



Operational Excellence Award

Chehalis River Basin Flood Authority

Vickie Raines, Chairperson
Chehalis River Basin Flood Authority
360/590-4100
vraines@co.grays-harbor.wa.us

Scott Boettcher, Staff
Chehalis River Basin Flood Authority
360/480-6600
scottb@sbgh-partners.com

Submitted by:

David C. Curtis, PhD, F,EWRI
WEST Consultants, Inc.
916-932-6870
dcurtis@westconsultants.com

The Chehalis River Basin Flood Authority (CRBFA) has developed and maintained an exceptional hydrologic warning system since its authorization in 2010. After more than a decade without a major flood, record flooding returned to the Chehalis River Basin in January 2022. The CRBFA's longterm support and investment paid off. The system worked when it was needed the most.

On June 22, 2023, the National Hydrologic Warning Council (NHWC), at its biannual conference, recognized the CRBFA flood warning system's outstanding sustained performance with the NHWC Operational Excellence Award.

The following pages summarize the flood warning system performance during the January 2022 flood event.



January 2022 Flood – Chehalis River Basin

Rain began falling in Washington’s Chehalis River Basin on October 1, 2022, and continued without a significant break until mid-January 2023. Numerous atmospheric river events pummeled the region. Just shy of 87 inches of rain fell on the Beeville gage during the period. (See Figure 1) The West Fork Satsup gage recorded 73.8 inches, Huckleberry Ridge reported 67.62 inches, while 57.75 inches fell at the Newaukum-Weyco gage. During the 30-day period from mid-December to mid-January rainfall totals in the basin ranged from 12 to more than 40 inches.

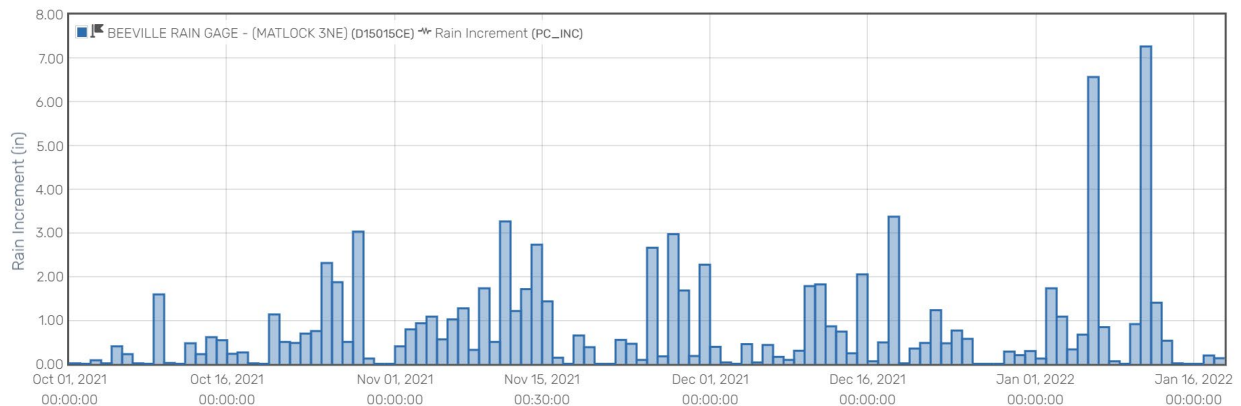


Figure 1: Daily precipitation reported at the Beeville gage from October 1, 2022, through January 18, 2023.

Cold temperatures from Christmas through New Year’s Day caused snow to accumulate at abnormally low elevations in the basin. Precipitation gages in the Chehalis River Basin only measure rain or melting snow. Temperature sensors are available to indicate whether incoming precipitation was falling as snow or rain. (See Figure 2) Precipitation during the last week of December likely fell as snow and not recorded by the gages until temperatures warmed. Accumulated low elevation snow meant several additional inches of water were available

for runoff when a Category 4 atmospheric river (See Figure 3) hit on January 6th with warmer temperatures and more heavy rain.

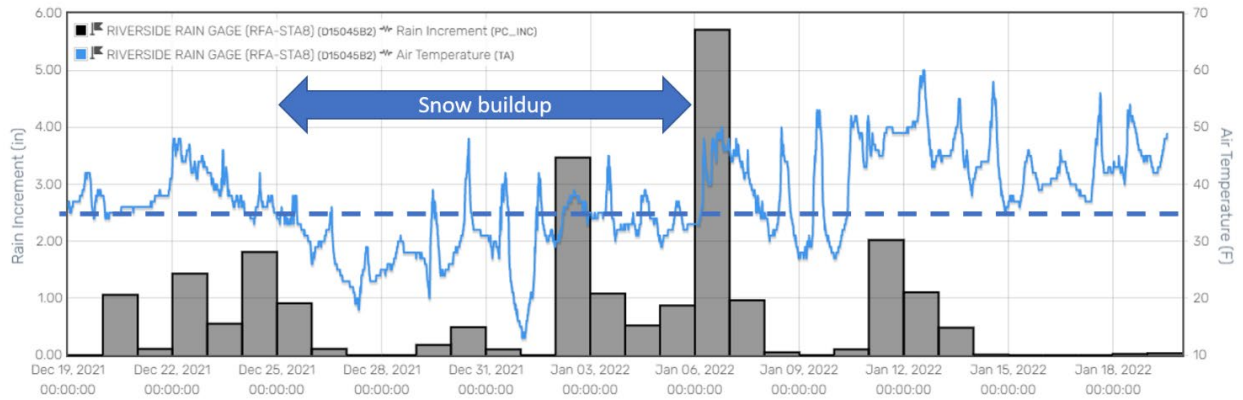


Figure 2: Daily rainfall with hourly temperatures at the Riverside gage.

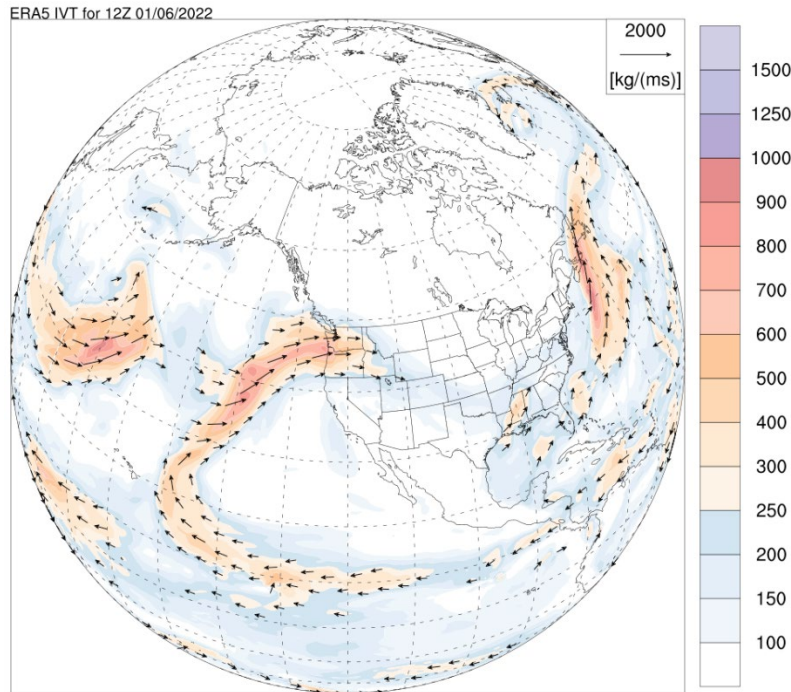


Figure 3: Atmospheric River shown as a plume of Integrated Water Vapor Transport striking the Pacific Northwest coast on January 6, 2023. (Source: CW3E)

Extremely wet antecedent conditions, significant snow on the ground, combined with a warming Category 4 atmospheric River were an ideal setup for flooding. Moderate to major flooding occurred with record stages on a major tributary, the Newaukum River at Chehalis, with near record flooding on another major tributary, the Skookumchuck River near Bucoda. Numerous other stations in the middle to lower Chehalis River Basin saw major and moderate flooding through January 9th.



Figure 4: Jurisdictions in the Chehalis River Basin.

Background

Floods are frequent visitors to the 2600 mi² Chehalis River Basin (Figure 4). As the Washington Department of Ecology notes: “Over the past few decades, peak seasonal flood levels have been rising -- with five of the Basin’s largest historical floods occurring during the last 30 years. Besides the 125-mile-long Chehalis River which flows into the Grays Harbor estuary on the Pacific Coast, the Chehalis Basin also includes the Black, Elk, Hoquiam, Humptulips, Johns, Newaukum, Satsop, Skookumchuck, Wishkah, and Wynoochee rivers, and their tributary streams (<https://ecology.wa.gov/Water-Shorelines/Shoreline-coastal-management/Chehalis-Basin>).” The trend continued in January 2022.

After the epic 2007 and 2009 Chehalis Basin Floods, Washington Governor Christine Gregoire created the Chehalis River Basin Flood Authority in 2010 to develop flood hazard mitigation measures throughout the Basin. Later, in 2016, the Washington State Legislature created the Washington State Office of Chehalis Basin to aggressively pursue a Basin-wide integrated strategy to:

- Reduce long-term flood damage.
- Restore aquatic species.

The intense interest in mitigating flood risk and improving aquatic ecosystems in the Chehalis Basin has fostered millions of dollars of investment over the course of the past decade to meet these objectives. Resulting projects include levees, pump stations, improved channel conveyance, bank stabilization, critter pads, residential flood proofing, and improved flood forecast/warning systems among others.

Flood Warning System

In 2010 the Flood Authority authorized development of a flood warning system specific to the Chehalis Basin (www.chehalisriverflood.com). The system was developed and designed to:

- Be a web portal for flood information serving flood preparedness decisions by the Chehalis Basin communities.
- Provide improved data to support and leverage NWS river forecasts in the Basin.

The flood warning system began with 22 new hydrometeorological sensors, including 10 rainfall, 10 temperature, and 2 stream gages. (See Figure 5 for a typical rain/temp station.) Connections were made to existing automated hydrometeorological monitoring networks in the region that added nearly 100 sensors to the system, most reporting data in 15-minute increments. Today, the system database includes nearly 300 sensors reporting in near real-time. The majority of these sensors are owned, operated, and professionally maintained by other agencies which means that the Chehalis River Basin Flood Warning System highly leverages available monitoring resources in the region. All these data are available to help inform flood mitigation activities in the basin at a fraction of the cost if the Flood Authority had to build the system from scratch.

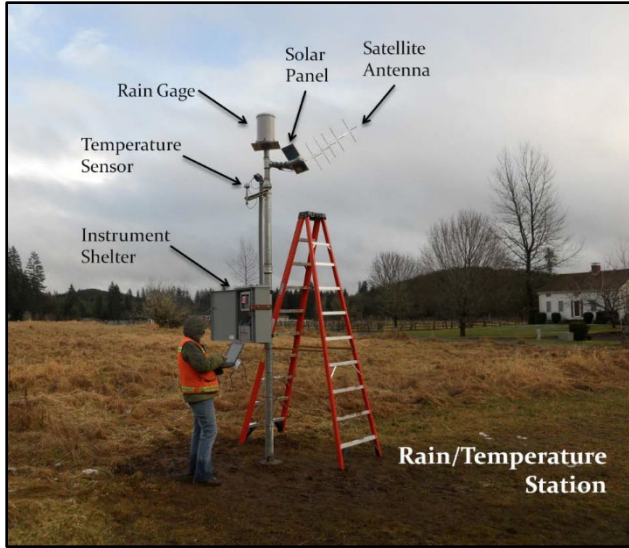


Figure 5: Example CRBFA Rain/Temperature Station

Since its inception, the flood warning system was incrementally improved and expanded each year. A key focus through the years is continuous efforts to make the system more visible and useful to the community. Implementing automated highwater alert emails, adding webcams (Figure 6), improving inundation maps (Figure 7), and developing better visual presentations of important data are significant contributions. (Figure 8 and Figure 9) The key is making the public more and more aware of the flood warning system how it can help inform decisions that aid flood preparedness and response.

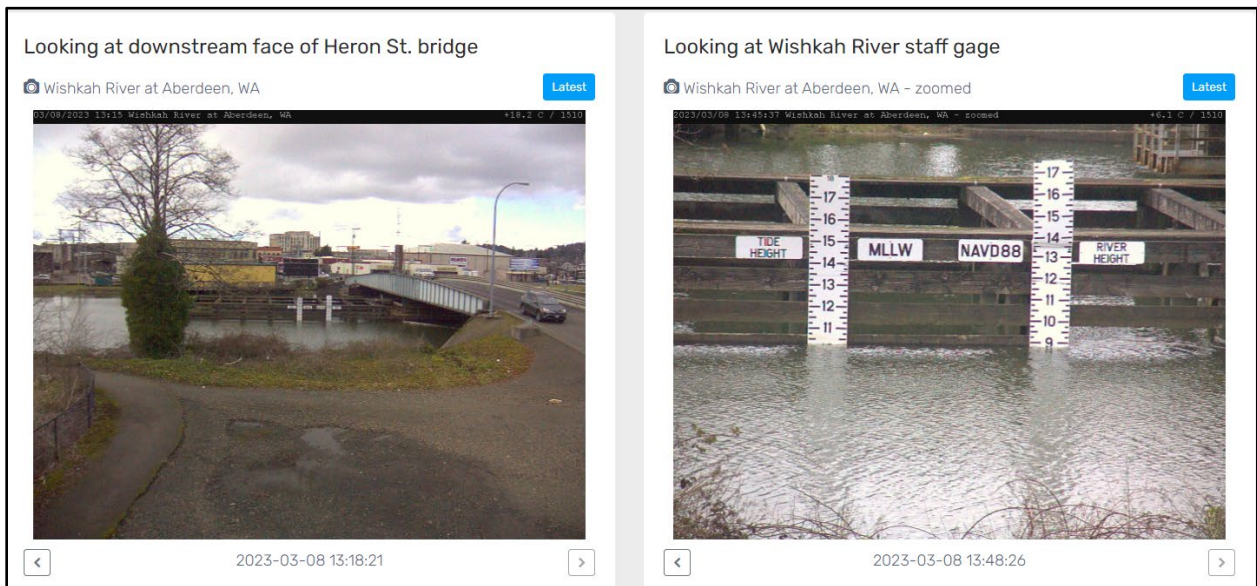


Figure 6: Webcam images on the Wishkah River at Heron St Bridge. Tidal influence is present. Stage is shown in both NAVD88 and MLLW datums.

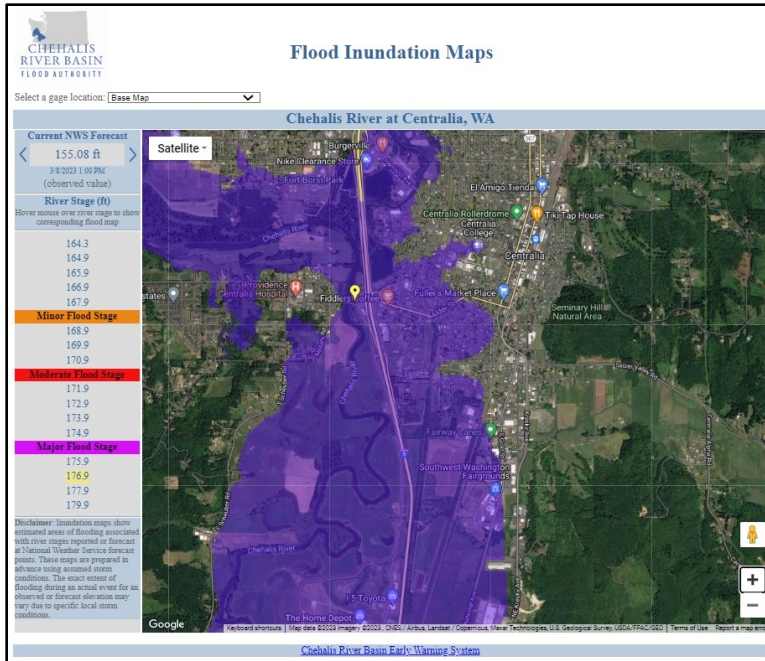


Figure 7: Example Inundation Map

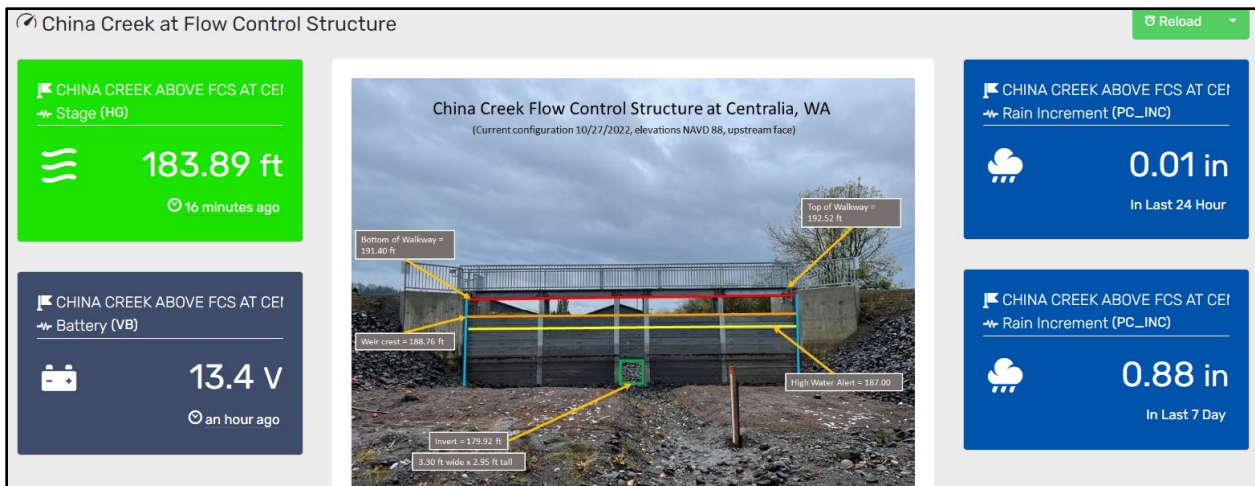


Figure 8: Visualization of China Creek Flow Control Structure

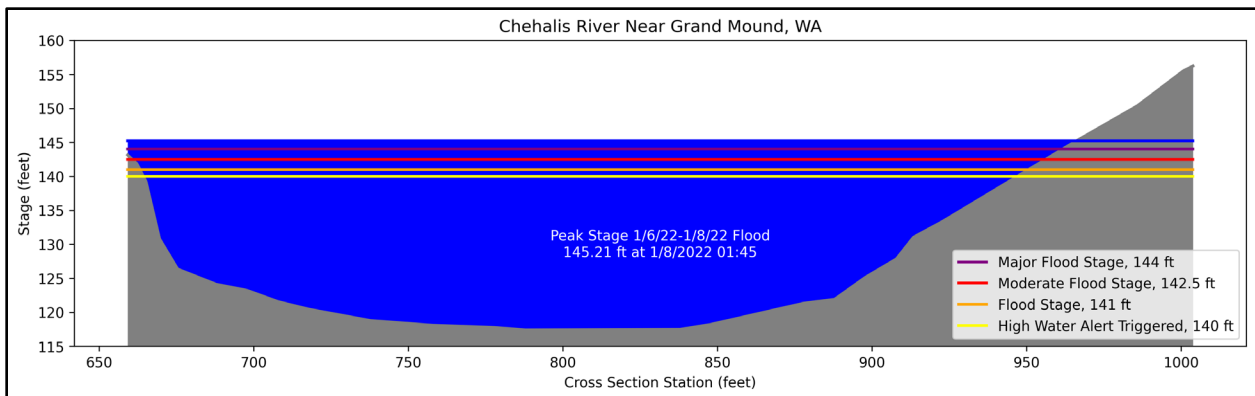


Figure 9: Visualization of river stage relative to channel cross-section and key flood warning stages.

In early-January 2022, record and near record flooding returned to the Chehalis Basin. By all measures the Flood Authority's Flood Warning System was a resounding success. Among the most valuable features of the system were the high-water alerts and flood inundation maps. Currently, there are over 2,400 registrations to receive email high water alerts from 13 key river gages in the Basin. The email alerts provide subscribers with additional warning time to respond to rising water levels. A web page was created to allow the public to both track basin wide interest in the highwater alert program and to sign up to receive highwater alerts. A link to a training video on utilizing the Chehalis the flood warning system is also provided. (Figure 10)

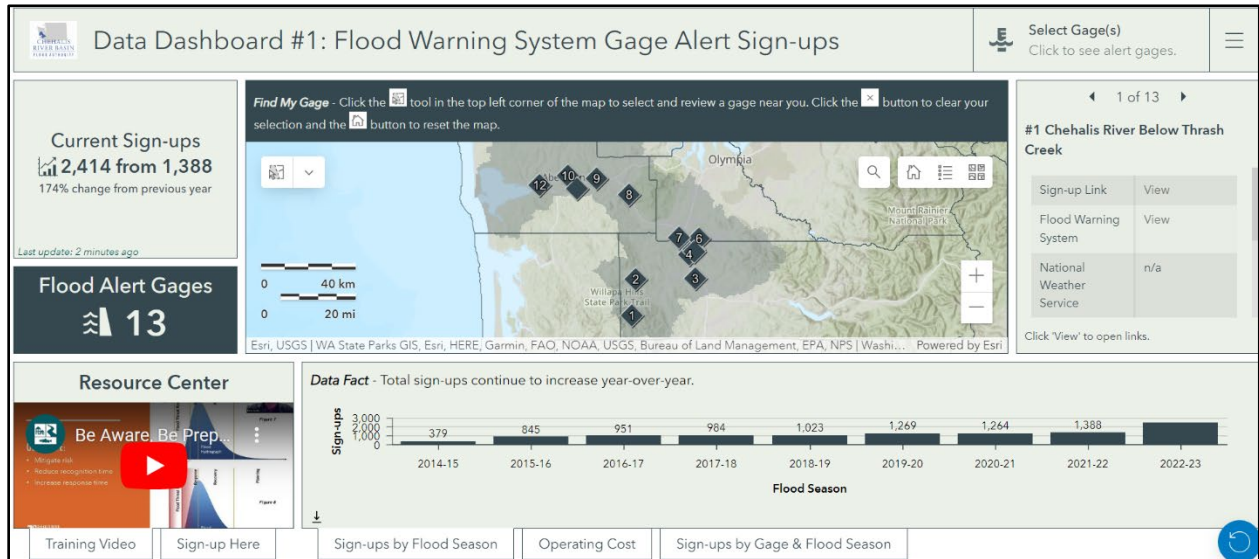


Figure 10: Public facing dashboard for Flood Warning System Gage Alert Sign-ups.

During the January 2022 event, in the largely rural basin with just 175,000 residents, more than 25,000 unique logins to the Flood Warning System website were recorded. The flood inundation map pages received approximately 73,000 hits in two days, January 6-7. (Figure 11) Social media posts about the website and inundation maps by a local newspaper (The Chronicle) and the Washington Emergency Management Department (Figure 12) helped drive traffic to the website and inundation maps based on NWS forecasts.

Day	Number of visits	Pages	Hits	Bandwidth
01 Jan 2022	12	18	20	1.79 MB
02 Jan 2022	23	69	116	31.39 MB
03 Jan 2022	32	97	138	31.88 MB
04 Jan 2022	56	203	355	98.69 MB
05 Jan 2022	356	1,338	2,111	237.06 MB
06 Jan 2022	6,090	29,057	44,094	758.75 MB
07 Jan 2022	4,538	19,214	29,426	382.12 MB
08 Jan 2022	738	2,377	3,690	174.84 MB
09 Jan 2022	261	613	960	84.44 MB
10 Jan 2022	178	412	649	147.73 MB

Figure 11: Website traffic January 1-10, 2022

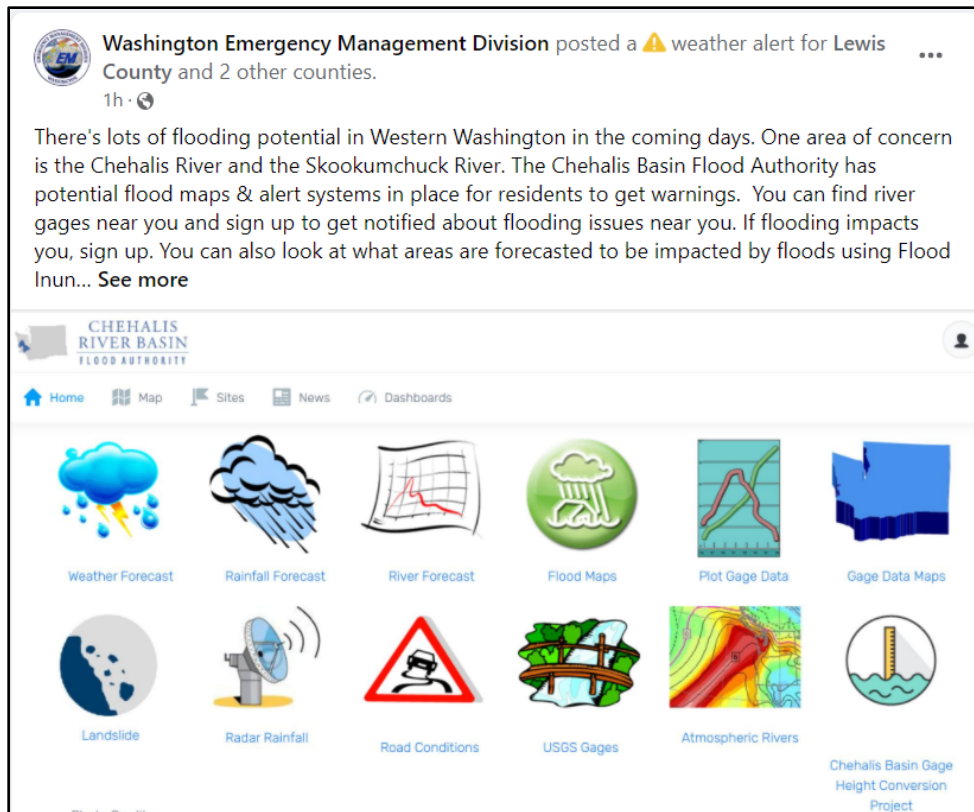


Figure 12: Facebook post by Washington Emergency Management during January 2022 flood event.

A post event survey identified several potential system improvements, including a Spanish language version of the website, that are currently under evaluation for a new master plan for the Chehalis River Basin Flood Warning System. The master plan will guide capital expenditures for system improvements for the next five years.

Summary

Floods, especially big ones, are rare. It is a huge challenge to maintain community interest in a flood warning system when many years may pass between significant flood events. An important lesson from the Chehalis is continuous unrelenting outreach helps. Making the system visible at public meetings, improving data visuals, leveraging traditional and social media platforms, adding functionality to serve a broader audience, and giving new reasons to visit the website all improve system awareness. You don't have to bang the drum loudly, just consistently. So, when the time comes, people know where to go for the flood information they need.

Additional Supporting Information

Through unrelenting outreach by the Chehalis River Basin Flood Authority and staff since 2010, the Chehalis region is more flood aware and now utilizes the flood warning system to make more informed decisions to protect life and property. As just one example of how residents leverage flood alerts, the following pages summarize an article from a local newspaper, **The Chronicle**. The article describes how Farm Pads, elevated pads designed to accommodate livestock, feed, and farm equipment during high water, dramatically reduced agricultural damage due to flooding in January 2022 compared to the damage from epic floods in 2007 and 2009. High water alerts help give farmers time to act.

Shop'n Kart. **FULLER'S MARKET PLACE** **Sid's MARKET** **WESTPORT**

Lending made easy!
Home, Construction or Business

Banking made easy!
for home, construction, business...or just a smile.

MOBILE & ONLINE TOO!

Timberland Bank Since 1915 800.562.8761

MOBILE & ONLINE TOO!

Timberland Bank Since 1915 800.562.8761

CHHALIS
714 W. Main Street (off I-5 at Exit 77)
360.746.0770

Also TOLEDO
WENLOCK, TILWATER & OLYMPIA

JERRY TUCK
MATT KAGAN
MATT BIRCH
TM COLLIN

Farm Pads Prove Worth in Protecting Livestock in First Big Test Since 2007 Flood



Brad Gregory shows affection to a young lamb while holding it in front of a critter pad among his flock of East Friesian sheep at Black Sheep Creamery in Adna.
JARED WENZELBURGER / JARED@CHRONLINE.COM

By Eric Rosane / ericr@chronline.com

Memories of the 2007 Chehalis Basin flood remain painfully fresh for Adna farmer Brad Gregory.

In a matter of hours, flood waters inundated his farm and property, located along Bunker Creek Road adjacent to the Chehalis River. In an attempt to get his livestock up to higher ground, Gregory and his family led his 100 sheep into their 1890s era barn.

It was a chaotic scene, one that Gregory and his family hadn't experienced in their 14 years of living there.

"We got a boat ride from here to the Adna store, then a helicopter ride over to the high school," said Gregory, 65, adding later: "It was pretty hard. We had an amazing amount of help."

MOST POPULAR STORIES

[Ted Cruz Says Joe Biden May Name VP Kamala Harris to Supreme Court 'to Get Her Out of the White House'](#)

[Ignorant Good Samaritans Kill Two North Idaho Moose](#)

[Parts of Eastern Washington State Park Closing Permanently; Four Visitors Have Died There](#)

[Parents of Missing Oakville Girl Now Accused of Exposing Kids to Meth](#)

[Crime Victims, Families Feel Blindsided as Oregon Governor Makes Historic Push to Release Prisoners](#)

['False Spring' Arrives in Western Washington, With Dry, Sunny and Warm Weather](#)

HOME CARPET WAREHOUSE
AND CABINETS

HUGE SELECTION.
GREAT SERVICE.
BEST PRICES.

FOR OVER 20 YEARS

The flood is known to have been especially deadly for livestock in the upper basin. Gregory's property was no exception. About three quarters of his sheep died as a result of the December 2007 flood, the survivors having likely lived by keeping their heads above the water by standing atop the carcasses of the deceased.

The memories of the flood remain etched on the water lines of the barn, though things have largely returned back to normal.

In the years after the flood, the Gregory family had a 10-foot high farm pad constructed on their property to park livestock and valuable tractor equipment in preparation for the next "big one." Standing atop the unkempt, gated structure, Gregory said he hasn't had to use it much since its construction.

"This would have been the closest (to 2007) and the elevation, it wasn't even close," Gregory said of the January flooding in the Chehalis River Basin.

But for many of the two dozen or so farm pads — also known as critter pads — that were built in the Chehalis Basin following the 2007 flood, last month's flooding served as the first real test to see how the structures could reduce the loss of livestock and valuable items, said Kelly Verd, special projects coordinator with the Lewis County Conservation District.

So far, according to feedback, the pads appear to be working.

"We have had a couple people who want to expand them because once they use them, they think, 'hmm, I have some equipment that I would like up there too,'" Verd said.

The Lewis County Conservation District and the Chehalis River Basin Flood Authority have played a pivotal role in linking property owners and farmers to funding sources to build farm pads, including Gregory's, which was funded through a federal Natural Resources Conservation Service grant. Most of the pads were constructed in the immediate wake of 2007, Verd said.

"I think we've become a model across the nation by doing these farm pads," said Edna Fund, vice president of the flood authority and also the daughter of a farmer. "One farm pad is not like another one."

Because of basinwide partnerships, Fund said, organizations and governments have been able to work together to construct these structures in many of the counties that lie within the Chehalis Basin, though mostly in Lewis County.

They're also effective in that they're tailor-made to the specifications and needs of each landowner.

"These not only protect property, but they protect communities and they ensure resilience and that people will be able to get back to work," said Scott Boettcher, a staff member with the Chehalis River Basin Flood Authority. "They're kind of super simple, but we didn't have them before and now we do. I look at them as a good example of living with floods."

About 80 to 90% of herds impacted by flood water drowned during the 2007 flooding, Boettcher said. It was devastating not only financially, but emotionally for a lot of farmers and agricultural workers.

Boettcher said the structure of a farm pad — compact, structurally-sound earth mounds covered in grass and gated — is "elegant in its simplicity" and gives farmers a "sense of relief so they could sleep at night."

"They have proven to be very effective. I mean, we haven't had an '07 event since '07," Boettcher said.

He's heard reports that property owners within the Newaukum River subbasin — which saw record-breaking flooding in January — found success in utilizing their pads this time around.

The fiscal return on the structures has also been noteworthy, Boettcher said. The basin's 25 or so total pads were built with approximately \$600,000 in funding and have mitigated damage or loss about 14 times that.

"If it works for somebody's farm, I think it's a great idea," said Michelle Schilter, an Adna cattle farmer who maintains about 300 dairy cows.

Schilter said she doesn't have a pad, but recently purchased about 100 acres of hillside land adjacent to her property so that they can use it to run cattle up the hillside.

"It was just life changing," she said of the 2007 flood. "We had water in our house, we had water in the dairy. I had three small kids. It was just catastrophic. We were lucky that we didn't lose the animals like a lot of farmers did in the area, but we did lose a lot of feed."

The leadup to last month's flooding showed that many rivers in the Chehalis Basin were due to reach or surpass historic flooding stages, though weather proved more favorable and allowed many communities to "dodge the bullet" of a similar 2007 flood, many county and city officials have said.

Schilter said there definitely was some post-traumatic stress in the community as farmers began moving their livestock, equipment and tractors to higher grounds last month. Boettcher said there have been no reports of loss of livestock from flooding in January.

Though water began covering parts of Bunker Creek Road during this last flood, Gregory, owner of Black Sheep Creamery, said his family wasn't too worried about the risk of flooding. The only loss this time around was some damp feed, which the sheep still took to.

"It probably got higher than we thought it would," he said. "This was higher than '09 for us."

At least once a year, Gregory said, he'll lead his sheep up to the farm pad with a bucket of grain to help pasture grass. Standing atop the structure, Gregory notes how it's about 4 or 5 feet higher than where '07 flood waters stood.

Herding them up the incline is nothing like pulling teeth, he said. It's rather simple.

It's just another tool in the box — just another safety net.

Just in case.



Figure 13 :Brad Gregory stands atop a critter pad while talking about his flock of East Friesian sheep at Black Sheep Creamery in Adna.
Source: JARED WENZELBURGER / JARED@CHRONLINE.COM



Figure 14: Calves along Bunker Creek Road in Adna sport blankets on high ground.
Source: JARED WENZELBURGER / JARED@CHRONLINE.COM

A unique guide, “Preparing a Household Flood Response Plan” was developed by the Office of the Chehalis Basin to provide detailed information to Chehalis River Basin residents on how to prepare flood resilient properties. The guide heavily leverages forecasts, inundation maps, highwater alerts and other information available in the Chehalis River Basin Flood Warning System. A copy of the guide is attached.

Preparing a Household Flood Response Plan

Responding to a flood can be intense. It is a good idea to decide with your family or housemates who is doing what, and write it down so nothing is forgotten. (“Be Aware, Be Prepared – Protect Yourself from Flooding in the Chehalis Basin,” page 10)

This is the essence of a household flood response plan – a list of things to protect your family and your property that should be done at different times when a flood is predicted or is happening. This guide provides step-by-step instructions on how to prepare such a plan. It references the “Protect Yourself” publication quoted above. “Protect yourself” can be downloaded at no cost from the Community Flood Assistance and Resilience (CFAR) program [website](#).

This guide includes examples from a flood response plan followed by Mike Smell, a resident of the Chehalis Basin. Mike’s property is located south of Chehalis near the Newaukum River. The property has been flooded several times since he moved there in 1989. Mike has learned flood response lessons and has adjusted the actions he takes based on his experiences. Below is an aerial view of the property and the buildings that are discussed later in this guide.



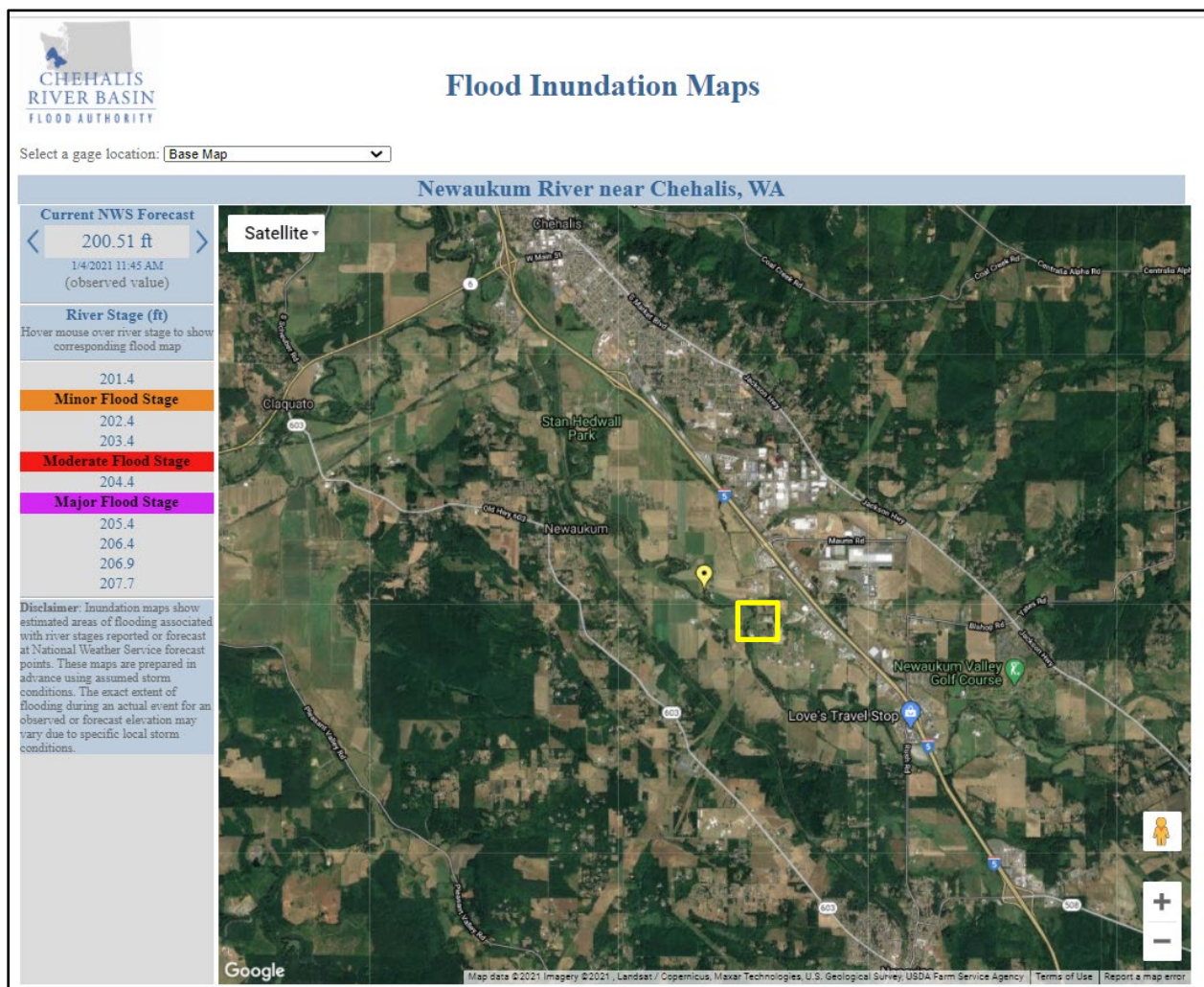
Step 1. Find your gage

Your plan and the things you do when a flood is predicted or happening should be based on one or more local river gage readings, especially a gage where the National Weather Service provides flood level predictions. Instructions on how to find a gage near your property can be found on pages 6 – 8 in the “Protect Yourself” publication.

Mike’s example:

Mike has relied on the Newaukum River near Chehalis gage for current stream water levels and flood predictions. The gage is located by the yellow pointer in the map below. It is 2/3 of a mile downstream from Mike’s property, which is in the yellow box. River gages report water heights in “stage,” as explained on pages 6 – 7 in the “Protect Yourself” publication.

Mike has “bookmarked” the gage’s website link, so he can quickly access the gage data at any time of day or night from his computer or his cell phone.



Step 2. Relate flood stages to your situation

River stages are discussed on page 7 of the “Protect Yourself” publication. River stages may be reported in feet above a local starting point or as the elevation above sea level at the gage. For your flood response plan, you want to relate what different stages reported at your gage look like or mean in terms of flood levels on your property. There are two ways you can do this:

1. Review gage records to find the stages of historical floods and relate them to what you remember about those floods. For example, you may have marked the high water line of the December 2007 flood on a building or tree on your property. The river gage websites include the elevation or stage of the crest of the December 2007 flood. If a flood is predicted to reach two feet below the stage of the crest of the 2007 flood, you know how high water will likely go on your property.
2. Using the Flood Inundation Map tool on the Chehalis River Basin Flood Authority's Flood Warning System website, review how different flood levels are predicted to cover your property and the surrounding areas. This tool is described on pages 8 – 10 in the “Protect Yourself” publication.

We recommend you do both of these things to gather all of the information you can about what happens on your property and surrounding areas at different river levels. First, you may have to convert some of the historic crest stages to feet above sea level, as explained below.

Converting Gage Stage to Elevation above Sea Level

To the right is the Newaukum River gage website’s record of the highest recent floods. Note that some flood crests are listed in feet above sea level (NAVD 1988) while the flood of 01/07/2009, is listed in gage stage (13.48). Current gage levels and flood predictions are reported in NAVD, so a factor needs to be added to convert older gage readings and flood records to today’s NAVD Datum.

Converting old gage stage readings to NAVD is discussed on page 7 of the “Protect Yourself” publication. There are seven gages in the Basin with inundation maps. Their conversion factors are listed below.

River Gage Stage Conversion Factors

Gage	Factor
Chehalis River at Porter	27.11
Chehalis River near Grand Mound	127.03
Chehalis River at Centralia	103.32
Chehalis River near Doty	304.90
Skookumchuck River near Bucoda	198.15
Skookumchuck River at Centralia	103.76
Newaukum River near Chehalis	191.94

The conversion factor is added to the stage readings before May 2018 that appear to be much lower than elevations above sea level. At the Newaukum gage, the 2009 stage of 13.49 is converted to NAVD: $13.49 + 191.94 = 205.43$, roughly the same level as the 1996 flood (205.48).

By clicking on “Show More Historic Crests,” you can see more gage records. The December 2007 reading was 13.45 or 205.39 NAVD. Mike was there for the 1996, 2007, and 2009 floods and they all crested at roughly the same level.

Flood Categories (in feet)	
Major Flood Stage:	205.5
Moderate Flood Stage:	204.5
Flood Stage:	202.5
Action Stage:	200.5
Low Stage (in feet):	0
Historic Crests	
(1)	205.48 ft on 02/08/1996
(2)	204.52 ft on 12/21/2019
(P)	
(3)	204.14 ft on 01/07/2020
(P)	
(4)	203.19 ft on 02/07/2020
(P)	
(5)	13.49 ft on 01/07/2009
Show More Historic Crests	
(P): Preliminary values subject to further review.	

Mike's example for the first approach:

Using the first approach, Mike looked at the Newaukum River gage website. It has some general information on what happens at different flood elevations, like:

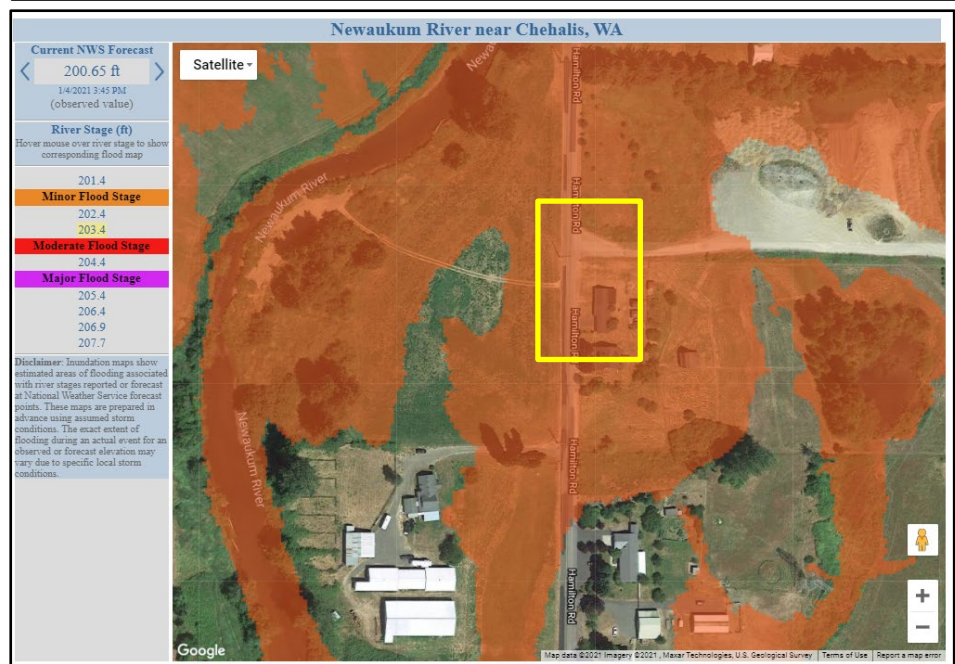
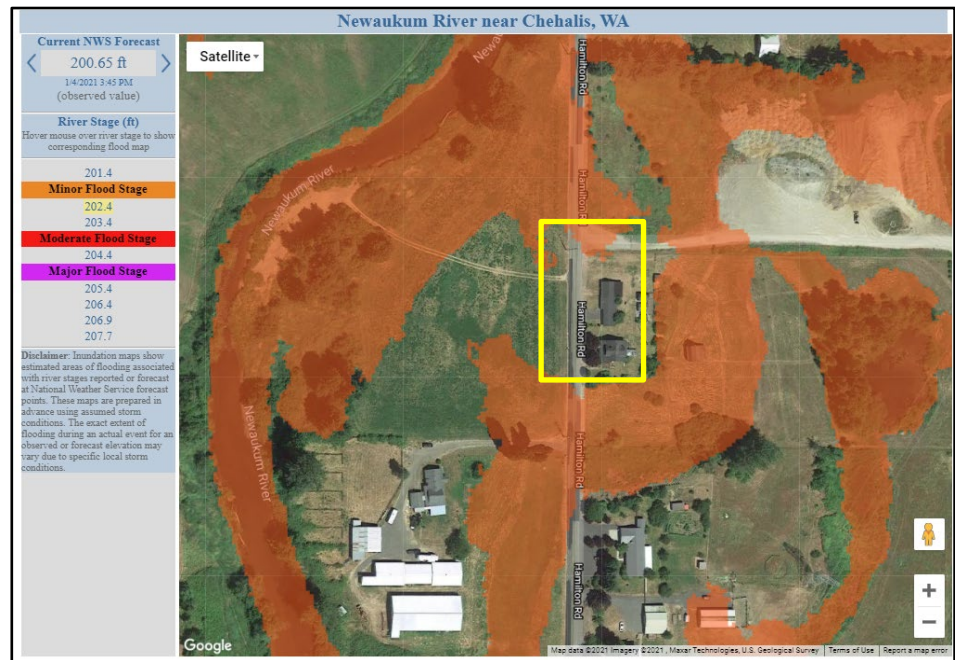
202.5 – flood waters will inundate many roads and residential and commercial areas along the Newaukum River and its forks....

204.5 – deep and hazardous flood waters will inundate many roads and residential and commercial areas...

Mike's example for the second approach:

Using the second approach, Mike chose different river stage levels on the legend on the left side of the inundation map tool website. His house and outbuildings are in the middle of the screen, in the yellow box to the right. At river stage 202.4, his property is surrounded by floodwater.

At the next higher level, 203.4, floodwaters will reach his buildings (right). A flood to the next level on the map, 204.4, would get into his outbuildings. His deck is higher than the outbuildings and the house is three feet higher than the deck, so it did not get flooded in recent floods. The floods of 1996, 2007, and 2009 (approximately 205.4) did flood the outbuildings and came close to covering his deck (see photo, page 11).



Step 3. Select your flood response stages

Page 7 in the “Protect Yourself” publication has two hydrographs. These charts show the past and current river levels and the National Weather Service’s predictions of future gage stages. The hydrographs and the inundation maps for each gage have three water levels highlighted in different colors: Minor Flood Stage (orange), Moderate Flood Stage (red), and Major Flood Stage (purple).

These water level designations are based on what happens in the area during a flood. The river may be coming out of its banks at lower levels, but the water is usually not high enough to damage property. In most cases, Minor Flood Stage means the water is high enough to affect buildings or close roads.

You may want to use the same water levels and designations when you take different actions to protect your property, but it is not likely that these water levels correspond directly to when impacts to your property may occur. For example, it may take a moderate flood stage of water to reach your garage and a major flood for water to get into your house.

After completing Step 2, you should have a good idea of what might happen on and around your property as a result of different predicted flood levels. Select stages or water levels for your response plan based on the potential impacts to your property from those water levels.

Mike’s example:

Mike chose to use round numbers to identify what happens when the water is at each level. His stages are lower than the minor, moderate and major stages ones discussed above. This gives him a little extra protection by triggering protection measures before they are absolutely needed.

- 202.0 – Access in and out of the property will be blocked.
- 203.0 – Flood water will be at the outbuildings
- 204.0 – Flood water will be in the outbuildings
- 206.0 – Flood water will be near the top of the deck



Flood stage 202.0 at Mike’s road



Flood stage 204.0 at Mike’s outbuildings

Step 4. Get a warning

Page 10 in the “Protect Yourself” publication describes how to sign up for flood warnings in the Chehalis Basin.

Step 5. Identify steps to take when the gage prediction means access in or out of your property will be blocked

Here is a checklist of things to consider:

- ___ Get all vehicles to high ground
- ___ Call neighbors who may not be monitoring gage readings
- ___ Consider leaving rather than riding out the flood. This is particularly important for properties on the mainstem Chehalis River and other large rivers where water levels may stay up for a day or more. You do not want to be isolated if you have an emergency.
- ___ Double check your “Go Kit,” a bag or case with all the things you need to take with you, like your medications, insurance policies, and food for your pets. These are called Survival Kits by the Red Cross (www.redcross.org/get-help/how-to-prepare-for-emergencies/survival-kit-supplies.html) and Ready Kits by FEMA (<https://www.ready.gov/kit>).
- ___ Check that items needed for your flood response, like sand bags, are still available and ready for use.

Mike’s example:

Mike has a NOAA Weather Radio that alerts him to possible high water. He checks the Newaukum gage and takes these steps when the gage shows a predicted crest at 202 or higher:

- ___ Call the neighbors who depend on him to give them a warning (although more and more neighbors have the Weather Service links on their own computers or tablets).
- ___ Check the Newaukum gage readings and predictions every hour.

Mike has found that at stage 201, he has five hours to take steps to protect his property before water gets in his outbuildings at stage 204. He starts work on those items that will get wet first.

If the prediction is 202 or higher, when the road will be underwater, his plan is to:

- ___ Move the car and truck down the road to the neighbor’s higher property.

Mike knows that the first flood crest predictions are not always 100% accurate. In January 2021, the water went 1.5 feet higher than the first predicted crest. To be safe, he will usually implement most of his response measures, including those for crest stages higher than predicted.



Mike stores filled sand bags on shelves and in nooks in his carport. Note the elevated electrical outlet above the sign.

Step 6. Identify steps to take if the flood will reach your building(s)

Walk around your property and identify things that will be damaged or float away if they get wet. Make a list so you will not forget something during the excitement of an impending flood.

Here is a checklist of things to consider:

- ___ Identify items like the barbecue grill that could be damaged or float away
- ___ Move damageable items that can be moved to a higher location
- ___ Tie down or otherwise secure damageable items that cannot readily be moved
- ___ Sandbag low points where water could enter a building, such as a window well

Mike's examples:

Here are some things Mike does when the gage predicts a crest of 203:

- ___ Move lighter, portable, items to higher locations. To the right, wheelbarrows of hay and the trash bin have been moved to the front porch, which is several feet above grade.



- ___ Secure the stack of firewood with pallets.



- ___ Get the boat out and tie it to the deck. This is a safety precaution should Mike have to leave his property when the water is high. It also allows Mike to monitor conditions on his property while the water is up (assuming no fast water).



___ Connect planks to the deck (below).

___ Drive the yard tractor up the planks and onto the deck.

To protect his riding mower, Mike built a ramp out of two planks that attach to his deck. He drives the mower up on the deck (below), then picks up the planks, and stores them there (right).

The deck would not be overtopped until a flood reached elevation 206.



Step 7. Identify steps to take if the flood will get into your building(s)

The best way to protect your buildings before a flood is to move them to a higher location, elevate them, or implement one of the other property protection measures discussed in Chapter 3 of the “Protect Yourself” publication.

Unless your building has been structurally flood proofed, you have to assume that water will get in. Therefore, Step 7 looks at protecting what is in the building from water damage. If you have a basement, do not try to keep the water out, as it will put so much pressure on the walls and floor that they may crack or break (see pages 11 and 16 in the “Protect Yourself” publication).

Here is a checklist of things to consider:

- ___ Identify damageable items that can readily be moved, such as smaller carpets and furniture.
- ___ Determine where the items can go, such as upstairs or on top of a table or counter.
- ___ Elevate damageable items, such as the washer and dryer. See the example on page 20 of the “Protect Yourself” publication.
- ___ Elevate damageable utilities, such as the furnace and water heater. See the examples on pages 21 – 22 of the “Protect Yourself” publication.
- ___ Consider renovating flood prone areas to minimize damage. This would involve wet flood proofing approaches discussed on pages 19 – 22 of “Protect Yourself.”
- ___ Consider renovating flood prone areas to make clean up easier. For example, replace a wooden floor with a concrete floor. Use batt insulation and do not tape or paint the lower levels of wallboard – put the wallboard in with screws so you can readily open the walls and throw out the insulation, before water wicks to a higher level.

More ideas on preventing flood damage and emergency flood protection measures can be found at the Louisiana State University AgCenter [website](#).

Mike's examples:

When the flood crest prediction is 204 or higher, Mike's outbuildings are the first to get wet and the easiest to retrofit for water. Here are some things he has done to his workshop.



The workshop and other outbuildings sit on a concrete pad. The floor is made of easily removable plywood sheets resting on the concrete pad. They are taken up after the flood and hosed off. The interior walls are left open, which facilitates hosing them off.



Almost all tools are stored at least three feet above the floor. The workshop has a loft over the workbench where lighter items that are not used regularly are stored.

Mike's basement

The first floor of Mike's house is more than five feet above ground level. It has not flooded, but the basement has. Having bare concrete walls and floors, the basement is easy to wet flood proof. The challenge is to ensure that utilities and items stored in the basement are elevated above flood levels.



Items are stored and appliances are elevated above past flood water levels



Electrical outlets are well above floor level. The freezer is turned off during a flood, but power can quickly be restored to the area after the flood.

The permanent sump pump (middle photo) keeps seepage out. Mike also has two portable submersible pumps that help keep the water level down during a flood and drain the basement after the flood recedes. He does not try to keep the basement dry because interior water counteracts the water pressure on the outside of the walls. He has a generator because the power always goes out when you need it the most (next page).

Shop vacs help during clean up.

Other outbuildings



The chicken coop and the greenhouse have no electricity and are floodable. The shelf in the chicken coop extends to the front and is large enough to store water and feed for the chickens during the flood. Before the flood, Mike does a run-through and moves damageable things (like bulk feed and the white bag of fertilizer) to a higher level.

Mike's barn (right) has no utilities and no longer houses any animals. When the flood comes, he does nothing – the water flows through the open doors and causes no damage.

The photo to the right was taken during the 2009 flood. Note the deck in the foreground, just above water level.

Mike has a generator available if there is a loss of power to the area

