

City of Portland

Flood Hazard-Specific Appendix to the Basic Emergency Operations Plan

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PORTLAND BUREAU OF EMERGENCY MANAGEMENT

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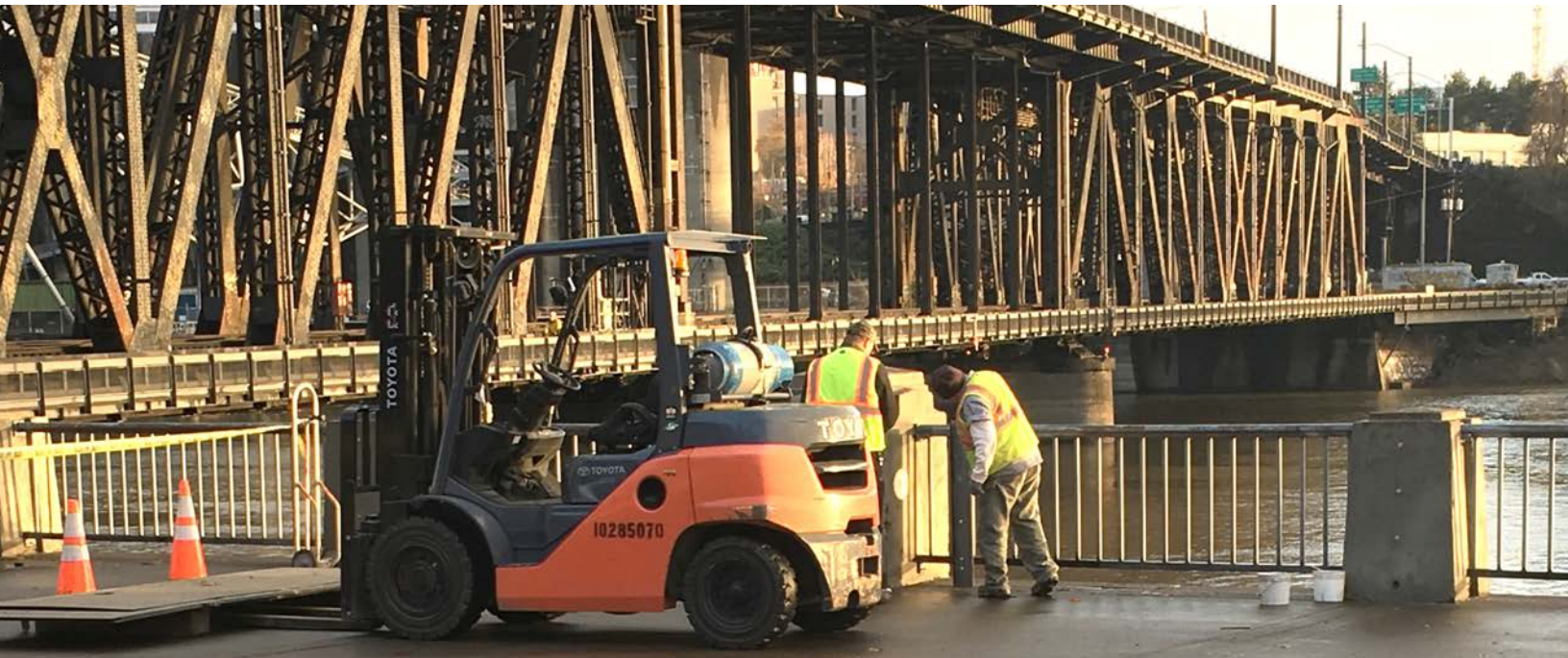
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INTRODUCTION



PURPOSE

The *Flood Hazard-Specific Appendix* (Appendix) provides an overview of the triggers, responsibilities, and authorities of City bureaus during a flood emergency, and describes how the City intends to work with partner agencies and jurisdictions for effective incident management. This Appendix does not guarantee that the actions in this plan will be carried out in the order listed, or at all. Response will depend on the needs of the incident and available resources.

SCOPE

This Appendix augments the City of Portland's *Basic Emergency Operations Plan* (BEOP) with information and procedures that are specific to flooding, and applies to all City bureaus. The Portland Bureau of Transportation (PBOT) serves as the lead response bureau, providing incident command for emergency flood response. Regional partners for flood response include the Multnomah County Drainage District

(MCDD), Port of Portland, United States Coast Guard (USCG) Sector Columbia River, United States Army Corps of Engineers (USACE), Multnomah County, the Joint Office of Homeless Services (JOHS), and the National Weather Service (NWS).

Other plans and procedures may be activated while responding to a flood, such as the *Alert and Warning Annex*, *Evacuation Annex*, or *Mass Shelter Plan*. If additional plans are activated at the same time, the thresholds for response activities (e.g. shelter) may shift to reflect those procedures. Urban and minor flooding is addressed through normal operations of several bureaus. There are also plans that work to reduce risk of flooding, such as the *Mitigation Action Plan*, plans for individual facilities, and plans regarding dam maintenance and operation. While these plans are an important part of the larger picture regarding flooding, they are separate and outside the scope of this Appendix.

OBJECTIVES

The objectives of this Appendix are to:

- **maximize life safety** of responders and the public by preventing life-threatening situations and rescuing people in life-threatening situations;
- **stabilize the incident** by employing protective measures to minimize effects; and
- **protect property and the environment** through flood-fighting activities.

SITUATION

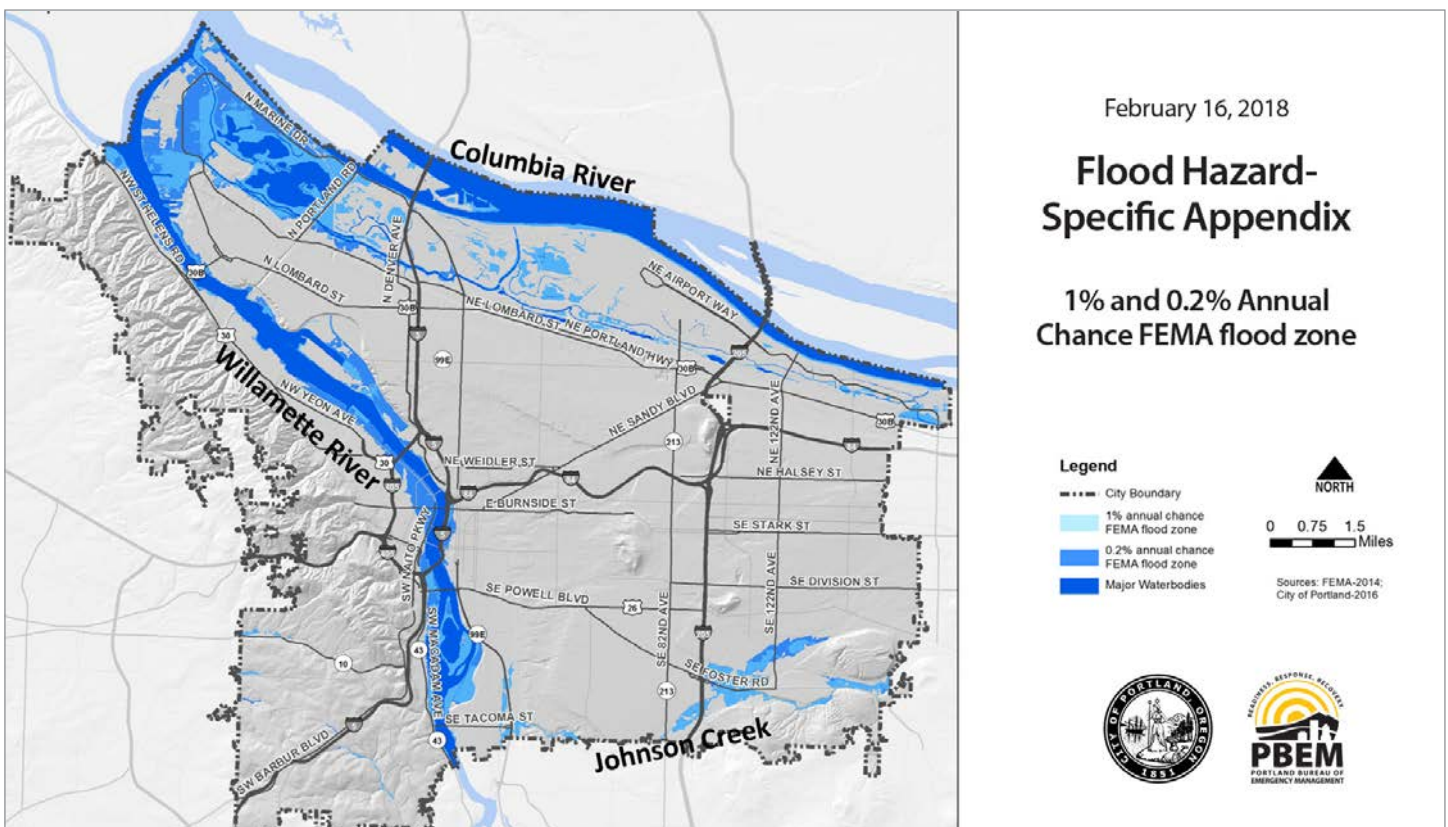
Portland is subject to flooding from rivers (Columbia and Willamette), creeks (Johnson, Fanno, Tryon, and others), and stormwater systems that become blocked or overwhelmed. Riverine flooding is typically caused by spring snowmelt and/or intense rainstorms. The flood season for Portland extends from late October through May. Historically, most flooding occurs in December,

January, and February. The most significant flood threats to Portland are from the Columbia River, Willamette River, and Johnson Creek, which are detailed further below and highlighted in Map 1. Beyond these threats, urban flooding can also occur when storm drains are blocked (e.g. by leaves or other debris) or when the sewer system becomes overwhelmed.

Flood Data

Flooding is measured in different ways by different agencies. The Federal Emergency Management Agency (FEMA) develops floodplain maps (which provide the basis for Map 1) using historic data, which are primarily used for flood insurance purposes. These maps use terms such as the 1% annual chance flood (sometimes called the 100-year flood), the Special Flood Hazard Area (sometimes called the floodplain, or the area susceptible to the 1% annual chance flood), and the 0.2% annual chance flood (sometimes called the 500-year flood).

MAP 1 | 1% AND 0.2% ANNUAL CHANCE FEMA FLOOD ZONE



Flooding is also measured by the United States Geologic Survey (USGS) and the National Weather Service (NWS), which track water elevations, volume, and temperature using stationary gauges¹ in water channels (see Figure 1), and issue flood watches and warnings. Flood watches indicate that conditions are favorable for flooding, while flood warnings indicate that flooding is imminent or occurring. The level of flooding is then divided into minor, moderate, and major flood stages. These flood stages do not align with FEMA’s 1% or 0.2% annual chance floods. Minor flooding generally indicates minimal to no property damage, but can still present a life safety concern, particularly for community members camping in a

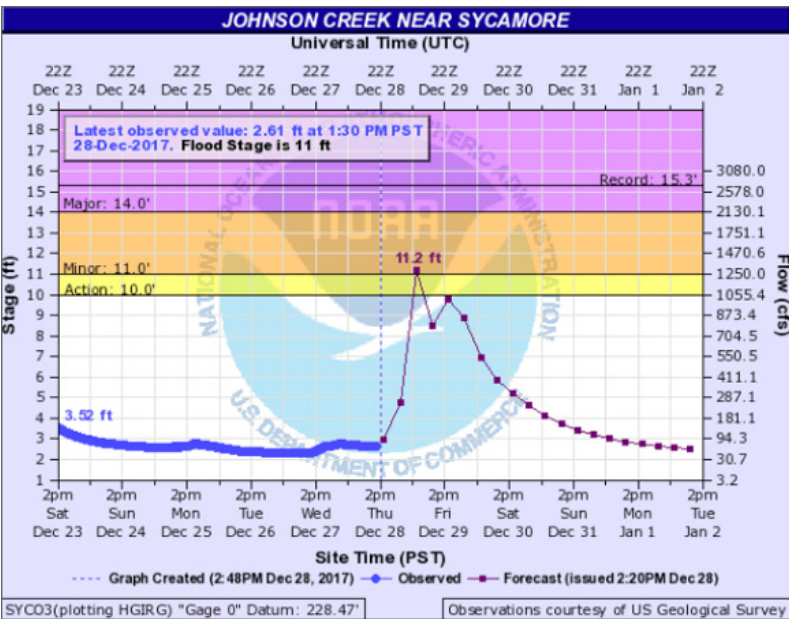
floodplain. Moderate flooding generally indicates inundation of some structures and roads, while major flooding indicates extensive inundation of structures and roads. Regardless of the impact to structures, all stages of flooding can require some amount of public warning, evacuation, and/or sheltering.

The NWS uses a specific geodetic datum (a coordinate system for describing geographic locations) to communicate the elevations of their gauge readings.² This datum is published and highly accessible, and is the default datum for this plan. However, it is important to note that other agencies and bureaus use different datum for aspects of their work. The datum can be converted using Table 1.

TABLE 1 | RIVER ELEVATION CONVERSION - all elevations in feet, rounded to nearest 0.1'

LOCATION	NWS	NGVD/MSL (ODOT)	CITY OF PORTLAND (PBOT, BES)	NAVD088 (PWB, MCDD)
Columbia River Gauge @ Vancouver	0.0	1.8	3.2	5.3
	(1.8)	0.0	1.4	3.5
	(3.2)	(1.4)	0.0	2.1
	(5.3)	(3.5)	(2.1)	0.0
Willamette River Gauge @ Morrison	0.0	1.6	2.9	5.3
	(1.6)	0.0	1.4	3.5
	(2.9)	(1.4)	0.0	2.1
	(5.0)	(3.5)	(2.1)	0.0

FIGURE 1 | EXAMPLE HYDROGRAPH OF JOHNSON CREEK NEAR SYCAMORE



¹ The USGS uses the spelling “gage,” however “gauge” is used in this document as the more common spelling.

² The National Geodetic Survey website <http://www.ngs.noaa.gov/faq.shtml> provides additional conversion information and guidance.

Willamette River

Flooding on the Willamette River is relatively infrequent, in large part due to dams and other infrastructure upstream. Map 2 shows the FEMA 1% and 0.2% annual chance flood zones for the Willamette River near Downtown Portland, and the location of the NWS gauge at Morrison Bridge. Historic crests have been 33 feet in 1894, 30 feet in 1948, and 29.8 feet in 1964. Most of the highest floods occurred before the regional dam system was fully constructed, which reduced flood risk. The most recent flood was in 1996 and crested at 28.55 feet. While this flood was considered a 1% annual

chance flood, there were areas beyond the 0.2% flood zone that were inundated, highlighting the uncertainty around mapped flood risk areas.

Figure 2 shows the flood stages (in NWS datum) for the Willamette at the Morrison Bridge gauge.³ “Flood Stage” (minor flooding) uses the top of the river bank as a reference, and does not account for the permanent harbor wall or the temporary seawall that can be installed to increase flood protection. One hazard of note for a Willamette River flood is that docks and floating homes can break free in a major flood event.

MAP 2 | WILLAMETTE RIVER 1% AND 0.2% ANNUAL CHANCE FEMA FLOOD ZONE

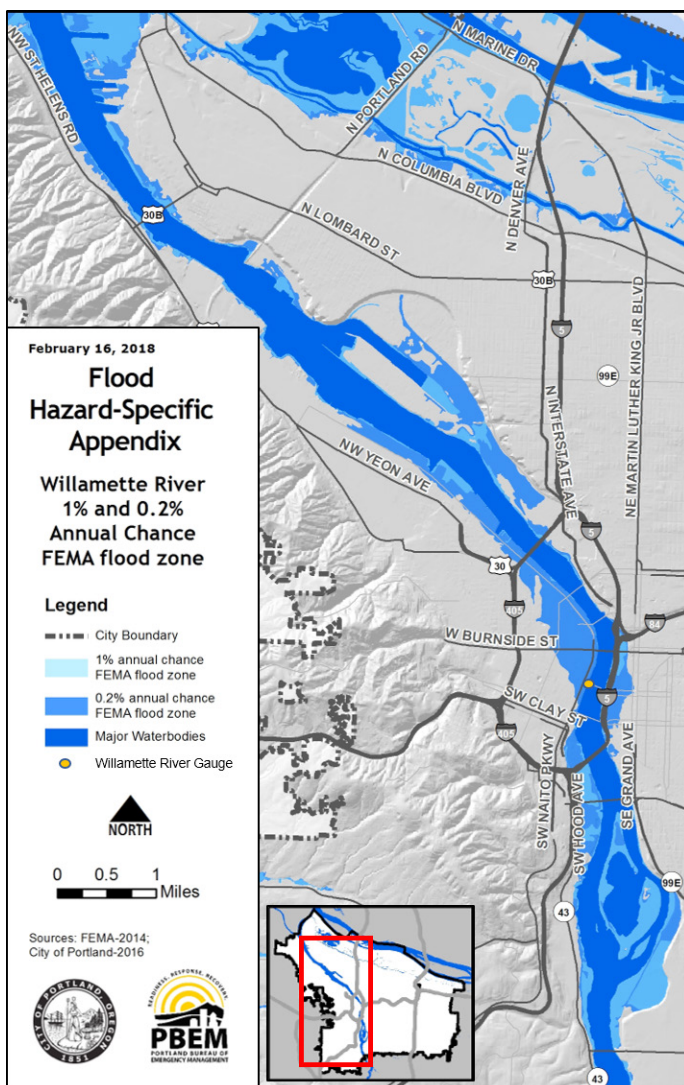
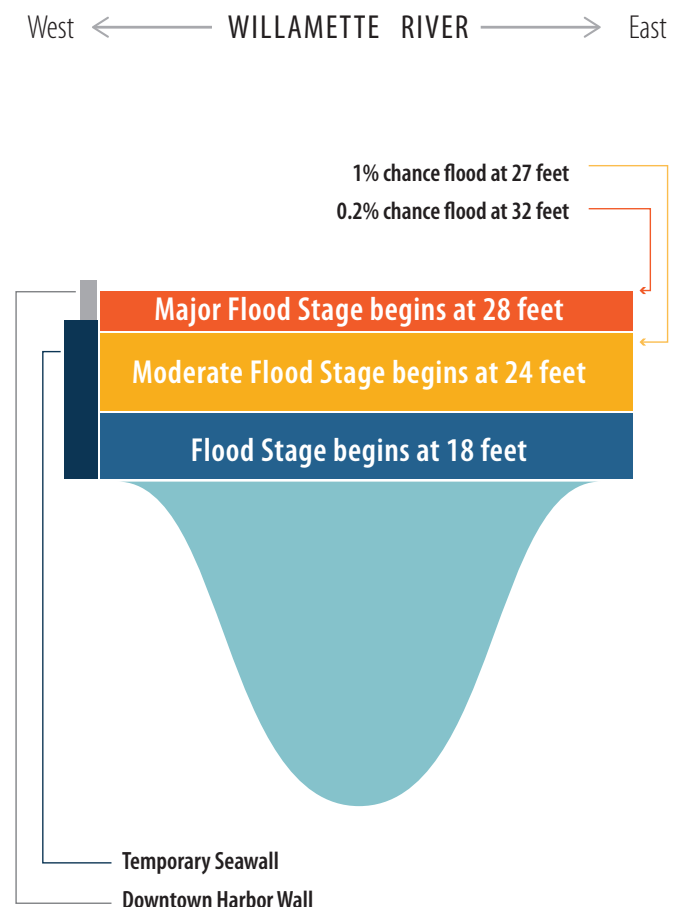


FIGURE 2 | NWS FLOOD STAGES - WILLAMETTE RIVER



³ Figure is representative and not to scale.

Johnson Creek

Due to frequent floods that have caused substantial damage to property and bridges, flood mitigation efforts are ongoing in the Johnson Creek watershed. Removal of flood-prone homes and construction of flood storage projects like the Foster Floodplain Natural Area have reduced flood impacts, but has not eliminated flood risk. Flooding still occurs in the area, and the creek can rise and fall rapidly. The historic crest of 15.33 feet in 2015 led to considerably less property damage than previous floods, but additional flood events need to be studied to determine the impact of mitigation efforts on flood severity.

MAP 3 | JOHNSON CREEK 1% AND 0.2% ANNUAL CHANCE FEMA FLOOD ZONE

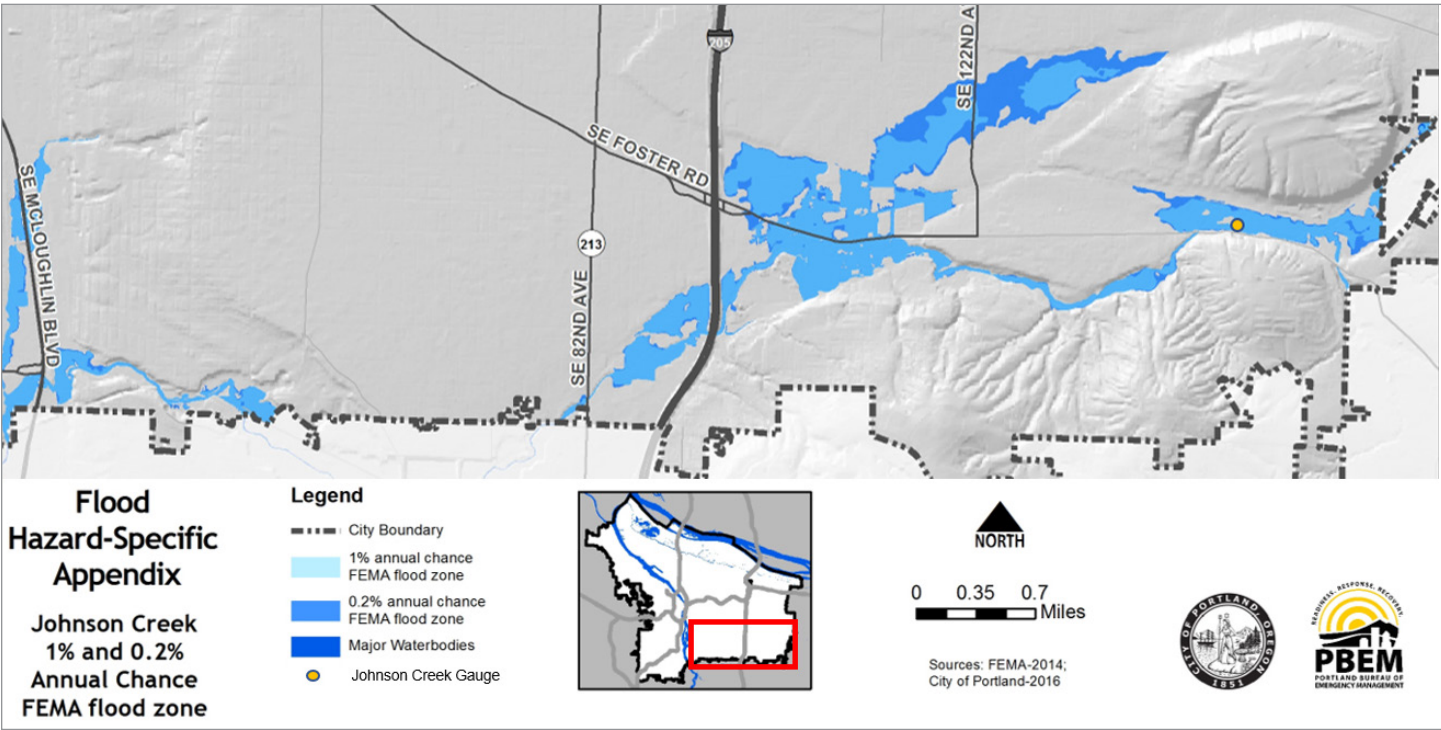
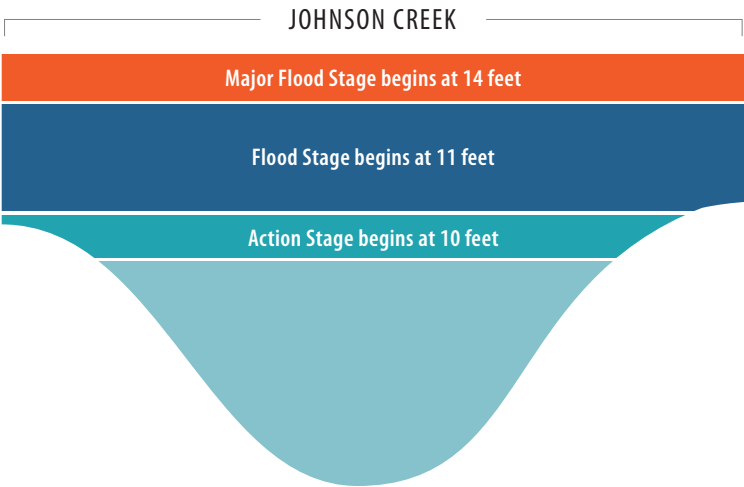


FIGURE 3 | NWS FLOOD STAGES – JOHNSON CREEK



Holgate Lake is a groundwater-fed ephemeral lake that sometimes appears near Johnson Creek between SE 128th and SE 136th Avenue, around SE Long Street when the water table rises. While it is shown in FEMA's 1% and 0.2% annual chance flood zones, it is not actually caused by creek flooding (hence being a separate area in a 1% annual chance flood). This lake emerges in a residential area, flooding homes and streets.

Map 3 shows the FEMA 1% and 0.2% annual chance flood zones for Johnson Creek in Portland, and the location of the NWS Sycamore gauge near SE Foster Road, south of Powell Butte. Figure 3 shows the flood stages (in NWS datum) for Johnson Creek at the Sycamore gauge.⁴

Columbia River

Like the Willamette, flooding on the Columbia River is relatively infrequent in Portland, due to dams and other infrastructure upstream, and the levee system maintained by Multnomah County Drainage District (MCDD). Map 4 shows the FEMA 1% and 0.2% annual chance flood zones for the Columbia River near Portland, and the location of the NWS gauge near Vancouver. These flood zones take the levee system into account, and do not show areas that would flood should the levees be compromised. In 1948, the Columbia River crested at 31 feet and broke through portions of the levees, devastating the city of Vanport.

⁴ Figure is representative and not to scale. "Action Stage" is an additional NWS notification option.

MAP 4 | COLUMBIA RIVER 1% AND 0.2% ANNUAL CHANCE FEMA FLOOD ZONE

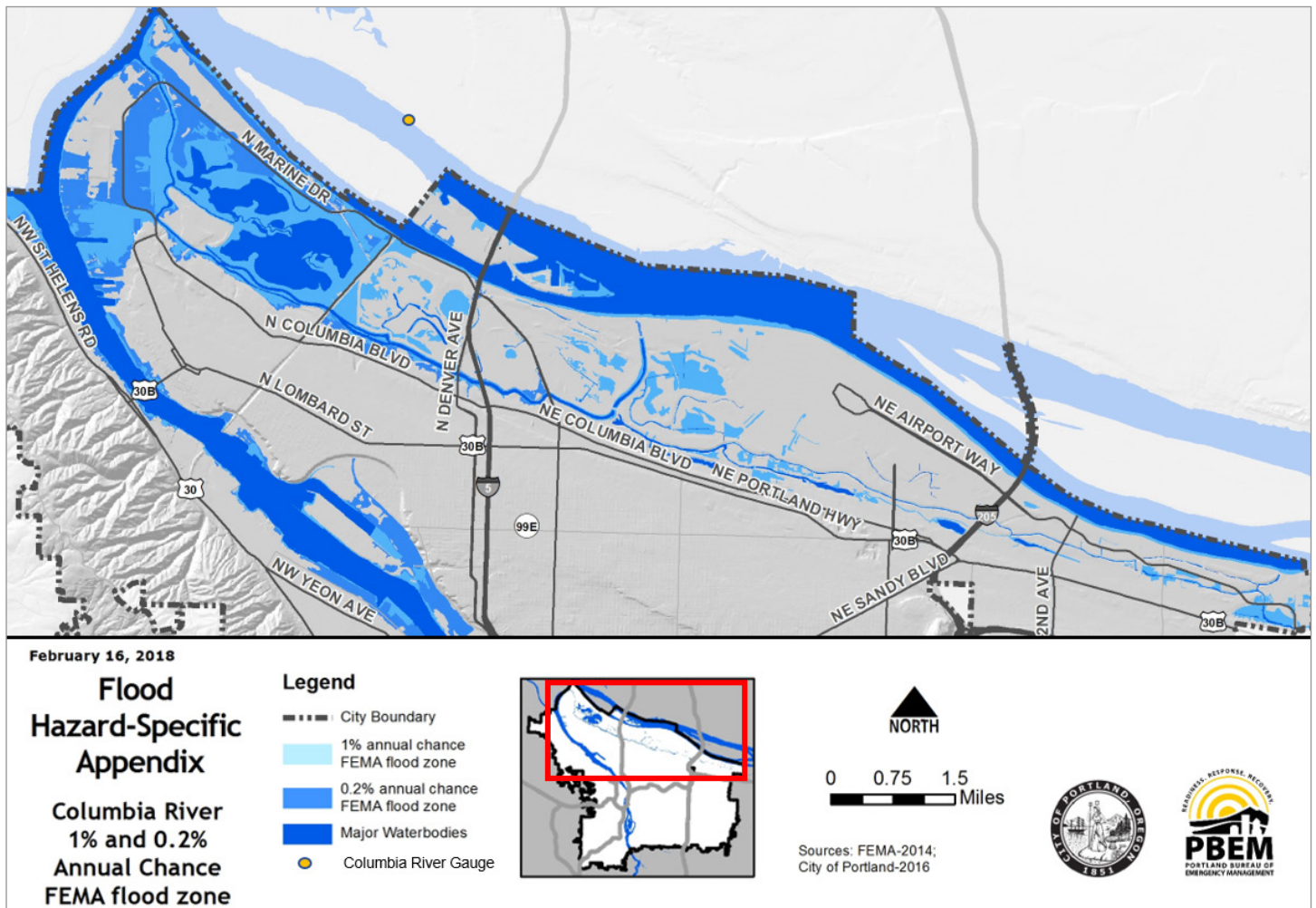


FIGURE 4 | NWS FLOOD STAGES - COLUMBIA RIVER

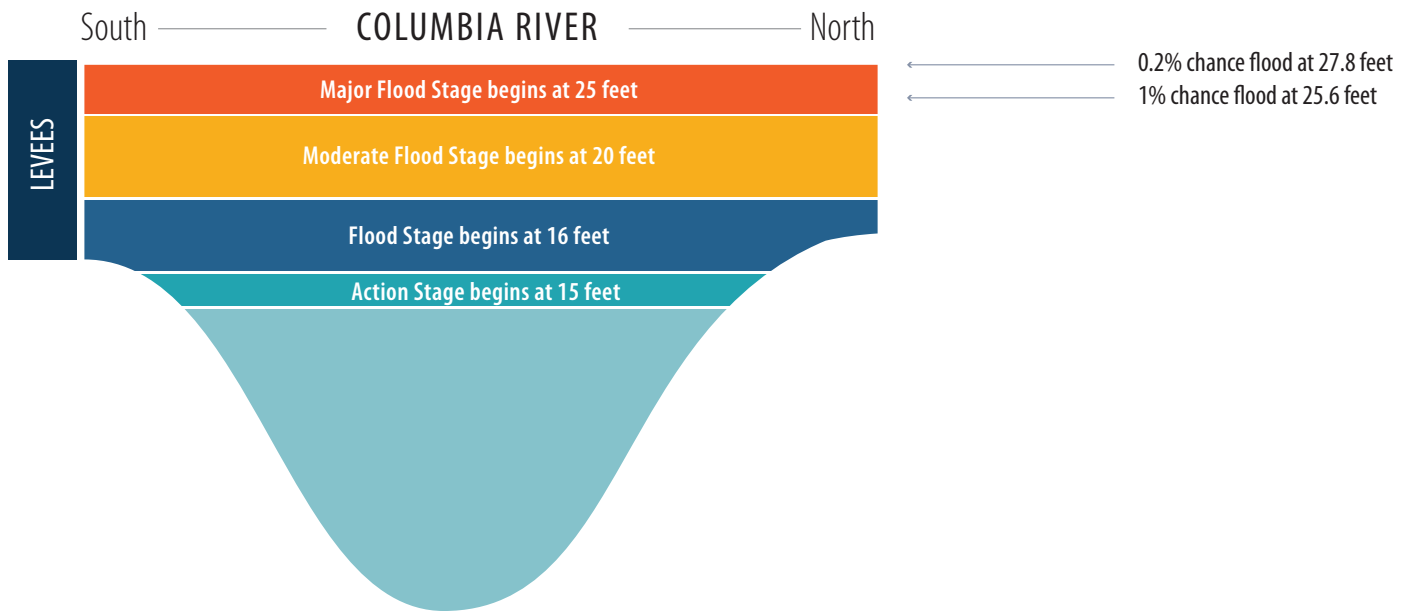
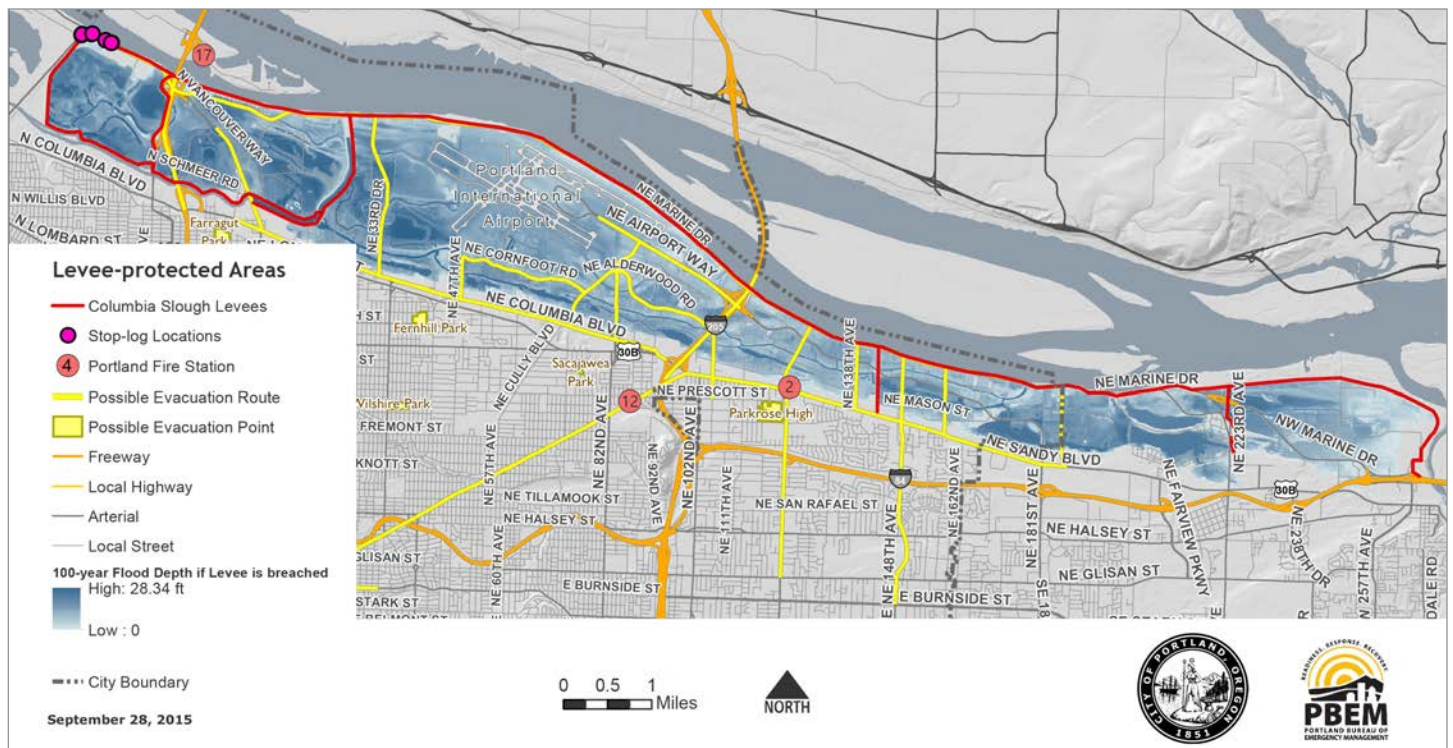


Figure 4 shows the flood stages (in NWS datum) for the Columbia at the Vancouver gauge.⁵ As with the Willamette River, “Flood Stage” (minor flooding) uses the top of bank as a reference, and does not account for the levees, which also provide flood risk reduction from the Columbia Slough. Floating communities on the Columbia River are at risk in a major flood event.

MAP 5 | COLUMBIA CORRIDOR LEEVE SYSTEM



⁵ Figure is representative and not to scale. “Action Stage” is an additional NWS notification option.

MCDD maintains its own Flood Emergency Action Plan (FEAP), which covers MCDD and two other districts within the city of Portland: Peninsula Drainage Districts #1 and #2.³ The FEAP also covers areas outside of Portland city limits. Elements of this plan are noted under Concept of Operations. MCDD maintains 27 miles of levees along the Columbia River and Columbia Slough, which reduce flood risk for more than 12,000 acres of land. This land includes approximately 2,000 landowners, 10% of Multnomah County jobs, the Portland International Airport, Portland International Raceway, Columbia South Shore Well Field (Portland's backup drinking water supply), the National Weather Service Portland office, the Northwest River Forecast Center office, and many other regional assets.

Frontline Communities

Certain groups within the city tend to experience impacts from disasters first and worst. Some of these populations include people without shelter, communities of color, low income populations, those who do not speak English as a primary language, and community members with functional or access needs. Because of their exposure, these frontline communities require special consideration during flood response to ensure that they receive warnings and can take protective actions or access additional resources if necessary.

ASSUMPTIONS

- Dams, levees, and other infrastructure upstream will operate to reduce flood risk.
- The existing flood defense and harbor wall elevations are adequate to protect the downtown central business district for a 1% annual chance flood event without installation of seawall panels.
- PBOT's proposed flood defense plan (including installation of the seawall) is adequate to protect the downtown core against a 0.2% annual chance flood event.
- The existing levee systems are adequate to protect the Columbia Corridor from a 1% annual chance flood event.
- Emergency Coordination Center (ECC) responders will report from bureaus across the City and bureaus will make resources and personnel available to Incident Command.
- Landslides and debris flows may occur in the West Hills or on other steep slopes and divert resources from the flood fighting response.
- Private property owners will take responsibility for their own flood risk reduction.
- A regional command structure may be necessary in the event of a major flood.
- Aid from external partners will be available in the event of a major flood.
- The US Army Corps of Engineers will actively manage Columbia and Willamette River levels to the degree possible, and will coordinate with the NWS to provide advance notice of forecasted river levels.

⁶ <https://www.mcdd.org/what-we-do/emergency-plan/>

ROLES AND RESPONSIBILITIES



This section outlines key roles and responsibilities specific to flood emergencies. Some bureaus and agencies may make additional contributions to those described. The roles below do not apply to all flood emergencies, but will depend on guidelines in the Concept of Operations and the specific needs of the incident. All bureaus must continue essential City services and assist in the response to and recovery from an incident. Bureaus will need to provide staffing and resources to facilitate the City's response and recovery goals during and after a flood. The City Emergency Coordination Center (ECC), which supports incident command from a separate location, may transition to an Emergency Operations Center (EOC) if the emergency reaches a level of complexity that incident command is better served by locating in that facility.

PORTLAND BUREAU OF TRANSPORTATION (PBOT)

- Provide Incident Command (IC) for any flood emergencies
- Activate Bureau Incident Command Post (BICP)
- Coordinate public information for flood emergencies
- Coordinate with other bureaus and agencies
- Provide policy guidance
- Oversee installation of the seawall and placement of stop log closures
- Assist with levee protection
- Liaise with public utilities
- Document and post information on WebEOC
- Initiate placement/removal of barricades or other traffic control devices

PORTLAND BUREAU OF EMERGENCY MANAGEMENT (PBEM)

- Act as support bureau for PBOT
- Monitor and disseminate weather advisories and warnings
- Disseminate public alerts or warnings of flood
- Notify and support Mayor and Disaster Policy Council (DPC)
- Coordinate assistance requests from bureaus and partners
- Activate and support City ECC
- Coordinate appropriate ECC staffing
- Liaise with other governmental agencies and EOCs
- Support PBOT Public Information Officer (PIO)
- Document and post information on WebEOC

BUREAU OF ENVIRONMENTAL SERVICES (BES)

- Act as support bureau for PBOT
- Protect critical BES infrastructure
- Monitor Willamette River elevations at Ankeny Pump Station
- Monitor Johnson Creek elevations at the Sycamore Gauge
- Report to appropriate regulatory authorities as needed
- Coordinate with IC
- Document and post information on WebEOC
- Make personnel and resources available to IC

PORTLAND PARKS AND RECREATION (PP&R)

- Act as support bureau for PBOT
- Activate BICP if needed
- Limit public access to park properties in flood zones via signage
- Enact emergency park closures per PCC 20.12.190
- Secure or remove unsafe dock infrastructure
- Assist with seawall assembly
- Utilize available park rangers to conduct outreach in impacted areas
- Document and post information on WebEOC
- Make personnel and resources available to IC

PORTLAND WATER BUREAU (PWB)

- Protect Water Bureau assets and critical infrastructure, including:
 - Reservoirs
 - Columbia South Shore Well Field
 - Bull Run watershed
- Document and post information on WebEOC
- Make personnel and resources available to IC

PORTLAND POLICE BUREAU (PPB)

- Support traffic management and detours
- Enforce traffic regulations and parking restrictions within impacted area
- Document and post information on WebEOC
- Make personnel and resources available to IC

PORTLAND FIRE & RESCUE (PF&R)

- Support ECC activation and operation
- Direct PF&R land and marine-based companies to conduct rapid damage assessments of their responsible Fire Management Areas (FMAs)
- Direct the removal of hazardous materials in danger of flood impacts
- Evacuate and/or rescue threatened occupants and treat injured victims
- PF&R Fireboats will assess all bridge support infrastructure when conducting rapid damage assessments and report damage debris clearance needs to Multnomah County
- Assist US Coast Guard (USCG) and Multnomah County Sheriff's Office (MCSO) River Patrol Unit within PF&R scope and capabilities
- Communicate with river residents for awareness of potential dangers
- Document and post information on WebEOC
- Make personnel and resources available to IC

BUREAU OF DEVELOPMENT SERVICES (BDS)

- Coordinate rapid damage assessment of structures impacted by flood, including posting of buildings and determining amount of damage
- Provide detailed damage assessments as needed or requested
- Assist with coordination of construction project erosion control removal to control sediment and manage drainage
- Assist property owners and businesses in the permitting of needed repairs to damaged properties and/or their demolition
- Issue demolition permits to maintain accurate records of building inventories and proper documentation within permitting system
- Document and post information on WebEOC
- Make personnel and resources available to IC

OFFICE OF MANAGEMENT AND FINANCE (OMF)

- Provide training/guidance for tracking emergency expenditures
- Release trained ECC responders to support ECC
- Make personnel and resources available to IC

OTHER CITY BUREAUS

- Release trained ECC responders to support ECC
- Document and post information on WebEOC
- Make personnel and resources available to IC

MAYOR AND DISASTER POLICY COUNCIL (DPC)

- Participate in required DPC meetings once notified of a potential large-scale flood
- Declare a local emergency
- Issue Evacuation Orders in accordance with Evacuation Annex
- Convene press conferences and conduct other necessary public outreach

JOINT OFFICE OF HOMELESS SERVICES (JOHS)

- Coordinate with PBEM prior to closing winter shelters regarding possible warnings about flood risk to community members leaving the shelters
- Provide guidance and coordination regarding outreach to potentially impacted unhoused populations
- Coordinate with City of Portland IC

MULTNOMAH COUNTY

- Emergency Management will coordinate with PBEM to support response through possible County EOC activation and deployment of additional resources as appropriate
- Emergency Management will coordinate with City of Portland IC, ECC and Oregon Office of Emergency Management
- Sheriff's Office River Patrol Unit will coordinate with US Coast Guard and PF&R to monitor river traffic and assist as needed
- Department of Community Services Transportation will coordinate with City of Portland IC regarding road and bridge closures
- Department of County Human Services will coordinate shelter operations as needed

MULTNOMAH COUNTY DRAINAGE DISTRICT (MCDD)

- Implement Flood Emergency Action Plan
- Provide incident management for MCDD, Peninsula Drainage District #1 and Peninsula Drainage District #2
- Protect flood risk reduction system (levee system and drainage infrastructure)
- Coordinate with US Army Corps of Engineers
- Notify PBOT of needed stop log closure installations
- Coordinate with City of Portland IC as levee system subject matter experts and regarding potential needs for evacuation of leveed areas

PORT OF PORTLAND

- Activate Port EOC during flood emergency
- Coordinate with MCDD and City of Portland IC

TRIMET

- Coordinate with City of Portland IC regarding road and light rail closures and bus rerouting

OREGON DEPARTMENT OF TRANSPORTATION (ODOT)

- Coordinate with City of Portland IC for road closure and perimeter control
- Provide mutual aid and assistance with traffic control and flow by Region 1 Incident Response Units

NATIONAL WEATHER SERVICE (NWS)

- Conduct ongoing monitoring of flood conditions
- Declare flood watches and warnings
- Hold teleconferences in the event of imminent flooding
- Coordinate water management actions with US Army Corps of Engineers to minimize flooding

OREGON EMERGENCY MANAGEMENT (OEM)

- If required, activate the State ECC
- If required, request Federal aid to support flood response and recovery efforts
- Communicate pertinent information received from State and Federal agencies to Multnomah County Emergency Management or the County EOC
- Coordinate provision of State and Federal resources

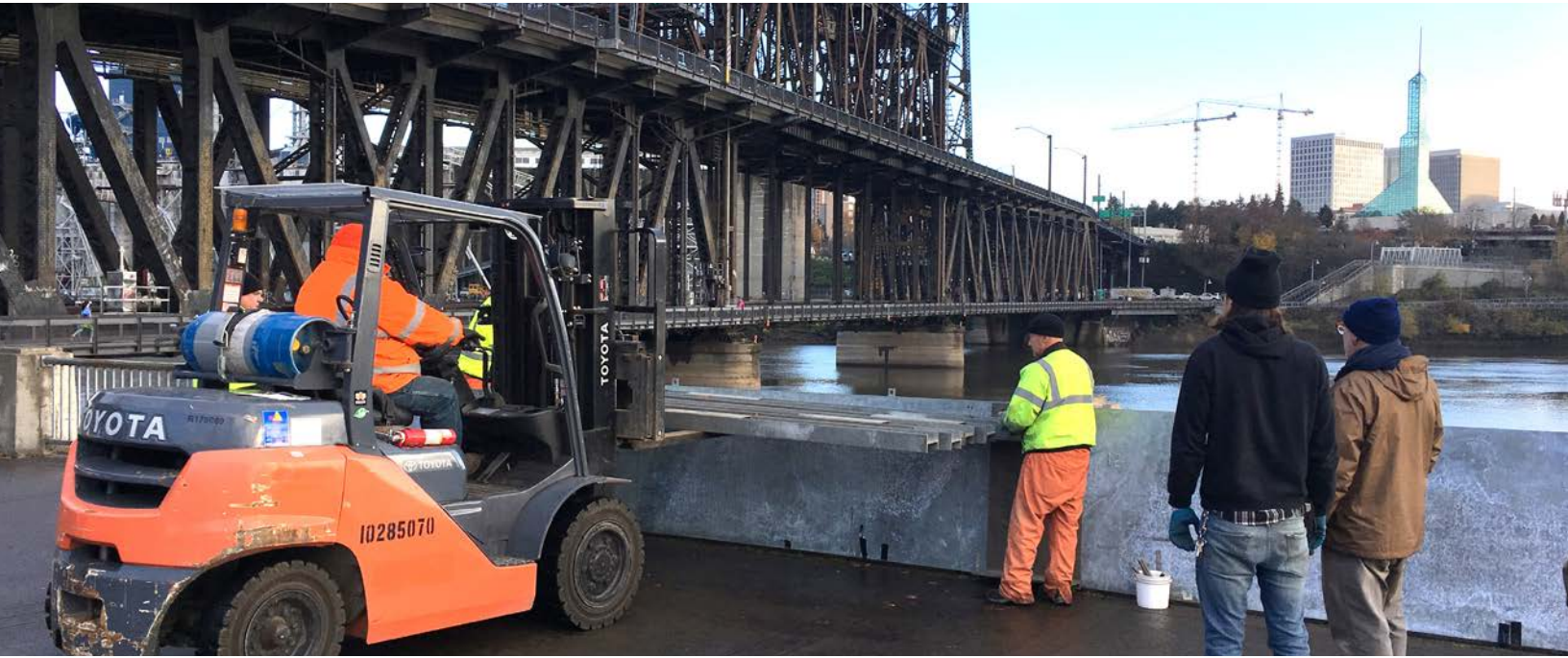
US COAST GUARD (USCG) – SECTOR COLUMBIA RIVER, STATION PORTLAND

- Control traffic on both Columbia and Willamette Rivers
- Assist with river search and rescue
- Coordinate with City of Portland IC

US ARMY CORPS OF ENGINEERS (USACE)

- Administer flood risk reduction projects (e.g. dams)
- If requested through Oregon EOC, assist with flood-fighting resources
- Coordinate with MCDD and City of Portland IC

CONCEPT OF OPERATIONS



PHASED OPERATIONS

Portland is susceptible to flooding from the Columbia River, the Willamette River, and Johnson Creek. All three are affected by regional weather patterns, but often flood at different times, or at different levels of severity. This concept of operations is designed to apply to any combination of flooding, through a phased approach. If only Johnson Creek is flooding, the *Johnson Creek Flooding Standard Operating Procedure* is the guiding document. If the Willamette or Columbia River is flooding, this Appendix is the guiding document.

Unusual Precipitation Considerations

Flooding often occurs with local precipitation to varying degrees. Moderate precipitation can contribute to river flooding, and can also generate urban flooding, where stormwater systems are overwhelmed. During extreme local precipitation events, additional actions must be

taken. One action that is unique to extreme precipitation events is the removal of erosion control measures if they interfere with storm drain function. The identification of conditions that warrant this action should be based on BES staff analysis. The communication and enforcement of this action should be performed by BDS staff. Specific procedures for this type of event are under development.

It is important to acknowledge that flooding can also occur based solely on upstream events, with light or even no local precipitation. During these incidents, some of the actions listed below in Table 4 and Table 6 may not be necessary. The Incident Commander, or lead staff if incident command has not been established, will make the determination regarding whether activities listed below are appropriate to the specific flood event.

Phase Structure

The phases outlined below reflect the expected impact of flooding and the response required. Although the headings of minor, moderate, and major flooding mirror the NWS categories, the gauge levels are different (see Figure 5). NWS levels are used for stretches of the rivers and apply to multiple communities. The response phases in this plan specifically address Portland's flood concerns and the resources needed to address flood risk.

The maps in this section were developed to provide a visual estimate of where flooding might geographically occur during each flood response phase. These maps use data developed through mathematical approximations of how Columbia and Willamette River levels would interact with Portland geography and are not based on historic flood data, though they correspond relatively closely. Separate mapping conducted by USGS is shown to communicate inundation around Johnson Creek.

If multiple rivers are flooding, the overall phase of operations will be that of the river with the most extreme flooding. Floods can develop quickly and response is often based on forecasts rather than current conditions, and forecasts will often change as conditions change. Phases may therefore not be implemented in order, and later phases should incorporate earlier response actions if those phases were skipped. **If a gauge level is predicted, actions noted for a level should be completed by the time the river reaches that level. Incident command will determine how these actions are pursued and when they are initiated based on the specifics of the flood event and how quickly water is rising.**

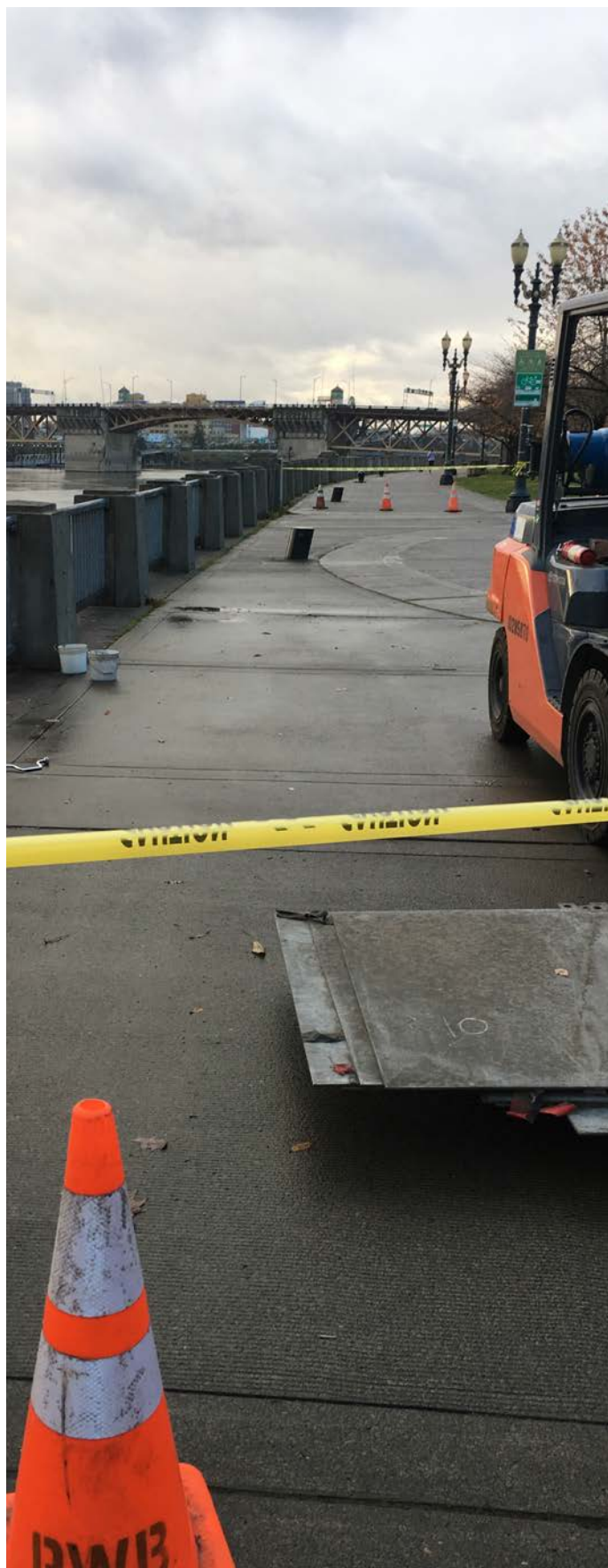


FIGURE 5 | RIVER FLOOD STAGE COMPARISONS

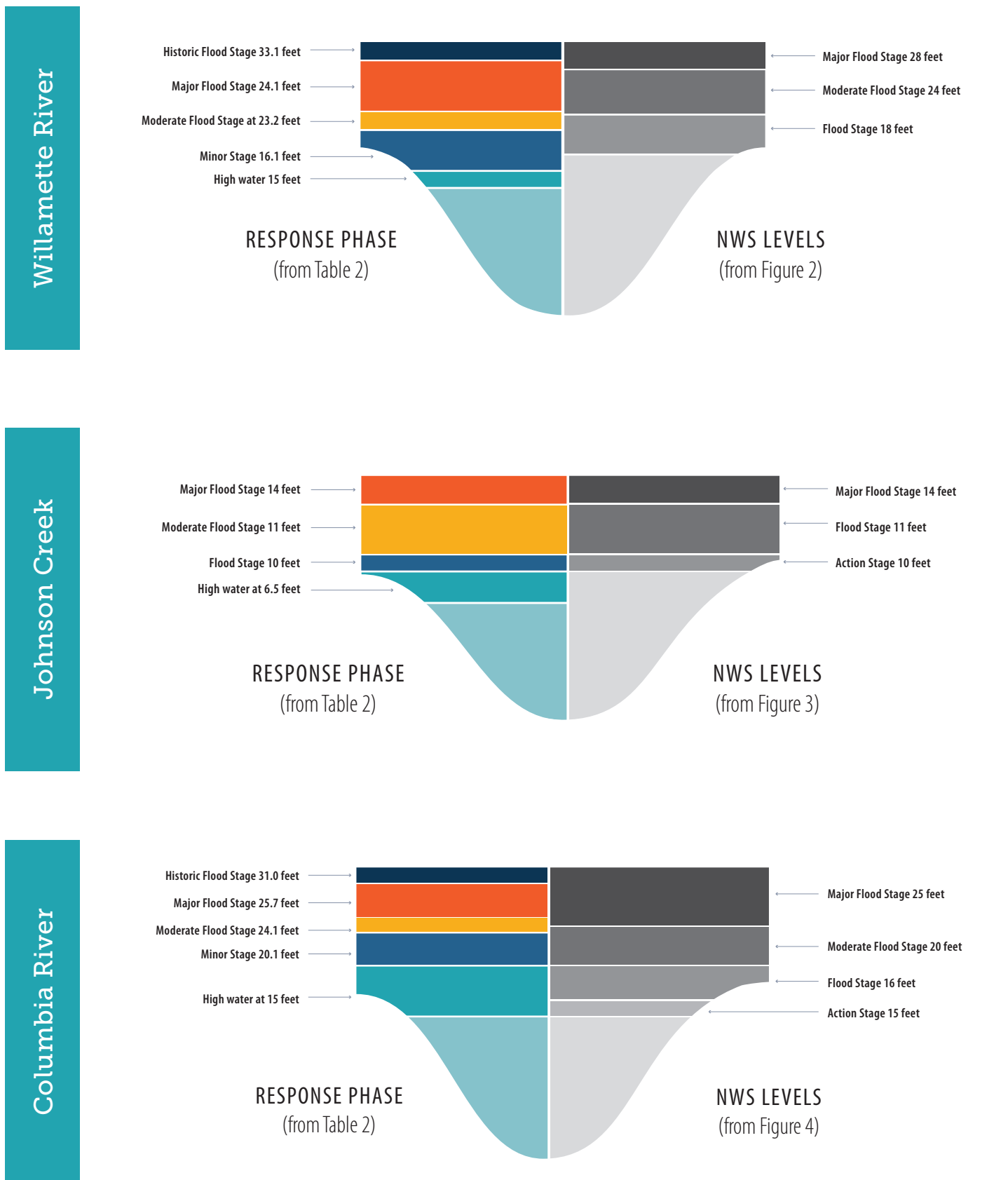


TABLE 2 | FLOOD RESPONSE PHASES

FLOOD RESPONSE PHASE	WILLAMETTE RIVER GAUGE LEVELS (NWS)	COLUMBIA RIVER GAUGE LEVELS (NWS)	JOHNSON CREEK GAUGE LEVELS (NWS)
1 - High Water/Pre-flood	15.0 - 16.0'	15.0 - 20.0'	6.5 - 9'
2 - Minor Flooding	16.1 - 23.1'	20.1 - 24.0'	10'
3 - Moderate Flooding	23.2 - 24.0'	24.1' - 25.6'	11 - 13'
4 - Major Flooding	24.1 - 33.0'	25.7 - 31.0'	14' +
5 - Historical Flooding	33.1' +	31.0' +	N/A
6 - Recovery	Receding	Receding	Receding

MONITORING

Different rivers are monitored by different agencies in anticipation of a flood emergency.

- The Willamette River Morrison Gauge will be monitored by the PBEM Duty Officer if the gauge is predicted to reach 15' within the next 5 days by the National Weather Service. This monitoring will be triggered by 14' actual height on the Willamette or a predicted 15' on the Columbia River.
- The levee system is visually monitored by MCDD year-round, with frequent monitoring during a NWS flood advisory, watch, or warning.
 - At 17.2' on the Vancouver Gauge, MCDD will coordinate with PBEM, Metro, BES, and PWB.
- Johnson Creek Sycamore Gauge is monitored daily by BES Eastside Watersheds staff year-round.
 - Monitoring becomes more frequent with a NWS flood advisory, watch or warning.

Any local flood watch or warning will cause PBEM to begin incident monitoring or shift into Enhanced Operations, providing monitoring and daily status reports. IC may also request aerial, on-the-ground, or other monitoring.



MAP 6 | PHASE 1 - PROJECTED INDUNDATION

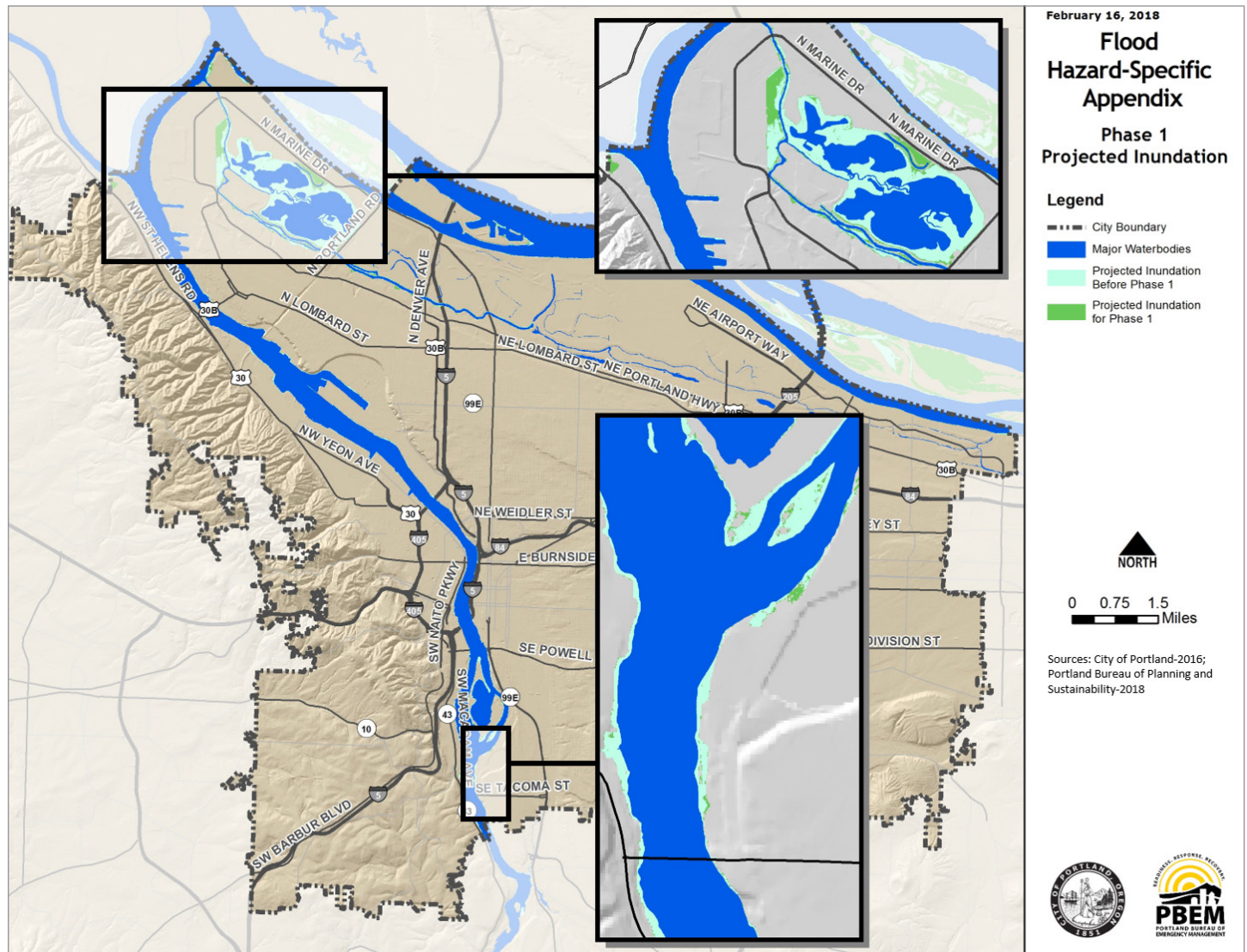


TABLE 3 | PHASE 1 - RIVER GAUGE LEVELS

PHASE	WILLAMETTE RIVER GAUGE LEVELS (NWS)	COLUMBIA RIVER GAUGE LEVELS (NWS)	JOHNSON CREEK GAUGE LEVELS (NWS)
1	15.0 - 16.0'	15.0 - 20.0'	6.5 - 9'

Early flood conditions can lead to urban ponding/flooding and affect people and infrastructure within the banks of rising rivers. Flood response work required in this phase is generally within the scope of PBOT and other bureaus' routine operations. Agencies other than the City of Portland (e.g. MCDD) may ramp up their level of response within this phase. As shown in Map 6, the parts of the city most likely to see overtopped banks in this phase are near Oaks Bottom and near the Willamette/Columbia confluence. Areas noted as "Projected Inundation Before Phase 1" indicate normal water levels that do not trigger any flood response. If waters are expected to crest within Phase 1 and then recede, efforts focus on protecting infrastructure on or adjacent to the rivers, such as pump stations and docks, providing warning to people likely to be impacted, and managing impacts to streets to the degree possible.

If waters are expected to continue to rise, these efforts are incorporated into longer-term actions, and public information is geared towards the overall forecast. Depending on the forecast, PBEM may be at Enhanced Operations and will create a new incident in WebEOC. If necessary, PBEM Duty Officer will convene daily teleconference calls to enhance situational awareness.

PBOT PIO will coordinate with PBEM and other response bureau PIOs as needed to provide consistent messaging to local media and the public regarding water levels, location of sand bagging supplies, detour routes, any potential hazards, and the expected timeframe of potential hazard impacts. If there are any recommended actions for the public to take, those may also be included in messaging.

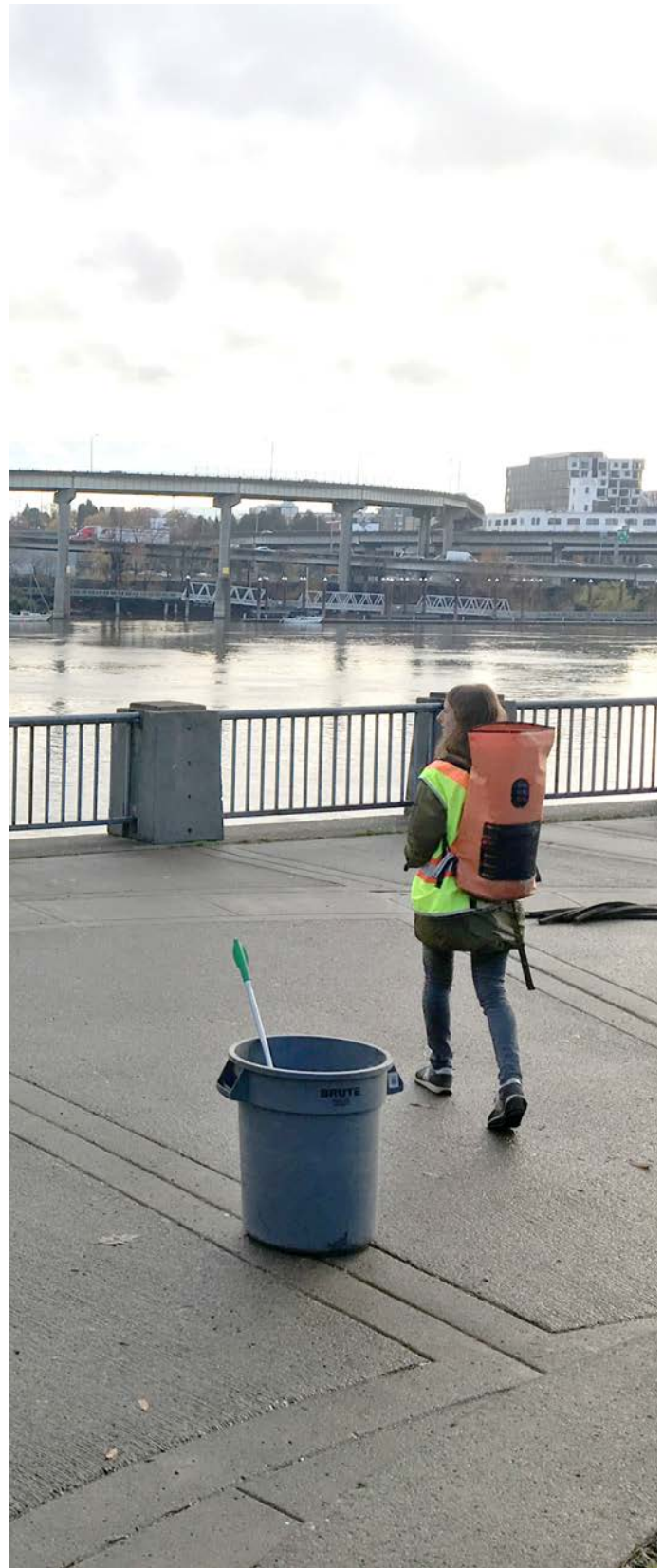


TABLE 4 | KEY RESPONSE ACTIONS FOR PHASE 1

PREDICTED GAUGE LEVEL (NWS)	RESPONSE ACTION
WILLAMETTE RIVER	
15'	PBEM: Notify other bureaus (PBOT, BES, PP&R) of river conditions. Coordinate with JOHS and Multnomah County to provide up-to-date sheltering information to agencies directing unsheltered people away from floodwaters.
15'	PBOT/BES/PP&R: Clear inlets/culverts. Post “high water” signs. May do some pumping jet/vactor work. Most work at this level is within the scope of routine operations.
15'	PP&R: Close walkways at both ends of Eastbank Esplanade floating walkway, and store handrails and benches under Burnside Bridge.
COLUMBIA RIVER	
15'	MCDD: Conduct a baseline levee system inspection, and then continue weekly levee inspections, at minimum. Enter Enhanced Operations. Inspection includes identification of campers, who will likely be at risk already, and coordination with JOHS. Also contact USACE for additional information and to discuss potential support from the Portland District. If resources from USACE are needed, MCDD will request through Multnomah County.
17.2'	MCDD: Enter Partial Emergency Activation if forecasted to rise further. Begin daily inspections of all levee systems.
17.2'	PBEM: Enter Enhanced Operations if MCDD enters Partial Emergency Activation.
20'	MCDD: Depending on levee performance and forecast, may begin 24-hour surveillance and Full Emergency MCDD will request assistance and further coordinate with support agencies.
20'	Port of Portland, PWB, BES, PBEM: Engage with MCDD to provide support as able.
JOHNSON CREEK	
6.5'	BES: Coordinate with JOHS to provide up-to-date sheltering information to people directing them away from floodwaters. May post flood risk signs and/or notify campers of possible risk.
6.5'	PP&R: Rangers may informally notify campers of flood risk.

PHASE 2 MINOR FLOODING

MAP 7 | PHASE 2 - PROJECTED INDUNDATION

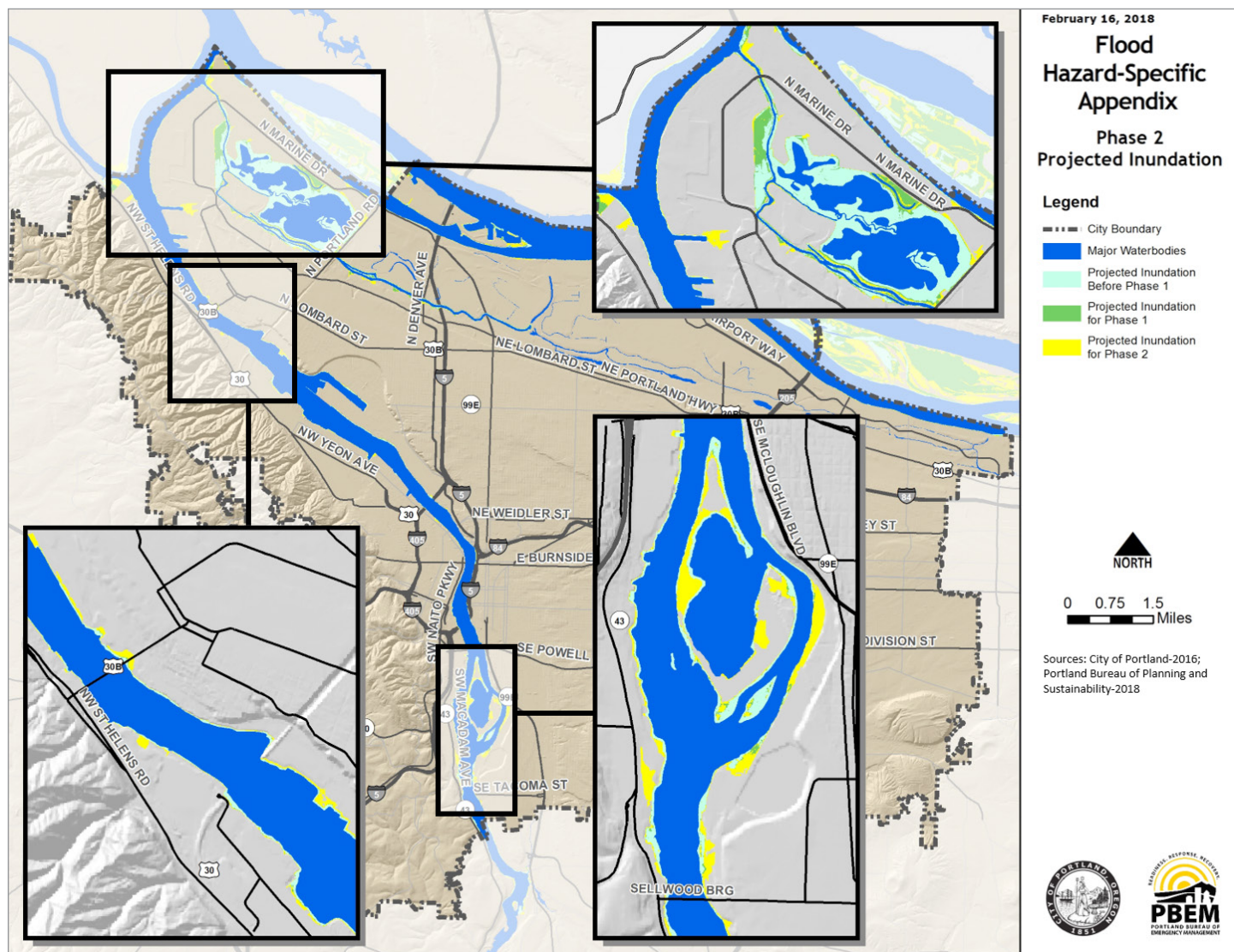


TABLE 5 | PHASE 2 - RIVER GAUGE LEVELS

PHASE	WILLAMETTE RIVER GAUGE LEVELS (NWS)	COLUMBIA RIVER GAUGE LEVELS (NWS)	JOHNSON CREEK GAUGE LEVELS (NWS)
2	16.1 - 23.1'	20.1 - 24.0'	10'

In Phase 2, rivers may experience minor flooding, and local rainfall may produce debris flows or landslides in areas with steep slopes. These additional responses are also led by PBOT. Map 7 highlights areas in North Portland where inundation may occur in Phase 2. At this phase, if not before, PBOT will activate their Bureau Incident Command Post (BICP), and all bureaus will coordinate their flood response activities with the Incident Commander. PBEM will support the BICP with staff for situational awareness and may fill other Incident Command System (ICS) roles, if requested.

As floodwaters rise, small-scale evacuations and associated sheltering may be required. Activation of any portion of the *Evacuation Annex* for flood should consider both forecasted crests and speed of water level rise. Sheltering will be coordinated with Multnomah County Emergency Management and Multnomah County Department of Human Services. Traffic control and street closure needs are likely to increase during this phase.⁷

As with Phase 1, if waters are expected to crest in Phase 2, response can focus on disseminating information to the public and protecting infrastructure within the forecasted water level. If floodwaters are expected to rise beyond Phase 2, key responses should be incorporated into longer-term actions. Because floodwaters can rise at very different speeds depending on the situation, the timing of response will need to adapt to the flood incident at hand.

⁷ The authority to designate street closures lies with the Traffic Engineer and is delegated to the Incident Commander during operations conducted in accordance with this Appendix.

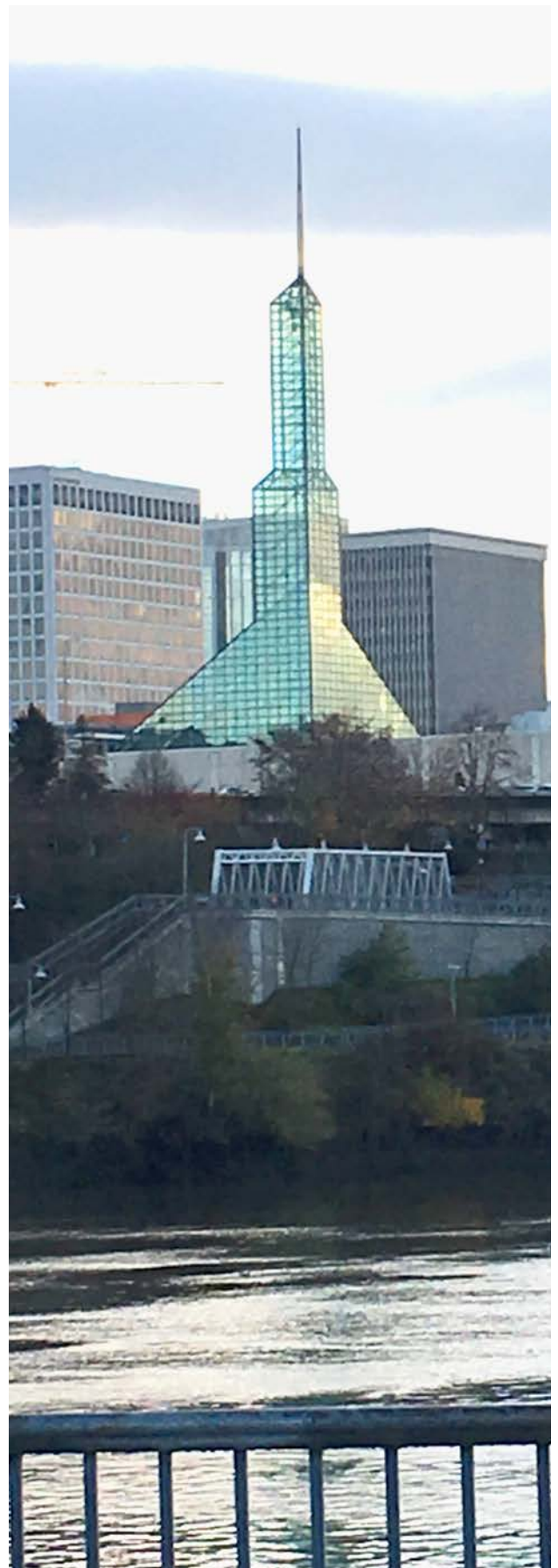


TABLE 6 | KEY RESPONSE ACTIONS FOR PHASE 2

PREDICTED GAUGE LEVEL (NWS)	RESPONSE ACTION
WILLAMETTE RIVER	
16'	PBOT/BES: Bureau ICPs open and functioning.
16'	BOEC: High flood-related call load increases may require additional staffing.
16'	PBEM: Shift into Enhanced Operations, if not before.
16.1'	PBOT: Debris removal, problem reports and investigation.
16.1'	PPB: Begin traffic control and preplanning for possible evacuations.
16.1'	PF&R HARBOR MASTER: Order the removal of hazardous materials from the danger area, concentrating on 55-gallon drums. Large tanks should be secured.
23'	PF&R: Small boat docks downtown should be removed.
23'	PBOT: Consider requesting advance assistance from USACE through the state if an emergency is declared. Discuss the installation of the downtown seawall and extensions with the DPC if river is forecasted to pass 28.9', the lowest Harbor Wall elevation.
COLUMBIA RIVER	
21.5'	MCDD: Enter Full Emergency Activation and 24-hour levee surveillance, see 20' actions.
21.5'	PBEM: Enter Partial Activation if MCDD enters full Emergency Activation.
23'	MCDD: Call PBOT Dispatch and request PEN 1 floodwall closure installations.
23'	PBOT: Install closures in PEN 1 floodwall and implement Marine Drive traffic and closure plan, closing N. Marine Drive between I-5 and N. Portland Road to all traffic.
23'	PBEM DUTY OFFICER: Activate MCDD Evacuation Annex Attachment, coordinating with the DPC and/or Unified Command, and MCEM for sheltering. Consider mandatory hazmat and voluntary additional needs populations evacuation in PEN 1.
JOHNSON CREEK	
10'	BES: Review Johnson Creek hydrographs and weather conditions; may discuss with NWS. Update PBEM regarding conditions.
10'	PBEM: Shift into Enhanced Operations.
10'	PBOT/PBEM/BES PIOs: Coordinate communications on flood preparedness actions and safety recommendations.

PHASE 3

MODERATE FLOODING

MAP 8 | PHASE 3 - PROJECTED INDUNDATION

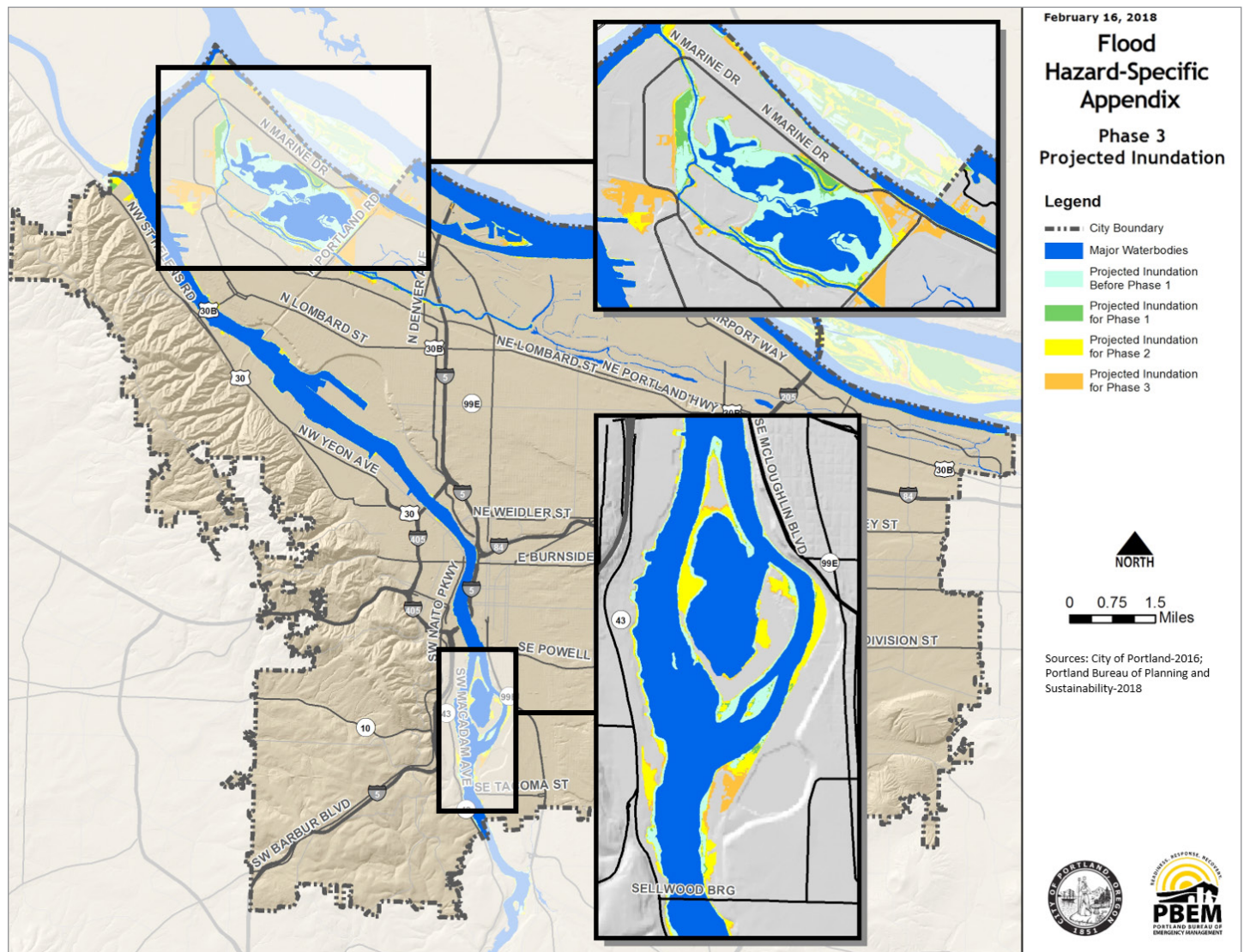


TABLE 7 | PHASE 3 - RIVER GAUGE LEVELS

PHASE	WILLAMETTE RIVER GAUGE LEVELS (NWS)	COLUMBIA RIVER GAUGE LEVELS (NWS)	JOHNSON CREEK GAUGE LEVELS (NWS)
3	23.2 - 24.0'	24.1 - 25.6'	11 - 13'

In Phase 3, impacts to developed properties are more likely, along with a significant increase in landslides in sloped areas. Map 8 shows the areas most likely to experience additional inundation from the Willamette or Columbia during this phase. Maps 8a and 8b show the projected inundation of Johnson Creek at the beginning of Phase 3 and the beginning of Phase 4, illustrating the range of inundation in Phase 3. As impacts increase, coordination and aid from regional partners becomes essential. The Operations Section may expand to include geographic branches to address

multiple areas of the city, and the ECC will be moved to Partial or Full Activation. PBEM will inform the Disaster Policy Council and Mayor of the situation if they are not already engaged. The IC may seek direction on critical infrastructure protection and prioritization of response efforts, particularly if water levels are forecasted to rise beyond Phase 3 levels. Continued infrastructure protections, coordinated public information, small-scale evacuations, and traffic management are the major focuses of response in this phase.

MAP 8a | JOHNSON CREEK PROJECTED FLOODING AT 11 FEET (EARLY PHASE 3)



MAP 8b | JOHNSON CREEK PROJECTED FLOODING AT 14 FEET (EARLY PHASE 4)

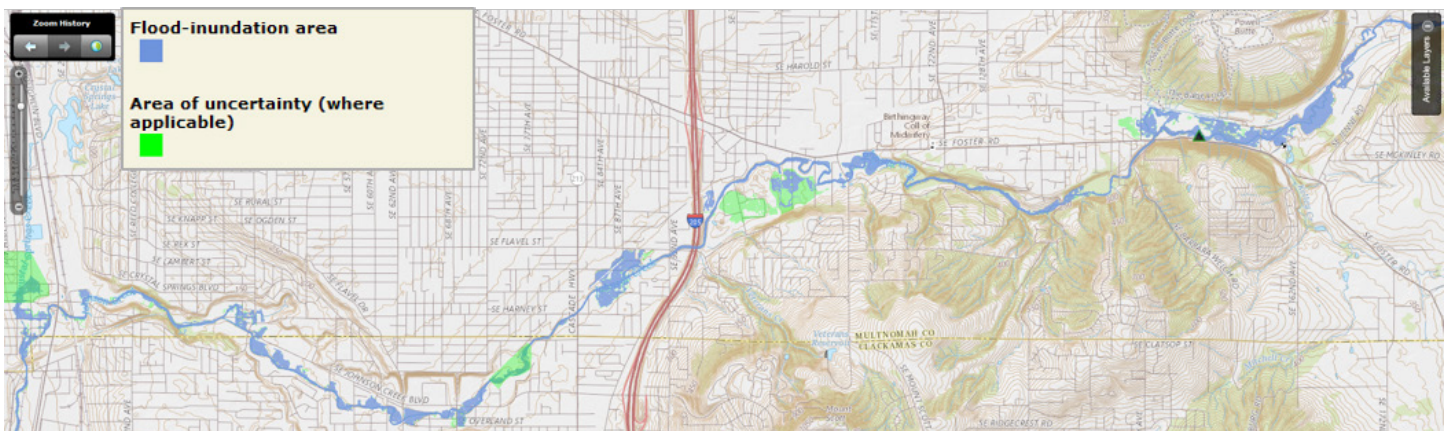


TABLE 8 | KEY RESPONSE ACTIONS FOR PHASE 3

PREDICTED GAUGE LEVEL (NWS)	RESPONSE ACTION
WILLAMETTE RIVER	
23.2'	PBEM: City ECC moves to Partial Activation.
23.2'	PBOT/BES: Initiate 24-hour operations to implement temporary barriers and improvisations to direct or divert flood waters, remove debris, stabilize slopes, close streets, and control traffic.
24.0'	PBEM: City ECC moves to Full Activation.
24.0'	PBOT: Begin downtown seawall installation and Naito extensions if river is forecasted to pass 28.9', the lowest Harbor Wall elevation. Personnel for installation and sandbag reinforcement may include staff, contracted personnel, and NETs.
COLUMBIA RIVER	
24.1'	PF&R HARBOR MASTER: Work with USCG and MCSO River Patrol, and request additional resources as needed to keep debris from bridges, restrict river traffic as necessary, and to check moorages and residential areas. Assist with evacuation planning for floating residences.
25.6'	PPB: Conduct traffic management on Marine Drive, evacuation planning for Hayden/Tomahawk Islands, Jantzen Beach, Columbia Slough.
25.6'	MCDD: Request reduced speeds or no traffic on Marine Drive along the levee system for patrolling safety and levee integrity, if not already started. Start Special watch of the PEN 1 railroad embankment.
25.6'	PBOT: Reduce speeds/close Marine Drive, if not yet done.
25.6'	PBEM: Enter Full Activation in anticipation of potential levee failure or overtopping.
JOHNSON CREEK	
11'	BES: Recommend applicable park closures and continue to monitor conditions with the possible addition of aerial photography and field investigations.
11'	PBEM: Convene a conference call and notify predetermined contacts (see SOP) of forecasted flood conditions. Coordinate with TriMet and MCEM Duty Officer.
11'	PIOs: Continue disseminating messages regarding flood safety issues.
11'	PBOT: Deliver sand and sandbags to designated locations (see SOP for locations). May assign an IC and appropriate Command Staff. May request ODOT's variable message boards.

PHASE 4 MAJOR FLOODING

MAP 9 | PHASE 4 - PROJECTED INDUNDATION

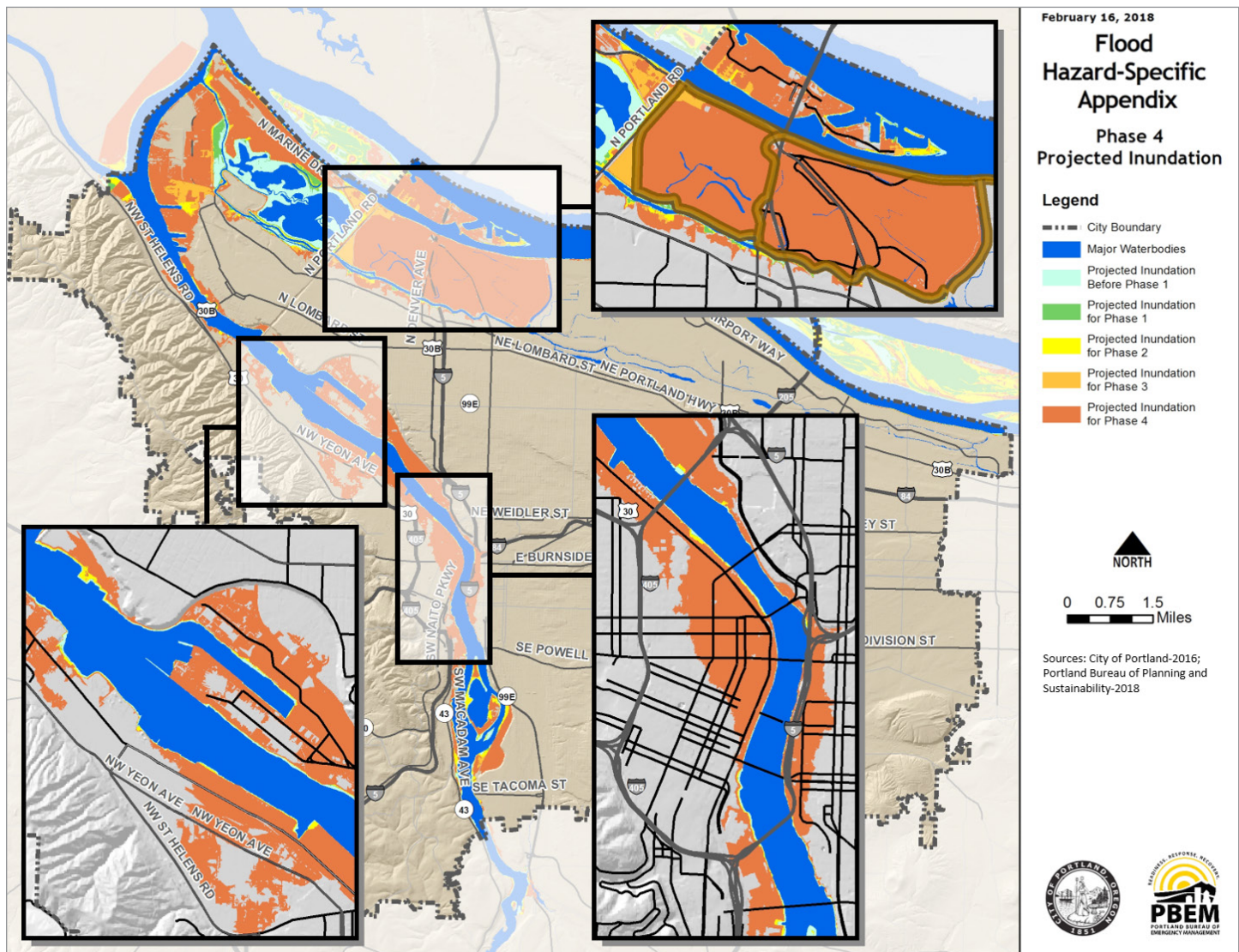


TABLE 9 | PHASE 4 - RIVER GAUGE LEVELS

PHASE	WILLAMETTE RIVER GAUGE LEVELS (NWS)	COLUMBIA RIVER GAUGE LEVELS (NWS)	JOHNSON CREEK GAUGE LEVELS (NWS)
4	24.1 - 33.0'	25.7 - 31.0'	14'+

Phase 4 addresses the highest level of flooding that Portland's flood infrastructure is designed to withstand. Flooding would be widespread along the rivers, including significant inundation in the city core, as shown in Map 9. The northernmost highlighted area of Map 9 includes two districts under MCDD's management, Peninsula Drainage Districts #1 and #2 (PEN 1 and PEN 2), and shows the levee system. The output that shows this area being inundated during this phase uses basic LiDAR, and so does not reflect actions taken by MCDD to close gaps through sandbagging, floodwalls, and other efforts. The southernmost highlighted area of Map 9 shows the downtown core. This inset map similarly shows flooding that would likely occur if no preventative actions, such as the installation of the seawall panels, were taken.

Both the 1% and 0.2% annual chance flood events would fall within Phase 4. The historic crest for the Willamette is 33' in 1894, prior to our current dam infrastructure. The 33' crest is also the design height of the downtown seawall. The historic crest for the Columbia River is 31' in 1948, also prior to the completion of our current dam infrastructure. The lowest design elevations for the levees are 26.1' for PEN 1, 29.6' for PEN 2, 31' for the MCDD west basin, and 33.6' for the MCDD east basin. Additionally, the Columbia Slough has the potential for flooding, and authorized design elevations for that stretch of the levee system vary as well. There is less flood data on the Columbia Slough portion of the system. The historic crest for Johnson Creek is 15.33' in 2015, however recent mitigation efforts led to fewer property impacts from this flood than earlier, lower floods.

The City ECC would be at Full Activation by Phase 4, with Incident Command or Unified Command likely providing command from there. This would transition the ECC to an EOC, which would prepare citywide Incident Action Plans, coordinate evacuations, and handle mutual aid and resource requests, advance planning, citywide situational awareness, and communication with the DPC. The City's emergency declaration process may also be initiated. PBOT and other bureaus would most likely also continue to staff BICPs to direct resources in the field. Both trained, affiliated volunteers and spontaneous, unaffiliated volunteers would be expected at this phase, requiring coordination and specific communication strategies. A citywide Joint Information Center (JIC) would be activated.

Significant evacuations in accordance with the *Evacuation Annex* may be required in this phase for floating communities or levee areas. Other major efforts in this phase include the installation and assembly of the downtown seawall, construction of other temporary floodwalls, protection of BES pump stations and other sewer/stormwater infrastructure, and sheltering for displaced residents.

TABLE 10 | KEY RESPONSE ACTIONS FOR PHASE 4

PREDICTED GAUGE LEVEL (NWS)	RESPONSE ACTION
WILLAMETTE RIVER	
24.1'	PF&R HARBOR MASTER: Work with USCG, MCSO River Patrol and requested additional resources to keep debris from bridges, restrict river traffic as necessary, and check moorages and floating homes.
24.1'	PPB: May be needed for evacuation planning and execution for South Waterfront, Pearl District, Oaks Bottom, and/or Sellwood area.
COLUMBIA RIVER	
25.7'	MCDD: Construct temporary floodwalls along levee system as necessary.
29.7'	MCDD: Construct temporary floodwalls on top of the levee system in NE PEN 2.
29.7'	MCDD: Mandatory evacuations triggered in leveed areas.
JOHNSON CREEK	
14'	PBEM: City ECC moves to Partial or Full Activation.
14'	PBOT: IC coordinates flood fighting, evacuation, or additional alerts as necessary.
14'	MCEM: Establish an emergency shelter for residents displaced by flooding.

MAP 10 | PHASE 1-4 PROJECTED INDUNDATION AND 0.2% ANNUAL CHANCE FEMA FLOOD ZONE

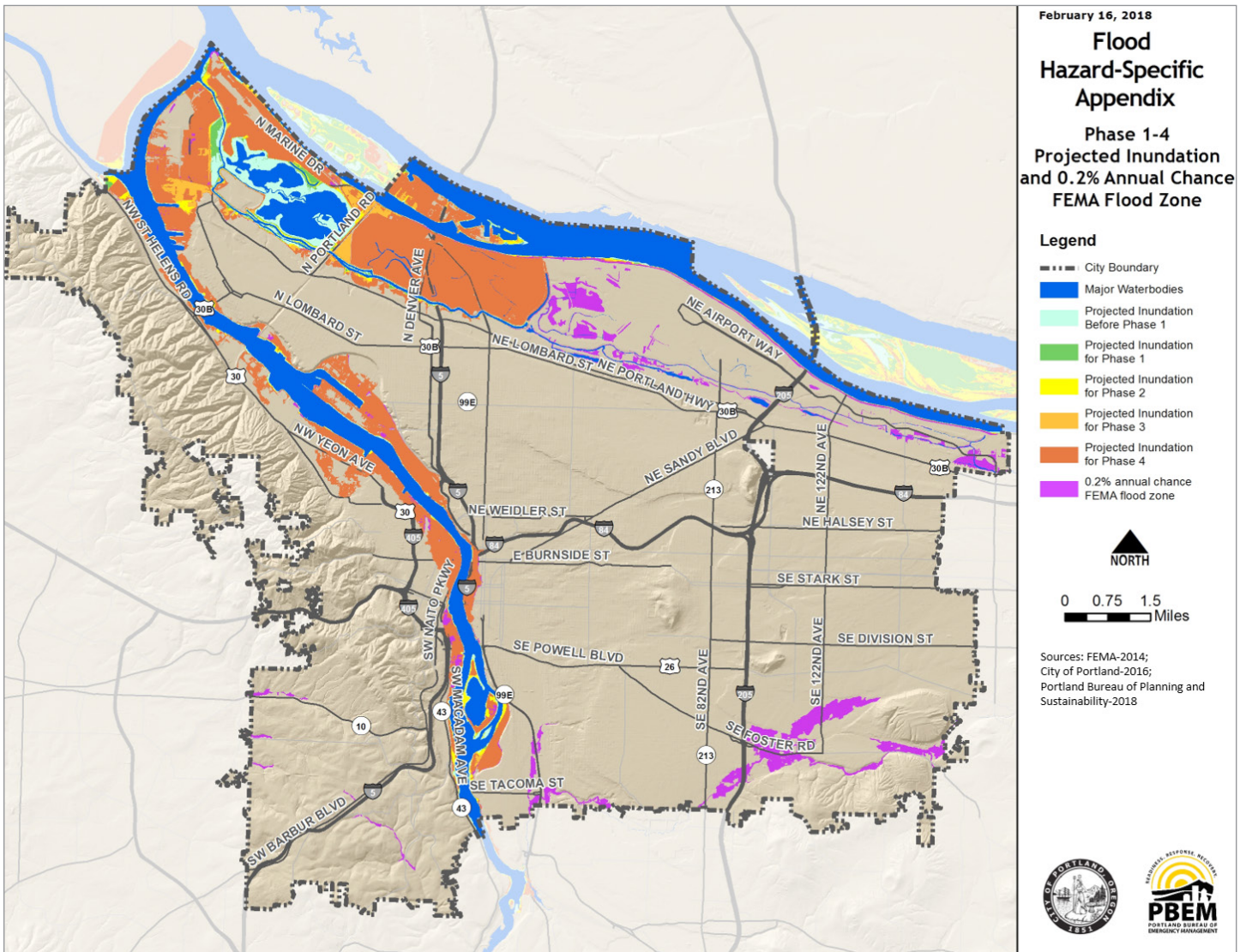


TABLE 11 | PHASE 5 - RIVER GAUGE LEVELS

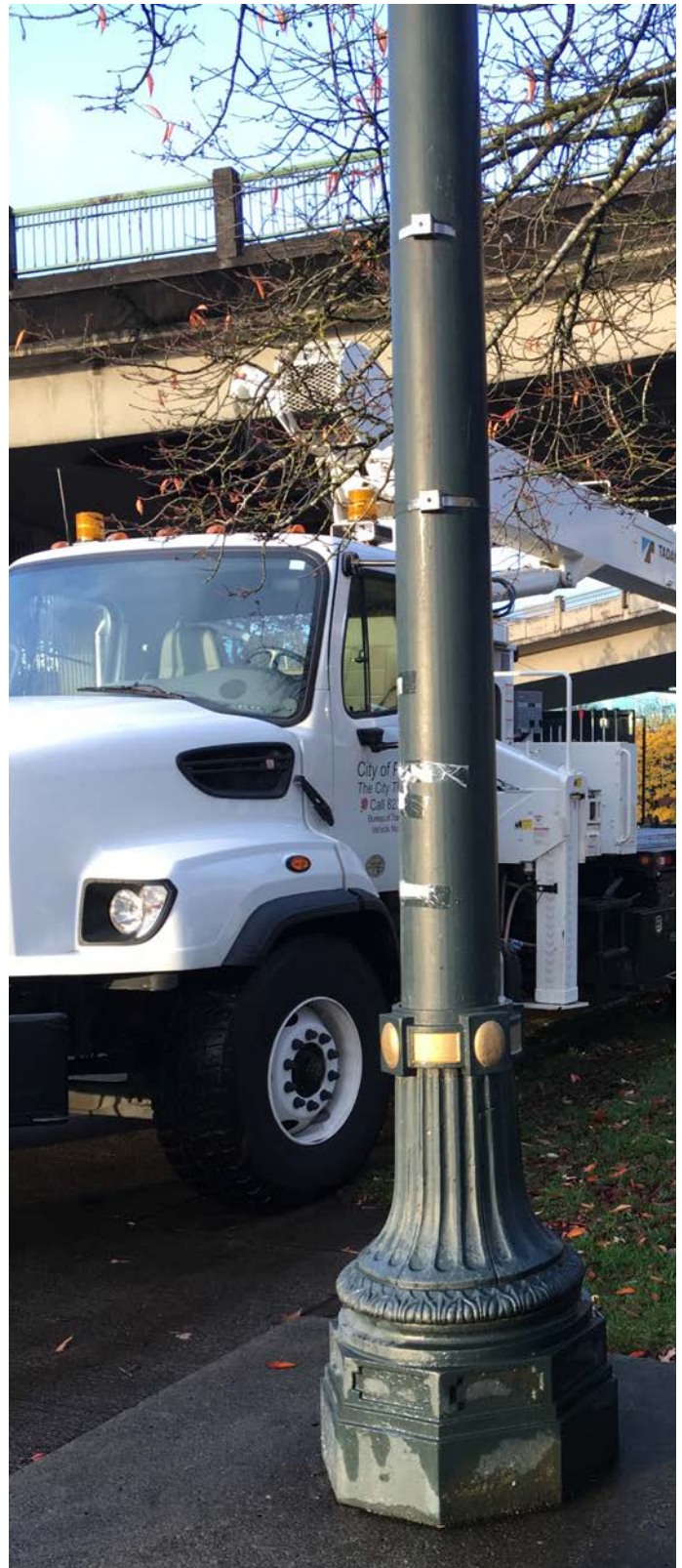
PHASE	WILLAMETTE RIVER GAUGE LEVELS (NWS)	COLUMBIA RIVER GAUGE LEVELS (NWS)	JOHNSON CREEK GAUGE LEVELS (NWS)
5	33.1' +	31.0' +	N/A

Should floodwaters rise into Phase 5 levels, the levees are likely to fail or be overtopped, and the downtown seawall would also be overtopped, resulting in extensive damage. While the seawall would be overtopped early in this phase, the levee area would be anticipated to inundate after 34' on the Vancouver gauge. Significant evacuations may be required throughout the metro area with the need for rescues and attention to life safety issues. At these levels of flooding, we do not know how much of the city might be inundated. Particularly with the changing climate, there is no confident maximum flood event. Map 10 shows all four earlier phases of flood response, and the additional areas (including Johnson Creek) that are within the 0.2% annual chance flood zone.

In the event of a flood that reached Phase 5, actions to be taken are covered in other plans:

- [Evacuation Annex](#)
- [Alert and Warning Annex](#)
- [Coordination, Direction and Control Annex](#)
- Mass Shelter Plan (Multnomah County)

The Disaster Policy Council and Mayor will provide policy direction for response actions. Documentation of actions, decisions, and expenses is critical for recovery from such an event. Frontline communities will require specific attention to maximize life safety. Recovery planning should begin immediately, in conjunction with damage assessment and debris management.





In this phase, floodwaters will crest and start to recede, and response will transition into recovery. Depending on the level of damage, recovery may include:

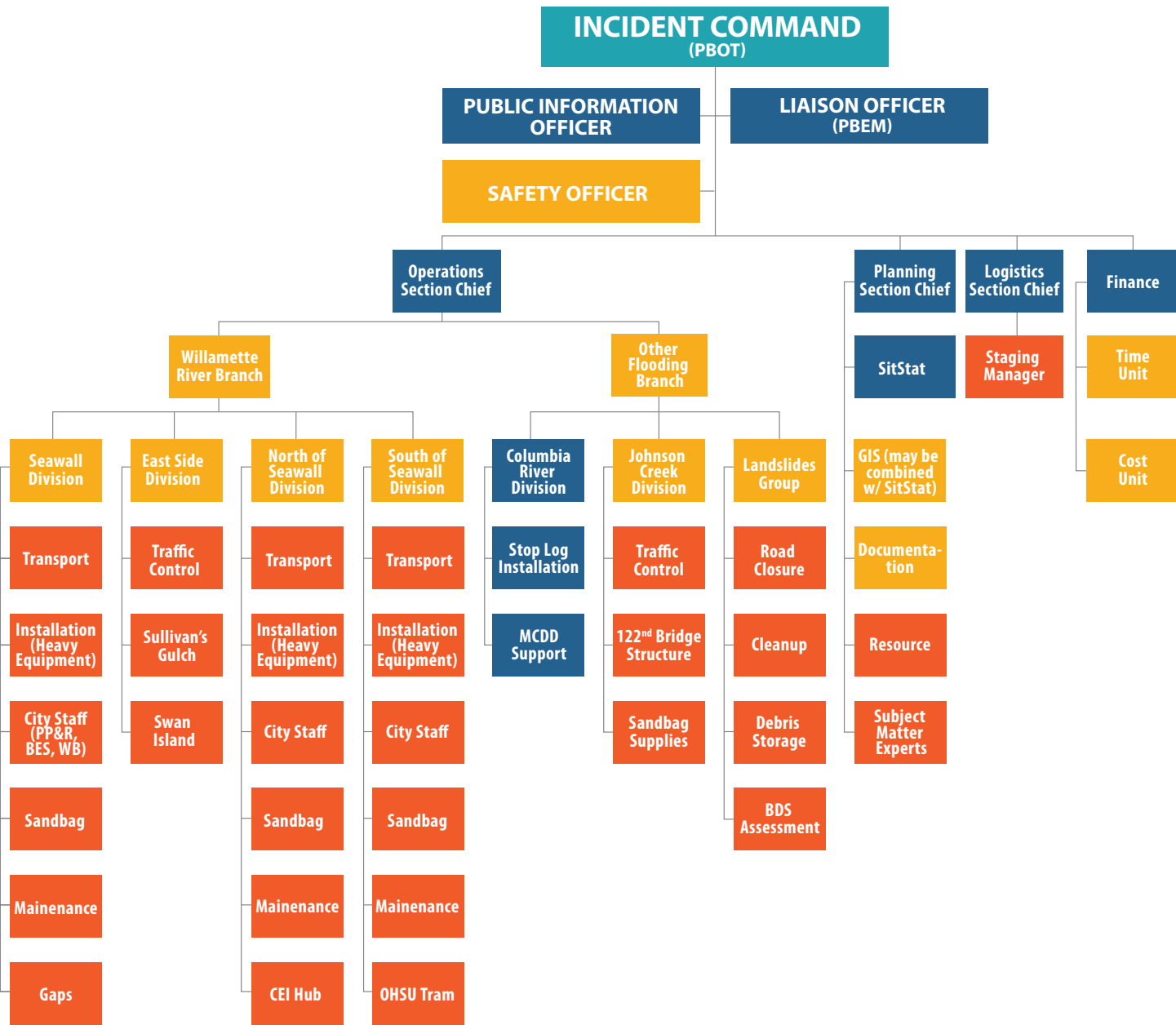
- Initial damage assessment in anticipation of a federal disaster declaration
- Deployment of Damage Assessment Teams (DATs)
- Debris removal
- Repairs by private property owners
- Repairs to city-owned facilities or systems
- Road repairs
- After-action review and reporting

After a major flood event, coordination and rapid damage assessment will be critical to recovery. BDS is responsible for determining whether flood-damaged structures are habitable or safe to enter; they must also permit demolitions and repairs. PBOT, BES, and PWB all have infrastructure in the city's rights-of-way, in addition to other facilities. Any needed repairs in rights-of-way will be coordinated among these three bureaus.

COMMAND STRUCTURE

The suggested staffing in different phases for both field operations and the Emergency Coordination Center are diagrammed on the following pages. This staffing plan addresses all sources of flooding, allowing positions to be eliminated if they are not needed.

FIGURE 6 | PBOT INCIDENT COMMAND POST ORGANIZATION CHART



LEGEND:

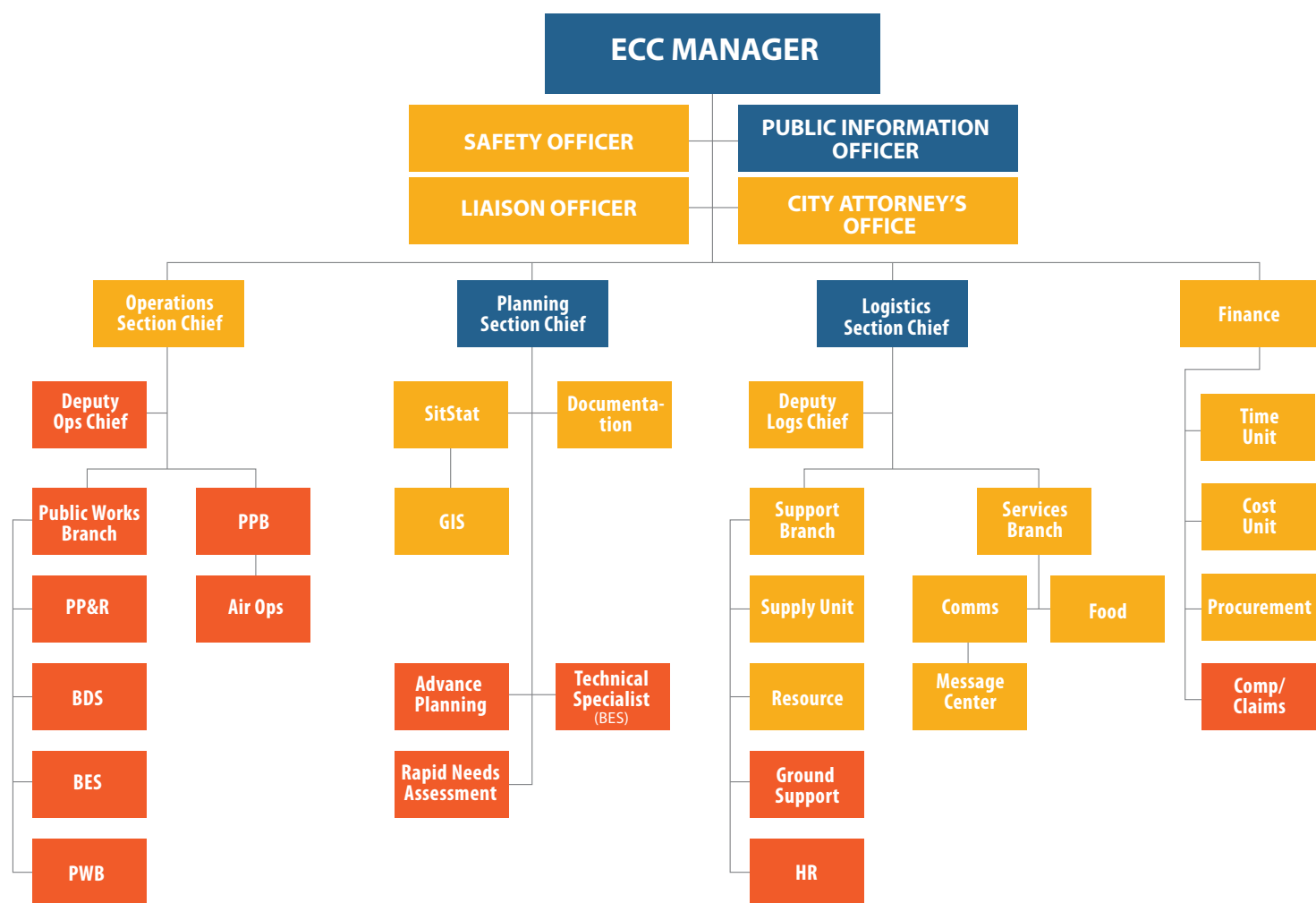
PHASE 1

PHASE 2

PHASE 3

PHASE 4

FIGURE 7 | ECC ORGANIZATION CHART



LEGEND:

PHASE 2

PHASE 3

PHASE 4

DIRECTION AND CONTROL

The BEOP addresses overall direction and control for emergencies. For flooding, PBOT is the lead agency. Other bureaus and agencies have key responsibilities across phases of flood response.

PHASE 1 - HIGH WATER/PRE-FLOOD

- Bureaus and agencies operate under routine operations or a bureau IC.

PHASE 2 - MINOR FLOODING, PHASE 3 - MODERATE FLOODING, AND PHASE 4 - MAJOR FLOODING

- PBOT IC coordinates flood response with support from other bureaus and the ECC.

PHASE 5 - HISTORIC FLOODING OR EARLIER ACTIVATION OF THE *EVACUATION ANNEX*

- With the activation of the *Evacuation Annex*, command shifts to Unified Command consisting of PBOT, PF&R, and PPB.

PHASE 6 – RECOVERY

- Recovery activities will shift away from IC/UC.
- Recovery from an event short of historic flooding can be managed by individual agencies.
- Historic flooding will require recovery efforts that are coordinated community-wide.

PLAN DEVELOPMENT & MAINTENANCE

PBEM is responsible for coordinating the review and update of this plan with PBOT every five years, or more often, as necessary. Other bureaus with responsibilities identified in this plan will assist according to the roles described. All responsible bureaus and collaborating agencies should be familiar with this Appendix and ensure that the content is consistent with their own agency's plans and procedures.

AUTHORITIES AND REFERENCES

The City assumes no legal responsibility for the implementation of this Appendix.

PORTLAND CITY CODE

- [Title 15](#) – Emergency Code
- [Title 16.10.200.N](#) – Duties of the Traffic Engineer
- [Title 20.12.190](#) – Emergency Park Closure

REFERENCES

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