City of Lake Oswego Addendum
to the Clackamas County Multi-Jurisdictional Natural Hazard Mitigation Plan

Photo Credit: Photo Credit: Martin Stabler

Effective: September 12, 2024 – September 11, 2029

Prepared for
The City of Lake Oswego

Updated:
July 16, 2024, (Resolution # 24-32)
May 21, 2019, (Resolution # 19-34)
May 21, 2013 (Resolution # 13-19)
March 23, 2010 (Resolution # 10-21)

This Natural Hazard Mitigation Plan was prepared by:

CLACKAMAS COUNTY

UNIVERSITY OF OREGON | School of Planning, Public Policy and Management | Institute for Policy Research and Engagement

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FEMA

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U.S. Department of Homeland Security
FEMA Region 10
130 228th Street, SW
Bothell, WA 98021-8627

FEMA

September 12, 2024

Tootie Smith, Chair
Clackamas County
2051 Kaen Road
Oregon City, Oregon, 97045

Reference: Approval of the Clackamas County Multi-jurisdictional Hazard Mitigation Plan

Dear Chair Smith:

In accordance with applicable[1] laws, regulations, and policy, the United States Department of Homeland Security's Federal Emergency Management Agency (FEMA) Region 10 has approved the Clackamas County multi-jurisdictional hazard mitigation plan for the following jurisdictions:

Clackamas County	City of Canby	City of Estacada
City of Gladstone	City of Happy Valley	City of Lake Oswego
City of Milwaukie	City of Molalla	City of Oregon City
City of Sandy	City of West Linn	City of Wilsonville
Clackamas Fire District #1	Clackamas River Water	Colton Water District
Oak Lodge Water Services		

The approval period for this plan is from September 12, 2024 through September 11, 2029.

An approved hazard mitigation plan is one of the conditions for applying for and receiving FEMA mitigation grants from the following programs:

- Hazard Mitigation Grant Program (HMGP)
- Hazard Mitigation Grant Program Post-Fire (HMGP-PF)
- Building Resilient Infrastructure and Communities (BRIC)
- Flood Mitigation Assistance (FMA)
- High Hazard Potential Dams Grants Program (HHPD)

Based on FEMA's review, the plan did not include all dam risk. Thus, the participating jurisdictions are not eligible for assistance from the HHPD Grant Program. If any participating jurisdictions with HHPDs are interested in this assistance, they should contact the FEMA Region 10 Hazard Mitigation Planning Team at FEMA-R10-MT_Planning@fema.dhs.gov, to learn more about how to include all dam risks in the plan.

[1] Robert T. Stafford Disaster Relief and Emergency Assistance Act, as amended; the National Flood Insurance Act of 1968, as amended; and National Dam Safety Program Act, as amended; Title 44 Code of Federal Regulations (CFR) Part 201, Mitigation Planning; and Local Mitigation Planning Policy Guide (FP-206-21-0002).

Having an approved hazard mitigation plan does not mean that mitigation grant funding will be awarded. Specific application and eligibility requirements for the programs listed above can be found in each FEMA grant program's respective policies and annual Notice of Funding Opportunities, as applicable.

To avoid a lapsed plan, the next plan update must be approved before the end of the approval period, including adoption by the participating jurisdiction(s). Before the end of the approval period, please allow sufficient time to secure funding for the update, including the review and approval process. Please include time for any revisions, if needed, and for participating jurisdictions to formally adopt the plan after the review, if not adopted prior to submission. This will enable each jurisdiction to remain eligible to apply for and receive funding from FEMA's mitigation grant programs with a hazard mitigation plan requirement. Local governments, including special districts, with a plan status of "Approvable Pending Adoption" are not eligible for FEMA's mitigation grant programs with a hazard mitigation plan requirement.

If you have questions regarding your plan's approval or FEMA's mitigation program, please contact Joseph Murray, Mitigation Planner at (503) 378-2911 or joseph.murray@oem.oregon.gov, who coordinates these efforts for local entities.

Sincerely,

Wendy Shaw, P.E.
Risk Analysis Branch Chief

Enclosures

cc: Stephen Richardson, Oregon Department of Emergency Management
Joseph Murray, Oregon Department of Emergency Management

JF:JG:WS

RESOLUTION 24-32

A RESOLUTION OF THE CITY COUNCIL ADOPTING THE CITY OF LAKE OSWEGO ADDENDUM TO THE CLACKAMAS COUNTY MULTI-JURISDICTIONAL NATURAL HAZARDS MITIGATION PLAN.

WHEREAS, the City of Lake Oswego recognizes the threat that natural hazards pose to people, property and infrastructure within our community; and

WHEREAS, undertaking hazard mitigation actions will reduce the potential for harm to people, property and infrastructure from future hazard occurrences; and

WHEREAS, an adopted Natural Hazards Mitigation Plan is required as a condition of future funding for mitigation projects under multiple FEMA pre- and post-disaster mitigation grant programs; and

WHEREAS, the City of Lake Oswego has fully participated in the FEMA prescribed mitigation planning process to prepare the Clackamas County Multi-Jurisdictional Natural Hazard Mitigation Plan, which has established a comprehensive, coordinated planning process to eliminate or minimize these vulnerabilities; and

WHEREAS, the City of Lake Oswego has identified natural hazard risks and prioritized a number of proposed actions and programs needed to mitigate the vulnerabilities of the City of Lake Oswego to the impacts of future disasters within the Clackamas County Multi-Jurisdictional Natural Hazard Mitigation Plan; and

WHEREAS, these proposed projects and programs have been incorporated into the Clackamas County, Multi-Jurisdictional Natural Hazard Mitigation Plan that has been prepared and promulgated for consideration and implementation by the participating cities and special districts of Clackamas County; and

WHEREAS, the Oregon Department of Emergency Management and Federal Emergency Management Agency, Region X officials have reviewed the City of Lake Oswego addendum to the Clackamas County Multi-Jurisdictional Natural Hazard Mitigation Plan and pre-approved it (dated June 11, 2024) contingent upon this official adoption of the participating governments and entities;

WHEREAS, the Clackamas County Multi-Jurisdictional Natural Hazard Mitigation Plan is in an on-going cycle of development and revision to improve its effectiveness; and

WHEREAS, City of Lake Oswego adopts its addendum to the Clackamas County Multi-Jurisdictional Natural Hazard Mitigation Plan and directs the City Manager or their designee to develop, approve, and implement the mitigation strategies and any administrative changes as outlined in the Plan.

NOW THEREFORE, BE IT RESOLVED that:

1. The City of Lake Oswego adopts the Lake Oswego addendum to the Clackamas County Multi-Jurisdictional Natural Hazards Mitigation Plan as an official plan; and

2. The City Council directs that this Adoption Resolution be submitted to the Oregon Department of Emergency Management and Federal Emergency Management Agency, Region X officials to enable final approval of the Clackamas County Multi-Jurisdictional Natural Hazards Mitigation Plan.

This resolution shall take effect upon passage.

Approved and adopted by the City Council of the City of Lake Oswego at a regular meeting held on the 16th day of July, 2024.

AYES: Mayor Buck, Afghan, Wendland, Verdick, Rapf, Corrigan

NOES: None

ABSTAIN: None

EXCUSED: Mboup

Joseph M. Buck, Mayor

ATTEST:

Kari Linder, City Recorder

APPROVED AS TO FORM:

Ellen Osoinach, City Attorney

Purpose

This is an update of the Lake Oswego addendum to the Clackamas County Multi-Jurisdictional Natural Hazard Mitigation Plan (NHMP). This addendum supplements information contained in Volume I (Basic Plan) which serves as the NHMP foundation and Volume III (Appendices) which provide additional information. This addendum meets the following requirements:

- Multi-Jurisdictional **Plan Adoption** §201.6(c)(5),
- Multi-Jurisdictional **Participation** §201.6(a)(3),
- Multi-Jurisdictional **Mitigation Strategy** §201.6(c)(3)(iv) and
- Multi-Jurisdictional **Risk Assessment** §201.6(c)(2)(iii).

Updates to Lake Oswego's addendum are further discussed throughout the NHMP and within Volume III, Appendix B, which provides an overview of alterations to the document that took place during the update process.

Lake Oswego adopted their addendum to the Clackamas County Multi-jurisdictional NHMP on July 16, 2024. FEMA Region X approved the Clackamas County NHMP and the City's addendum on September 12, 2024. With approval of this NHMP the City is now eligible to apply for the Robert T. Stafford Disaster Relief and Emergency Assistance Act's hazard mitigation project grants through September 11, 2029.

NHMP Process, Participation and Adoption

This section of the NHMP addendum addresses 44 CFR 201.6(c)(5), *Plan Adoption*, and 44 CFR 201.6(a)(3), *Participation.*

In addition to establishing a comprehensive community-level mitigation strategy, the Disaster Mitigation Act of 2000 (DMA2K), and the regulations contained in 44 CFR 201, require that jurisdictions maintain an approved NHMP to receive federal funds for mitigation projects. Local adoption, and federal approval of this NHMP ensures that the city will remain eligible for pre- and post-disaster mitigation project grants.

The Oregon Partnership for Disaster Resilience (OPDR) at the University of Oregon's Institute for Policy Research, and Engagement (IPRE) collaborated with the Oregon Office of Emergency Management (OEM), Clackamas County, and Lake Oswego to update their NHMP.

The Clackamas County NHMP, and Lake Oswego addendum, are the result of a collaborative effort between citizens, public agencies, non-profit organizations, the private sector, and regional organizations. The Lake Oswego HMAC guided the process of developing the NHMP.

Convener

The Lake Oswego City Manager, or their designee, serves as the NHMP addendum convener. The convener of the NHMP will take the lead in implementing, maintaining, and updating the addendum to the Clackamas County NHMP in collaboration with the designated convener of the Clackamas County NHMP (Clackamas County Resilience Coordinator).

Representatives from the City of Lake Oswego HMAC met formally and informally, to discuss updates to their addendum (Volume III, Appendix B). The HMAC reviewed and revised the City's addendum, with focus on the NHMP's risk assessment and mitigation strategy (action items).

This addendum reflects decisions made at the designated meetings and during subsequent work and communication with the Clackamas County Resilience Coordinator, and the OPDR. The changes are highlighted with more detail throughout this document and within Volume III, Appendix B. Other documented changes include a revision of the City's risk assessment and hazard identification sections, NHMP mission and goals, action items, and community profile.

The Lake Oswego HMAC was comprised of the following representatives:

- Rob D. Amsberry - Program Lead/Flood Plain Manager, Engineering Department
- Megan Big John - Parks Manager, Parks & Recreation Department
- Bonnie Hirshberger - Citizen Information & Emergency Management Specialist, City Manager's Office
- Jessica Morey-Collins - Sr Development Specialist, Planning Department
- Jeff Munro - Deputy Director, Parks & Recreation Department
- Megan Phelan - Assistant City Manager, City Manager's Office
- Edward VanBuren - Deputy Director, Public Works Department
- Amanda Watson - Sustainability Program Manager, City Manager's Office
- Darryl Wrisley - Police Department Lieutenant, Police Department
- Gert Zoutendijk - Fire Marshal, Fire Department

The HMAC served as the local review body for the NHMP update.

NHMP Implementation and Maintenance

The City Council will be responsible for adopting the Lake Oswego addendum to the Clackamas County NHMP. This addendum designates a HMAC and a convener to oversee the development and implementation of action items. Because the City addendum is part of the County's multi-jurisdictional NHMP, the City will look for opportunities to partner with the County. The City's HMAC will convene after re-adoption of the Lake Oswego NHMP addendum on an annual schedule. The County is meeting on a semi-annual basis and will provide opportunities for the cities to report on NHMP implementation and maintenance during their meetings. The convener will serve as the conveners and will be responsible for assembling the HMAC. The HMAC will be responsible for:

- Reviewing existing action items to determine suitability of funding;
- Reviewing existing and new risk assessment data to identify issues that may not have been identified at NHMP creation;
- Educating and training new HMAC members on the NHMP and mitigation actions in general;
- Assisting in the development of funding proposals for priority action items;
- Discussing methods for continued public involvement;
- Evaluating effectiveness of the NHMP at achieving its purpose and goals (use Table 26, Volume I, Section 4, as one tool to help measure effectiveness); and
- Documenting successes and lessons learned during the year.

The HMAC will be responsible for the following activities described in detail in Volume I, Section 4:

The jurisdiction will utilize the same implementation and maintenance process identified in Volume I, Section 4.

The jurisdiction will provide continued public participation during the plan maintenance process through periodic presentations to elected officials, public meetings, postings on social media, and/or through interactive content on the jurisdiction's website (for more information see Volume I, Section 4).

The jurisdiction will utilize the same action item prioritization process as the County (for more information see Volume I, Section 4 and Volume III, Appendix E).

Implementation through Existing Programs

This NHMP is strategic and non-regulatory in nature, meaning that it does not necessarily set forth any new policy. It does, however, provide: (1) a foundation for coordination and collaboration among agencies and the public in the city; (2) identification and prioritization of future mitigation activities; and (3) aid in meeting federal planning requirements and qualifying for assistance programs. The mitigation plan works in conjunction with other city plans and programs including the Comprehensive Land Use Plan, Capital Improvements Plan, and Building Codes, as well as the Clackamas County NHMP, and the State of Oregon NHMP.

The mitigation actions described herein (and in Attachment A) are intended to be implemented through existing plans and programs within the city. Plans and policies already in existence have support from residents, businesses, and policy makers. Where possible, Lake Oswego will implement the NHMP's recommended actions through existing plans and policies. Many land-use, comprehensive and strategic plans get updated regularly, allowing them to adapt to changing conditions and needs. Implementing the NHMP's action items through such plans and policies increases their likelihood of being supported and implemented. Implementation opportunities are further defined in action items when applicable.

Capability Assessment

The Capability Assessment identifies and describes the ability of the City of Lake Oswego to implement the mitigation strategy and associated action items. Capabilities can be evaluated through an examination of broad categories, including: existing authorities, policies, programs, funding, and resources. As applicable the 2019 NHMP was integrated into these authorities/documents over the last five years (e.g., land use regulations, water system master plan, capital improvement plan, etc.).

Existing Authorities

Hazard mitigation can be executed at a local scale through three (3) methods: integrating hazard mitigation actions into other local planning documents (i.e., plan integration), adopting building codes that account for best practices in structural hardening, and codifying land use regulations and zoning designations that prescribe mitigation into development requirements. The extent to which a municipality or multi-jurisdictional effort leverages these approaches is an indicator of that community's capabilities.

Comprehensive Plan

Oregon's Statewide Planning Goal 7 requires comprehensive planning within every jurisdiction that is designed to reduce risks to people and property from natural hazards.

Lake Oswego addresses Statewide Planning Goal 7 Natural Hazards as part of their Comprehensive Plan Element, Community Health, and Public Safety. This element was updated in 2014, and contains policies related to air, water, and natural resources, areas subject to natural disasters and hazards, public facilities, and energy. It incorporated the findings and recommendations of the 2010 City of Lake Oswego

Natural Hazards Mitigation Plan for six major hazards: floods, landslides, severe storm (wind and winter), wildfires, earthquakes, and volcanoes.

Planned updates to the jurisdiction's Goal 7 element or its broader comprehensive plan will reflect the data and findings within this NHMP and integrate analyses of future climate and natural hazard impacts into the community's long-range plans.

Land Use Regulations

Existing land use policies that define zoning and address hazardous conditions provide another source of mitigation capability.

- Chapter 50, Community Development Code (revised July 2023)

  This Chapter includes Article 50.05.011 Flood Management Area, which applies to the lands within the "flood management area" and is applied when development occurs within the "flood management area," which are the areas of special flood hazard, as identified by the Federal Insurance Administrator in a scientific and engineering report entitled "The Flood Insurance Study for Clackamas County, OR and Incorporated Cities" dated January 18, 2019. It also regulates based on the 1996 flood areas, which were those areas inundated during the February 1996 flood along the Willamette River. This code was amended by Ord. 2847, January 2022. Their flood prevention code section is based on the Oregon Model Flood Hazard Prevention code, which includes provisions addressing substantial improvement/substantial damage.

  Article 50.04.010 Sensitive Lands Overlay Districts manages the impacts of development on lands with environmental and natural resource significance in order to protect the functions and values of wetlands, stream corridors, and tree groves within the Lake Oswego City limits. Many of these significant resources are associated with hillsides, ravines, and ridge lines.

  This Chapter also includes Article 50.06.006 Geologic Hazards and Drainage, addressing development in known potential severe landslide hazard areas.

- Chapter 52, Erosion Control

  This chapter aims to control erosion at its source as a means of maintaining and improving water quality and minimizing water pollution, downstream flooding, and wildlife habitat damage.

- Lake Oswego City Code and Charter, Chapter 38.25

  This chapter was established to protect the health, safety, and welfare of the public residing in watersheds in the jurisdiction of the City by controlling the rate, quality and volume of stormwater originating from development and redevelopment sites to the maximum extent practicable, so that surface water and groundwater are protected from pollution and flooding, and so that erosion potential does not increase.

- Lake Oswego Bridge Inspections and Records Manual

  This manual outlines the City's bridge inspection program that was implemented to better respond in the event of a natural disaster. The intent of the program is to utilize trained City personnel to closely document bridge conditions through visual inspections, establishing baseline condition information to use for comparison to bridge conditions after a disaster. Overall, bridges throughout the City are old and in need of upgrading. Additionally, the manual outlines a disaster response plan, including identification of disaster response team members and a bridge closure and detour plan.

The Lake Oswego Planning Department is the oversight entity for all matters related to long range planning, development review, and code enforcement. It is responsible for the administration of state, county, and local land use policies and regulations as they relate to the preservation and quality development of property lying within the city limits and urban growth boundary (UGB). Planning works closely with Building, Engineering, and Fire in the review of development applications and building permits. Planning is also responsible for administering and maintaining the Lake Oswego Comprehensive Plan and Community Development Code, Tree Code, and Sign Code. Planning staff also administer the City's Annexation, Neighborhood Planning, Historic Preservation, and Urban and Community Forestry programs. They work closely with the County and neighboring jurisdictions to ensure plans are aligned.

Recent efforts to update land use regulations to integrate hazard mitigation and resilience include:

- Section 50-05-011 (The Flood Management Area) of the Community Development Code was completely updated. Adopted in January of 2022.
- Chapter 15, Section 15.06.616 of the Fire Protection Code was updated in 2021 in order for the Fire Chief or Fire Marshal to implement a burn ban within the limits of the City of Lake Oswego.
- Staff is currently working with a consultant team and internal staff to update the Surface Water Management Manual and the Stormwater Management Code (Article 38.25).

Structural Building Codes

The Oregon Legislature recently adopted updated building codes for both residential (2023 adoption) and commercial structures (2022) since the last update of this Plan. These building codes are based on the 2021 version of the International Building Code and the 2021 International Residential Code.

The Lake Oswego Building Department administers and enforces the 2022 Oregon Structural Specialty Code, which includes fire provisions from the 2022 Oregon Fire Code. As a result, both new residential and commercial structures will be required to build according to the latest seismic and wind hardening standards. The Fire Department administers the Fire Code, however, current legislation prevents adoption of the WUI Code, which would administer standards for using fire resistant building materials in proximity to or within the wildland-urban interface (WUI).

Public Works

The City of Lake Oswego Public Works Department is responsible for surface water management, water treatment and delivery, wastewater collection and treatment (with Portland Bureau of Environmental Services), street construction and maintenance, and public facilities maintenance. Much of their work is associated with the reduction of hazards to the community and the implementation of resilience measures.

The Lake Oswego Public Works Department Engineering Section administers and enforces the Flood Management Area code. Minimum submission requirements stipulate an Elevation Certificate is required at submittal if property is in a flood hazard area, and require a two (2) foot free board and other flood construction requirements.

City Administration

The City Council of Lake Oswego has the responsibility of developing and adopting the annual city budget. Integrating hazard mitigation goals and projects into the annual budget is key to implementing the plan. The City Council tries to broadly address resilience planning needs while it determines city and departmental priorities and looks for multiple-impact projects wherever possible. They also work with staff to apply for federal and state grant funding to pursue larger projects that are outside of general fund capacity.

The City's solid waste management program is managed by the Sustainability Program Manager in the City Manager's Office.

Policies and Programs

This Plan directs Lake Oswego and Clackamas County to explore integration into other planning documents and processes. Lake Oswego has made significant progress in integrating the NHMP into its portfolio of planning processes and programs over the last five years.

Emergency Operations Plan

The City's Emergency Operations Plan is in the process of being updated and we anticipate that it will be adopted by the City Council in early 2024.

Sustainability and Climate Action Plan

The City's Sustainability and Climate Action Plan was adopted in May 2020. This plan built on the City's 2014 Sustainability Action Plan for City Operations and includes climate adaptation goals, including updating disaster management policies and procedures in preparation for more extreme weather events.

Intergovernmental cooperation

The City Council passed resolution 23-09 which authorized an IGA for the lending of personnel within Clackamas County when personnel are unable to get to their normal reporting location dues to an emergency and/or natural hazard.

Water management and Conservation Plan

The City of Lake Oswego and the City of Tigard joined together to develop a Water Management and Conservation Plan in 2019. This plan coordinates the management and conservation of their shared water resource in the Clackamas River.

MS4 Permit

Lake Oswego's Phase II Municipal Separate Storm Sewer System (MS4) permit was reissued by Oregon Department of Environmental Quality (DEQ) in 2021. The permit program has six areas of focus that are consistent with EPA's Federal Clean Water Act: public education, public involvement, illicit discharge detection and elimination, construction, post-construction, and municipal operations.

The City revised its Stormwater Management Plan and Monitoring Plans in 2022 to meet the requirements of the new MS4 Permit. These plans are awaiting approval from DEQ.

TMDL Plan

The City also maintains a Total Maximum Daily Load (TMDL) Plan (updated in 2019). The Total Maximum Daily Load (TMDL) program includes many of the same requirements as the MS4 program, but also incorporates measures that stabilize stream temperatures. The affected watersheds within the City's jurisdiction include the Willamette and Tualatin Rivers. The NHMP actions are incorporated into this document as appropriate. Example projects include participation in regional stormwater outreach projects, staff training on pollution control, and street cleaning after major storm events. Several new stormwater facilities were constructed as a result of capital improvement projects. An infiltration raingarden and two filtration swales were constructed in the Tryon Creek watershed. Two detention tanks and 41 infiltration planters were constructed in the Oswego Lake watershed.

Capital Improvement Plans

The City adopts a new updated capital improvement plan (CIP) every two years, in conjunction with our biennial budget process. The most recent CIP was approved for July 1, 2023.

Community Wildfire Protection Plan

The Clackamas County Community Wildfire Protection Plan (CWPP) will be incorporated into this Plan as a functioning annex. The NHMP will also be integrated into the City's Capital Improvement Plan, to be adopted by early 2024.

National Flood Insurance Program

Lake Oswego participates in the National Flood Insurance Program. The Engineering Section within Public Works Department is responsible for administering the day-to-day activities of the city's floodplain program. They are assisted by the Building Department, the Planning Department, and by the City Administrator.

Specifically, the Engineering Section:

- maintains and administers Lake Oswego's floodplain regulations;
- reviews and issues floodplain development permits;
- maintains elevation certificates for all new and substantially improved structures (and maintains an extensive database of historic elevation certificates);
- ensures that encroachments do not occur within the regulated floodway;
- implements measures to ensure that new and substantially improved structures are protected from flood losses;
- maintains floodplain studies and maps and makes this information available to the public;
- maintains a flood information website with digital flood insurance rate map (DFIRM) data;
- conducts site visits to assess conditions and provide technical assistance to the public;
- maintains a library of historical flood related information;
- informs the public of flood insurance requirements; and
- conducts outreach and training about flood hazards and development within the floodplain.

In 2022, the Lake Oswego City Council adopted Ordinance 2847, which introduced a new version of Chapter 50.05.011 Flood Management Area and adopted an updated Flood Insurance Study for Clackamas County, OR and Incorporated Areas (effective January 18, 2019).

Community Emergency Response Teams (CERT)

The City has an unique Community Emergency Response Team (CERT) program that trains residents in emergency management. The program has trained around 2,000 people since 1995.

Personnel

The following Lake Oswego personnel have assignments related to natural hazard mitigation planning and implementation:

Emergency Management: City Manager's Office, Police Department, Fire Department, and Public Works Department

Public Information Officer: City Manager's Office staff oversees a Communications Team comprised of members from all City departments

Floodplain Manager: Engineering Division of Public Works Department

Grant writing (for Public Works or emergency management): Public Works Department, Fire Department, Police Department, and City Manager's Office

Capital improvement planning: Engineering Division of Public Works Department

Capital improvement execution: Engineering Division of Public Works Department

Lake Oswego does not have any employees solely designated to Emergency Management or Mitigation. These personnel integrate hazards and resilience planning into their greater work programs to the best of their abilities. However, there is limited capacity to expand upon their capabilities or workloads.

Capital Projects

Lake Oswego has implemented recommendations from the last NHMP into its capital improvement projects.

The following mitigation-related or resilience projects have been completed prior to 2018:

- Lake Oswego Interceptor Sewer (LOIS) (replacement, seismic upgrades to elevated wastewater mains)
- Tualatin River flood model
- First Addition drainage improvement plan
- Evaluation of Flood Management Alternatives for Oswego Lake and Canal (Pacific Water Resources, Inc. June 2003)
- Clean Streams Plan (2009)
- Lakewood Bay Flood Protection at North Shore Road Bridge Plan (2000)
- Dam spillway improvements (2011-2012) (FEMA Flood Mitigation Assistance grant funded)
- Rockinghorse Lane landslide area stabilization

The following mitigation-related or resilience projects have been completed since 2018: [1]

- New City Hall (2021)
- Lake Front Drainage Improvements
- Deer Oak Circle Water Main Replacement
- Wastewater Lift Station Generator Additions
- Wembley Park Road and Stormwater Project
- Wastewater Collection System Rehabilitation
- Boones Ferry Road Project, including stormwater facilities
- 10th Street Water Reservoir removal and Pump Station upgrade
- Fosberg Road drainage improvements
- Telemetry upgrades
- Lakewood Trunk Sewer Rehabilitation
- Blue Heron Trunk Sewer Rehabilitation
- South Shore wastewater System Rehabilitation
- North Shore Bridge Retaining Wall Improvements
- Blue Heron Stormwater Outfall Replacement
- Water Quality Monitoring
- Telemetry Upgrades in all water distribution pump stations and reservoirs
- Completed seismic upgrades at Adult Community Center
- Lakeridge Junior High School (rebuilt 2022)
- Lake Oswego Middle School to be rebuilt starting in 2024, (expected completion 2026)
- Seismic rehabilitation of elementary schools (Hallinan Elementary, Oak Creek Elementary, Westridge Elementary, Palisades, Lake Grove, Forest Hills). All elementary schools gyms have been

upgraded to Category IV seismic level and all elementary schools have received incremental seismic upgrades throughout.

- River Grove Elementary School (new building is currently being constructed)

Mitigation Successes

The community has several examples of mitigation success including the following projects funded through FEMA Hazard Mitigation Assistance and the Oregon Infrastructure Finance Authority's Seismic Rehabilitation Grant Program[2].

FEMA Funded Mitigation Successes

- None identified

Seismic Rehabilitation Grant Program Mitigation Successes

- None identified

Other Mitigation Successes

Lake Oswego School District

- 2017: Lakeridge Junior High School, rebuilt per local bond (2019)
- 2017: Lake Oswego Junior High School, seismic retrofit local bond (The entire school is to be replaced by Lake Oswego Middle School. Demolition of Lake Oswego Junior High School expected to begin after 2024 school year ends. Projected completion date, 2026.)
- 2018: River Grove Elementary School, seismic retrofit of gym/play area per local bond (Replacement in process 2024 - school to be rebuilt to level 4)
- 2018: Uplands Elementary School, seismic retrofit of entire building, gym/play area per local bond
- 2018: Westridge Elementary School, seismic retrofit of entire building per local bond
- 2019: Oak Creek Elementary School, seismic retrofit per local bond
- 2020: Hallinan Elementary School, seismic retrofit of entire building per local bond
- 2021: Lake Grove, Seismic retrofit, gym
- 2021: Forest Hills, Seismic retrofit, gym and covered play
- 2022: Lake Oswego High School, seismic retrofit gym local bond
- 2022: Lakeridge High School, seismic retrofit of gym per local bond

City Facilities

- 2021: City Hall (which includes Police Department and LOCOM (9-1-1 Center)), rebuilt to meet Category IV risk standards pursuant to Section 202 of the 2014 Oregon Structural Specialty Code
- 2017: Maintenance Center, rebuilt to meet Category IV risk standards (main building) and Category III risk standards (vehicle barn/motor pool)
- 2017: Water Treatment Plant, updated to current seismic codes - finished water building at the WTP and river intake pump station built to Category IV
- 2011: Overhead mains to wastewater treatment plant replaced as part of Lake Oswego Interceptor Sewer (LOIS) Project

[2] The Seismic Rehabilitation Grant Program (SRGP) is a state of Oregon competitive grant program that provides funding for the seismic rehabilitation of critical public buildings, particularly public schools, and emergency services facilities.

Capital Resources

Lake Oswego maintains several capital resources that have important roles to play in the implementation of the natural hazard mitigation plan.

Critical facilities with power generators for use during emergency blackouts include:

- Lake Oswego City Hall, 380 A Avenue
- Station 210 Westlake Fire Station, 4900 Melrose Street
- Station 211 Jean Road Fire Station, 4555 Jean Road
- Station 212 South Shore Fire Station, 1880 South Shore Blvd
- Station 214 Main Fire Station and Admin Office, 300 B Avenue
- Lake Oswego Maintenance Center, 17601 Pilkington Road
- Adult Community Center, 505 G Avenue
- Lake Oswego Public Library, 706 Fourth Street
- Lake Oswego Water Treatment Plant, 4260 Kenthorpe Way, West Linn (administration building only)
- Several water pump stations and wastewater lift stations
- Lakeridge High School, 1235 Overlook Drive
- Lake Oswego High School, 2501 Country Club Road
- Lakeridge Middle School, 4700 Jean Road
- Oak Creek Elementary School, 55 Kingsate Road
- Forest Hills Elementary School, 1133 Andrews Road
- Many (if not all) buildings located on Meadows in the Kruse Woods Corporate Park have generators

Warming or cooling shelters include:

- Adult Community Center, 505 G Avenue
- Lake Oswego Public Library, 706 Fourth Street

Facilities listed in the American Red Cross National Shelter System include:

- Lake Oswego United Methodist Church, 1855 South Shore Boulevard
- The Church of Jesus Christ of Latter-Day Saints
- Lake Oswego High School, 2501 Country Club Road
- Lakeridge High School, 1235 Overlook Drive
- Lakeridge Middle School (to be added), 4700 Jean Road

Food pantries include:

- Hunger Fighters of Oregon, 4 Monroe Parkway, Suite A

Fueling storage:

- Lake Oswego Maintenance Center, 17601 Pilkington Road

The main fuel island holds 8,193 gallons of unleaded and 5,447 gallons of diesel. We have currently 4 fuel "cubes" that hold anywhere from 50 -150 gallons depending on the cube (the cubes are filled and driven to various locations for generator or other critical equipment refueling).

Findings

Several important findings from this capability assessment informed the design of the Plan's mitigation strategy and aided in prioritizing action items.

Staffing Limitations and Capacity

Lake Oswego staff are assigned hazard mitigation responsibilities as a (small) part of their larger job responsibilities. Restricted capacity reduces the breadth of the programming the community can undertake in any year. The city relies upon its relationships with the County and other cities within its region to expand its operations.

Reliance upon outside funding streams and local match requirements

Lake Oswego operates on a limited budget with many conflicting priorities. This leaves few opportunities for using local financial resources to implement hazard mitigation work. They lean heavily upon state and federal grant funds as the primary means for securing mitigation funding. Hazard mitigation grants such as HMGP and BRIC require 10-25% local funding match, as well as extra staff capacity and expertise to navigate the application process and manage the funding.

Leveraging Partnerships with Public and Nonprofit Entities

Regional planning displayed in Community Wildfire Protection Planning process demonstrates the City's ability to effectively share information and identify priority needs.

Mitigation Plan Mission

The 2024 HMAC reviewed the previous NHMP Mission and Goals in comparison to the State NHMP Goals and determined that they would make necessary updates to include references to community lifelines and to advance equity and inclusion in hazard mitigation.

The NHMP mission states the purpose and defines the primary functions of NHMP. It is intended to be adaptable to any future changes made to the NHMP and need not change unless the community's environment or priorities change.

The mission of the NHMP is to:

Enhance county resiliency and capacity to address natural hazards by promoting sound public policy and effective mitigation strategies designed to equitably reduce risk and impacts on community members, community lifelines, historic and cultural resources property, and ecological systems.

This can be achieved by increasing public awareness, documenting the resources for risk reduction and loss-prevention, and identifying activities to guide the county towards building a safer, more sustainable community.

Mitigation Plan Goals

Mitigation plan goals are more specific statements of direction that residents and public and private partners can take while working to reduce the risk from natural hazards. These statements of direction form a bridge between the broad mission statement and action items. The goals listed here serve as checkpoints as agencies and organizations begin implementing mitigation action items.

Meetings with the HMAC, previous hazard event reports, and the previous NHMPs served as methods to obtain input and identify priorities in developing goals for reducing risk and preventing loss from natural hazards.

All the NHMP goals are important and are listed below in no order of priority. Establishing community priorities within action items neither negates nor eliminates any goals, but it establishes which action items to consider implementing first, should funding become available.

Goal 1: Protect Life and Property

- Develop and implement mitigation and climate adaptation projects and policies that aid in protecting lives by making homes, businesses, community lifelines, and other property more resilient to natural hazards and impacts from climate change.
- Establish mitigation projects and policies that minimize losses and repetitive damages from recurring disasters while promoting insurance coverage for severe hazards.
- Improve hazard identification and risk assessment information to inform and provide recommendations for enhanced resilience in new development decisions and promote preventative measures for existing development in areas vulnerable to natural hazards.

Goal 2: Enhance Natural Systems

- Incorporate natural hazard mitigation planning and activities into watershed planning, natural resource management, natural systems enhancement, and land use planning to protect life, property, and ecological system.

Goal 3: Augment Emergency Services

- Strengthen emergency operations by enhancing communication, collaboration, and coordination of natural hazard mitigation activities and policies across agencies at all levels and regions of government, sovereign tribal nations, and the private sector.

Goal 4: Encourage Partnerships for Implementation

- Improve communication, coordination, and participation among and with public agencies, community members, community lifelines, and private sector organizations to prioritize and implement hazard mitigation activities and policies.
- Enhance efforts toward identifying and optimizing opportunities across state agencies, surrounding communities, and private entities for resource sharing, mutual aid, and funding sources/support.

Goal 5: Promote Public Awareness

- Build community resilience and awareness and reduce the effects of natural hazards and climate change through community-wide engagement, collaboration, resource-sharing, learning, leadership-building, and identifying mitigation project-related funding opportunities.

Goal 6: Advance Equity and Inclusion

- Mitigate the inequitable impacts of natural hazards by prioritizing the directing of resources and efforts to build resilience and engagement in the most vulnerable communities least able to prepare, respond, and recover.
- Strengthen efforts aimed at increasing engagement, outreach, and collaboration with community and cultural organizations and agencies that are dedicated to providing services and support to vulnerable and underserved communities.

Mitigation Strategy

This section of the NHMP addendum addresses 44 CFR 201.6(c)(3(iv), *Mitigation Strategy.*

The City's mitigation strategy (action items) was first developed during the 2009 NHMP planning process and revised during subsequent NHMP updates. During these processes, the HMAC assessed the City's risk, identified potential issues, and developed a mitigation strategy (action items).

During the 2023 update process, the City re-evaluated their mitigation strategy (action items). During this process action items were updated, noting if the action is complete, not complete and whether the actions were still relevant; any new action items were identified at this time (see Attachment B for more information on changes to action items).

Action Items

Table LO-1 documents the title of each action along with, the lead organization, partners, timeline, cost, and potential funding resources. The HMAC decided to modify the prioritization of action items in this update to reflect current conditions (risk assessment), needs, and capacity (see Attachment A for more information). High priority actions are shown with orange highlight. The City will focus their attention, and resource availability, upon these achievable, high leverage, activities over the next five-years. Although this methodology provides a guide for the HMAC in terms of implementation, the HMAC has the option to implement any of the action items at any time. This option to consider all action items for implementation allows the committee to consider mitigation strategies as new opportunities arise, such as capitalizing on funding sources that could pertain to an action item that is not currently listed as the highest priority. Refer to Attachment A for changes to actions since the previous NHMP.

Table LO-1 Action Items

		Impacted Hazard									Implementation and Maintenance			
Action Item #	Statement	Drought	Earthquake	Extreme Heat	Flood	Landslide	Volcanic Event	Wildfire	Windstorm	Winter Storm	Lead	Timeline	Potential Funding Source	Estimated Cost
1	With a focus on reaching vulnerable populations, conduct public education and outreach on strategies to stay safe during extreme heat and hazardous air quality events, including information about available cooling shelters and clean air spaces.			X			X	X	X	X	City Manager's Office	Ongoing	Local Resources. DLCD TA, FEMA HMA	Low
2	Integrate the goals and action items from the Lake Oswego Hazards Mitigation Plan into existing regulatory documents and programs, where appropriate.	X	X	X	X	X	X	X	X	X	City Manager's Office, Planning, and Engineering	Ongoing	Local Resources. DLCD TA, FEMA HMA	High
3	Improve vegetation management throughout the city. Prioritize the removal of hazard trees. Maintain status as Tree City USA.							X	X	X	Parks & Recreation, Public Works	Ongoing	Local Resources. FEMA HMA	High
4	Develop a community resilience hub designed to support residents and coordinate resource distribution before, during, or after a natural hazard event. Hub could also provide refuge site from cold, heat, and poor air quality.	X	X	X	X	X	X	X	X	X	Development Services	Medium	Local Resources, FEMA HMA-C&CB,	Medium (scoping) to High (implementation)
5	Conduct seismic evaluations on identified critical/essential facilities and infrastructure. Implement appropriate structural and non-structural mitigation strategies first on high priority buildings and infrastructure (including the library, reservoirs, and lift/pump stations.).		X								City Manager's Office and Public Works	Ongoing	Local Resources, FEMA HMA (BRIC, C&CB), SRGP	Medium
6	Ensure continued compliance in the National Flood Insurance Program (NFIP) through enforcement of local floodplain management ordinances.				X						Planning, and Engineering	Ongoing	Local, State, Federal Grants	Low

Table LO-1 Action Items

		Impacted Hazard									Implementation and Maintenance			
Action Item #	Statement	Drought	Earthquake	Extreme Heat	Flood	Landslide	Volcanic Event	Wildfire	Windstorm	Winter Storm	Lead	Timeline	Potential Funding Source	Estimated Cost
7	Improve knowledge of landslide hazard areas and understanding of vulnerability and risk to life and property in hazard-prone areas.					X					Community Development	Ongoing	Local Resources, FEMA HMA-C&CB, FEMA Risk MAP	Low to High
8	Reduce frequency and duration of power outages from the severe wind and winter storm hazards, where possible. Potential projects include undergrounding utilities, establishing, and maintaining backup generators at critical facilities, developing energy redundancy through microgrids.								X	X	Public Works, Planning	Ongoing	Local Resources, FEMA HMA, Energy Trust of Oregon	High
9	Promote fire resistant strategies and home hardening by evaluating and making recommendations to current code to encourage noncombustible building materials for newly constructed residences in Lake Oswego.							X			Fire, Planning, Building	Medium	Local Resources. DLCD TA, FEMA HMA (FMA)	Low
10	Promote wildland home assessments and NFPA Firewise Communities.							X			Fire, Planning	Medium	Local Resources, FEMA HMA (FMA)	Low
11	Implement Clackamas County Community Wildfire Protection Plan in areas listed at risk of wildfire.							X			Fire, Planning, Building	Ongoing	Local Resources, FEMA HMA, CWDG	Low to High

Source: Lake Oswego NHMP HMAC, updated 2023
Cost: Low (less than $50,000), Medium ($50,000-$100,000), High (more than $100,000)
Timing: Ongoing (continuous), Short (1-2 years), Medium (3-5 years), Long (5 or more years)
Priority Actions: Identified with orange highlight

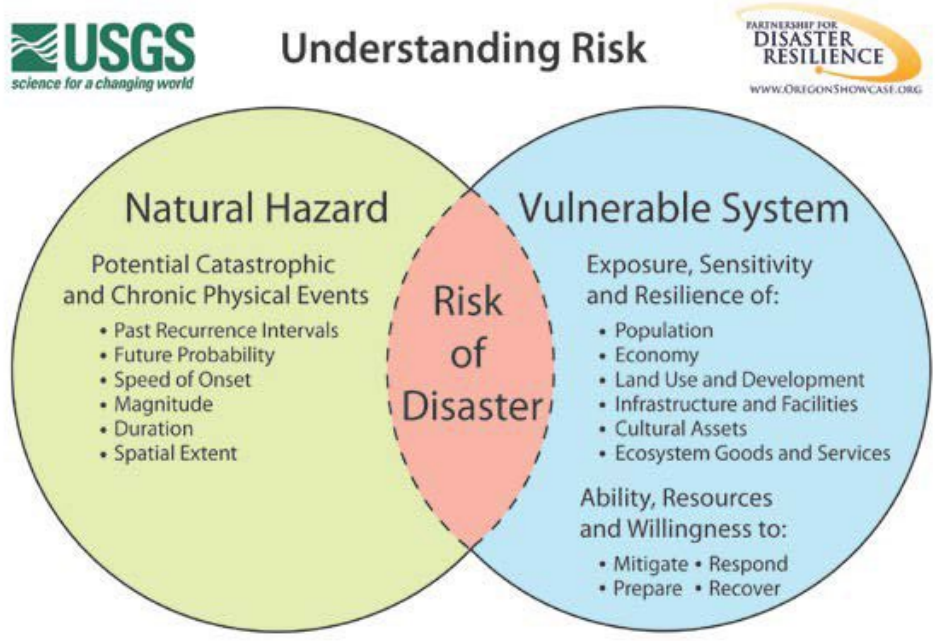
Risk Assessment

This section of the NHMP addendum addresses 44 CFR 201.6(b)(2) - Risk Assessment. In addition, this chapter can serve as the factual basis for addressing Oregon Statewide Planning Goal 7 – Areas Subject to Natural Hazards. Assessing natural hazard risk has three phases:

- Phase 1: Identify hazards that can impact the jurisdiction. This includes an evaluation of potential hazard impacts – type, location, extent, etc.
- Phase 2: Identify important community assets and system vulnerabilities. Example vulnerabilities include people, businesses, homes, roads, historic places and drinking water sources.
- Phase 3: Evaluate the extent to which the identified hazards overlap with or have an impact on, the important assets identified by the community.

The local level rationale for the identified mitigation strategies (action items) is presented herein and within Volume I, Section 3 and Volume III, Appendix C. The risk assessment process is graphically depicted in Figure LO-1. Ultimately, the goal of hazard mitigation is to reduce the area of risk, where hazards overlap vulnerable systems.

Figure LO-1: Understanding Risk



Source: USGS- Oregon Partnership for Disaster Resilience Research Collaboration, 2006

Hazard Analysis

The Lake Oswego HMAC developed their hazard vulnerability assessment (HVA), using their previous HVA and the County's HVA as a reference. Changes from their previous HVA and the County's HVA were made where appropriate to reflect distinctions in vulnerability and risk from natural hazards unique to Lake Oswego, which are discussed throughout this addendum. Table LO-2 shows the HVA matrix for Lake

Oswego listing each hazard in order of rank from high to low. For local governments, conducting the hazard analysis is a useful step in planning for hazard mitigation, response, and recovery. The method provides the jurisdiction with a sense of hazard priorities but does not predict the occurrence of a hazard. Two catastrophic hazards (Cascadia Subduction Zone earthquake and Crustal earthquake) and two chronic hazards (wildfire and winter storm) rank as the top hazard threats to the City (Top Tier). Extreme heat event, drought, flood, and windstorm comprise the next highest ranked hazards (Middle Tier), while landslide and volcanic event comprise the lowest ranked hazards (Bottom Tier).

Table LO-2 Hazard Analysis Matrix – Lake Oswego

Hazard	History	Vulnerability	Maximum Threat	Probability	Total Threat Score	Hazard Rank	Hazard Tiers
Wildfire	18	35	80	56	189	1	Top Tier
Earthquake - Cascadia	2	45	100	35	182	2	
Earthquake - Crustal	6	50	100	21	177	3	
Winter Storm	12	30	70	49	161	4	
Extreme Heat Event	10	35	70	35	150	5	Middle Tier
Drought	10	15	50	56	131	6	
Flood	16	20	30	56	122	7	
Windstorm	14	15	50	42	121	8	
Landslide	14	15	20	63	112	9	Bottom Tier
Volcanic Event	2	25	50	7	84	10	

Source: Lake Oswego HMAC, 2023.

Community Characteristics

Table LO-3 and the following section provides information on City specific demographics and assets. Many of these community characteristics can affect how natural hazards impact communities and how communities choose to plan for natural hazard mitigation. Considering the City specific assets during the planning process can assist in identifying appropriate measures for natural hazard mitigation.

Lake Oswego is in the northwestern corner of Clackamas County, located in the Tualatin Valley, and within the Metro Portland UGB. There are three major drainage basins: Oswego Lake, the Tualatin River, and the Willamette River. Lake Oswego has a complex geography with many steep, wooded hillsides, and streams that flow from the higher areas to the drainage basins. Oswego Lake is the largest physical feature, and its geographic center.

Lake Oswego's temperatures range from a monthly average low of 35°F in the winter months to a high of 82°F in the summer months. The coldest month is January, and the hottest month is August. The average annual precipitation is about 37 inches.

Population, Housing, and Income

Lake Oswego has grown substantially since its incorporation in 1910 and has an area today of 10.78 square miles. It is in the south-central region of Clackamas County, located approximately 25 miles southeast of the City of Portland.

Between 2016 and 2021 the City grew by 3,723 people (10%; as of 2022 the population is 41.148). Between 2022 and 2045 the population is forecast to grow by 2% to 42,133.

Most of the population is White/Caucasian (78%) and about 18% of the population is Hispanic or Latino. The poverty rate is 4% (3% of children under 18, 5% for people 65 and older),3% do not have health

insurance, and49% of renters pay more than 30% of their household income on rent (38% for owners). About 73% of the population has a bachelor's degree or higher (1% do not have a high school degree). Approximately 8% of the population lives with a disability (19% of population 65 and older), and 46% are either below 15 (23%) or over 65 (23%) years of age. About 15% of the population are 65 or older and living alone and 5% are single parents.

The City includes a diversity of land uses but is zoned primarily residential. About 73% of housing units are single-family, 27% are multifamily, and less than 1% are mobile homes. One quarter of homes (25%) were built before 1970 and 31% were built after 1990. Newer homes are more likely to be built to current seismic, flood, wildfire, and other hazard standards. Almost two-thirds (66%) of housing units are owner occupied, 27% are renter occupied, 2% are seasonal homes, and 5% are vacant.

Transportation and Infrastructure

In the City of Lake Oswego, the town is surrounded by hills on the north, and the south, the Willamette River to the east, and I-5 to the west. Highway 43, a State highway, runs through the eastside of town with Oswego Lake in the center of the City. The current freight railroad system is the Portland, and Western Railroad, which serves local, and regional industry. Lake Oswego's commercial areas developed along primary routes, and residential development followed nearby.

Motor vehicles represent the dominant mode of travel through and within Lake Oswego. Twenty-three percent (8%) of renters and 1% of owners do not have a vehicle. Most workers drive alone to work 69%); 5% carpool, 2% use public transit, 2% either walk or use a bicycle, and 20% work at home. Tri-Met provides local, and regional bus service, to serve the high number of commuters within the Tri-Met region. There are also free or donation-based shuttle services for residents going to the Adult Community Center, medical escorts for doctor appointments, wheelchair, and/or special transportation needs, and services provided by the Tri-Met Lift program.[4]

Economy

Lake Oswego is an inner-urban suburb of the Portland metropolitan region, and has easy access to downtown Portland, and surrounding communities. There is significant economic activity happening within the City of Lake Oswego, making it a desirable place to live, work, and visit. The Kruse Way Corridor, from I-5 to Boones Ferry Road, is a significant economic engine within the City of Lake Oswego.

About 48% of the resident population 16 and over is in the labor force (19,214 people) and are employed in a variety of occupations including professional (35%), management, business, and financial (31%), sales (10%), office and administrative (10%), and transportation and material moving (4%) occupations.

Most workers residing in the city (88%, 14,887 people) travel outside of the city for work primarily to Portland and surrounding areas.[3] A significant population of people travel to the city for work, (91% of the workforce, 20,464 people) primarily from Portland and surrounding areas.[4]

[3] U.S. Census Bureau. LEHD Origin-Destination Employment Statistics (2002-2021). Longitudinal-Employer Household Dynamics Program, accessed on December 21, 2023 at https://onthemap.ces.census.gov.

[4] Ibid.

Table LO-*3* Community Characteristics

Population Characteristics		Population Growth
2016 Population Estimate	37,425	
2022 Population Estimate	41,148	10%
2045 Population Forecast*	42,133	2%
Race		
American Indian and Alaska Native		< 1%
Asian		8%
Black/ African American		1%
Native Hawaiian and Other Pacific Islander		< 1%
White		78%
Some Other Race		< 1%
Two or More Races		7%
Hispanic or Latino/a (of any race)		18%
Limited or No English Spoken	1,292	3%
Vulnerable Age Groups		
Less than 5 Years	1,883	5%
Less than 15 Years	7,104	18%
65 Years and Older	8,483	21%
85 Years and Older	820	2%
Age Dependency Ratio		0.63
Disability Status (Percent age cohort)		
Total Disabled Population	3,138	8%
Children (Under 18)	184	2%
Working Age (18 to 64)	1,316	6%
Seniors (65 and older)	1,638	19%

Household Characteristics		
Housing Units		
Single-Family (includes duplexes)	12,891	73%
Multi-Family	4,783	27%
Mobile Homes (includes RV, Van, etc.)	29	< 1%
Household Type		
Family Household	11,150	68%
Married couple (w/ children)	4,183	25%
Single (w/ children)	836	5%
Living Alone 65+	2,479	15%
Year Structure Built		
Pre-1970	4,452	25%
1970-1989	7,765	44%
1990-2009	4,356	25%
2010 or later	1,130	6%
Housing Tenure and Vacancy		
Owner-occupied	11,636	66%
Renter-occupied	4,822	27%
Seasonal	293	2%
Vacant	952	5%
Vehicles Available (Occupied Units)		
No Vehicle (owner occupied)	171	1%
Two+ vehicles (owner occupied)	8,989	77%
No Vehicle (renter occupied)	385	8%
Two+ vehicles (renter occupied)	2,007	42%

Income Characteristics		
Households by Income Category		
Less than $15,000	684	4%
$15,000-$29,999	909	6%
$30,000-$44,999	1,104	7%
$45,000-$59,999	1,388	8%
$60,000-$74,999	851	5%
$75,000-$99,999	1,867	11%
$100,000-$199,999	5,164	31%
$200,000 or more	4,491	27%
Median Household Income		$120,585
Gini Index of Income Inequality		0.49
Poverty Rates (Percent age cohort)		
Total Population	1,693	4%
Children (Under 18)	302	3%
Working Age (18 to 64)	941	4%
Seniors (65 and older)	450	5%
Housing Cost Burden (Cost > 30% of household income)		
Owners with a Mortgage	3,014	38%
Owners without a Mortgage	878	24%
Renters	2,343	49%

Employment Characteristics		
Labor Force (Population 16+)		
In labor Force (% Total Population)	19,214	48%
Unemployed (% Labor Force)	1,014	5%
Occupation (Top 5) (Employed 16+)		
Professional & Related	6,645	35%
Management, Business, & Financial	5,991	31%
Sales & Related	2,001	10%
Office & Administrative	1,815	10%
Transportation and Material Moving	726	4%
Health Insurance		
No Health Insurance	1,401	3%
Public Health Insurance	11,247	28%
Private Health Insurance	33,606	83%
Transportation to Work (Workers 16+)		
Drove Alone	13,068	69%
Carpooled	1,031	5%
Public Transit	458	2%
Motorcycle	23	< 1%
Bicycle/Walk	394	2%
Work at Home	3,724	20%

Source: U.S. Census Bureau, 2016-2021 American Community Survey; Portland State University, Population Research Center, "Annual Population Estimates", 2016 & 2022; Portland State University. METRO 2040 Population Distributed Forecast (2021, Exhibit A to Ordinance 21-1457).

Note: ACS 5-year estimates represent average characteristics from 2012-2016 or 2017-2021. Sampling error may result in low reliability of data. This information or data is provided with the understanding that conclusions drawn from such information are the responsibility of the user. Refer to the original source documentation to better understand the data sources, results, methodologies, and limitations of each dataset presented.

Community Lifelines

This section outlines the resources, facilities, and infrastructure that, if damaged, could significantly impact the public safety, economic conditions, and environmental integrity of the city. Community Lifelines are the most fundamental services in the community that, when stabilized, enable all other aspects of society to function. Mitigating these facilities will increase the community's resilience.

The community lifelines identified below were identified by the City of Lake Oswego. This integrated network of assets, services, and capabilities are used day-to-day to support the recurring needs of the community and enable all other aspects of society to function. Decisive intervention (e.g., rapid re-establishment or employment of contingency response solutions) is required to maintain/reestablish these facilities and services following a hazard incident.

Critical Facilities

Facilities that are critical and essential to government response, and recovery activities (i.e. life, safety, property, and environmental protection). These facilities include: 911 Centers, Emergency Operations Centers, Police and Fire Stations, Public Works facilities, sewer, and water facilities, hospitals, bridges, roads, shelters, and more. Table LO-4 includes critical facilities identified in the DOGAMI Risk Report (2024) and assumed impact from individual hazards.

Table LO-4 Critical Facilities

Critical Facilities by Community	Flood 1% Annual Chance	CSZ 9.0 Earthquake Moderate to Complete Damage	Canby-Molalla Fault Mw-6.8 Moderate to Complete Damage	Landslide High and Very High Susceptibility	Wildfire High or Moderate Risk
	Exposed	>50% Prob.	>50% Prob.	Exposed	Exposed
Bethlehem Christian Preschool	-	-	X	-	-
Forest Hills Elementary School	-	X	X	-	-
Hallinan Elementary School	-	-	X	-	-
Harmony Academy	-	X	X	-	-
International Leadership Academy	-	X	X	-	-
Lake Grove Elementary School	-	-	X	-	-
Lake Oswego Fire Department - Station 210 Westlake	-	-	-	-	-
Lake Oswego Fire Department - Station 211 Jean Road	-	X	X	-	-
Lake Oswego Fire Department - Station 212 South Shore	-	-	-	-	-
Lake Oswego Fire Department - Station 214 Main Station and Admin.	-	-	-	-	-
Lake Oswego Middle School	-	-	-	-	-
Lake Oswego Police Department	-	X	X	-	-
Lake Oswego Public Works	-	X	X	-	-
Lake Oswego High School	-	X	X	-	-
Lakeridge High School	-	X	X	-	-
Lakeridge Middle School	-	X	X	-	-
Legacy Medical Group - Lake Oswego	-	-	-	-	-
Mountain Park Kindercare	-	-	-	-	-
Oak Creek Elementary School	-	-	-	-	-

Critical Facilities by Community	Flood 1% Annual Chance	CSZ 9.0 Earthquake Moderate to Complete Damage	Canby-Molalla Fault Mw-6.8 Moderate to Complete Damage	Landslide High and Very High Susceptibility	Wildfire High or Moderate Risk
	Exposed	>50% Prob.	>50% Prob.	Exposed	Exposed
Our Lady of the Lake School	-	X	X	-	-
Palisades Elementary School	-	-	X	-	-
Park Academy	-	X	X	-	-
Portland - Tryon Creek WWTP	-	X	X	-	-
Providence Medical Group - Mercantile	-	X	X	-	-
River Grove Elementary School	-	X	X	-	-
Sonshine Express Preschool	-	-	-	-	-
Touchstone Elementary School	-	-	-	-	-
Uplands Elementary School	-	-	X	-	-
Village Montessori of Lake Oswego	-	-	-	-	-
West Hills Montessori School - Lake Oswego Campus	-	X	X	-	-
Westridge Elementary School	-	-	X	-	-
Westside Christian High School	-	-	-	-	-
Oswego Place Assisted Living		y	y		
The Pearl at Kruse Way		y	y		
The Springs at Carman Oaks		y	y		
The Springs Living at Lake Oswego		y	y		
Greenridge Estates		y	y		
The Stafford and Mary's Woods		y	y		

Source: DOGAMI, *Multi-Hazard Risk Report for Clackamas County, Oregon* (2024), Table A-24.
Note: Oswego Place Assisted Living, The Pearl at Kruse Way, The Springs at Carman Oaks, The Springs Living at Lake Oswego, Greenridge Estates, and The Stafford and Mary's Woods not included in the DOGAMI analysis. Hazard ranking providing by City (y).

Additional Critical Facilities not included in the DOGAMI Risk Report:

- City Hall (includes Police Department, 9-1-1 Center, and primary EOC)
- Adult Community Shelter
- Water Treatment Plant
- Tennis Center

Critical Infrastructure

Infrastructure that provides necessary services for emergency response include:

- Communications towers
- Fiber optic lines
- Highway 43 (State St.), McVey Avenue, Stafford Road
- Highway 43 (State St.) and Sucker Creek Bridge
- NW Natural gas pipelines and gas substations
- Oswego Lake dam and headgate
- Oswego Lake sanitary sewer interceptor
- Portland & Western Railroad
- Portland General Electric substations
- Transportation networks, including all major roads and all bridges including Country Club Rd, Boones Ferry Rd, and Kruse Way
- Tryon Creek Wastewater Treatment Plant, lift stations, and main lines

- Water treatment plant, water pumping stations, major water lines, reservoirs, water intake on Clackamas River

Essential Facilities

Facilities that are essential to the continued delivery of key government services, and/or that may significantly impact the public's ability to recover from the emergency. These facilities may include: community gathering places, commercial centers, and other public facilities such as school fields.

- Area Churches
- Forest Hills Elementary School
- Hallinan Elementary School
- Lake Grove Elementary School
- Lake Oswego High School
- Lakeridge High School
- Lakeridge Middle School
- Oak Creek Elementary School
- Our Lady of the Lake School
- Palisades Elementary School
- Park Academy
- River Grove Elementary School
- St Stephen's Academy South Campus
- Uplands Elementary School
- Westridge Elementary School
- Lake Oswego Public Library
- Lake Oswego Tennis Center
- Lake Oswego Municipal Golf Course

Environmental Facilities

Environmental assets are those parks, green spaces, wetlands, and rivers that provide an aesthetic and functional ecosystem service for the community include: Bryant Woods Park, Canal Acres Natural Area, Cook's Butte Park, Foothills Park, Freepons Park, George Roger Park, Hallinan Natural Area, Iron Mountain Park, Lake Grove Swim Park, Lake Oswego Hunt Club, Luscher Farm, Millennium Plaza Park, Oswego Lake, Oswego Lake Country Club Golf Course, River Run Park, Roehr Park, Rossman Park, Southwood Park, Springbrook Park, Sundeleaf Park, Tryon Cove Park, Tryon Creek State Natural Area, Tualatin River, East Waluga Park, West Waluga Park, Westlake Park, and the Willamette River.

Vulnerable Populations

Vulnerable populations, including seniors, disabled citizens, women, and children, as well those people living in poverty, often experience the impacts of natural hazards and disasters more acutely. Populations that have special needs or require special consideration include:

Adult Care Facilities

- Abby's Adult Foster Care
- Always Caring
- Autumn Health Care II
- Best Family Care
- Cherry Crest Adult Care Home
- Daniel's Adult Care Home
- Eva & Gabriel Adult Care Home
- Felisia's Adult Care Home
- Greenridge Estates
- Greentree Adult Care
- Home Health for Life
- Hillside Home Adult Care
- Hope's Sweet Home
- Indian Springs Adult Care Home
- Lake Oswego Care
- Home Lake Oswego
- Comfort Living Loving
- Care Adult Care Home
- Lucky's Home
- Mary's Woods
- Oswego Care Home LTD
- Oswego Place Assisted Living
- Oswego Pointe Adult Care Home
- Rosewood Inn Adult Foster Care

- Sunshine Adult Foster Care
- The Pearl at Kruse Way
- The Stafford
- The Springs at Carman Oaks
- The Springs Living at Lake Oswego

Child Care Centers

- Bethlehem Church Pre-School
- Child's View Montessori
- Christ Church Episcopal Preschool
- Community Arts Pre-School
- DropNPlay
- Early Years Children's Center
- International Leadership Academy
- KCE Champions LLC (Palisades)
- KCE Champions LLC (Westridge)
- Kiddie Care Child Care
- KinderCare (Lake Grove)
- KinderCare (Monroe Pkwy)
- King's Children Preschool
- Lake PreK
- Maayan Ha Torah Day School
- Maple Street Kids
- Noah's Arc Pre-School
- Oswego Play School
- Our Lady of the Lake Extended Care
- Palisades School
- Play Boutique/Peake Academy
- Pipster Prep Lake Oswego
- Riverdale After School Program
- Sonshine Express Pre-School and Kindergarten
- Sprout & Spark School
- Storybook Daycare
- The Children's Hour Academy
- The Play School at Mt. Park
- Village Montessori
- West Hills Montessori
- Westridge Elementary School

Hazardous Materials

Facilities that, if damaged, could cause serious secondary impacts may also be considered "critical." Hazardous materials sites are particularly vulnerable to earthquake, landslide, volcanic event, wildfire, and winter storm hazards. A hazardous material facility is one example of this type of critical facility. Those sites that store, manufacture, or use potentially hazardous materials include: Gas Stations, Biotronics, Bus Barn School District, Interstate 5, Lakeshore Concrete Co., Portland Willamette Railroad, Quest Corporation, State Highway 43, Taylor Made Labels Inc., Verizon Northwest Inc., Water Treatment Plant (in West Linn).

Economic Assets/Population Centers

Economic assets include businesses that employ large numbers of people and provide an economic resource to the city of Lake Oswego. If damaged, the loss of these economic assets could significantly affect economic stability, and prosperity. Population Centers usually are aligned with economic centers, and are a concern during evacuation/notification during a hazard event include: City Hall, Meadows Road and Center Pointe Complex, School District, SW Employment Area (Industrial Zone).

Cultural and Historic Assets

The cultural and historic heritage of a community is more than just tourist charm. For families that have lived in the city for generations and new resident alike, it is the unique places, stories, and annual events that makes the community an appealing place to live. The cultural and historic assets are both intangible benefits and obvious quality-of-life- enhancing amenities. Because of their role in defining and supporting the community, protecting these resources from the impact of disasters is important.

Examples of the types of properties that should be considered before, during, and after an event include the following properties:

- Allen House I and II
- Angler's Club
- Aquinas Hall
- Bickner Building
- Black House
- Brown-Vose House
- Bryant Home
- Marker
- Carl House
- Carmen House
- Carter House
- Christie School
- Clara Weinstein House
- Cleary House
- Collard House
- Conway House
- Davidson House
- Didzun House
- Eastman House
- Education Hall
- Erickson House
- F. Davidson House
- Flavia Hall
- Harris House
- Headrick-Carothers House
- Hofer House
- Iron Furnace Chimney
- Jantzen Estate
- Johnson Barn
- Klose House
- Laidlaw House
- Lake Grove Fire Station
- Lake Oswego Country Club
- Lake Oswego Hunt Club
- Lakewood School
- Larson School
- Log Hoist
- Lueg House
- Marylhurst Administration Building
- Marylhurst Cemetery/Alter
- McCall House
- McWaters House
- Methodist Episcopal Church
- Mulder House
- Murphy Company Building
- Noel Dew House
- Odd Fellows Hall
- Old Mine Trail
- Parelius House
- Parron House
- Peg Tree
- Pioneer Cemetery
- Rogers Building I and II
- Rogers House
- Rosentreter House
- Sacred Heart School
- Shepard House
- Smith House
- St. Catherine's Dormitory
- Sundeleaf House
- Trueblood House
- Tualatin-Oswego Canal
- Tug Masters House
- Twinings House
- Van Houten House
- Vose House
- Waldfork House
- Warren House
- White House
- Worker's Cottage
- Worthington House

Hazard Characteristics

Drought

The HMAC determined that the City's probability for drought is **high** and that their vulnerability to drought is **low**. *The probability rating did not change and the vulnerability rating decreased since the previous version of this NHMP.*

Volume I, Section 2 describes the characteristics of drought hazards, history, as well as the location, extent, and probability of a potential event. Due to the climate of Clackamas County, past and present weather conditions have shown an increasing potential for drought.

Lake Oswego draws its main water supply from the Clackamas River intake facility in Gladstone, which is then treated at the Water Treatment Plant in West Linn.[5] The West Linn Water Treatment Plant was originally built in unincorporated Clackamas County for the City of Lake Oswego in the 1960s, it now

[5] Water Source, and System. Lake Oswego Tigard Water Partnership. Last visited 10/9/18. http://lotigardwater.org/?p=water-source-and-system

serves multiple jurisdictions-- including Tigard, and Lake Oswego. There was recently a project completed in October 2017 to increase the treated water capacity (to 38 million gallons per day) for residents of Lake Oswego, and Tigard.[6] The treatment plant has two different utility substations on the property for back up electricity, and has agreements with other treatment plants around the region for water use that creates redundancies within the water supply system for residents, and businesses. During the 2020 windstorm, both power sources at the water treatment plant were comprised. The Engineering Department is currently preparing the designs to develop onsite emergency backup power to the treatment plant and the water intake facility in Gladstone.

Vulnerability Assessment

Due to insufficient data and resources, Lake Oswego is currently unable to perform a quantitative risk assessment, or exposure analysis, for this hazard. For a list of facilities and infrastructure vulnerable to this hazard see the Community Assets Section and Table LO-44.

Future Projections

According to the Oregon Climate Change Research Institute "Future Climate Projections, Clackamas County,"[7] drought, as represented by low summer soil moisture, low spring snowpack, low summer runoff, and low summer precipitation, is projected to become more frequent in Clackamas County by the 2050s.

Increasingly frequent droughts will have economic and social impacts upon those who depend upon predictable growing periods (ranches, farms, vineyards, gardeners) as well as upon the price and availability of fresh vegetables. It may also stress local jurisdiction's ability to provide water for irrigation or commercial and household use.

Earthquake (Cascadia Subduction Zone)

The HMAC determined that the City's probability for a Cascadia Subduction Zone (CSZ) earthquake is moderate and that their vulnerability to a CSZ earthquake is high. *The probability and vulnerability rating did not change since the previous version of this NHMP.*

Volume I, Section 2 describes the characteristics of earthquake hazards, history, as well as the location, extent, and probability of a potential event. Generally, an event that affects the County is likely to affect Lake Oswego as well. The causes and characteristics of an earthquake event are appropriately described within Volume I, Section 2 as well as the location and extent of potential hazards. Previous occurrences are well documented within Volume I, Section 2 and the community impacts described by the County would generally be the same for Lake Oswego as well.

Within the Northern Willamette Valley/Portland Metro Region, three potential faults and/or zones can generate high-magnitude earthquakes. These include the Cascadia Subduction Zone, Gales Creek-Newberg-Mt Angel Structural Zone, Portland Hills Fault Zone, and the Canby-Lake Oswego Fault Zone (discussed in the crustal earthquake section).

Cascadia Subduction Zone

The Cascadia Subduction Zone is a 680-mile-long zone of active tectonic convergence where oceanic crust of the Juan de Fuca Plate is subducting beneath the North American continent at a rate of 4 cm per

[6] Lake Oswego-Tigard Water Treatment Plant. Public Works, City of West Linn. Last visited 10/9/18: https://westlinnoregon.gov/publicworks/lake-oswego-tigard-water-treatment-plant

[7] Oregon Climate Change Research Institute, *Future Climate Projections, Clackamas County, Oregon*. February 2023.

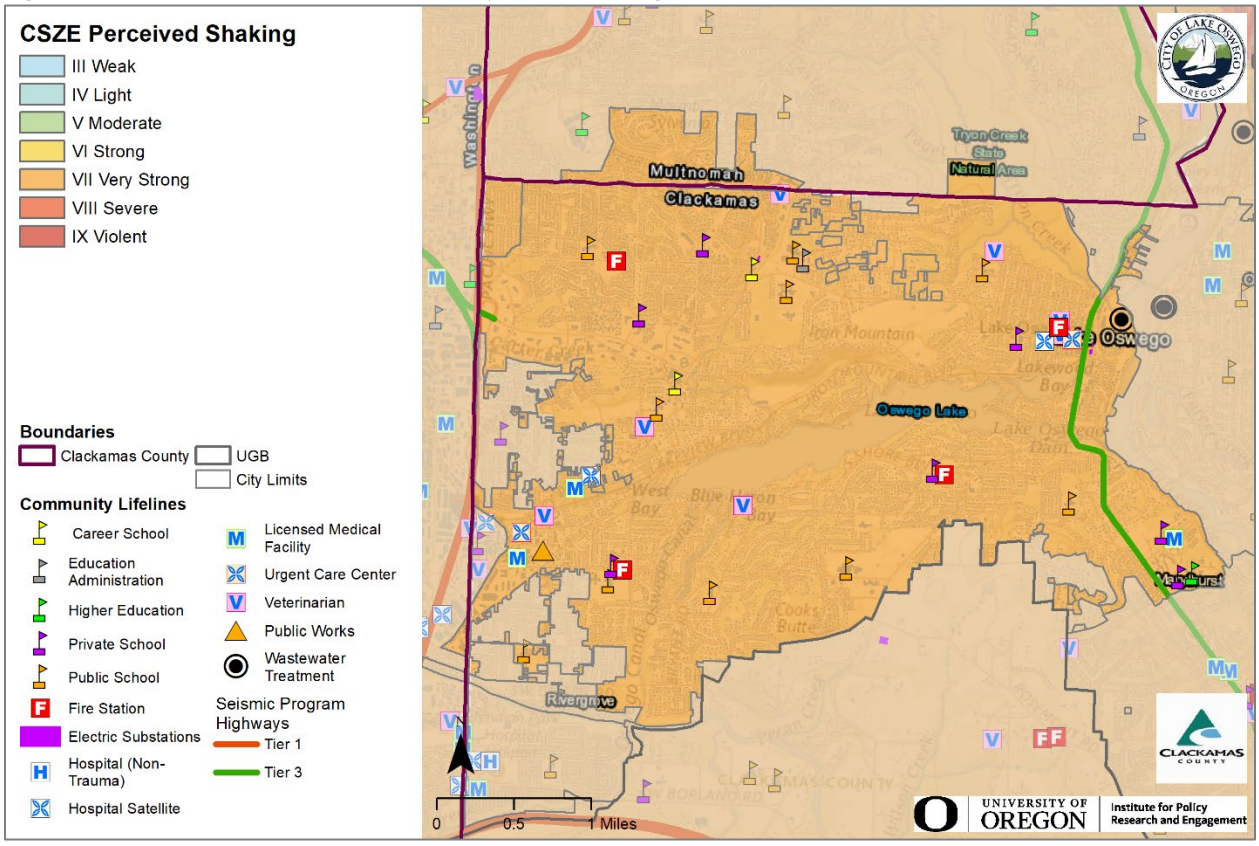
year. Scientists have found evidence that 11 large, tsunami-producing earthquakes have occurred off the Pacific Northwest coast in the past 6,000 years. These earthquakes took place roughly between 300 and 5,400 years ago with an average occurrence interval of about 510 years. The most recent of these large earthquakes took place in approximately 1700 A.D. [8]

The city's proximity to the Cascadia Subduction Zone, potential slope instability and the prevalence of certain soils subject to liquefaction and amplification combine to give the city a high-risk profile. Due to the expected pattern of damage resulting from a CSZ event, the Oregon Resilience Plan divides the State into four distinct zones and places the city predominately within the "Valley Zone" (Valley Zone, from the summit of the Coast Range to the summit of the Cascades). Within the Northwest Oregon region, damage and shaking is expected to be strong and widespread - an event will be disruptive to daily life and commerce and the main priority is expected to be restoring services to business and residents.

The City is not within the severe shaking area, though there is significant area around the City that have severe and very severe shaking if a large earthquake were to occur.

Figure LO-2 displays relative shaking hazards from a Cascadia Subduction Zone earthquake event. As shown in the figure, most of the city is expected to experience very strong shaking (orange), while areas around the city will experience severe shaking (light red) (shown by the red northeast corner) in a CSZ event.

Figure LO-2 Cascadia Subduction Zone Expected Shaking



Source: Map created by Oregon Partnership for Disaster Resilience.

[8] The Cascadia Region Earthquake Workgroup, 2005. Cascadia Subduction Zone Earthquakes: A magnitude 9.0 earthquake scenario. http://www.crew.org/PDFs/CREWSubductionZoneSmall.pdf

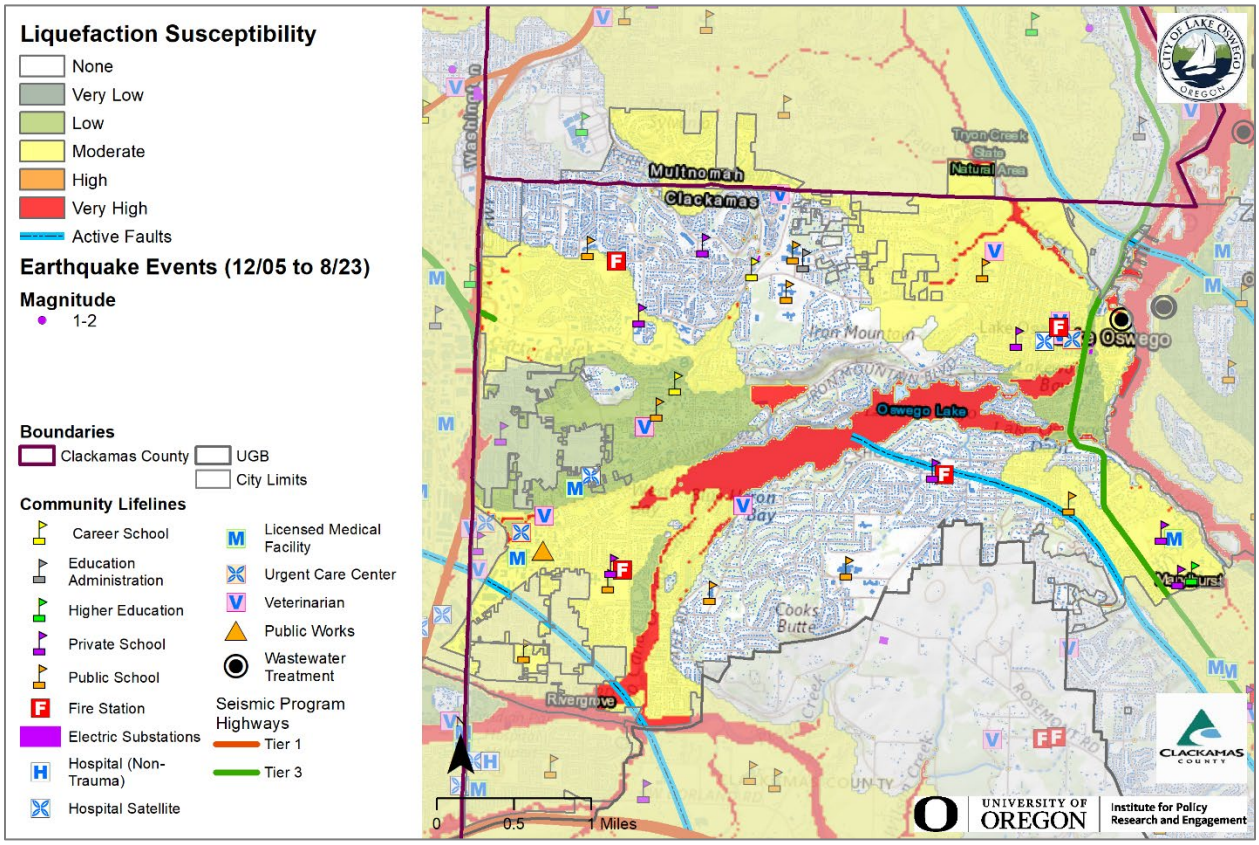
Data: Oregon Department of Geology and Mineral Industries. Preparedness Framework Implementation Team (IRIS v3).
Note: To view hazard detail click this link to access Oregon HazVu

Earthquake (Crustal)

The HMAC determined that the City's probability for a crustal earthquake is **low** and that their vulnerability to crustal earthquake is **high**. *These ratings did not change since the previous version of this NHMP.*

Volume I, Section 2 describes the causes and characteristics of earthquake hazards, history, as well as the location, extent, and probability of a potential event. Generally, an event that affects the County is likely to affect Lake Oswego as well. Figure LO-3 shows a generalized geologic map of the Lake Oswego area that includes the areas for potential regional active faults, earthquake history (1971-2008), and soft soils (liquefaction) hazard. The figure shows the areas of greatest concern within the City limits as red and orange.

Figure LO-3 Active Crustal Faults, Epicenters (1971-2008), and Soft Soils



Source: Map created by Oregon Partnership for Disaster Resilience.
Data: Oregon Department of Geology and Mineral Industries. Preparedness Framework Implementation Team (IRIS v3).
Note: To view hazard detail click this link to access Oregon HazVu

Earthquake-induced damages are difficult to predict, and depend on the size, type, and location of the earthquake, as well as site-specific building, and soil characteristics. Presently, it is not possible to accurately forecast the location or size of earthquakes, but it is possible to predict the behavior of soil at any site. In many major earthquakes, damages have primarily been caused by the behavior of the soil.

There are two potential crustal faults and/or zones near the City that can generate high- magnitude earthquakes. These include the Gales Creek-Mt. Angel Structural Zone (about 15 miles southwest of the city, not pictured) and the Portland Hills Fault Zone (about 3 miles northwest of the city, not pictured). The fault pictured in the southwest is the Canby-Molalla Fault, the Bolton Fault runs through Oswego Lake, and the Oatfield Fault is pictured in the northeast. More distant is the Mt. Hood Fault in eastern Clackamas County which has potential to impact Lake Oswego. Historical records count over 56 earthquakes in the Portland-metro area. The more severe ones occurred in 1877, 1880, 1953 and 1962. The most recent severe earthquake was the March 25, 1993 Scotts Mills quake. It was a 5.6 magnitude quake with aftershocks continuing at least through April 8.

Canby-Lake Oswego Fault Zone

The Canby-Lake Oswego Fault Zone is a series of NE-trending fault that vertically displace the Columbia River Basalt with discontinuous aeromagnetic anomalies that represent significant offset of Eocene basement and volcanic rocks. The fault zone extends for 31 miles from the vicinity of Tigard south through the towns of Canby and Lake Oswego in northern Oregon.

Portland Hills Fault Zone

The Portland Hills Fault Zone is a series of NW-trending faults that vertically displace the Columbia River Basalt by 1,130 feet and appear to control thickness changes in late Pleistocene (approx. 780,000 years ago) sediment. The fault zone extends along the eastern margin of the Portland Hills for 25 miles and lies about 3 miles northwest of Lake Oswego.

Vulnerability Assessment

In 2018 the Department of Geology and Mineral Industries (DOGAMI) completed a regional impact analysis for earthquakes originating from the Cascadia Subduction Zone and Portland Hills faults (O-18-02). Findings from that report are provided at the end of the crustal earthquakes hazard section.

City Hall, the Main Fire Station, and the Adult Community Center are critical facilities exposed to relative earthquake hazard Zone A, the highest hazard zone. Seismic design standards range by category from Seismic Zone 1 to Seismic Zone 4. Occupancy Category IV is the highest design standard achievable. Construction of the new City Hall was completed in September 2021. City Hall contains the City's law enforcement and emergency dispatch facilities as well as the City's primary Emergency Operations Center (EOC) and is considered an essential facility. City Hall was built to meet Category IV risk standards pursuant to Section 202 of the 2014 Oregon Structural Specialty Code. As such, it is intended to remain operational in the event of extreme environmental event, including flood, wind, snow, or earthquake. The Main Fire Station, and the main building of the new Maintenance Center, which houses the alternate EOC, were built to Occupancy Category IV standards, a step above the required standard for Seismic Zone 3. The Maintenance Center's vehicle barn/motor pool was built to Occupancy Category III standards. The Adult Community Center, which would serve as an emergency short-term shelter, has not had any seismic upgrades, and does not meet modern seismic standards.

Several Essential Facilities are in the high earthquake hazard zone. These facilities include the former Marylhurst University building, Lake Grove Elementary (proposed to be replaced, voter approval required). Our Lady of the Lake School, and several churches, which could potentially serve as Red Cross shelter sites.

Operation of and access to exposed infrastructure including the Oswego Lake headgate, City water pumping stations, a PGE substation and the communications towers located at City Hall, could potentially be impacted during an earthquake. Other exposed infrastructure including wastewater main lines, major water lines, natural gas pipeline and fiber optic lines are buried, however they are also vulnerable to damage from earthquake hazards, potentially limiting or delaying access for the purposes of operation or

repair. The fiber optic lines located along Highway 43/State Street, McVey Avenue and Stafford Road is a significant communication link for the entire region.

The City's fresh drinking water supply comes from the water treatment plant in West Linn and is in earthquake hazard Zone A (highest hazard), while the water intake located on the Clackamas River in Gladstone is in Zone C. The water line from the West Linn water treatment plant enters Lake Oswego along Highway 43, which crosses through earthquake Zone A. The water treatment plant and the intake have been upgraded to earthquake Zone 4 standards. There are 16 reservoirs serving Lake Oswego.

The three newest reservoirs, Touchstone II, McNary II, and Palisades II were constructed to earthquake Zone 4 standards.

The regional Emergency Transportation Route follows State Highway 43 from the northern City limits, and continues south on State Street to McVey Avenue, and then southwest to and along Stafford Road. The Emergency Transportation Route passes through earthquake hazard Zone A at the northern City limits along State Street, possibly impacting access to and from the City. The City, working with Clackamas County, is currently working on evacuation plans and zones based on key roadways, neighborhood and community areas, geographic features, and population.

Additionally, several the City's environmental assets are exposed to the high earthquake hazard. These include Iron Mountain Park, Canal Acres Natural Area, River Run Park, Glenmorrie Park, Foothills Park, Roehr Park, Rossman Park, and Tryon Creek State Natural Area.

Seismic building codes were implemented in Oregon in the 1970s; however, stricter standards did not take effect until 1991 and early 2000s. As noted in the community profile, approximately 69% of residential buildings were built prior to 1990, which increases the City's vulnerability to the earthquake hazard. Information on specific public buildings' (schools and public safety) estimated seismic resistance, determined by DOGAMI in 2007, is shown in Table LO-6; each "X" represents one building within that ranking category. Of the facilities evaluated by DOGAMI using their Rapid Visual Survey (RVS), zero (0) have a very high (100% chance) collapse potential, however, seven (7) schools have a high (greater than 10% chance) collapse potential.

For a list of facilities and infrastructure vulnerable to this hazard, see the Community Assets Section and Table LO-4. In addition to building damages, utility (electric power, water, wastewater, natural gas), and transportation systems (bridges, pipelines) are also likely to experience significant damage. There is a low probability that a major earthquake will result in failure of upstream dams.

Utility systems will be significantly damaged, including damaged buildings, and damage to utility infrastructure, including water treatment plants, and equipment at high voltage substations (especially 230 kV or higher which are more vulnerable than lower voltage substations). Buried pipe systems will suffer extensive damage with approximately one break per mile in soft soil areas. There would be a much lower rate of pipe breaks in other areas. Restoration of utility services will require substantial mutual aid from utilities outside of the affected area.

Table LO-5 Rapid Visual Survey Scores

Facility	Site ID*	Level of Collapse Potential			
		Low (<1%)	Moderate (>1%)	High (>10%)	Very High (100%)
Schools					
Bryant Elementary (4750 Jean Rd)	Clac_sch03	Closed in 2013			
Forest Hills Elementary^^ (1133 Andrews Rd)	Clac_sch04	(X)		X	
Hallinan Elementary (16800 Hawthorne Dr) **see mitigation successes**	Clac_sch05	X			
Lake Grove Elementary^^ (15777 Boones Ferry Rd)	Clac_sch06	(X)		X	
Lake Oswego Middle^ (2500 Country Club Rd) **see mitigation successes**	Clac_sch10	(X)		X	
Lake Oswego High (2501 Country Club Rd) **see mitigation successes**	Clac_sch12	X			
Lakeridge Junior High (4700 Jean Rd) **see mitigation successes**	Clac_sch11	Structure rebuilt ca. 2022			
Lakeridge High (1235 Overlook Dr) **see mitigation successes**	Clac_sch13	X			
Oak Creek Elementary (55 Kingsgate Rd) **see mitigation successes**	Clac_sch74	(X)		X	
Palisades Elementary (1500 Greentree Ave)	Clac_sch69		X		
Rivergrove Elementary^ (5850 McEwan Rd) **see mitigation successes**	Clac_sch07	(X)		X	
Uplands Elementary (2055 Wembley Park Rd) **see mitigation successes**	Clac_sch08		X		
Westridge Elementary (3400 Royce Way) **see mitigation successes**	Clac_sch09	X			
Fire Facilities					
Fire Department Station 210 Westlake (4900 Melrose St)	Clac_fir21	X			

Facility	Site ID*	Level of Collapse Potential			
		Low (<1%)	Moderate (>1%)	High (>10%)	Very High (100%)
Fire Department Station 211 Jean Road (4555 Jean Rd)	Clac_fir23	X			
Fire Department Station 212 South Shore (1880 S Shore Blvd)	Clac_fir07	X			
Fire Department Station 214 Main Station and Admin. (300 B Ave)	Clac_fir06	X			
Police Facilities					
Police Dept/ EOC/ City Hall (380 A Ave)	Clac_pol02	**Structure rebuilt ca. 2021**			

Source: DOGAMI 2007. Open File Report 0-07-02. Statewide Seismic Needs Assessment Using Rapid Visual Assessment.
"*" – Site ID is referenced on the RVS Clackamas County Map
Note 1: Collapse potential ratings indicated in parentheses (x) provided in 2008 by Froelich Consulting Engineers.
Note 2: ^ Phase 2 (2021) proposes to demolish and rebuild this school (voter approval required). Lake Oswego MS is scheduled to be rebuilt in 2025/2025. Will be built to a Category IV seismic level. Rivergrove Elementary school is currently being rebuilt (ca. 2024). Will be built to a Category IV seismic level.
Note 3: ^^ Phase 3 (2025) proposes to demolish and rebuild this school (voter approval required)

Earthquake Regional Impact Analysis

In 2018 DOGAMI completed a regional impact analysis for earthquakes originating from the Cascadia Subduction Zone and Portland Hills faults (O-18-02). Their study focused on damage to buildings, and the people that occupy them, and on two key infrastructure sectors: electric power transmission and emergency transportation routes. Each earthquake was studied with wet and dry soil conditions and for events that occur during the daytime (2 PM) and nighttime (2 AM). Impacts to buildings and people were tabulated at the county, jurisdictional (city), and neighborhood unit level. Estimated damage varied widely across the study area depending on local geology, soil moisture conditions, type of building, and distance from the studied faults. In general, damage from the Cascadia Subduction Zone scenario was greater in the western portion of the study area, however, damage could still be significant in some areas east of the Willamette River. The report found that damage to high-value commercial and industrial buildings was high since many of these facilities are in areas of high to very high liquefaction hazard. Casualties were higher during the daytime scenario (generally double) since more people would be at work and occupying non-wood structures that fare worse in an earthquake.

The Portland Hills fault scenario created greater damages than the Cascade Subduction Zone scenario due primarily to its placement relative to population centers and regional assets; however, at distances 15 or more miles from the Portland Hills fault the damages from the Cascadia Subduction Zone scenario generally were higher. In both the Cascadia Subduction Zone and Portland Hills Fault scenarios it is forecasted that emergency transportation routes will be fragmented, affecting the distribution of goods and services, conditions are worse under the Portland Hills Fault scenario. Portions of the electric distribution system are also expected to be impacted under both scenarios; however, the impact is considerably less than it is to the transportation routes. Additional capacity or redundancy within the electric distribution network may be beneficial in select areas that are likely to have greater impacts.

Table LO-6 shows the permanent resident population that are vulnerable to injury or death (casualty) and the buildings in the City that are susceptible to liquefaction and landslides, it does not predict that damage will occur in specific areas due to either liquefaction or landslide. More population and property

are exposed to higher degrees of expected damage or casualty under the Portland Hills Fault "wet" scenario than in any other scenario.

Table LO-6 Expected damages and casualties for the CSZ fault and Portland Hills fault: earthquake, soil moisture, and event time scenarios

	Cascadia Subduction Zone (M9.0)		Portland Hills Fault (M6.8)	
	"Dry" Soil	"Wet" Saturated Soil	"Dry" Soil	"Wet" Saturated Soil
Number of Buildings	13,770	13,770	13,770	13,770
Building Value ($ Million)	6,805	6,805	6,805	6,805
Building Repair Cost ($ Million)	337	523	1,877	2,377
Building Loss Ratio	5%	8%	28%	35%
Debris (Thousands of Tons)	134	184	552	685
Long-Term Displaced Populatio	220	1,207	3,243	6,391
Total Casualties (Daytime)	174	258	965	1,194
Level 4 (Killed)	8	12	53	65
Total Casualties (NIghttime)	50	130	418	659
Level 4 (Killed)	2	4	14	21

Source: DOGAMI, Earthquake regional impact analysis for Clackamas, Multnomah, and Washington Counties,Oregon (2018, O-18-02), Tables 12-8, 12-9, 12-10, and 12-11.

Cascadia Subduction Zone Scenario

The City of Lake Oswego is expected to have a 5% building loss ratio with a repair cost of $337 million under the CSZ "dry" scenario, and an 8% building loss ratio with a repair cost of $523 million under the "wet" scenario.[9] The city is expected to have around 174 daytime or 50 nighttime casualties during the CSZ "dry" scenario and 258 daytime or 130 nighttime casualties during the "wet" scenario. It is expected that there will be a long-term displaced population of around 220 for the CSZ "dry" scenario and 1,207 for the "wet" scenario.[10] (See Risk Report content for additional information.)

Portland Hills Fault Scenario

The City of Lake Oswego is expected to have a 28% building loss ratio with a repair cost of $1.877 billion under the Portland Hills Fault "dry" scenario, and a 35% building loss ratio with a repair cost of $2.377 billion under the "wet" scenario.[11] The long-term displaced population and casualties are greatly increased for all the Portland Hills Fault scenarios. The city is expected to have around 965 daytime or 418 nighttime casualties during the "dry" scenario and 1,194 daytime or 659 nighttime casualties during the "wet" scenario. It is expected that there will be a long-term displaced population of around 3,243 for the "dry" scenario and 6,391 for the "wet" scenario.[12]

Recommendations from the report included topics within Planning, Recovery, Resiliency: Buildings, Resiliency: Infrastructure Improvements, Resiliency: Essential and Critical Facilities, Enhanced Emergency Management Tools, Database Improvements, Public Awareness, and Future Reports. The recommendations of this study are largely incorporated within this NHMP's mitigation strategies (Table LO-1 and Volume I, Section 3). For more detailed information on the report, the damage estimates, and

[9] DOGAMI, Earthquake regional impact analysis for Clackamas, Multnomah, and Washington Counties, Oregon (2018, O-18-02), Tables 12-8 and 12-9.

[10] Ibid, Tables 12-8 and 12-9.

[11] Ibid, Tables 12-10 and 12-11

[12] Ibid, Tables 12-10 and 12-11.

the recommendations see: Earthquake regional impact analysis for Clackamas, Multnomah, and Washington Counties, Oregon (2018, O-18-02).

Natural Hazard Risk Report for Clackamas County

The Risk Report (DOGAMI, 2O24) [13] provides hazard analysis summary tables that identify populations and property countywide that are vulnerable to the earthquake hazard. According to the Risk Report the following population and property within the study area may be impacted by the profiled events:

Cascadia Subduction Zone event (M9.0 Deterministic): 752 buildings (15 critical facilities) are expected to be damaged for a total potential loss of $665 million (a loss ratio of about 8%). Over 1,000 residents may be displaced (about 3% of the population).

Crustal event (Canby-Molalla fault M6.8 Deterministic): 2,353 buildings are expected to be damaged (21 critical facilities), for a total potential loss of $1.5 billion (a loss ratio of about 17%). More than 2,600 residents may be displaced (about 7% of the population).

Future Projections

Future development (residential, commercial, or industrial) within Clackamas County will be at risk to earthquake impacts, although this risk can be mitigated by the adoption and enforcement of high development and building standards. Reducing risks to vulnerable populations should be considered during the redevelopment of existing properties.

Mitigation Activities

Earthquake mitigation activities listed here include current mitigation programs and activities that are being implemented by Lake Oswego agencies or organizations.

A primary mitigation objective is to construct or upgrade critical and essential facilities and infrastructure to withstand future earthquake events. The Main Fire Station, a critical facility which serves as an alternate to the City's Emergency Operations Center (EOC), was constructed to Seismic Zone 4 standards. The South Shore Fire Station recently underwent seismic upgrades, and upgrades have been completed at the West Lake and Jean Road Fire Stations to harden the apparatus bays. Seismic upgrades have also been made to the City's water treatment plant to ensure it remains operational after a magnitude seven earthquake. Additionally, school remodels must now include seismic upgrades and the installation of sprinkler systems.

City Hall which contains the police department and 9-1-1 dispatch center (LOCOM) and the City's primary EOC, was rebuilt to meet Category IV risk standards pursuant to Section 202 of the 2014 Oregon Structural Specialty Code in 2021. The City's Maintenance Center, which houses Public Works and Parks Maintenance, was rebuilt in 2017. The main building was built to category 4 seismic code (highest available) and the motor pool shop/vehicle barn was built to a category 3. Completed in 2017, the City's Water Treatment Plant, which serves the City of Lake Oswego and Tigard, was designed to seismic standards above current codes. In addition, the City's wastewater (sewer) interceptor system was completely rebuilt and seismically upgraded with the LOIS Project, including the overhead mains into the treatment plant.

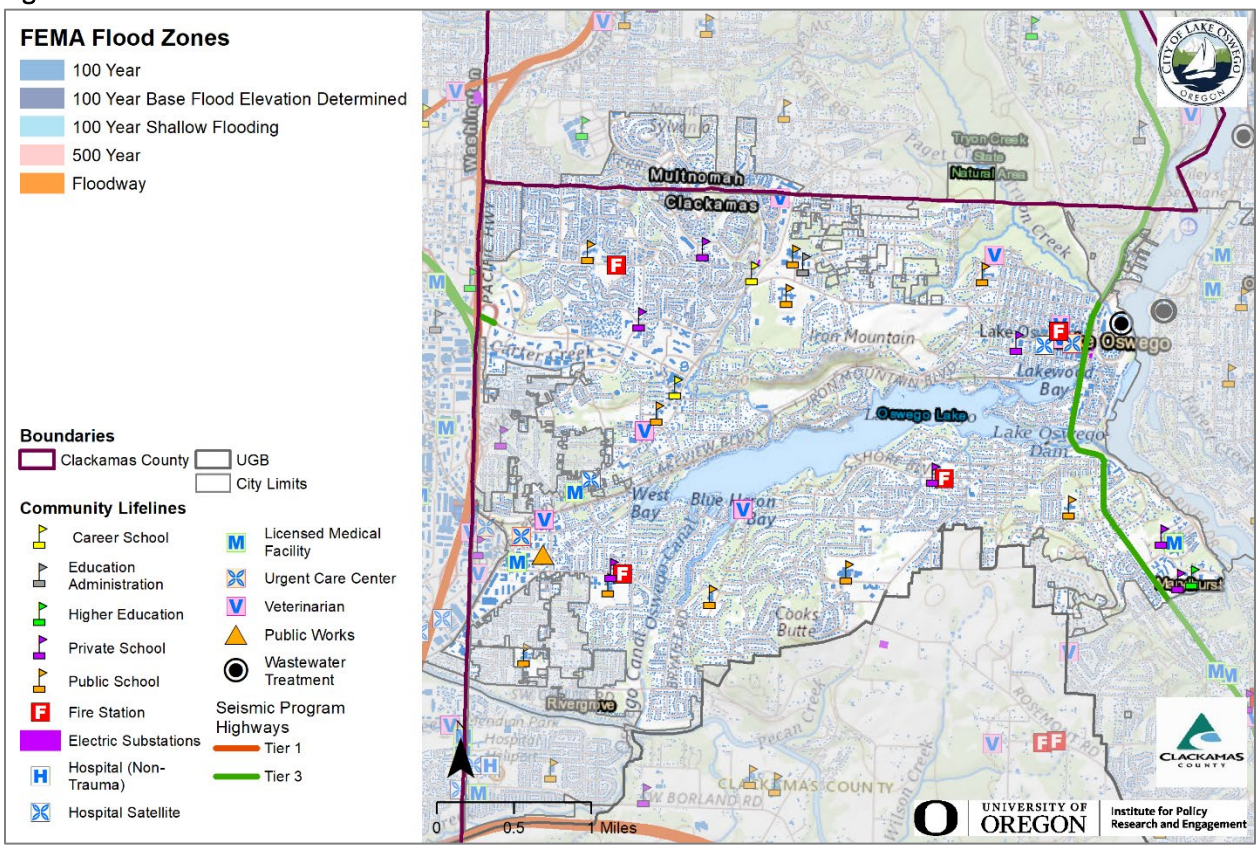
[13] DOGAMI, *Multi-Hazard Risk Report for Clackamas County, Oregon* (2O24), Table A-24.

Flood

The HMAC determined that the City's probability of flooding is **high** and that their vulnerability to flooding is **moderate**. *These ratings did not change since the previous version of this NHMP.*

Volume I, Section 2 describes the characteristics of flood hazards, history, as well as the location, extent, and probability of a potential event. Figure LO-4 illustrates the flood hazard area for Lake Oswego. Volume I, Section 2 describes the characteristics of flood hazards, history, as well as the location, extent, and probability of a potential event. Portions of Lake Oswego have areas of floodplains (special flood hazard areas, SFHA). These include areas include along Willamette River, Tualatin River, Oswego Canal, and Oswego Lake (Figure LO-4). Furthermore, other portions of Lake Oswego, outside of the mapped floodplains, are also subject to flooding from local storm water drainage.

Figure LO-4 FEMA Flood Zones



Source: Map created by Oregon Partnership for Disaster Resilience.
Data: Oregon Department of Geology and Mineral Industries. Preparedness Framework Implementation Team (IRIS v3).
Note: To view hazard detail click this link to access Oregon HazVu

Oswego Lake and Canal

Oswego Lake is three and a half miles long, with the main portion covering 385 acres, and an additional seven acres in West Bay and 28 acres in Lakewood Bay. The Lake is a reservoir and is privately owned and managed by the Lake Oswego Corporation, commonly known as The Lake Corporation. The Lake Corporation has owned and maintained the Lake since 1942. In addition to its natural resource values, Oswego Lake is a multiple-use facility that serves the community in a variety of roles. It is a hydroelectric reservoir at the center of a 7,400-acre drainage basin. The lake receives most of its water from streams,

storm drain outfalls, and surface runoff. Also, there is a City sanitary sewer interceptor below the lake's normal surface water elevation that has been constructed at an engineered grade to convey sewage to the Tryon Creek Sewage Treatment Plant. A spillover dam was completed in 1921 that raised the lake and greatly increased its size, creating Blue Heron Bay and West Bay on the west end of the lake, and Lakewood Bay on the east end. [14]

Floods can have a devastating impact on almost every aspect of the community, including private property damage, public infrastructure damage, and economic loss from business interruption. It is important for the City to be aware of flooding impacts and assess its level of risk. The City has been proactive in mitigating flood hazards by purchasing floodplain property.

The economic losses due to business closures often total more than the initial property losses that result from flood events. Business owners, and their employees are significantly impacted by flood events. Direct damages from flooding are the most common impacts, but indirect damages, such as diminished clientele, can be just as debilitating to a business.

For mitigation planning purposes, it is important to recognize that flood risk for a community is not limited only to areas of mapped floodplains. Other portions of Lake Oswego outside of the mapped floodplains may also be at relatively high risk from over bank flooding from streams too small to be mapped by FEMA or from local storm water drainage.

The City of Lake Oswego has been impacted by floods several times since incorporating in 1910. There have been at least six events in the past fifty years which have caused widespread damage. Flooding within the City has been caused by the Willamette River, Tualatin River, Oswego Canal, and Oswego Lake. The FEMA Flood Insurance Study (June 17, 2008) has a brief history of flooding in Clackamas County, and Lake Oswego (Volume I, Section 2).

The highest recorded flood levels on the Tualatin River were recorded on February 10, 1996. The period of record on this river only extends back to 1928. As measured from the Oswego Canal Inlet gage, this record flood reached an elevation of 120.12 feet (National Geodetic Vertical Datum of 1929, NGVD). Waters that normally flow from the Tualatin River into the Oswego Canal are regulated by the canal headgate structure which has a top of headgate height of 113.6 feet. Once Tualatin River levels exceeded the top of headgate, the water flows unimpeded into the canal, and northward to Oswego Lake. When the river reaches a level of 117.5 feet, water begins to leave the north banks of the Tualatin near the 5400 block of Dogwood Drive, and then migrates across Sycamore Avenue eventually rejoining the main Oswego Canal near Childs Road, and Bryant Woods Park.

In 2011-2012 the Oswego Lake Corporation completed a dam spillway modification project funded by a FEMA Flood Mitigation Assistance grant via the City of Lake Oswego. The project involved the installation of new, larger, spillway gates, sized to allow the passage to the 100-year flood flows. The project resulted in the lowering of the base flood elevation (BFE) by 3.5 feet (to 99.7 feet NGVD of 1929), which is below the top of the seawall on the main lake, Lakewood Bay, Westlake, and Blue Heron Canal. The Letter of Map Revision (LOMR) covering the entirety of Oswego Lake is effective as of August 31, 2012. Before the flood project the Lake Corporation's ability to release water at the east end of Oswego Lake was outstripped by the flows entering the lake from the Oswego Canal, and the lake level would rise uncontrollably. Dozens of homes, businesses, and boathouses were damaged by these floodwaters. Properties along Dogwood Drive, Melissa Drive, Canal Road, Pioneer Court, Bryant Road, Cardinal Drive, Kelok Road, Sarah Hill Lane, Lake Haven Drive, Canal Circle, many homes surrounding Oswego Lake

[14] Comprehensive Plan of the City of Lake Oswego. Adopted December, 1994

(including all bays, and canals), businesses along State Street from the railroad crossing south to North Shore Road, plus many apartments, businesses, and carports in the Oswego Pointe area all experienced severe water, and structural damage. With the completion of the dam spillway modification project flooding is no longer expected to happen to the homes surrounding Oswego Lake (including all bays, Blue Heron canal), businesses along State Street from the railroad crossing south to North Shore Road, plus many apartments, businesses, and carports in the Oswego Pointe area, with the exception that there might be some minor roadway flooding (less than a foot deep) on North Shore at North Shore Circle, Eena Road, and perhaps at South Shore Boulevard near the Gerber Pond.

Heavy rains following a severe winter storm from January 1 to 2, 2009 contributed to a sewer interceptor overflow on Cardinal Drive near Oswego Canal. Approximately 226,000 gallons of wastewater were sent out of the sewer system. Maintenance crews were able to capture about 75% of the discharge using vacuum trucks.

Record flooding is usually accompanied by low elevation snows in the Coast, and Cascade Mountain foothills. Often snow is on the ground at the 1,000' elevation, and sometimes it is even present all the way down to sea level. Larger than normal snow depths in the middle, easily melted, elevations such as 2000' to 3,500' are another major source of water runoff. These depths are frequently observed at the Saddle Mountain Snowtel station located at 3,250' in the Coast range of western Washington County. Both the 1964, and 1996 floods were preceded by a period of sub-freezing temperatures that caused the soils of the drainage basins to solidify and become relatively impervious.

Finally, there is a rainfall pattern known as the "Pineapple Express" which brings very heavy, and warm rains from the southwest. These warm rains begin their journey from parts of the Pacific near Hawaii, holding their heat, and moisture until making landfall along the Oregon coast. As an example, at 1 A.M. on the morning of February 8, 1996, the temperature had risen to 61°F with a driving rain following a period of freezing conditions. This warm rainstorm preceded the flood crest on the Willamette River by 2.5 days.

Vulnerability Assessment

The City of Lake Oswego GIS Department completed an analysis, using the best available data, as a component of the vulnerability assessment in 2013 and reviewed and updated it, as appropriate, in 2018. This analysis looked at identified hazard areas in conjunction with available data on property exposed to the hazard. Exposure of community assets to natural hazards was determined by manually comparing critical and essential facilities and infrastructure with each hazard and identifying where assets and hazards intersected.

While no essential or critical facilities are in the floodplain, several critical infrastructure and environmental assets are exposed to the flood hazard. Exposed critical infrastructure includes Tryon Creek Wastewater Treatment Plant, Oswego Lake sanitary sewer interceptor, Oswego Lake dam and headgate, Highway 43, McVey Avenue, wastewater main lines, water lines, NW Natural gas pipelines, the fiber optic line along Highway 43, several wastewater lift stations, and the Foothills power substation. Exposed environmental assets include Bryant Woods Park, Canal Acres Natural Area, Foothills Park, George Rogers Park, Iron Mountain Park, Lake Grove Swim Park, Lake Oswego Hunt Club, Lake Oswego Swim Park, Millennium Park, River Run Park, Roehr Park, and Tryon Creek State Park.

The Tryon Creek Wastewater Treatment Plant, located in the Foothills area, is located on a parcel that is affected by the Flood Management Area. In off-peak hours, the facility is remotely operated, reducing potential life safety issues from a flood hazard. However, flood conditions that result in a change in hydraulics could affect the operation of the facility.

The water transmission main from the intake on the Clackamas River in Gladstone is susceptible to flooding hazards. The transmission main is buried in the peninsula but can be exposed in a large flood, making it susceptible to damage. Additionally, prolonged periods of rain can cause the sewer interceptor system to back up and flow out of manholes and into Oswego Lake or onto streets near the lake.

The three wastewater main lines located in the Foothills area are elevated above ground level, potentially increasing susceptibility to flood damage. Other exposed infrastructure including wastewater main lines, natural gas pipeline and fiber optic lines are buried, decreasing their vulnerability to damage from flood hazards. However, these service lines and pipes could be exposed in large flooding events and become susceptible to damage. Hazardous flood conditions could potentially limit or delay access for the purposes of operation or repair. The fiber optic line located in Highway 43/State Street, McVey Avenue and Stafford Road is a significant communication link for the entire region.

The regional Emergency Transportation Route follows State Highway 43 from the northern City limits, and continues south on State Street to McVey Avenue, and then southwest along Stafford Road. This route crosses a bridge on McVey Road (Oswego Lake Outlet/McVey Ave. Bridge) that could be potentially affected during flood conditions. Culverts located along the Emergency Transportation Route could also be affected during hazardous conditions as flood waters could exceed the hydraulic capacity of the facility. For a list of facilities and infrastructure vulnerable to this hazard see the Community Assets Section and Table LO-4.

2024 Natural Hazard Risk Report for Clackamas County

The Risk Report (DOGAMI, 2O24) [15] provides hazard analysis summary tables that identify populations and property countywide that are vulnerable to the flood hazard.

According to the Risk Report, 82 buildings could be damaged for a total potential loss of $6.6 million (a building loss ratio of less than 1%). About 224 residents may be displaced by flood (less than 1% of the population).

National Flood Insurance Program (NFIP)

FEMA's Flood Insurance Study (FIS), and Flood Insurance Rate Maps (FIRMs) are effective as of June 17, 2008. The City complies with the NFIP through enforcement of their flood damage prevention ordinance and their floodplain management program. The last Community Assistance Visit (CAV) for Lake Oswego was on August 28th, 2003. Lake Oswego does not participate in the Community Rating System (CRS). The Community Repetitive Loss record (Table LO-7) identifies one (1) Repetitive Loss Property [16] and zero (0) Severe Repetitive Loss Properties [17]. For information on the location of the property see Volume I, Section 2, Figure 14.

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[15] DOGAMI, *Multi-Hazard Risk Report for Clackamas County, Oregon* (2O24), Table A-24.

[16] A Repetitive Loss (RL) property is any insurable building for which two or more claims of more than $1,000 were paid by the National Flood Insurance Program (NFIP) within any rolling ten-year period, since 1978. A RL property may or may not be currently insured by the NFIP.

[17] A Severe Repetitive Loss (SRL) property is a single family property (consisting of 1 to 4 residences) that is covered under flood insurance by the NFIP and has incurred flood-related damage for which 4 or more separate claims payments have been paid under flood insurance coverage, with the amount of each claim payment exceeding $5,000 and with cumulative amount of such claims payments exceeding $20,000; or for which at least 2 separate claims payments have been made with the cumulative amount of such claims exceeding the reported value of the property.

Table LO-7 Community Repetitive Loss Properties

RL #	RL or SRL Property	Occupancy	Mitigated?	Currently NFIP Insured	Rated Flood Zone	Post FIRM	Paid Claims	Total Paid Amount
86066	RL	Single Family	No	Yes	C	No	2	$52,587
						Total	**2**	**$52,587**

Source: FEMA Region X, Regional Flood Insurance Liaison, email February 23, 2023.

Future Projections

According to the Oregon Climate Change Research Institute "Future Climate Projections, Clackamas County,"[18] winter flood risk at mid- to low elevations in Clackamas County, where temperatures are near freezing during winter and precipitation is a mix of rain and snow, is projected to increase as winter temperatures increase. The temperature increase will lead to an increase in the percentage of precipitation falling as rain rather than snow. The projected increases in total precipitation, and in rain relative to snow, likely will increase flood magnitudes in the region. Vulnerable populations adjacent to floodways (including the unhoused, manufactured home communities, and campground occupants) will be more at risk as the winter flood risk increases.

Flood Mitigation Projects

Between 2009-2011, the City replaced the Lake Oswego Interceptor Sewer (LOIS), which is located in Oswego Lake. The project also involved seismic upgrades to the elevated wastewater mains that lead into the Tryon Creek Wastewater Treatment Plant.

The previous interceptor was undersized, resulting in overflows during heavy rains and was vulnerable during an earthquake. Replacement of LOIS was critical to ensuring the environmental protection of Oswego Lake and maintaining sewer service for residents. The project was identified in Lake Oswego's 2004 mitigation plan addendum.

Lake Oswego has completed a study to incrementally model the flood levels of the Tualatin River. The final product of this effort is the production of a series of flood inundation area maps that are based upon the level of the river as measured at the USGS "West Linn" gage station. The city will use these maps to provide critical information to the Emergency Operation Center and crews in the field in an effort to better manage flood response. The maps will allow for strategic allocation of resources necessary to evacuate specific areas, close threatened roads, set up detours and deploy sand bagging materials.

The Engineering Division is developing a drainage improvement plan for the First Addition Neighborhood. Currently, due to a lack of designed neighborhood-wide drainage system, rainwater does not drain properly and streets can flood in this neighborhood. The improvements include the design and construction of new storm drainage systems throughout the neighborhood. The new drainage systems will help to reduce the amount of roadway sediments and pollutants entering into the drainage system, by utilizing various methods such as pollution control manholes and catch basins, infiltration swales, and compost filters. The FAN drainage plan was completed and identifies several projects. The projects have been included in the city CIP Plan, and to date, several have been constructed.

In 2003, Lake Oswego commissioned a study, "Evaluation of Flood Management Alternatives for Oswego Lake and Canal" (Pacific Water Resources, Inc., June, 2003) which detailed strategies to help alleviate

[18] Oregon Climate Change Research Institute, *Future Climate Projections, Clackamas County, Oregon*. February 2023.

flooding of Oswego Lake. In the fall of 2009, the City completed a surface water master plan called the "Clean Streams Plan," a completed action item from the 2004 mitigation plan.

After the 1996 flood event the City of Lake Oswego commissioned a study, "Lakewood Bay Flood Protection at North Shore Road Bridge" (Pacific Water Resources, June 30, 2000), to evaluate the event of the 1996 flood and what impacts would be experienced by the main part of Oswego Lake if Lakewood Bay were isolated during a similar flood event. During a flood event, blocking the inlet of Lakewood Bay would stop flood waters from filling the bay and overtopping State Street (Highway 43), as occurred in 1996. During the 1996 flood, State Street was flooded and blocked for over a day, affecting emergency access to the eastern part of Lake Oswego. With improvements to the dam spillway in 2011-2012, the city will no longer need to consider blocking the flow path into Lakewood Bay. All flood flows (up to the 100-yr event) will spill over the dam.

During the flood event in 1996, the primary cause of the flooding in the Foothills Road area was due to two sources. Both sources have since been mitigated, as described below:

- A low point in the levy behind (north of) the Tryon Creek Treatment Plant allowed flood waters from the Tryon Creek/Willamette River to overtop the levy and enter the Foothills Road area. The City of Portland has since made repairs and improvements to address the problem.
- A large diameter storm drain pipe that receives runoff from an area of downtown (200+ acres) drains through the Toklat Industries parking lot and discharges into Tryon Creek. Flood waters from the Tryon Creek/Willamette River system backed up through this storm system, surcharging the manholes and catch basins, contributing to the flooding in the Foothills Road area. Subsequently, this problem has been rectified. Redundant check valves have been installed on the storm pipes to prevent back up, and two pump stations have been designed and built that will accept the runoff generated in the upstream drainage basin and "force" it into the drain pipe and through the submerged outlet.

The smaller pump station is an electric submersible pump, designed to handle runoff that accumulates at the Lakeshore Concrete site. Should power fail during a flood event, the pump is positioned so a trailer-mounted portable generator can be plugged into the control panel to provide backup power.

The other pump station is located at the north end of Toklat Industries parking lot. These are two variable speed pumps with a combined capacity of 5,000 GPM. Each pump is powered by a Ford six-cylinder engine, fueled with natural gas. In the event of a loss of supply of natural gas, the backup power source is a power take-off (PTO) drive that is mounted on the vertical drive shaft of the pumps. City Maintenance staff would then mobilize a piece of equipment that employs hydraulics (such as a back-hoe, tractor, or dump truck,) and plug in the quick-connect hoses (stored on site) into the PTO and the piece of mobile equipment.

These pumps were installed in the late 1990's and City Maintenance staff is familiar with their operation. These systems are inspected and exercised on a regular basis.

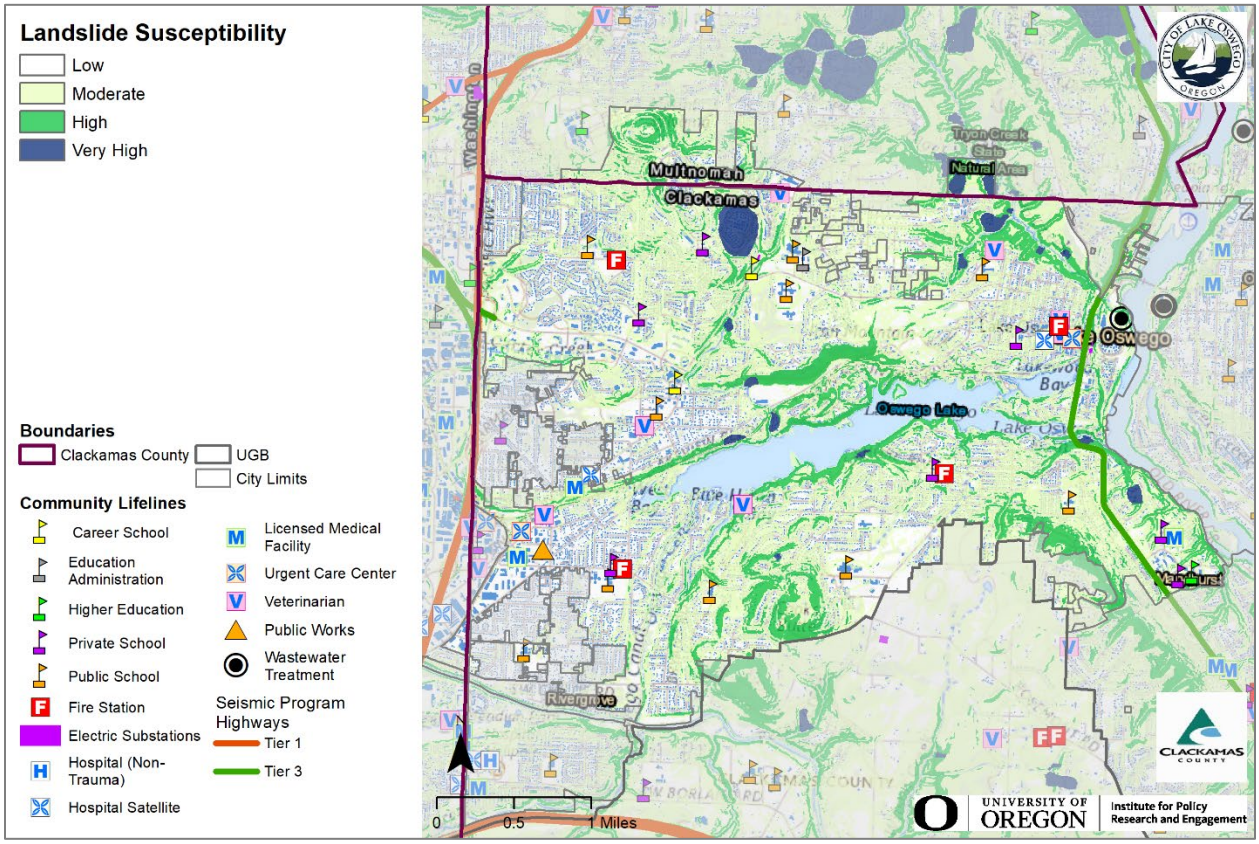
In 2011-2012 the Oswego Lake Corporation completed a dam spillway modification projected funded by a FEMA Flood Mitigation Assistance grant via the City of Lake Oswego (see above for more information).

Landslide

The HMAC determined that the City's probability for landslide is **high** and that their vulnerability to landslide is **low**. *These ratings did not change since the previous version of this NHMP.*

Volume I, Section 2 describes the characteristics of landslide hazards, history, as well as the location, extent, and probability of a potential event within the region. Most of Lake Oswego demonstrates a low to moderate landslide susceptibility exposure, with an area of high exposure around Mountain Park. Approximately 14% of Lake Oswego has very high or high, and approximately 44% moderate, landslide susceptibility exposure. The City's wastewater main lines, major water lines, and fiber optic lines are identified as being especially vulnerable. Landslide susceptibility exposure for Lake Oswego is shown in Figure LO-5.

Figure LO-5 Landslide Susceptibility Exposure



Source: Map created by Oregon Partnership for Disaster Resilience.
Data: Oregon Department of Geology and Mineral Industries. Preparedness Framework Implementation Team (IRIS v3).
Note: To view hazard detail click this link to access Oregon HazVu

The City's drinking water supply comes from the 38 million gallon per day Lake Oswego - Tigard Water Treatment Plant. Located in West Linn, the plant uses water sourced from the Clackamas River in Gladstone to serve Tigard and Lake Oswego. Electricity for the water treatment plant is provided through separate connections located on its property with two utility substations. There are also agreements with other regional water suppliers for back up sources of drinking water.

The water line from the City's water treatment plant located in West Linn enters the City along Highway 43, and runs north through George Rogers Park, an area vulnerable to landslide hazards. The fiber optic

line located in Highway 43/State Street, McVey Avenue, and Stafford Road is a significant communication link for the entire region.

The last major landslide event occurred in 2009 when a large landslide originated from the slopes above Green Bluff Drive in the Marylhurst area and slid into a home on Woodhurst Place just after 1:00am. Twenty-one homes, and twenty-eight people were evacuated, while five people were transported to the hospital. The Adult Community Center was opened to accommodate families in need of shelter. A second slide down the hill from Green Bluff damaged another home, and the right of way. A third slide on Oak Street deposited earth onto the road and diverted runoff to the properties downhill. Additional landslide events occurred on February 2, 2008 in George Rogers Park, leading to the closure of the pathway between George Rogers Park and Old River Road for five months; in 2008 on Green Street; in December 2007, a rain event led to three slides on Iron Mountain Boulevard and Green Bluff; in 2007 on Eagle Crest Drive and Glenmorrie Drive; in 2006 on Royce Way, Oak Street, and Laurel Street; and in 2004 on Kerr Parkway, Del Prado Street, and Oak Terrace.

Vulnerability Assessment

DOGAMI completed a statewide landslide susceptibility assessment in 2016 (O-16-02).

Potential landslide-related impacts are adequately described within Volume I, Section 2, and include infrastructure damages, economic impacts (due to isolation, and/or arterial road closures), property damages, and obstruction to evacuation routes. Rain-induced landslides, and debris flows can potentially occur during any winter, and thoroughfares beyond City limits are susceptible to obstruction as well. For a list of facilities and infrastructure vulnerable to this hazard see the Community Assets Section and Table LO-4.

Note that even if a jurisdiction has a high percentage of area in a high or very high landslide exposure susceptibility zone, this does not mean there is a high risk, because risk is the intersection of hazard, and assets.

The most common type of landslides are slides caused by erosion. Slides move in contact with the underlying surface, are generally slow moving, and can be deep. Rainfall-initiated landslides tend to be smaller; while earthquake induced landslides may be quite large. All soil types can be affected by natural landslide triggering conditions.

The Adult Community Center, a critical facility, is within a potential landslide area and is exposed to landslide hazards. However, the portion of the parcel that contains the Adult Community Center is relatively flat, while the undeveloped rear portion of the parcel is at the top of a steep slope leading down to Tryon Creek, thereby minimizing risks of the facility to the landslide hazard. The Hallinan School and Westridge Elementary are essential facilities exposed to the landslide hazard.

Exposed infrastructure including wastewater main lines, major water lines and fiber optic lines are buried, decreasing their vulnerability to damage from landslide hazards. However, hazardous landslide conditions could potentially damage the infrastructure and limit or delay access for the purposes of operation or repair. The City's fresh drinking water supply comes from the water treatment plant in West Linn, with the water intake located on the Clackamas River in Gladstone. The water line from the City's water treatment plant located in West Linn enters the City along Highway 43 and runs north through George Rogers Park, an area vulnerable to landslide hazards.

The fiber optic line located in Highway 43/State Street, McVey Avenue and Stafford Road is a significant communication link for the entire region. Exposed environmental assets include George Rogers Park, Iron Mountain Park, Lake Oswego Hunt Club, Lake Oswego Swim Park, and Tryon Creek State Natural Area.

The regional Emergency Transportation Route follows State Highway 43 from the north City limits, and continues south on State Street to McVey Avenue, and then southwest along Stafford Road. At the northern City limits, the Emergency Transportation Route along State Street passes through a potential landslide area, possibly impacting access to and from the City.

The portion of Lake Oswego in Multnomah County, primarily the northern part of the Mountain Park neighborhood, contains steep slopes that are potentially susceptible to landslide hazards. Additionally, a communications tower that is used for emergency communications is in this area on Mt. Sylvania.

Natural Hazard Risk Report for Clackamas County

The Risk Report (DOGAMI, 2024) [19] provides hazard analysis summary tables that identify populations and property countywide that are vulnerable to the landslide hazard.

According to the Risk Report 1,305 buildings (no critical facilities) are exposed to the *high and very high landslide susceptibility* hazard for a total exposure of $791.5 million (a building exposure ratio of about 9%). About 4,500 residents may be displaced by landslides (about 11% of the population).

Future Projections

Landslides are often triggered by rainfall when the soil becomes saturated. As a surrogate measure of landslide risk, the Oregon Climate Change Research Institute report presents a threshold based on recent precipitation (cumulative precipitation over the previous 3 days) and antecedent precipitation (cumulative precipitation on the 15 days prior to the previous 3 days). By the 2050s under the higher emissions scenario, the average number of days per year in Clackamas County on which the landslide risk threshold is exceeded is not projected to change substantially. However, landslide risk depends on multiple factors, and this metric, which is based on precipitation, does not reflect all aspects of the hazard. Additional triggers, such as earthquakes, wildfires, or development, can increase risks of landslides. Future development along slopes or adjacent to riverbanks will be a greater risk of impact from this hazard.

Severe Weather

Severe weather can account for a variety of intense, and potentially damaging hazard events. These events include extreme heat, windstorms, and winter storms. The following section describes the unique probability, and vulnerability of each identified weather hazard.

Extreme Heat

The HMAC determined that the City's probability for extreme heat events is **moderate** and that their vulnerability is **moderate**. *The probability rating increased and the vulnerability rating did not change since the previous version of this NHMP.*

Volume I, Section 2 describes the characteristics of extreme heat, history, as well as the location, extent, and probability of a potential event within the region. Generally, an event that affects the County is likely to affect the City as well.

A severe heat episode or "heat wave" occurs about every two to three years, and typically lasting two to three days but can last as many as five days. A severe heat episode can be defined as consecutive days of upper 90s to around 100. Severe heat hazard in the Portland metro region can be described as the

[19] DOGAMI, *Multi-Hazard Risk Report for Clackamas County, Oregon* (2024), Table A-24.

average number of days with temperatures greater than or equal to 90-degrees, or 100-degrees, Fahrenheit. On average the region experiences 13.6 days with temperatures above 90-degrees Fahrenheit, and 1.4 days above 100-degrees Fahrenheit, based on new 30-year climate averages (1981-2010) from the National Weather Service – Portland Weather Forecast Office.

The City of Lake Oswego has not experienced any life-threatening consequences from the few historical extreme heat events, although changes in climate indicate that the area should expect to see more extreme heat events. resulting from hazards.

Future Projections

According to the Oregon Climate Change Research Institute "Future Climate Projections, Clackamas County,"[20] the number, duration, and intensity of extreme heat events will increase as temperatures continue to warm. In Clackamas County, the number of extremely hot days (days on which the temperature is 90°F or higher) and the temperature on the hottest day of the year are projected to increase by the 2020s and 2050s under both the lower (RCP 4.5) and higher (RCP 8.5) emissions scenarios. The number of days per year with temperatures 90°F or higher is projected to increase by an average of 12 (range 3–21) by the 2050s, relative to the 1971–2000 historical baselines, under the higher emissions scenario. The temperature on the hottest day of the year is projected to increase by an average of about 7°F (range 2–11°F) by the 2050s. Higher temperatures and longer/more extreme heat events will have negative impacts upon vulnerable populations such as those over 65+, children, those living in older or temporary housing, and field workers.

Windstorm

The HMAC determined that the City's probability for windstorm is moderate and that their vulnerability to windstorm is low. *The probability rating did not change and the vulnerability rating decreased since the previous version of this NHMP.*

Volume I, Section 2 describes the characteristics of windstorm hazards, history, as well as the location, extent, and probability of a potential event within the region. Because windstorms typically occur during winter months, they are sometimes accompanied by flooding and winter storms (ice, freezing rain, and very rarely, snow). Other severe weather events that may accompany windstorms, including thunderstorms, hail, lightning strikes, and tornadoes are generally negligible for Lake Oswego.

During a 2021 windstorm, wind caused one minor injury, property damage, power outages, and road closures due to falling tree limbs. Community members also reported flooding, including in the Lake Oswego Public Library. Additionally, both electric power sources at the West Linn Water Treatment Plant were compromised. The Engineering Dept is currently preparing a design to develop onsite emergency backup power to the treatment plant and the water intake facility in Gladstone.

Volume I, Section 2 describes the impacts caused by windstorms, including power outages, downed trees, heavy precipitation, building damages, and storm-related debris. Additionally, transportation and economic disruptions result as well.

Damage from high winds generally has resulted in downed utility lines, and trees usually limited to several localized areas. Electrical power can be out anywhere from a few hours to several days. Outdoor signs have also suffered damage. If the high winds are accompanied by rain (which they often are), blowing leaves, and debris clog drainage-ways, which in turn may cause localized urban flooding.

[20] Oregon Climate Change Research Institute, *Future Climate Projections, Clackamas County, Oregon*. February 2023.

Future Projections

Limited research suggests little if any change in the frequency and intensity of windstorms in the Northwest as a result of climate change. Those impacted by windstorms at present, including older residential or commercial developments with above-ground utilities, poor insulation or older construction, heavy tree canopies, or poor storm drainage, will continue to be impacted by windstorms in the future.

Winter Storm (Snow/Ice)

The HMAC determined that the City's probability for winter storm is **moderate** and that their vulnerability to winter storm is **moderate**. *The probability rating decreased and the vulnerability rating did not change since the previous version of this NHMP.*

Volume I, Section 2 describes the characteristics of winter storm hazards, history, as well as the location, extent, and probability of a potential event within the region. Severe winter storms can consist of rain, freezing rain, ice, snow, cold temperatures, and wind. They originate from troughs of low pressure offshore that ride along the jet stream during fall, winter, and early spring months. Severe winter storms affecting the City typically originate in the Gulf of Alaska or in the central Pacific Ocean. These storms are most common from November through March.

Major winter storms can, and have occurred in the Lake Oswego area, including in December 2008 with the largest winter storm in forty years. The storm led to significant power outages, eight water main breaks, and hazardous road conditions. The City contracted forces to assist in snow removal efforts. Additional recent winter storm (including wind) events occurred in 2021, December 2016/January 2017, January 2016, December 2015 (DR-4258), February 2014 (snow/ice), January 2009, December 2008, and December 2007.

During a winter snow/ice storm in 2021 power was lost throughout the City due to down trees impacting power lines. Water became a significant issue as power was lost at the River Intake Pump Station (RIPS). No permanent generator exists at this location cause extreme difficulty "wiring in" a generator during the weather event.

Most winter storms typically do not cause significant damage; however, they are frequent, and have the potential to impact economic activity. Road and rail closures due to winter weather are an uncommon occurrence but can interrupt commuter and commercial traffic as noted above.

Vulnerability Assessment

Due to insufficient data and resources, Lake Oswego is currently unable to perform a quantitative risk assessment, or exposure analysis, for the extreme heat, windstorm, and winter storm hazards. For a list of facilities and infrastructure vulnerable to these hazards see the Community Assets Section and Table LO-4.

Future Projections

According to the Oregon Climate Change Research Institute "Future Climate Projections, Clackamas County,"[21] cold extremes will become less frequent and intense as the climate warms. In Clackamas County, the number of cold days (maximum temperature 32°F or lower) per year is projected to decrease by an average of 6 (range -3– -8) by the 2050s, relative to the 1971–2000 historical baselines, under the

[21] Oregon Climate Change Research Institute, *Future Climate Projections, Clackamas County, Oregon*. February 2023.

higher emissions scenario. The temperature on the coldest night of the year is projected to increase by an average of 6°F (range 0– 11°F) by the 2050s.

The intensity of extreme precipitation is expected to increase as the atmosphere warms and holds more water vapor. In Clackamas County, the number of days per year with at least 0.75 inches of precipitation is not projected to change substantially. However, by the 2050s, the amount of precipitation on the wettest day and wettest consecutive five days per year is projected to increase by an average of 15% (range 0–31%) and 10% (range -1–26%), respectively, relative to the 1971–2000 historical baselines, under the higher emissions scenario.

Vulnerable populations will be more likely to experience the negative impacts of winter storms in the future, particularly the unhoused and the elderly.

Volcanic Event

The HMAC determined that the City's probability for a volcanic event is **low** and that their vulnerability to a volcanic event is **moderate**. *These ratings did not change since the previous version of this NHMP.*

Volume I, Section 2 describes the characteristics of volcanic event hazards, history, as well as the location, extent, and probability of a potential event within the region. Volcanoes are located near Lake Oswego, the closest of which are Mount Hood, Mount Adams, Mount Saint Helens, Mount Rainier, and the Three Sisters.

Vulnerability Assessment

Due to Lake Oswego's relative distance from volcanoes, the city is unlikely to experience the immediate effects that eruptions have on surrounding areas (i.e., mud and debris flows, or lahars). Depending on wind patterns and which volcano erupts, however, the city may experience ashfall. The eruption of Mount St. Helens in 1980, for example, coated the Willamette Valley with a fine layer of ash. If Mount Hood erupts, however, the city could experience a heavier coating of ash.

Future Projections

Although the science of volcano predictions is improving, it remains challenging to predict a potential volcanic event. Ash fall, which will be the greatest impact, will impact the entire County. Impacts will be felt hardest by property managers (ranches, farmers, etc.) and by those relying upon clean surface water (for drinking water production and irrigation).

Natural Hazard Risk Report for Clackamas County

The **Risk Report** (DOGAMI, 2024)[22] provides hazard analysis summary tables that identify populations and property countywide that are vulnerable to the volcanic event (lahar) hazard. The Risk Report did not identify population or property within the study area that may be impacted by the profiled volcanic event (lahar) hazard.

[22] DOGAMI, *Multi-Hazard Risk Report for Clackamas County, Oregon* (2024), Table A-24.

Wildfire

The HMAC determined that the City's probability for wildfire is **high**, and that their vulnerability to wildfire is **moderate**. *The probability rating increased and the vulnerability rating did not change since the previous version of this NHMP.*

The Clackamas County Community Wildfire Protection Plan (CWPP) is hereby incorporated into this NHMP addendum by reference, and it will serve as the wildfire section for this addendum. The following presents a summary of key information; refer to the full CWPP for a complete description, and evaluation of the wildfire hazard. Information specific to Lake Oswego is found in the following chapter: Chapter 9.8: Lake Oswego Fire Department.

Volume I, Section 2 describes the characteristics of wildland fire hazards, history, as well as the location, extent, and probability of a potential event within the region. The location and extent of a wildland fire vary depending on fuel, topography, and weather conditions. The forested hills within, and surrounding Lake Oswego are interface areas. High Priority Communities at Risk (CARs) include: Iron Mountain Bluff, Palisades, Cooks Butte Park, and Mountain Park. Medium priority CARs include: Tryon Creek State Park, Springbrook Park, and Waluga Park.[23] These areas are characterized by varying housing structures (often large houses on small lots, some with shake roofs), natural, and ornamental vegetation, and topography that may increase the risk for wildfire spreading.[24]

Most of the city has less severe (moderate or less) wildfire burn probability that includes expected flame lengths less than four-feet under normal weather conditions.[25] However, conditions vary widely and with local topography, fuels, and local weather (including wind) conditions. Under warm, dry, windy, and drought conditions expect higher likelihood of fire starts, higher intensity, more ember activity, and a more difficult to control wildfire that will include more fire effects and impacts.

Weather and urbanization conditions are primarily at cause for the hazard level. Lake Oswego has not experienced a wildfire within City limits, but the city has abundant wooded areas that are a concern in the case of a wildfire event. Figure LO-6 shows overall wildfire risk in Lake Oswego.

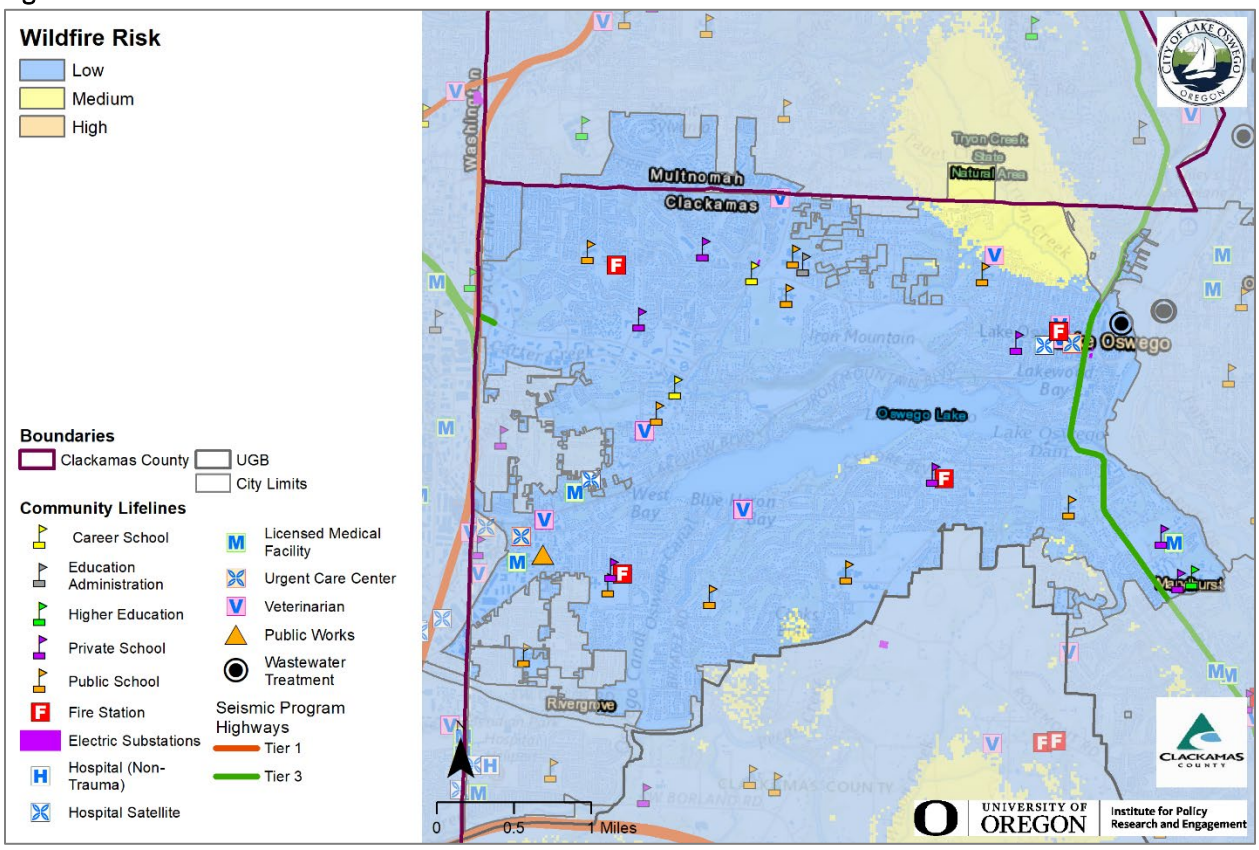
Clackamas County has two major physiographic regions: the Willamette River Valley in western Clackamas County and the Cascade Range Mountains in eastern and southern Clackamas County. The Willamette River Valley, which includes Lake Oswego, is the most heavily populated portion of the county and is characterized by flat or gently hilly topography. The Cascade Range has a relatively small population and is characterized by heavily forested slopes. Eastern Clackamas County is at higher risk to wildfire than western portions of the county due to its dense forest land. Human caused fires are responsible for most fires in Clackamas County.

[23] Clackamas County Community Wildfire Protection Plan, *Lake Oswego Fire Department* (2018), Table 10.8-1.

[24] Ibid.

[25] Oregon Wildfire Risk Explorer, date accessed November 9, 2018.

Figure LO-6 Wildfire Risk



Source: Map created by Oregon Partnership for Disaster Resilience.
Data: Oregon statewide wildfire risk map created by Oregon State University (unpublished). Preparedness Framework Implementation Team (IRIS v3).
Note: To view additional wildfire risk information click this link to access Oregon Explorer's CWPP Planning Tool

Vulnerability Assessment

The potential community impacts, and vulnerabilities described in Volume I, Section 2 are generally accurate for the City as well. Lake Oswego's fire response is addressed within the CWPP which assesses wildfire risk, maps wildland urban interface areas, and includes actions to mitigate wildfire risk. The City will update the City's wildfire risk assessment if the fire plan presents better data during future updates (an action item is included to participate in future updates to the CWPP).

Property can be damaged or destroyed with one fire as structures, vegetation, and other flammables easily merge to become unpredictable, and hard to manage. Other factors that affect ability to effectively respond to a wildfire include access to the location, and to water, response time from the fire station, availability of personnel, and equipment, and weather (e.g., heat, low humidity, high winds, and drought).

The Adult Community Center, a critical facility, is exposed to a high hazard wildfire area. The rear (northern) portion of the parcel is covered with trees, and slopes steeply down to Tyron Creek, potentially exposing the facility and limiting its availability as an emergency short- term site in the event of a wildfire. The South Shore Fire Station is another critical facility in the high wildfire hazard zone. Essential facilities exposed to high wildfire hazard include Oak Creek Elementary, Westridge Elementary, Hallinan Elementary, Uplands Elementary, Forest Hills Elementary, the area west of Lake Oswego Jr. High, portions of the former Marylhurst University campus, and several churches, which could potentially serve as Red Cross shelter sites.

Exposed infrastructure including wastewater main lines, major water lines, natural gas pipeline and fiber optic lines are buried, decreasing their vulnerability to damage from wildfire hazards. However, wildfire conditions could potentially limit or delay access for the purposes of operation or repair. The City's fresh drinking water supply comes from a water treatment plant in West Linn, with the water intake located on the Clackamas River in Gladstone. The water line from the City's water treatment plant in West Linn enters the City along Highway 43/State Street and runs north through George Rogers Park. This alignment includes areas that could be vulnerable to wildfire hazards. The fiber optic line located along Highway 43/State Street, McVey Avenue and Stafford Road is a significant communication link for the entire region. Operation of and access to other exposed infrastructure including the Oswego Lake headgate, several water pumping stations and reservoirs, a PGE substation in the Mountain Park area and communications towers used for emergency communications located on Cook's Butte and Mt. Sylvania, could be potentially impacted during a wildfire hazard.

The regional Emergency Transportation Route follows State Highway 43 from the northern City limits, and continues south on State Street to McVey Avenue, and then southwest to and along Stafford Road. The Emergency Transportation Route passes through several high wildfire hazard areas, at the northern City limits along State Street and McVey Avenue to the south, possibly impacting access to and from the City.

Several Lake Oswego's parks and open spaces are considered wildfire hazards. These include Bryant Woods Park, Canal Acres Natural Area, **Cooks Butte Park**, Freepons Park, George Rogers Park, Hallinan Natural Area, **Iron Mountain Park**, River Run Park, Roehr Park, Lake Grove Swim Park, Southwood Park, **Springbrook Park**, and **Waluga Park** (parks and open spaces denoted in **bold** are considered high or medium priority CARs within the CWPP, see above for more information). Fuels reduction priority areas identified in the CWPP include: Cooks Butte Park, Iron Mountain Bluff, Springbrook Park, Tryon Park, and Waluga Park.

For the portion of Lake Oswego in Multnomah County, primarily the northern part of the Mountain Park neighborhood, Lake Oswego Fire Department staff has determined that due to the steep slopes and wooded character of this neighborhood, the wildfire hazard ranges from moderate to high.

Natural Hazard Risk Report for Clackamas County

The **Risk Report** (DOGAMI, 2O24)[26] provides hazard analysis summary tables that identify populations and property countywide that are vulnerable to the wildfire hazard.

According to the Risk Report 233 buildings (no critical facilities) are exposed to the *high and (or) moderate (medium) risk wildfire* hazard for a total exposure of $124.8 million (a building exposure ratio of about 2%). About 765 residents may be displaced by wildfires (about 2% of the population).

Future Projections

According to the Oregon Climate Change Research Institute "Future Climate Projections, Clackamas County,"[27] wildfire frequency, intensity, and area burned are projected to continue increasing in the Northwest. Wildfire risk, expressed as the average number of days per year on which fire danger is very high, is projected to increase in Clackamas County by 14 (range -6– 34) by the 2050s, relative to the historical baseline (1971–2000), under the higher emissions scenario. Similarly, the average number of days per year on which vapor pressure deficit is extreme is projected to increase by 29 (range 10–44) by the 2050s. Communities at risk to wildfire include those within the urban wildfire interface or along river

[26] DOGAMI, *Multi-Hazard Risk Report for Clackamas County, Oregon* (2O24), Table A-24.

[27] Oregon Climate Change Research Institute, *Future Climate Projections, Clackamas County, Oregon*. February 2023.

or creek corridors, where fire can travel quickly. Communities will need to address growing wildfire risks if populations are not restricted from expanding further into higher risk areas.

Attachment A: Action Item Changes

Table LO-8 is an accounting of the status (complete or not complete) and major changes to actions since the previous NHMP. All actions were renumbered in this update to be consistent with other jurisdictions that are participating in the multi-jurisdictional NHMP. All actions marked not complete are ongoing, are still relevant, and are included in the updated action plan (Table LO-1).

Previous NHMP Actions that are Complete:
Multi-Hazard #3, "Address wireless communication deficiencies locally and regionally." Complete.

- In 2022, the Clackamas County Public Safety Radio Communications System replaced its outdated analog system with a new digital emergency radio system. This system is used by the multi-agency Clackamas 800 Radio Group (C800). The new digital radio system was funded in part from bond funds (Ballot Measure 3-476).
- In January 2024, City Council approved a contract with Motorola Solutions, Inc. to replacer 9-1-1 telephone and mapping equipment. The State Office of emergency Management will reimburse the cost through 9-1-1 state telephone fees.
- Lake Oswego's Emergency Operations Center (EOC) has been set up for Family Radio Service (FRS) and General Mobile Radio Service (GMRS) systems.

Multi-Hazard #5, "Upgrade Lake Oswego wastewater system." Complete.

- The Lake Oswego Interceptor Sewer (LOIS) was completed in June 2011. This project replaced the 20,000-foot interceptor pipe that forms the backbone of the City's sewer collection system and is in Oswego Lake. Sewer from roughly 75% of Lake Oswego households and businesses flows through the interceptor pipe to Portland's Tryon Creek Wastewater Treatment Facility in the Foothills area. (Note - An interceptor sewer line or pipe is a large sewer line that controls the flow of sewage to the treatment plant. It collects the sewage from main and trunk sewer pipes and carries it to the treatment plant.) The LOIS project included seismic upgrades to the new sewer main as well as seismic retrofits to the elevated sewer mains in the Foothills area.

Wildfire #2, "Develop and implement an Urban Forest Fire Management Plan. Complete.

In December 2022, the City Council adopted a Natural Area Habitat Management Plan. In the plan, Objective 4 - Reduce Wildfire Hazards states:

The natural areas that make Lake Oswego a beautiful and desirable place to live and work inherently come with the risk of wildfire by supplying a potential fuel source. Fire hazards are present when there is fuel (e.g., wood) combined with conditions related to local topography and seasonal weather, particularly relative humidity, heat, and wind. Lake Oswego's Fire Department website provides instructions for maintaining defensible space and fire-resistant plants along the interface between human developments and forested areas. The City's Addendum to the Multi-Jurisdictional Hazard Mitigation Plan lists wildfire hazards for neighborhoods bordering specific natural areas, including Iron Mountain Bluff, Palisades neighborhood, Tryon Creek State Park, Springbrook Park, and Waluga Park. In general, this objective is met by reducing fuels along the periphery of natural areas where they are adjacent to human developments. Because of the risk posed by fallen trees or debris generated during windstorms, the City should monitor the edges of these natural areas and identify hazards. Then, within one year or less, those

hazards should then be removed to the park interior or modified (e.g., chipped) to create a less hazardous condition.

Success Criteria: City will monitor applicable park boundaries at least once every two years and remove fire hazards observed within those boundaries within one year. Actions taken to thin dense vegetation and reduce woody debris piles within these edge areas will be documented in a Natural Areas Management Plan Effectiveness Monitoring Report once every five years.

For this action item, the City also:

- Ongoing - Target areas of brush and implement management strategies that are consistent with habitat protection requirements;
- Ongoing - Replace flammable non-native vegetation with native plants that are less flammable; and
- Completed - Enhance water storage facilities and water distribution systems (including hydrants) to serve the wild land/urban interface.

In addition, an early draft of the update to the City's Urban and Community Forestry Plan (UCFP) has been completed. The UCFP brings together policies, practices, and plans related to Lake Oswego's urban forest and serves as a planning and policy tool for managing our urban forest. The UCFP includes some high-level policy guidance related to fire. The final UCFP is expected to be adopted by City Council in Spring 2024.

The City's 2020 Sustainability and Climate Action Plan also contains information relating to wildfires, specifically, noting how proper management of forests will reduce the risk of wildfire events and protect natural resources.

Previous NHMP Actions that are Not Complete and No Longer Relevant:

None identified.

Table LO-8 Status of All Hazard Mitigation Actions in the Previous Plan

2019 Action Item	2024 Action Item	Status	Still Relevant? (Yes/No)
Multi-Hazard #1	#1	Not Complete, revised	Yes
Multi-Hazard #2	#2	Not Complete	Yes
Multi-Hazard #3	-	Complete	No
Multi-Hazard #4	#3	Not Complete	Yes
Multi-Hazard #5	-	Complete	No
-	#4	New	-
Earthquake #1	#5	Not Complete, revised	Yes
Flood #1	#6	Not Complete	Yes
Landslide #1	#7	Not Complete	Yes
Severe Weather #1	#8	Not Complete, revised	Yes
Wildfire #1	#9, #10	Not Complete	Yes
Wildfire #2	-	Complete	No
Wildfire #3	#11	Not Complete	Yes

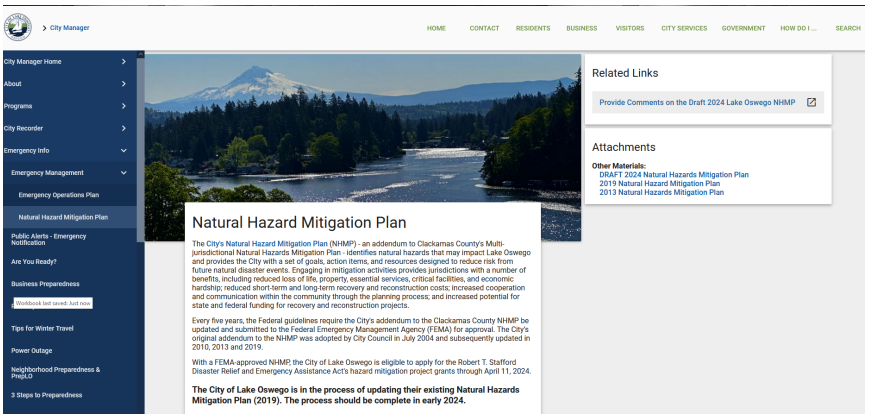
Attachment B: Public Involvement Summary

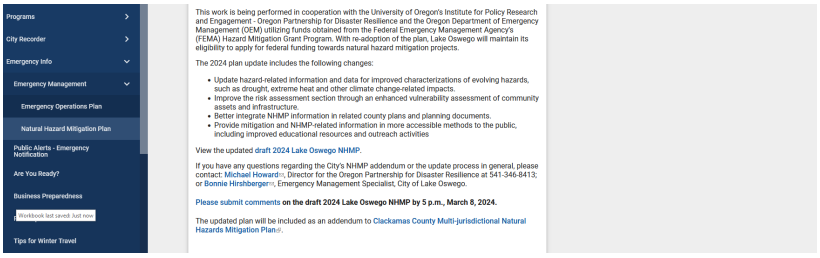
Members of the steering committee provided edits and updates to the NHMP prior to the public review period as reflected in the final document.

To provide the public information regarding the draft NHMP addendum, and provide an opportunity for comment, an announcement (see below) was provided from February 15 through March 8 on the City's website. The plan was also posted and announced on the County's website. There were several comments provided that have been reviewed and integrated into the NHMP as applicable. Additional opportunities for stakeholders and the public to be involved in the planning process are addressed in Volume III, Appendix B.

A diverse array of agencies and organizations were provided an opportunity to provide input to inform the plan's content through a variety of mechanisms including the opportunity for comment on the draft plan. The agencies and organizations represent local and regional agencies involved in hazard mitigation activities, those that have the authority to regulate development, neighboring communities, representatives of businesses, academia, and other private organizations, and representatives of nonprofit organizations, including community-based organizations, that work directly with and/or provide support to underserved communities and socially vulnerable populations. For more information on the engagement strategy see Volume III, Appendix B.

Website Posting





HMAC

The Hazard Mitigation Advisory Committee (HMAC) members possessed familiarity with the community and how it is affected by natural hazard events. The HMAC guided the update process through several steps including goal confirmation and prioritization, action item review and development, and information sharing, to update the NHMP and to make the NHMP as comprehensive as possible. The steering committee met formally on the following date:

Meeting #1: March 20 and May 30, 2023

During these meetings, the HMAC:

- Reviewed the previous NHMP, and were provided updates on hazard mitigation planning, the NHMP update process, and project timeline.
- Updated recent history of hazard events in the city.
- Reviewed and confirmed the County NHMP's mission and goals.
- Reviewed and provided feedback on the draft risk assessment update including community vulnerabilities and hazard information.
- Reviewed and updated their existing mitigation strategy (actions).
- Reviewed and updated their implementation and maintenance program.
- Discussed the NHMP public outreach strategy.

Meeting #2: November 13, 2023 (via remote conference)

During this meeting, the HMAC:

- Confirmed and provided feedback on the final draft risk assessment update including community vulnerabilities and hazard information provided by DOGAMI (Risk Report).
- Reviewed and confirmed the city's capabilities assessment.
- Reviewed, confirmed, and prioritized the city's mitigation strategies.