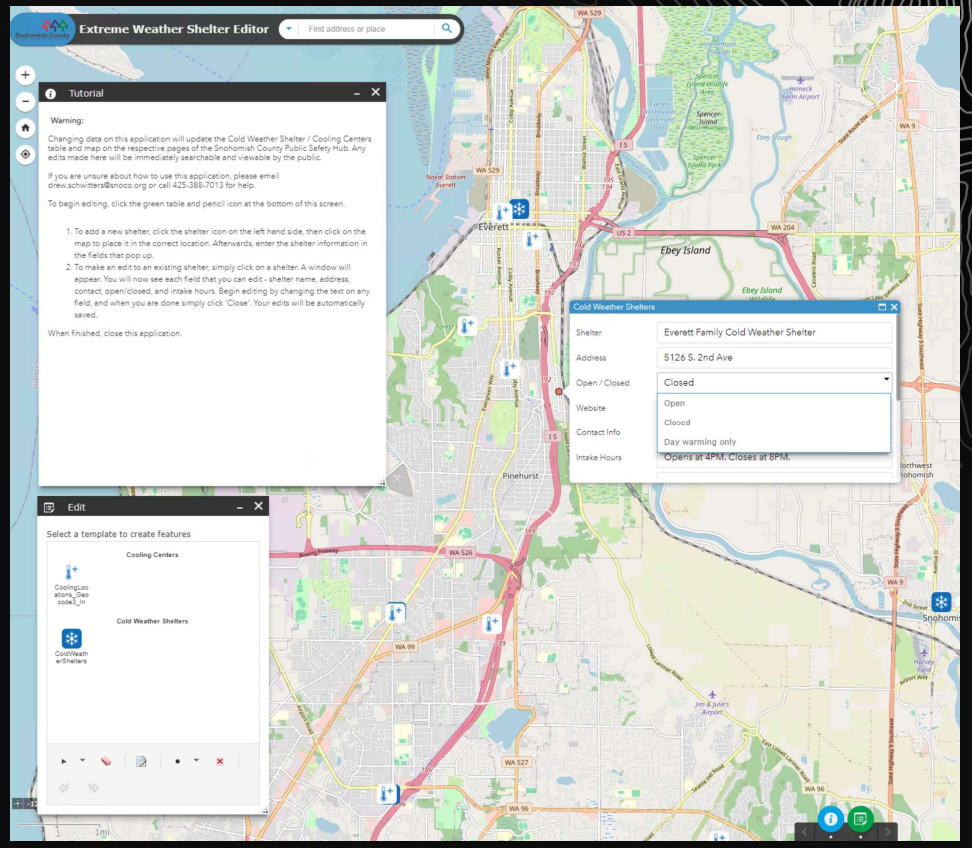


Interaction invites engagement

- Embedded maps showing existing hazards, evacuation areas, special events, and more allow for direct engagement
  - “Let’s type in my address!”
- Embed surveys for damage assessments, community feedback, even volunteer management
- PIO outreach and engagement across all social media platforms *before* a major event ensures plenty of reach when directing traffic to these resources *during* an event

What platform to use?

- The hub is, most simply, a website that can be directly edited by key EM staff
  - GIS Analysts are not needed to keep most content current
  - Centralized IT GIS staff may not be best equipped for this job anyway
- Federal, tribal, state, and local governments may have ArcGIS Hub as part of their enterprise GIS agreements
  - Mapping capabilities and online data library a huge benefit
  - IT GIS can build tools for non-GIS staff to edit data and maps
    - EX – Cold Weather Shelter Hub site in Snohomish County



Hub Emergency Messaging Recommendations

- Build a hub site for your organization *before* major anticipated events
- Include a URL to the hub in your emergency message/WEA
  - Social science says people try to find more info instead of taking action. Don't fight human nature, give them a place to find all necessary information!
- Build into your workflow a process that makes the hub updates live at the same time your social media is sharing the new information. The discipline of writing a well-crafted social media post can create content that holds up well and can quickly be incorporated on a hub
- Social media, particularly X (formerly Twitter), is where many people live now, including during emergencies. The hub should occupy middle space, between social media and the other more fixed options, especially the static websites your agency and others use daily

Questions?

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Emergency Management