Annex E: City of North Plains

1. Introduction

1.1. Planning Process Contact

The point of contact during the Washington County Natural Hazard Mitigation Plan (NHMP) planning process for the City of North Plains was the City Manager.

1.2. Annex Organization

This annex includes six sections that satisfy mitigation requirements outlined in the Code of Federal Regulations (CFR) Title 44, Part 201 (44 CFR §201):

- **Section 1:** Introduction
- **Section 2:** Planning Process
- **Section 3:** Hazard Identification and Risk Assessment
- **Section 4:** Capability Assessment
- **Section 5:** Mitigation Strategy
- **Section 6:** Action Items

The information provided in this annex is for the City of North Plains alone. All pertinent information that is not identified in this annex is included in other sections of this NHMP or in the respective appendices.

1.3. NHMP Adoption Process

Once the Washington County NHMP received the designation “Approvable Pending Local Adoption” from the Federal Emergency Management Agency (FEMA), the City presented the plan to City Council for final public comment and local adoption. A copy of the resolution was inserted into the NHMP and is held on file in the City of North Plains and Washington County.

2. Planning Process

(In compliance with 44 CFR §201.6(c)(1))

2.1. Development and Adoption Process

To apply for certain types of federal aid, technical assistance, and most post-disaster funding, local jurisdictions and special districts must comply with 44 CFR §201.3, which sets forth the requirement that communities develop a plan outlining their present and proposed efforts to mitigate risks from natural hazards.

City officials recognize the benefits of having a long-term, all-hazards approach to mitigating natural hazards. The passage of the Disaster Mitigation Act of 2000 (DMA 2000) enabled City officials to recognize the benefits of having a long-term, all-hazards approach to hazard mitigation and mitigating natural hazards. The City's involvement in the Washington County NHMP represents the collective efforts of the NHMP Steering Committee members, all participating local Technical Committee members, the public, and stakeholders

The City developed this annex in accordance with guidance outlined in 44 CFR §201.6(c)(5) of DMA 2000. The complete NHMP and this annex identify hazards and mechanisms to minimize damages associated with these hazards as they occur in the geographical area of the City.

2.2. Organizing the Planning Effort

A comprehensive approach was taken in developing this NHMP. An open involvement process was established for the public and all stakeholders, which provided an opportunity for everyone to become engaged throughout the planning process and make known their views about perceived hazards and how best to mitigate them.

Two teams worked simultaneously throughout the development of this mitigation plan:

1. **Hazard Mitigation Steering Committee:** This committee consisted of points of contact from each planning participant. The group met to discuss county-wide topics, including hazards and mitigation strategies. The points of contact were the leads of their local Technical Committee.
2. **Local Technical Committee:** Each plan participant formed a Technical Committee that consisted of the Steering Committee representative for that jurisdiction or special district as well as designated representatives from special jurisdictions, county fire departments, and others. This team met to assess capabilities, hazards, and mitigation strategies within the planning area.

2.2.1. Technical Committee of the City of North Plains

The City of North Plains annex of the overall NHMP was developed by the local Technical Committee of the City of North Plains with support from IEM, a consulting firm hired to assist with the planning process. The efforts of the committee, which took place throughout 2022, were led by the City Manager.

Table 190: City of North Plains Technical Committee Members for the 2023 NHMP

Job Title and Department	Role in Committee and Planning Process
City Manager, City Manager's Office	General oversight, hazard identification, and plan development.
Public Works Director/Emergency Manager, Public Works Department	Hazard identification and plan development.

IEM also supported or led the following activities associated with the development, approval, and adoption of the plan:

1. Facilitated the NHMP update process.
2. Based on committee direction and stakeholder and community input, prepared the first draft of the plan and provided technical writing assistance for plan review, editing, and formatting.

3. Submitted the proposed plan to the State of Oregon Department of Emergency Management (OEM) and FEMA for review and approval, and completed edits or revisions requested by these organizations.
4. Coordinated the plan adoption processes with the City, OEM, and FEMA.

2.3. Public Participation

Public participation is an important component of this NHMP and also a required element as outlined in 44 CFR §201.6(c)(5), FEMA's mitigation planning guidance. Public participation offered community members the opportunity to voice their ideas, interests, and opinions about hazards that affect them and the best way to mitigate hazard impacts. As the City implements the mitigation actions identified in this annex, there will be additional opportunities for public participation.

Plan participants used a survey to collect information about community perceptions of natural hazards and priorities. The Steering and Technical Committees used the results to inform their risk assessments and mitigation strategies. Community members were also provided an opportunity to comment on a draft of the NHMP. See Appendix B in the NHMP for additional information about the survey and opportunities for public comment.

3. Hazard Identification and Risk Assessment

(In compliance with 44 CFR §201.6(c)(2)(i), §201.6(c)(2)(ii), §201.6(c)(2)(ii)(A), §201.6(c)(2)(ii)(B), §201.6(c)(2)(ii)(C), §201.6(c)(2)(iii), and §201.6(c)(3)(ii))

The following information serves to assist the City of North Plains in determining and prioritizing appropriate mitigation action items to reduce losses from identified hazards.

3.1. Community Profile

This section provides information on City-specific characteristics. Additional discussion of the planning area's community characteristics is outlined in Appendix A of the NHMP.

Some community characteristics may suggest how natural hazards may impact communities and how communities choose to plan for natural hazard mitigation. Identifying and considering the City-specific assets during the planning process may assist in identifying appropriate measures for natural hazard mitigation.

The following table reflects the community demographics and vulnerable populations in the City. This information was gathered from the U.S. Census, Portland State University, and the City of North Plains.

Table 191: Community Demographics*

Population	Total	Percent Change
2010 population[410]	1,928	
2021 population[411]	3,446	+79%
2035 forecasted population	6,190	+80%
Race and Ethnicity[412]	**Total**	**Percent of Population**
White alone	2,276	84%
Hispanic/Latino/a/x of any race	195	7%
Asian alone	160	6%
Two or more races	145	5%
Black or African American alone	102	4%
American Indian and Alaska Native alone	9	0.3%
Native Hawaiian and Other Pacific Islander alone	0	0%
Language Spoken at Home[413]	**Percent of Population**	
English only	89%	
Asian and Pacific Island languages	6%	
Indo-European languages	5%	
Spanish	1%	
Other languages	0%	
Vulnerable Age Groups[414]	**Percent of Population**	
Less than 15 years of age	12%	
65 years and older	15%	

[410] United States Census Bureau. (2010). 2010–2015 American Community Survey 5-Year Estimates, Demographic and Housing Estimates, Table DP05. Accessed October 7, 2022, from https://data.census.gov/cedsci/table?g=1600000US4153150&y=2010&tid=ACSDP5Y2010.DP05
[411] Portland State University Population Research Center. (2022). Population Estimate Reports. https://www.pdx.edu/population-research/population-estimate-reports
[412] United States Census Bureau. (2021, July 1). 2016–2020 American Community Survey 5-Year Estimates Demographic and Housing Estimates, Table DP05. Accessed September 21, 2022, from https://data.census.gov/cedsci/table?q=North%20Plains%20oregon&tid=ACSDP5Y2020.DP05
[413] United States Census Bureau. (2021, July 1). 2016–2020 American Community Survey 5-Year Estimates, Language Spoken at Home, Table S1601. Accessed September 21, 2022, from https://data.census.gov/cedsci/table?q=North%20Plains%20oregon%20language
[414] United States Census Bureau. (2021, July 1). 2016–2020 American Community Survey 5-Year Estimates, Age and Sex, Table S0101. Accessed September 21, 2022, from https://data.census.gov/cedsci/table?q=North%20Plains%20oregon%20language&tid=ACSST5Y2020.S0101

Disability Status	Percent of Population
Total	Data Not Available
Less than 17 years of age	Data Not Available
65 years and older	

* Due to how respondents identify and answer questions, there may be overlapping responses, and results may equal greater than 100% of the population. Percentages are rounded.

3.1.1. Geography, Topography, and Climate

The City of North Plains, Oregon, is a small, semi-rural city located in western Washington County. The City has an area of 1.09 square miles and has an elevation of 176 feet. The City is surrounded by agricultural land and wooded areas. The climate for North Plains is moderate. Mean daily temperatures range from highs of around 82 °F in August to lows of 34 °F in January. On average, the City receives approximately 41 inches of rain and 3 inches of snow per year.

3.1.2. Transportation, Infrastructure, and Housing

3.1.2.1. Transportation

North Plains is a small community located along US Highway 26, which connects it to the cities of Hillsboro and Portland. Arterial roads include NW Glencoe Road, which runs north–south, and NW Commercial Street, which runs east–west.

The City is served by Ride Connection Community Bus Service, which provides a free shuttle to the Tri-County Metropolitan Transit District (TriMet) public transportation system hub in Hillsboro, the western terminus of the 33-mile metropolitan light rail line that links Portland's west and east suburbs as well as the Portland International Airport. Portland & Western Railroad services the City and operates a 520-mile regional system of rail lines in western Oregon with freight capacity and Class 1 connections. There are spur line opportunities along the North Plains corridor.

3.1.2.2. Infrastructure

In North Plains, Clean Water Services provides wastewater treatment services. The power provider is Portland General Electric (PGE). PGE has a total combined generating capacity of 1,957 megawatts and they also operate several Reliability Centers throughout the region. NW Natural is the natural gas provider that serves residential, commercial, and industrial customers in western Oregon and southwest Washington.

The City of North Plains critical and vulnerable facilities listed below in Table 192 may be vulnerable to one or more natural hazards.

Table 192: Critical Facility and Asset Inventory[415]

Name of Infrastructure, Facility, or Resource	Type of Asset	Address	Comments
North Plains City Hall	Infrastructure or Facility	31360 NW Commercial Street	Soon to be moved to new larger building on #2 Water Station Site.
North Plains Water Station #1	Infrastructure or Facility	32175 NW Commercial Street	
North Plains Water Station #2	Infrastructure or Facility	29905 NW West Union Road	

3.1.2.3. Housing

Housing characteristics are an important factor in mitigation planning. The information below shows that most housing units are owner-occupied and consist of one-unit buildings built before 1999. The older the housing, the more at risk it can be to damage from natural hazards such as earthquakes and windstorms, including tornadoes.

The Census estimates North Plains grew 75% between 2010 and 2020. The city grew at nearly 6% per year, adding an average of 147 new residents each year.[416] Housing development has been increasing to meet this need. As of 2021, the City of North Plains had a total of 67 buildable residential acres by zoning designation.[417] Approximately 80% of housing in the City is predominantly single-family detached housing units.[418]

[415] City of North Plains NHMP planning documentation
[416] City of North Plains. (2022, February). Draft Economic Opportunities Analysis. https://www.northplains.org/sites/default/files/fileattachments/city_manager/page/786471/north_plains_eoa_report_append_3_30_22.pdf
[417] City of North Plains. (2022, April). City of North Plain Housing Needs Analysis Consolidated Report. https://www.northplains.org/sites/default/files/fileattachments/city_manager/page/786471/draft_north_plains_hna_04.06.22.pdf
[418] City of North Plains. (2022, April). City of North Plain Housing Needs Analysis Consolidated Report. https://www.northplains.org/sites/default/files/fileattachments/city_manager/page/786471/draft_north_plains_hna_04.06.22.pdf

Table 193: Housing Characteristics*

Households	Total
Total households[419]	1,006
Units in Housing Structure[420]	**Percent of Housing**
One-unit structures	91%
Structures with two or more units	6%
Manufactured homes and all other types	3%
Year Housing Structure Built[421]	**Percent of Housing**
Pre-1979	20%
1980–1999	40%
2000 to present	41%

Housing Tenure and Vacancy	Percent of Housing
Owner-occupied[422]	80%
Renter-occupied[423]	20%
Vacant[424]	3%

* Due to how respondents answer questions, there may be overlapping responses, and results may equal greater than 100%. Percentages are rounded.

[419] United States Census Bureau. (2021, July 1). 2016–2020 American Community Survey 5-Year Estimates Households and Families Table S1101. Accessed September 21, 2022, from https://data.census.gov/cedsci/table?q=North%20Plains%20oregon%20housing&tid=ACSST5Y2020.S1101
[420] United States Census Bureau. (2021, July 1). 2016–2020 American Community Survey 5-Year Estimates Households and Families Table S1101. Accessed September 21, 2022, from https://data.census.gov/cedsci/table?q=North%20Plains%20oregon%20housing&tid=ACSST5Y2020.S1101
[421] United States Census Bureau. (2021, July 1). 2016–2020 American Community Survey 5-Year Estimates, Physical Housing Characteristics for Occupied Housing Units, Table S2504. Accessed September 21, 2022, from https://data.census.gov/cedsci/table?q=North%20Plains%20oregon%20housing&tid=ACSST5Y2020.S2504
[422] United States Census Bureau. (2021, July 1). 2016–2020 American Community Survey 5-Year Estimates Households and Families Table S1101 https://data.census.gov/cedsci/table?q=North%20Plains%20oregon%20housing&tid=ACSST5Y2020.S1101, accessed September 21, 2022
[423] United States Census Bureau. (2021, July 1). 2016–2020 American Community Survey 5-Year Estimates Households and Families Table S1101 https://data.census.gov/cedsci/table?q=North%20Plains%20oregon%20housing&tid=ACSST5Y2020.S1101, accessed September 21, 2022
[424] United States Census Bureau. (2021, July 1). 2020 Decennial Census Occupancy Status, Table H1. https://data.census.gov/cedsci/table?q=North%20Plains%20oregon%20housing, accessed September 21, 2022

3.1.3. Economy

Located in the heart of Oregon's Silicon Forest, North Plains is part of a thriving tech scene and is within a short drive to the Portland metro area's larger cities. The residents have access to jobs at multinational employers such as Intel, Genentech, and Nike, along with diverse industries including education, healthcare, agriculture, and craft beer brewing. Oregon Canadian and Jewett Cameron are two of the City's larger employers.

The City has 166 businesses and these businesses attract workers from across the Portland Metro region. The local employment base is largely dominated by small employers of fewer than five employees (65% of firms). There is one employer of over 100 or more employees, and four employers with between 50 and 100 employees.[425] The sectors with the greatest number of employees in 2021 were manufacturing, construction, administration and waste management services, leisure and hospitality, and wholesale trade.[426] The City's location along US Highway 26 provides good transportation access and makes it a gateway to the Oregon Coast. It also is close to major employment centers in western Washington County and has good access to the regional workforce. North Plains is located in an agricultural region, with a diverse offering of agricultural products including fruits, wheat, wine, and nursery plants.[427]

Table 194: Income Characteristics*[428]

Households by Income Category	Percent of Households
Less than $5,000	.3%
$5,000 to $9,999	0%
$10,000 to $14,999	2%
$15,000 to $19,999	4%
$20,000 to $24,999	4%
$25,000 to $34,999	6%
$35,000 to $49,999	5%
$50,000 to $74,999	16%
$75,000 to $99,999	17%
$100,000 to $149,999	20%
$150,000 or more	27%
Median Household Income	
$95,875	

* Due to how respondents answer questions, there may be overlapping responses, and results may equal greater than 100%. Percentages are rounded.

[425] City of North Plains. (2022, February). Draft Economic Opportunities Analysis. https://www.northplains.org/sites/default/files/fileattachments/city_manager/page/786471/north_plains_eoa_report_append_3_30_22.pdf
[426] City of North Plains. (2022, February). Draft Economic Opportunities Analysis. https://www.northplains.org/sites/default/files/fileattachments/city_manager/page/786471/north_plains_eoa_report_append_3_30_22.pdf
[427] North Plains Comprehensive Plan. https://www.northplains.org/sites/default/files/fileattachments/city_council/page/786411/north_plains_comprehensive_plan_adopted_june_3_2019.pdf
[428] United States Census Bureau. (2021, July 1). 2016–2020 American Community Survey 5-Year Estimates, Financial Characteristics, Table S2503. Accessed September 21, 2022, from https://data.census.gov/cedsci/table?q=North%20Plains%20oregon%20income

3.2. Natural Hazard Profiles

The Technical Committee for the City of North Plains utilized the OEM's hazard analysis methodology to examine hazard vulnerability and probability by collecting information about history, probability, vulnerability, and maximum threat for each hazard that impacts the City. This methodology does not compare hazards to each other or rank hazards against each other. Instead, this process provides a sense of hazard priorities or relative risk and allows comparison of the same hazard across participants.

Each of the hazards examined by this analysis was scored using a formula that incorporates the four rating criteria, a weight factor, and three levels of severity: low, medium, and high. The score range for this methodology is 24 (lowest possible) to 240 (highest possible). For additional detail about the OEM risk and hazard analysis methodology, see Volume I, Section 2.

All natural hazards included in the NHMP have the potential to impact the City; however, due to geographic location and topography, the City cannot be directly impacted by dam failure and landslide events. The City assigned relatively low scores to these hazards and identify their potential impacts as secondary and not direct. The scores for each hazard that impacts the City are presented below.

Table 195: Natural Hazard Risk Scores

Natural Hazard	History	Vulnerability	Maximum Threat	Probability	Score
Dam failure	Low	Low	Low	Low	56
Drought	Low	High	High	Medium	170
Earthquake: Cascadia (3–5-minute event)	Low	High	High	Medium	201
Earthquake: Crustal (1-minute event)	Low	Low	Low	Medium	71
Extreme heat	High	Medium	High	High	177
Flooding, including channel migration and streambed erosion	High	High	Medium	High	181
Landslide	Low	Low	Low	Low	24
Volcanic ash	Low	Medium	High	Low	124
Wildland fire	High	Medium	High	High	201
Windstorm, including tornado	High	Medium	Medium	High	132
Winter storm	High	Medium	High	High	187

Full descriptions of each hazard are provided in Volume I, Section 2. The potential effects of climate change on the magnitude and frequency of natural hazard events are described in each hazard description in this annex and in Volume I, Section 2.

The timeframe of data collected during the planning process for the City of North Plains was from as far back as available to February 22, 2022. Hazard events that occurred during this period and were deemed significant by the City's Technical Committee are included in this annex's hazard profiles.

The following hazard profiles are in alphabetical order and include a brief hazard description, significant events, if applicable, and potential impacts and vulnerabilities. The potential impacts for each hazard are

presented in the same order, as applicable: populations, economies, structures, improved property, critical facilities and infrastructure, historical properties and cultural resources, and natural environments.

In addition to the natural hazards scored above, the City identified water supply disruption and dust storm as hazards that could impact the City. Water supply disruption was given a score of 179, and dust storm was given a score of 138. Brief descriptions of these hazards are included in this section.

3.2.1. Dam Failure

Due to geographic location and topography, the City cannot be directly impacted by dam failure. Any impacts in the City due to dam failure would be minimal. Potential impacts of and vulnerabilities to dam failure are identified below.

3.2.1.1. Potential Impacts and Vulnerabilities

The potential impacts of and vulnerabilities to a dam failure event would likely be economic. If a dam were to fail it could disrupt the ability of residents to commute to jobs outside the city and the ability to get to and from other areas that may experience a direct or secondary impact from a failure. The City's drinking water source, the Joint Water Commission (JWC), could experience secondary impacts of a Scoggins Dam failure; however, any effects are considered minimal.

3.2.2. Drought

Drought typically occurs as a regional event and often affects more than one city and county simultaneously. The City's primary drinking water supplier is the JWC, which wholesales to North Plains. Potential impacts of and vulnerabilities to drought are identified below.

3.2.2.1. Potential Impacts

The potential drought impacts are identified below. The type, magnitude, and extent of impacts can vary based on the scale of the event. Potential impacts include:

- Reduction or loss of water supply, water use restrictions, and lack of potable water supply.
- Health effects, including increased heat-related, waterborne, and cardiorespiratory illnesses, as well as mental health conditions.
- Reduced economic productivity or business closures, including agriculture, livestock, recreation, energy, tourism, timber, and fisheries.
- Supply chain restrictions, including food shortages.
- Loss of power or reduced availability of electricity due to infrastructure damage and high demand.
- Property and infrastructure damage due to expansive soils, which are clay-based soils that expand and contract based on the amount of moisture in the soil.
- Damage to natural environments, including low water levels in lakes, rivers, and other water bodies, reduced plant growth, local species reduction or extinction, increased water temperature, and deteriorated water quality, which may result in fish kills and increased waterborne pollutants.
- Concurrent hazards, including extreme heat, wildfire, flooding, and landslides.

3.2.2.2. Vulnerabilities

All populations, economies, structures, improved property, critical facilities and infrastructure, and natural environments in the City are vulnerable to drought. These include:

- People in the City with preexisting health conditions, those without access to clean water, children, pregnant women, and older adults.
- JWC's water supply sources, including the upper Tualatin River, Barney Reservoir, and Scoggins Reservoir.
- Critical infrastructure, including the City's two water stations and city hall.
- Critical transportation infrastructure, including US Highway 26 and arterial roads.
- Natural environments throughout the City, including parks, the community garden, and walking trails.
- Landscaping and trees located throughout the City.

3.2.3. Earthquake

The City could experience earthquakes that originate from the Cascadia Subduction Zone, Portland Hills Fault Zone, and Gales Creek Fault Zone. It could also experience liquefaction as the result of an earthquake. Potential impacts of and vulnerabilities to earthquake are identified below.

3.2.3.1. Potential Impacts

The potential impacts of an earthquake event are identified below. The type, magnitude, and extent of impacts can vary based on the scale of the event. Impacts may include:

- Injuries or deaths.
- Mental health impacts, including post-traumatic stress disorder.
- Public health hazards resulting from disruption of drinking water and wastewater systems.
- Need for widespread search and rescue operations.
- Displaced residents in need of sheltering.
- Delayed emergency response times due to debris, blocked transportation routes, and damaged infrastructure and vehicles.
- Economic impacts to governments, including reduced future revenues, increased costs resulting from response activities, and increased future costs resulting from recovery and reconstruction activities.
- Industries can experience commerce losses from power interruptions, damaged buildings and assets, and road closures. Industries can also sustain direct losses to buildings, personnel, and other vital equipment.
- Personal and household economic impacts of loss of income, increased medical costs, and property damage that may not be covered by insurance.
- Damage to underground utilities; residential, public, and private buildings; and transportation systems.
- Disruption of essential infrastructure systems, such as power systems, public utilities, and telecommunications.
- Blocked roads and rail transportation routes due to debris from trees and damaged property, ground deformation, and liquefaction.
- Downed or damaged power lines that can lead to wildfires.
- Power outages and natural gas leaks.
- Hazardous material releases due to infrastructure and facility damage.
- Harm to ecosystems from loss of habitat, death and destruction of vegetation and animals, and erosion.
- Change in water flows, including paths of rivers and streams.
- Damage to crops, livestock, vegetation, parks, and natural systems.
- Concurrent hazards initiated by an earthquake, including flood, wildland fire, and landslide.

3.2.3.2. Vulnerabilities

All populations, the economies, structures, improved property, critical facilities and infrastructure, and natural environments in the City are vulnerable to earthquakes. These include:

- Critical infrastructure and facilities including two water stations and city hall. City facilities, except for the water reservoir and pump house, are not retrofitted.
- The newest two-million-gallon water reservoir and pump house is built to withstand an earthquake; however, should it fail, the City is ready to use the abandoned well as an emergency source of water.
- In 2019, the City worked with a contractor to complete a Water System Seismic Assessment and Mitigation Plan.[429] This assessment evaluated and rated the structural and nonstructural performance of the system's critical facilities, as applicable, and rated them as excellent, good, or poor. The assessment identified several assets vulnerable to earthquakes. The results of the assessment are provided below in the Water System Seismic Assessment section.
- Other critical infrastructure, such as pipelines and utility lines, US Highway 26, arterial roads, communication structures, and emergency generators can be vulnerable to damage from liquefaction due to the type of soil in the City.
- Unreinforced masonry buildings in the older central business district of the City are more vulnerable to potentially substantial damage during an earthquake compared to other nearby structures built to modern standards.[430]
- Wood frame buildings with sill plates not bolted to foundation, cripple wall perimeter systems, and buildings on steep slopes, partially supported on "stilts" are generally substantially vulnerable to major seismic damage.[431]
- Buildings with very high or high collapse potential include residential and commercial buildings constructed prior to 1990.
- Areas near the epicenter of an earthquake event are likely to incur a significant amount of damage to all buildings, infrastructure, facilities, and property.
- Using 2022 Hazus®-MH information, it is estimated a 6.7 magnitude Gales Creek Fault earthquake event could result in 37 yellow-tagged buildings, 7 red-tagged buildings, and $15,449,000 in total economic losses.[432]
- A 2018 Oregon Department of Geology and Mineral Industries (DOGAMI) report shows that a:
  - Cascadia Subduction Zone magnitude 9.0 earthquake in "dry" soil conditions could result in $38,000,000 in building repair costs, 24,000 tons of debris, 7 long-term displaced residents, and up to 41 deaths;
  - Cascadia Subduction Zone magnitude 9.0 earthquake in "wet" soil conditions could result in $61,000,000 in building repair costs, 32,000 tons of debris, 157 long-term displaced residents, and up to 71 deaths;
  - Portland Hills fault magnitude 6.8 earthquake in "dry" soil conditions could results in $53,000,000 in building repair costs, 28,000 tons of debris, 20 long-term displaced residents, and up to 50 deaths; and

[429] Stantec. (2019, April 29). Water System Seismic Assessment and Mitigation Plan–Addendum to 2018 Water Master Plan Update: Technical Memorandum. north_plains_2019_water_system_master_plan_update_10-2-19.pdf
[430] Oregon Department of Geology and Mineral Industries. (2022). Open-File Report O-22-04: Natural Hazard Risk Report for Washington County. https://www.oregongeology.org/pubs/ofr/O-22-04/p-O-22-04.htm
[431] Washington County Natural Hazard Mitigation Plan. (2017). https://www.co.washington.or.us/EmergencyManagement/plans-and-agreements.cfm
[432] Oregon Department of Geology and Mineral Industries. (2022). Open-File Report O-22-04: Natural Hazard Risk Report for Washington County. https://www.oregongeology.org/pubs/ofr/O-22-04/p-O-22-04.htm

- Portland Hills fault magnitude 6.8 earthquake in “wet” soil conditions could results in $92,000,000 in building repair costs, 41,000 tons of debris, 266 long-term displaced residents, and up to 98 deaths.[433]

- Natural environments throughout the City, including parks, the community garden, and walking trails.
- Landscaping and trees located throughout the City.

3.2.3.2.1. Water System Seismic Assessment

In 2019, the City worked with a contractor to complete a Water System Seismic Assessment and Mitigation Plan.[434] This assessment evaluated and rated the structural and nonstructural performance of the system’s critical facilities, as applicable, and rated them as excellent, good, or poor. The structural category was related to the structural building systems, the structural walls, the foundation, and similar elements. The nonstructural category related to architectural, mechanical, and electrical systems. The results of the evaluation are provided below.

3.2.3.2.1.1. JWC Vault

This facility is owned by the City of Hillsboro and is the critical point of connection to the primary water supply of the City of North Plains.

- Structural Performance Level: Good
  - Potential for liquefaction or settlement of the vault; liquefaction may lead to differential settlement.
  - Lateral spreading may occur due to sloping ground to the northeast.
- Nonstructural Performance Level: Poor
  - The interface between the vault and where the pipes enter is a hard connection. If the vault settles during a seismic event, the pipe will be forced to displace. The pipe does not have any expansion joints to accommodate this displacement.
  - Pipe supports provide vertical support only. No horizontal restraint is provided.
- Consequences of Failure:
  - The consequences of a seismic failure at this facility would be significant. This vault is along the only pipeline that provides drinking water to the City. Repair of the vault and associated piping could take weeks.

3.2.3.2.1.2. JWC Supply Pipeline from Hillsboro to North Plains

The 16-inch JWC supply pipeline from Hillsboro to North Plains conveys the water supply from the point of purchase from JWC in the City of Hillsboro to the City of North Plains.

- Overall Performance Level: Poor
  - The overall rating for the JWC pipeline is poor due to the significant length of pipeline constructed with unrestrained joints.

[433] Oregon Department of Geology and Mineral Industries. (2018). Open-File Report O-18-02: Earthquake Regional Impact Analysis for Clackamas, Multnomah, and Washington Counties, Oregon. https://www.oregongeology.org/pubs/ofr/O-18-02/O-18-02_report.pdf

[434] Stantec. (2019, April 29). Water System Seismic Assessment and Mitigation Plan–Addendum to 2018 Water Master Plan Update: Technical Memorandum. north_plains_2019_water_system_master_plan_update_10-2-19.pdf

- Consequences of Failure:
  - The consequences of a seismic failure of the JWC pipeline are significant. Severing of the transmission main pipeline could leave the City without water for a month or more, depending on the number of breaches.

3.2.3.2.1.3. 314th Avenue Pressure-Reducing Valve Vault

This vault contains valves that control the flow of water into the City's distribution system under normal and fire-flow conditions.

- Structural Performance Level: Poor
  - The 314th Avenue vault is located near a McKay Creek Tributary and Wetland, indicating a high groundwater table. Evidence of water infiltration into the vault confirms the high groundwater table.
  - Liquefaction could cause significant soil pressures on the walls and uplift forces on the bottom of the vault. No evidence has been found that the vault design considered liquefaction.
  - Soft soils susceptible to liquefaction are expected in this area due to the high groundwater table and wetland. It is likely that liquefaction settlement and lateral displacements towards the creek at the vault will occur. The vault may move horizontally and vertically and undergo differential settlements associated with the liquefaction in this area.
- Nonstructural Performance Level: Poor
  - The connection between the 314th Avenue vault and the JWC pipeline are at risk of differential settlement and horizontal displacement due to liquefaction and lateral displacement issues in this area.
- Consequences of Failure:
  - The consequences of a seismic failure at this facility would be significant. This vault is along the only pipeline that supplies drinking water to the City. Repair of the vault and associated piping could take weeks, depending on the extent of damage and the availability of materials and labor.

3.2.3.2.1.4. Well #3 at Water Station No. 1

This well is the City's only backup water supply.

- Structural and Nonstructural Performance Levels: Poor
  - The well and its electrical and control gear are located within the Water Station No. 1 booster pump building that is assumed not to be seismically resilient.
  - Well #3 may be susceptible to damage if the seismic lateral loads and seismic velocities on the well are too large for Well #3 to accommodate.
  - The McKay Creek Tributary known as Ghost Creek is within 50 feet of Well #3, indicating that there is likely high groundwater and sloping ground in this area. Lateral displacements due to liquefaction in this area are likely.
  - Due to the lack of information on the construction of Well #3, the uncertainty about whether the well will accommodate the seismic loads and deformations is high.
- Consequences of Failure:
  - Failure of Well #3 would result in the loss of a backup water supply for the City for periods on the order of months. If the JWC connection is maintained, this is not expected to have a significant impact on water supply to the City.

3.2.3.2.1.5. Trunk Distribution Pipes 12 Inches in Diameter or Larger

These pipelines within the City's distribution system are critical to maintaining pressure and flow.

- Overall Performance Level: Good
  - The overall rating for the City's distribution system is good. Use of ductile iron pipe with restrained joints for future construction along with completing looping within the distribution system will continue to improve seismic resiliency.
  - In any areas where the pipeline is near a slope, crossing a slope, or near a creek, it is likely that lateral displacement issues will be present.
  - The extent of unrestrained piping joints is unknown.
  - Looping of distribution piping with redundancy is an important mitigation strategy for pipeline breaks. There are currently some non-looped transmission mains, such as the 14-inch diameter PVC pipeline extending to the east.
- Consequences of Failure:
  - The consequences of these breakages could be significant because loss of large-diameter trunk lines could cause service outages for large portions of the City, especially in areas without looped piping. Pipe breaks in major trunk lines may also limit water distribution to and from Reservoir and Pump Station No. 2, even though that facility is to be built with seismic resiliency.

3.2.4. Extreme Heat

Due to a rise in the frequency, severity, and impacts of extreme heat events, the NHMP Steering Committee chose to include this hazard for the first time in the Washington County NHMP. Potential impacts of and vulnerabilities to extreme heat and previous significant events are identified below.

3.2.4.1. Significant Events

The City identified two significant extreme heat events it has experienced.

- **June 26–29, 2021:** The maximum temperature reached 108 °F, with a heat index of 115 °F. Throughout Washington County there were numerous fatalities, closures and postponements of businesses and events, and buckled roads, and cooling shelters were opened.
- **August 11–24, 2021:** The high temperature at Hillsboro Airport was 103 °F with a heat index of 109 °F on August 11 and 12. Peak afternoon temperatures ranged from 100 °F to 105 °F. Throughout the county there were fatalities, closures and postponements of businesses and events, and cooling shelters were opened.

3.2.4.2. Potential Impacts

The potential impacts of an extreme heat event are identified below. The type, magnitude, and extent of impacts can vary based on the scale of the event. Impacts may include:

- Injuries or deaths.
- Heat illnesses, including heat rashes, heat cramps, heat exhaustion, heat stroke, and death.
- Extended operational hours of County staff and additional resources needed for response to the event, including the operation of daytime cooling centers and overnight cooling shelters.
- Strain on or loss of water supply due to increased demand.
- Industries can experience commerce losses from power interruptions, damaged buildings and assets, and road closures. Industries can also sustain direct losses to buildings, personnel, and other vital equipment.
- Economic losses from decreased worker efficiency and effectiveness and time lost on the job when workers take more frequent or longer breaks to avoid overheating.
- Economic impacts of closure of outdoor activities and events, such as farmers markets and concerts.
- Property damage, such as roof expansions, leading to warped, cracked, and leaking shingles; dry, cracked, and leaking caulking around flashing and joints; cracked foundations; excessive drying of wood structures; and melted siding.
- Disruption of essential infrastructure systems from overheated and damaged utilities, including power, water, transportation, and communication systems.
- Impacts to roadways as heat expands concrete or causes cracking and buckling. Public transit can also be impacted due to melted cables, sagging wires, and warping tracks.
- Damage to crops, livestock, vegetation, parks, and natural systems.
- Impacts to greenspaces, such as scorch and sunscald of new foliage, branches or tops of trees dying, and significant stress and die-off of native trees, particularly Douglas fir and cedar. These impacts are intensified if drought is also occurring.
- Concurrent hazards include drought and wildland fire.

3.2.4.3. Vulnerabilities

All populations, economies, structures, improved property, critical facilities and infrastructure, and natural environments in the City are vulnerable to extreme heat. The City utilizes two city facilities and one private facility as cooling centers within city limits as needed.

Populations substantially vulnerable to extreme heat include:

- People who work or spend a significant amount of time outdoors, including those in construction, landscaping, maintenance and repair, roofing, and solid waste collection.
- People who live and/or work in buildings without air conditioning or cooling equipment.
- People living, working, or spending time in heat islands within the City.
- People living outdoors or in the upper floors of multi-family housing units.
- Populations with higher heat sensitivity, including older adults, infants and children, pregnant women, people with preexisting or chronic diseases, and those who take certain medications that affect thermoregulation or block nerve impulses.
- People with limited mobility and no access to cooling systems who may not be able to travel to cooling centers or shelters.
- People who live in social isolation, including linguistic isolation or those living alone with few social relationships.
- Factors including race and ethnicity, income, and educational attainment are correlated with heat-related illness.

Additional vulnerabilities to extreme heat include:

- Critical infrastructure, including the City's two water stations and city hall.
- Other critical infrastructure, such as pipelines and utility lines, US Highway 26, arterial roads, communication structures, and emergency generators.
- Bridge infrastructure is vulnerable to thermal expansion of bridge joints and paved surfaces and deterioration of steel, asphalt, protective cladding, coats, and sealants.
- Asphalt pavement is vulnerable to accelerated deterioration through softening, rutting, and migration of liquid asphalt.
- Vehicles, including first responder vehicles, are vulnerable to engine overheating and tire deterioration.
- Aboveground utility and power lines can droop or sag and create a heightened fire risk.
- Plants, animals, ecosystems, and natural environments are vulnerable to high rates of mortality due to excessive heat.
- Natural environments throughout the City, including parks, the community garden, and walking trails.
- Landscaping and trees located throughout the City.

3.2.5. Flooding, Including Channel Migration and Streambed Erosion

The City experiences localized flooding typically from October through April. Several homes and business are located within the City's 100-year floodplain. Potential impacts of and vulnerabilities to flooding and previous significant events are identified below.

3.2.5.1. Significant Events

The City identified one significant flooding event it has experienced.

- **February 5–9, 1996:** The combination of heavy rain and rapidly melting snowpack in the mountains swelled rivers and streams. This caused some road closures and debris issues in the City. No facilities were impacted or damaged.

3.2.5.2. Potential Impacts

The potential impacts of a flooding event are identified below. The type, magnitude, and extent of impacts can vary based on the scale of the event. Potential impacts include:

- Injuries or deaths.
- Public health concerns, such as the spread of infectious diseases, exposure to hazardous materials and debris, and water quality issues.
- Need for widespread search and rescue operations, including water rescues.
- Displaced residents in need of sheltering.
- Delayed emergency response times and disruption of traffic due to high water, debris, blocked transportation routes, and damaged infrastructure and vehicles.
- Economic impacts to governments, including reduced future revenues, increased costs resulting from response activities, and increased future costs resulting from recovery and reconstruction activities.
- Industries can experience commerce losses from power interruptions, damaged buildings and assets, and road closures. Industries can also sustain direct losses to buildings, personnel, and other vital equipment.
- Personal economic impacts of loss of income and property damage that may not be covered by insurance.
- Damage and destruction to the built environment, including above- and belowground utility lines; residential, public, and private buildings; and transportation systems.
- Disruption of essential infrastructure systems, such as power systems, public utilities, telecommunications, and transportation routes.
- Harm to ecosystems from loss of habitat, death and destruction of vegetation and animals, and erosion.
- Damage to crops, livestock, vegetation, and parks.

3.2.5.3. Vulnerabilities

Populations, economies, built environment, critical facility, infrastructure, and natural environment vulnerabilities to a flooding event include:

- Populations without access to private transportation.
- Critical infrastructure, such as pipelines and utility lines, US Highway 26, arterial roads, communication structures, and emergency generators.
- Some homes and businesses along Ghost Creek and McKay Creek could be vulnerable to flooding. Additionally, properties without flood insurance may be more prone to risk from flooding.
- North Plains has 77 acres of floodplain within the 100-year floodplain of McKay Creek and its tributary Ghost Creek; however, there is virtually no development in this area.[435]
- Flood loss estimates determined by Hazus-MH include[436]:
  - 10-year flood scenario
    - Number of buildings lost: 1
    - Loss estimate: $51,000
  - 50-year flood scenario
    - Number of buildings lost: 4
    - Loss estimate: $162,000
  - 100-year flood scenario
    - Number of buildings lost: 9
    - Loss estimate: $383,000
  - 500-year flood scenario
    - Number of buildings lost: 58
    - Loss estimate: $1,963,000

[435] City of North Plains. (n.d.). City 101: Floodplains Explained. https://www.northplains.org/planning/page/city-101-floodplains-explained
[436] Oregon Department of Geology and Mineral Industries. (2022). Open-File Report O-22-04: Natural Hazard Risk Report for Washington County. https://www.oregongeology.org/pubs/ofr/O-22-04/p-O-22-04.htm

Table 196: Land Use Type in the 100-Year Floodplain in the City of North Plains

Land Use Type	Total Parcels in 100-Year Floodplain	Total Value of Exposed Parcels	Total Area in Jurisdiction (Acres)	Total Area in the 100-Year Floodplain (Acres)	Percentage of Area in the 100-Year Floodplain
Agriculture	0	$0	39.17	0	0%
Commercial	11	$10,718,870	117.61	18.19	15.5%
Forest	0	$0	2.24	0	0%
Industrial	2	$2,648,250	8.41	8.41	100%
Multi-Family Residential	0	$0	1.77	0	0%
Public	10	$580,520	49.21	18.58	37.8%
Rural	0	$0	0.22	0	0%
Single-Family Residential	100	$46,612,540	185.62	30.40	16.4%
Vacant	12	$464,940	29.49	9.74	33%
Other	17	$7,468,850	79.22	23.09	29.2%
Total	**152**	**$68,493,970**	**512.96**	**108.41**	**21.1%**

Table 197: Buildings in North Plains within FEMA-Mapped Floodplains

Building Classification	Buildings within North Plains	Buildings within 100-Year Floodplain
Total Buildings	1,422	71
Percentage of Buildings within North Plains	100%	5%

3.2.6. Landslide

Due to geographic location and topography, the City cannot be directly impacted by landslides. Any impacts in the City due to landslides are identified as secondary. Potential secondary impacts of and vulnerabilities to landslides are identified below.

3.2.6.1. Potential Impacts and Vulnerabilities

The potential impacts of and vulnerabilities to a landslide event would likely be economic. If a landslide outside city limits were to occur, it could disrupt the ability of residents to commute to jobs outside the city and the ability to get to and from other areas that may experience a direct or secondary impact from an event.

3.2.7. Volcanic Ash

Volcanic activity is possible at mountains within 60 miles of the County, including Mount St. Helens and Mount Hood. Ashfall from a volcanic eruption has the potential to impact the County, although the scale and types of impacts and vulnerabilities may differ depending on which volcano erupts, the level of eruption, and the wind direction during and after eruption. Potential ashfall impacts and vulnerabilities to volcanic ash are identified below.

3.2.7.1. Potential Impacts

Though unlikely, the impacts of a significant ashfall can be substantial, including:

- Indirect injuries and deaths, such as those sustained during ash cleanup operations or in traffic accidents.
- Short-term health effects, including respiratory effects.
- Widespread public health issues stemming from failing or damaged infrastructure, such as lack of clean water and sanitation. This includes public water systems that rely on outdoor reservoirs.
- The need to shelter individuals to protect them from poor air quality, including houseless persons and persons displaced from their residences due to poor residential air filtration systems.
- Delayed emergency response times due to decreased visibility and increased traffic hazards.
- Extended operational hours of County staff and resources needed for response to the event.
- Economic impacts to governments, including reduced future revenues, increased costs resulting from response activities, and increased future costs resulting from recovery and cleanup activities.
- Industries can experience commerce losses from power interruptions, damaged buildings and assets, and road closures. Industries can also sustain direct losses to buildings, personnel, and other vital equipment.
- Personal and household economic impacts of loss of income, increased medical costs, and property damage that may not be covered by insurance.
- Damage to the built environment, including aboveground utility lines; residential, public, and private buildings; and transportation systems.
- Disruption of essential infrastructure systems, such as power systems, public utilities, drainage systems, telecommunications, and transportation routes.
- Downed or damaged power lines can lead to wildfires.
- Damage to crops, livestock, vegetation, parks, and natural systems.

3.2.7.2. Vulnerabilities

All populations, economies, structures, improved property, critical facilities and infrastructure, and natural environments in the City are vulnerable to volcanic ash. These include:

- People in the City with chronic lung problems and other preexisting health conditions, children, pregnant women, and older adults.
- People without access to effective dust masks, eye protection, and drinking water and food uncontaminated by volcanic ash.
- Critical infrastructure, including the City’s two water stations and city hall.

- Critical transportation infrastructure, including US Highway 26 and arterial roads.
- Emergency generators.
- Older buildings and infrastructure not built to withstand the weight and impacts of large amounts of volcanic ash, including manufactured homes and buildings, and the people who live or work in them.
- Natural environments throughout the City, including parks, the community garden, and walking trails.
- Landscaping and trees located throughout the City.

3.2.8. Wildland Fire

Although the City could experience a wildland/urban interface event, historically it is more likely to be affected by smoke and poor air quality due to wildland fires outside its boundaries. Potential impacts of and vulnerabilities to wildland fire and previous significant events are identified below.

3.2.8.1. Significant Event

The City has not been directly impacted by a wildland fire event. However, in September 2020, multiple wildfires occurred concurrently in the county, outside the county, and outside the state, and the City experienced significant smoke from the fires.

3.2.8.2. Potential Impacts

The potential impacts of a wildfire event are identified below. The type, magnitude, and extent of impacts can vary based on the scale of the event. Impacts may include:

- Injuries or deaths.
- Exposure to wildfire smoke, which can lead to eye, nose, and throat irritation and the worsening of chronic heart and lung diseases.
- Widespread public health issues stemming from failing or damaged infrastructure, such as lack of clean water and sanitation.
- Need for widespread search and rescue operations.
- Displaced residents in need of sheltering.
- Delayed emergency response times due to blocked transportation routes and debris, congested transportation routes due to evacuations, and damaged infrastructure and vehicles.
- Extended operational hours of County staff and resources needed for response to the event.
- Strain on or loss of water supply due to increased demand.
- Economic impacts to governments, including costs for fire suppression, staff, equipment, supplies, transportation and mobilization of first responders, evacuations, sheltering operations, post-fire recovery, and rebuilding costs associated with government-owned buildings, property, and infrastructure.
- Economic impacts, including loss of local revenue due to business and property tax losses, agriculture production losses, and reduced recreation and tourism activity. Scoggins Valley Park receives one million visitors a year, most during summer, which is when wildland fires tend to occur.
- Industries can experience commerce losses from power interruptions, damaged buildings and assets, and road closures. Industries can also sustain direct losses to buildings, personnel, and other vital equipment.
- Personal and household economic impacts of loss of income, increased medical costs, and property damage that may not be covered by insurance.
- Damage and destruction to the built environment, including above- and belowground utility lines; residential, public, and private buildings; and transportation systems.
- Disruption of essential infrastructure systems, such as power systems, public utilities, telecommunications, and transportation routes.
- Debris from trees and damaged property, causing blocked roads and rail transportation routes.

- Downed or damaged power lines. This impact may be compounded since powerline failures can lead to additional wildfires.
- Power outages and natural gas leaks.
- Hazardous material releases due to infrastructure and facility damage.
- Harm to ecosystems from loss of habitat, death and destruction of vegetation and animals, and erosion.
- Damage to crops, livestock, vegetation, parks, and natural systems.
- Concurrent hazards, including air and water quality issues.

3.2.8.3. Vulnerabilities

Given the dynamic nature of wildland fires, all populations, economies, structures, improved property, critical facilities and infrastructure, and natural environments in the City are vulnerable to this hazard. These include:

- People in the City with chronic lung problems and other preexisting health conditions, children, pregnant women, and older adults.
- Populations without access to private transportation.
- Drinking water sources and water treatment infrastructure, food supplies and availability, and access to medical resources or care may also be impacted by wildfire and can cause health impacts on a large scale.
- Homes, businesses, and infrastructure, such as power lines and storm sewers, adjacent to the agricultural and wooded areas outside city limits.
- Critical infrastructure, including the City's two water stations and city hall.
- Critical transportation infrastructure, including US Highway 26 and arterial roads.
- Emergency generators.
- Natural environments throughout the City, including parks, the community garden, and walking trails.
- Landscaping and trees located throughout the City.
- Per analysis of the Oregon State University–Extension Service Fire Program and Wildland Fire Associates dataset, there are 184 buildings with a total value of $56,825,000 exposed to a low risk of wildland fire.[437] The dataset did not identify any buildings at a high or moderate risk. Additionally, a community risk profile completed by DOGAMI shows no residents may be potentially displaced due to a wildland fire event.[438]

[437] Oregon Department of Geology and Mineral Industries. (2022). Open-File Report O-22-04: Natural Hazard Risk Report for Washington County. https://www.oregongeology.org/pubs/ofr/O-22-04/p-O-22-04.htm
[438] Oregon Department of Geology and Mineral Industries. (2022). Open-File Report O-22-04: Natural Hazard Risk Report for Washington County. https://www.oregongeology.org/pubs/ofr/O-22-04/p-O-22-04.htm

3.2.9. Windstorm, Including Tornado

The City has an elevation of 176 feet and historically has not experienced the same frequency of windstorms as those parts of the County at higher elevations. Potential impacts of and vulnerabilities to windstorms are identified below.

3.2.9.1. Potential Impacts

The potential impacts of a windstorm event are identified below. The type, magnitude, and extent of impacts can vary based on the scale of the event. Impacts may include:

- Injuries or deaths.
- Displaced residents in need of sheltering.
- Delayed emergency response times due to debris, blocked transportation routes, and damaged infrastructure and vehicles.
- Extended operational hours of County staff and resources needed for response to the event.
- Economic impacts to governments, including reduced future revenues, increased costs resulting from response activities, and increased future costs resulting from recovery and reconstruction activities.
- Industries can experience commerce losses from power interruptions, damaged buildings and assets, and road closures. Industries can also sustain direct losses to buildings, personnel, and other vital equipment.
- Personal and household economic impacts of loss of income, increased medical costs, and property damage that may not be covered by insurance.
- Damage and destruction to the built environment, including aboveground utility lines; residential, public, and private buildings; and transportation systems. Significant damage could lead to the complete loss of structures or totaled vehicles.
- Disruption of essential infrastructure systems, such as power systems, public utilities, telecommunications, and transportation routes.
- Debris from trees and damaged property causing blocked roads and rail transportation routes.
- Downed or damaged power lines can lead to wildfires.
- Power outages.
- Harm to ecosystems from loss of habitat, and death and destruction of vegetation and animals.
- Damage to crops, livestock, vegetation, parks, and natural systems.

3.2.9.2. Vulnerabilities

All populations, economies, structures, improved property, critical facilities and infrastructure, and natural environments in the City are vulnerable to windstorms, including tornadoes. These include:

- Older buildings and infrastructure not built to withstand high winds, including manufactured homes and buildings.
- Critical infrastructure, including the City’s two water stations and city hall.
- Critical transportation infrastructure, including US Highway 26 and arterial roads.
- Aboveground utility and power lines.

- Natural environments throughout the City, including parks, the community garden, and walking trails.
- Landscaping and trees located throughout the City.

3.2.10. Winter Storm

The City has an elevation of 176 feet and historically has not experienced the same frequency and intensity of winter storms as those parts of the County at higher elevations. Potential impacts of and vulnerabilities to winter storms are identified below.

3.2.10.1. Potential Impacts

The potential impacts of a winter storm event are identified below. The type, magnitude, and extent of impacts can vary based on the scale of the event. Impacts may include:

- Injuries or deaths, including from carbon monoxide poisoning, falls from slick or icy conditions, frostbite, and hypothermia.
- Delayed emergency response times due to debris, blocked transportation routes, damaged infrastructure and vehicles, and difficulty using fire hydrants because of frozen or damaged water system components.
- Stranded travelers due to ice, snow, and transportation impacts.
- Extended operational hours of County staff and resources needed for response to the event.
- Economic impacts to governments, including reduced future revenues, increased costs resulting from response activities, and increased future costs resulting from recovery and reconstruction activities.
- Industries can experience commerce losses from power interruptions, damaged buildings and assets, and road closures. Industries can also sustain direct losses to buildings, personnel, and other vital equipment.
- Personal and household economic impacts of loss of income, increased medical costs, and property damage that may not be covered by insurance.
- Damage and destruction to the built environment, including aboveground utility lines; residential, public, and private buildings; and transportation systems.
- An increased number of house fires due to unsafe alternate heating methods.
- Significant property damage and loss of water due to frozen or damaged pipes or the thawing of frozen pipes.
- Disruption of essential infrastructure systems, such as power systems, public utilities, telecommunications, and transportation routes.
- Debris from trees and damaged property causing blocked roads and rail transportation routes.
- Downed or damaged power lines can lead to wildfires, and tree debris can create fuel load for wildfire.
- Power outages.
- Harm to ecosystems from loss of habitat, and death and destruction of vegetation and animals.
- Damage to crops, livestock, vegetation, parks, and natural systems.
- Concurrent hazards, including flooding.

3.2.10.2. Vulnerabilities

All populations, economies, structures, improved property, critical facilities and infrastructure, and natural environments in the City are vulnerable to winter storms. These include:

- People who do not have access to sufficient heating, insulated clothing, or dry living conditions, including unhoused populations.
- Older adults and infants, people who take certain medications, people who have certain medical conditions, and people who have been drinking alcohol are at increased risk for hypothermia.
- People in households lacking appropriate and functional heating devices. Older buildings and infrastructure not built to withstand the weight and impacts of large amounts of snow and ice.
- Critical infrastructure, including the City's two water stations and city hall.
- Critical transportation infrastructure, including US Highway 26 and arterial roads.
- Natural environments throughout the City, including parks, the community garden, and walking trails.
- Landscaping and trees located throughout the City.

3.2.11. Additional Hazards Identified by the City

In addition to the core natural hazards identified and scored in this NHMP, the City of North Plains identified two additional hazards that it could be impacted by-dust storm and water contamination.

3.2.11.1. Dust Storm

Due to its more rural location than other NHMP participants, the City can experience dust storms from wind blowing dust into the City from surrounding open farmland areas. Potential impacts of and vulnerabilities to dust storms are identified below.

3.2.11.1.1. Potential Impacts

The potential impacts of a dust storm are identified below. The type, magnitude, and extent of impacts can vary based on the scale of the event. Impacts may include:

- Indirect injuries and deaths, such as those sustained during dust cleanup operations or in traffic accidents.
- Short-term health effects, including respiratory effects.
- Widespread public health issues stemming from failing or damaged infrastructure, such as lack of clean water and sanitation.
- Displaced residents in need of sheltering.
- Delayed emergency response times due to debris, blocked transportation routes, and damaged infrastructure and vehicles.
- Extended operational hours of City staff and resources needed for response to the event.
- Economic impacts to governments, including reduced future revenues, increased costs resulting from response activities, and increased future costs resulting from recovery and reconstruction activities.
- Industries can experience commerce losses from power interruptions, damaged buildings and assets, and road closures. Industries can also sustain direct losses to buildings, personnel, and other vital equipment.
- Personal and household economic impacts of loss of income, increased medical costs, and property damage that may not be covered by insurance.
- Damage and destruction to the built environment, including aboveground utility lines; residential, public, and private buildings; and transportation systems.
- Disruption of essential infrastructure systems, such as power systems, public utilities, drainage systems, telecommunications, and transportation routes.
- Blocked roads and rail transportation routes due to debris.
- Downed or damaged power lines can lead to wildfires.
- Harm to ecosystems from loss of habitat, and death and destruction of vegetation and animals.
- Damage to crops, livestock, vegetation, parks, and natural systems.

3.2.11.1.2. Vulnerabilities

All populations, economies, structures, improved property, critical facilities and infrastructure, and natural environments in the City are vulnerable to dust storms. These include:

- People in the City with chronic lung problems and other preexisting health conditions, children, pregnant women, and older adults.
- People without access to effective dust masks, eye protection, and drinking water and food uncontaminated by dust.
- JWC's water supply sources, including the upper Tualatin River, Barney Reservoir, and Scoggins Reservoir.
- Critical transportation infrastructure, including US Highway 26 and arterial roads, may experience large scale accidents and traffic issues.
- Other critical infrastructure, including the City's two water stations.
- Emergency generators and heating, ventilation, and air-conditioning (HVAC) systems.
- Older buildings and infrastructure not built to withstand the weight and impacts of large amounts of dust, including manufactured homes and buildings, and the people who live or work in them.
- Natural environments throughout the City, including parks, the community garden, and walking trails.
- Landscaping and trees located throughout the City.

3.2.11.2. Water Contamination

In addition to the core natural hazards identified in this NHMP, the City has identified water contamination as a hazard that could impact the City. Potential impacts of and vulnerabilities to water contamination are identified below.

3.2.11.2.1. Significant Event

North Plains previously utilized a well system for drinking water until the system became contaminated when former creosote pits near the well locations seeped into the water table. The City has since transitioned to a pipeline that connects to the JWC system. The Commission wholesales water to the City; however, North Plains is looking for an alternative to this system in order to better serve the needs of the community.

3.2.11.2.2. Potential Impacts

Though unlikely, the impacts of a water contamination event can be substantial, including:

- Health effects, such as gastrointestinal illnesses, nervous system or reproductive effects, and chronic diseases such as cancer.[439]
- Damage to or long-term contamination to water infrastructure. Infrastructure may need to be replaced or repaired.
- Need to find short- and long-term alternative drinking water sources.
- Personal and household economic impacts of increased medical costs that may not be covered by insurance.

[439] United States Environmental Protection Agency. (2021, September 28). Drinking Water. https://www.epa.gov/report-environment/drinking-water#:~:text=If%20drinking%20water%20contains%20unsafe,chronic%20diseases%20such%20as%20cancer.

3.2.11.2.3. Vulnerabilities

All populations, economies, structures, improved property, and critical facilities and infrastructure in the City are vulnerable to water contamination. These include:

- People in the City with preexisting health conditions, those without access to clean water, children, pregnant women, and older adults.
- The City and its businesses could lose economic revenue from increased costs resulting from response activities, costs of repair and construction activities, and lost working hours due to personnel being sick or not being able to perform job duties due to lack of clean water.

3.3. Historical Events

The timeframe of data collected during the planning process for the City of North Plains was from as far back as available to February 22, 2022. Hazard events that have affected the entire planning area since adoption of the 2017 NHMP are detailed in Volume I, Section 2. During the data collection period, the City experienced impacts of extreme heat, flooding, wildland fire smoke, and water contamination.

A disaster declaration for the COVID-19 pandemic was in effect from March 12, 2020, to April 7, 2021. Although pandemic is not a hazard included in this NHMP, this declaration is noted because FEMA provided support and Hazard Mitigation Grant Program funding during the event.

3.4. Overall Vulnerability

Based on the analysis completed by the Technical Committee, wildland fire, earthquake, winter storm, flooding, and extreme heat present the highest relative risk to the City of North Plains. These hazards can create widespread events, and all populations, economies, structures, improved property, critical facilities and infrastructure, and natural environments in the City can be vulnerable to these hazards.

Areas of greatest vulnerability to these hazards within the City include:

- Populations with higher vulnerability, such as those with preexisting health conditions, older adults, children, and pregnant women.
- Populations that are unhoused, do not have access to private transportation, and/or are without access to air conditioning, cooling equipment, sufficient heating, and clean water.
- Populations with limited income and financial resources.
- Populations whose primary language is not English.
- Industries can experience commerce losses from power interruptions, damaged buildings and assets, and road closures. Industries can also sustain direct losses to buildings, personnel, and other vital equipment.
- Economic impacts to the City, including loss of local revenue due to business and property tax losses, reduced future revenues, reduced recreation and tourism activity, increased costs resulting from response activities, and increased future costs resulting from recovery and reconstruction activities.
- Critical infrastructure, including the City's two water stations and city hall.
    - Older buildings and infrastructure not built to current building codes or seismic standards may be more vulnerable. City facilities, except for the water reservoir and pump house, are not retrofitted.
- Critical transportation infrastructure, including US Highway 26 and arterial roads.

- Other critical infrastructure, including emergency generators and above- or belowground utility and power lines.
- Areas near the epicenter of an earthquake event are likely to incur a significant amount of damage to all buildings, infrastructure, facilities, and property.
- The City purchases treated water from the JWC. The water sources used by JWC could be vulnerable to hazard events.
- Natural environments throughout the City, including parks, the community garden, and walking trails.
- Landscaping and trees located throughout the City.

4. Capability Assessment

(In compliance with 44 CFR §201.6(c)(3))

The following capability assessment and safe growth analysis examine the ability of the City to implement and manage a comprehensive mitigation strategy. Strengths, opportunities, and resources of the jurisdiction are identified to develop an effective hazard mitigation action plan. The capabilities identified in this assessment were evaluated collectively to develop feasible recommendations, which support the implementation of effective mitigation activities.

A capability questionnaire was distributed to the City's Technical Committee to initiate this assessment. The survey included questions regarding existing plans, policies, and regulations that contribute to or hinder the ability to implement hazard mitigation activities, including legal and regulatory capabilities, administrative and technical capabilities, education and outreach capabilities, and fiscal capabilities. The Technical Committee also completed a safe growth analysis to identify potential gaps in growth guidance instruments and improvements that could be made to reduce vulnerability to future development.

4.1. Planning and Regulatory Assessment

Planning and regulatory capabilities include plans, policies, codes, and ordinances within the City that can prevent and reduce the impacts of hazards.

The City's Comprehensive Plan addresses natural hazards, identifies projects that can be included in the mitigation strategy, and can be used to implement mitigation actions. This plan provides adequate space for expected future growth and in areas located outside natural hazard areas. Many of the goals and policies in the City's Comprehensive Plan are related to those in this NHMP and safe growth objectives. The monitoring and implementation section of the NHMP covers these and all other hazard mitigation strategies discussed in the plan. Safety is explicitly included in the Comprehensive Plan's growth and development policies.

The Capital Improvement Plan for the City of North Plains addresses natural hazards, identifies projects that can be included in the mitigation strategy, and can be used to implement mitigation actions. Additionally, this plan's corresponding Capital Improvement Program provides funding for hazard mitigation projects identified in this NHMP; however, the program does not limit expenditures on projects that would encourage development in areas vulnerable to natural hazards. The City's infrastructure policies do not limit extension of existing facilities and services that would encourage development in areas vulnerable to natural hazards.

The City's Capital Improvement Plan, Local Emergency Operations Plan, Stormwater Management Plan, and Transportation System Plan address natural hazards, identify projects that can be included in the

mitigation strategy, and can be used to implement mitigation actions. North Plains has included an evacuation order and shelter location in Appendix 5 of their Emergency Operations Plan.

The North Plains Transportation System Plan allows for its current and future infrastructure growth, encourages walking and biking with walkways and bike trails that reduce vehicle use, and provides a street grid system that provides good connectivity, thereby reducing the environmental impact.

Land use planning and ordinances, including zoning, subdivision, floodplain, and open space preservation regulations, are adequately administered and enforced and are an effective measure for reducing hazard impacts. The City has a future land use map that clearly identifies natural hazard areas. Additionally, land use policies discourage development or redevelopment within natural hazard areas.

The City's zoning and ordinances recognize the need to avoid or mitigate natural hazards. The City has zoning ordinances that conform to the Comprehensive Plan in terms of discouraging development or redevelopment within natural hazard areas. Any development in the floodplain goes through extensive scrutiny and must meet strict boundaries. The ordinance also contains natural hazard overlay zones that set conditions for land use within such hazard zones. Rezoning procedures recognize natural hazard areas as off limits to any zoning changes that would allow for increased activity or development in the area. The City does not have subdivision regulations that restrict the subdivision of land within or adjacent to natural hazard areas, provide for conservation subdivisions or cluster subdivisions in order to conserve environmental resources, or allow density transfer where hazard areas exist.

The City's Planning Manager leads and facilitates review of land use applications and enforces site plan review requirements. The City's building code contains provisions to strengthen or elevate construction to withstand hazard forces. The City of North Plains utilizes the most current building codes as they are adopted by the State of Oregon.[440] A city permit is needed to obtain a building permit from Washington County for construction of any structure in the City. The Land Use Process application is used for the following Type II, III, and IV land use processes (except home occupations): annexation, appeal, comprehensive plan amendment (text), comprehensive plan amendment (map), conditional use (residential/industrial/commercial), design review (Type II and III), floodplain permit, partition (with and without street dedication), lot line adjustment, non-conforming use, subdivision, manufactured home park, modification (minor and major), significant natural resources permit, similar use, street vacation, Urban Growth Boundary expansion, variance (administrative and Planning Commission hearing), and zoning code amendments.

Tualatin Valley Fire & Rescue services the residents of North Plains and has an Insurance Services Office (ISO) rating of 2. The last Public Protection Classification survey was completed in January 2003.

The City has environmental systems that protect development from hazards identified and mapped and policies that maintain and restore protective ecosystems, including land use policies. North Plains manages 6.24 acres of land designated as parks, open spaces, trails and recreational facilities. McKay Creek and Ghost Creek present excellent opportunities for usable open space withing the City. The City does not have policies that provide incentives to development that is located outside protective ecosystems.

4.1.1. National Flood Insurance Program Compliance

Participation in the National Flood Insurance Program (NFIP) is based on a voluntary agreement between a community and FEMA. For communities that adopt a floodplain management ordinance to reduce flood risks to new construction, federally backed flood insurance is made available to property owners in the community. Compliance with the NFIP, however, extends beyond participation in the program. The three

[440] City of North Plains. (2022). Codes & Standards
https://www.northplains.org/search/site/codes%20and%20standards?f[0]=im_field_microsite%3A20

basic components of the NFIP include floodplain identification and mapping risk, responsible floodplain management, and flood insurance.

A repetitive loss (RL) property is a property insured under the NFIP for which the program has paid at least two claims of more than $1,000 in any 10-year period since 1978, regardless of any change(s) of ownership during that period. As of September 30, 2021, there were no FEMA-identified RL properties in the City.

4.1.1.1. National Flood Insurance Program Details

Insurance Summary

The number of NFIP policies, dollar amount of coverage in force, dollar amount of premiums paid annually, and number and dollar amount of claims paid in the City was not available at the time this NHMP was published. Identifying this information is an improvement for the next planning cycle.

There are 15 structures exposed to flood risk within the community.

Staff Resources

There are no barriers to running an effective NFIP program in the City. The City Manager and Community Development Department enforce the floodplain ordinance and administer the NFIP. The City Manager oversees the reviewing, recommending, and approving of planning permits and related land use applications. The City partners with Washington County on certain permit applications.

Compliance History

The City is in good standing with the NFIP and there are no outstanding compliance issues.

The City will continue NFIP compliance during the next five years of NHMP implementation by enforcing floodplain management requirements, including new construction and substantial improvements, maintaining and using floodplain mapping, and undertaking any code amendments needed to maintain compliance.

Regulation

The City entered the NFIP on July 16,1976. The initial flood insurance rate map (FIRM) was identified on April 1, 1982, and the current effective map date is October 19, 2018. Floodplain development regulations meet or exceed the minimum FEMA and state requirements. The City works with FEMA and Washington County to regulate development and to periodically update the delineation of the floodplain to minimize risk and enable residents to qualify for flood insurance.[441]

The City of North Plains has adopted a floodplain ordinance and enforces building codes that detail rules and requirements to protect people and property and reduce future flood losses. In North Plains, the City handles straightforward permits for development within floodplains and works with Washington County on more complex applications.

Community Rating System

The City does not participate in the Community Rating System.

4.2. Administrative and Technical Assessment

This portion of the assessment includes staff and their skills and tools that can be used for mitigation planning and implementing specific mitigation actions.

[441] City of North Plains. (n.d.). City 101: Floodplains Explained. https://www.northplains.org/planning/page/city-101-floodplains-explained

The City's Planning Manager oversees the reviewing, recommending, and approving of planning permits and related land use applications. The City's Planning, Land Use, and Building section of the Community Development Department implements the goals of the City Council and community through objective and consistent application of City development standards and state law. The Planning Commission reviews designs for future structures and remodels, develops standards for building in North Plains, and assists City Council with policy development. Significant documents developed with the Planning Commission's guidance are the Comprehensive Plan, which is Chapter 15 of the Municipal Code, and zoning and development standards, which can be found in Chapter 16 of the Municipal Code.

The City administers maintenance programs to reduce risk, including tree trimming, clearing drainage systems, and landscape maintenance of open spaces and rights of way. The City also has multiple effective mutual aid agreements and planning partnerships, including intergovernmental agreements and a partnership with the Washington County Emergency Management Cooperative.

The Public Works Director acts as the City's Emergency Manager. The City of North Plains has adequate staffing levels to enforce regulations, staff are trained on hazards and mitigation efforts, and coordination on mitigation initiatives with staff is effective. The floodplain ordinance is enforced by Community Development Department staff. The City handles straightforward permits for development within the floodplain and works with Washington County on more complex building permit applications.

Multiple City departments have staff who can support the mitigation strategy, including planners and engineers (contracted) with an understanding of natural hazards, engineers and professionals trained in construction practices related to buildings and infrastructure, staff with education or expertise to assess vulnerability to hazards, and staff with geographic information system (GIS) knowledge and capabilities.

Additionally, the City has many technical capabilities that have been used to assess or mitigate risk and could be used in future efforts. Warning systems include Everbridge and OR-Alert in partnership with Washington County. Grant writing is completed by individual departments as needed. The City has access to GIS programs and can create mapping products for specific projects, and hazard data and information can be pulled from a variety of sources, including historical records and DOGAMI.

4.3. Education and Outreach Assessment

Education and outreach programs and methods already in place that could be used to implement mitigation activities and communicate hazard-related information were assessed to determine the City's capabilities.

The City's Emergency Management Division maintains a website that promotes disaster preparedness for hazards and provides information on basic disaster response skills. These online resources include the Take 5 to Survive campaign, Red Cross survival kit supplies, the Neighborhood Ready program, and how to access the Preparing Together Discussion Guide and Toolkit from any library in Washington County. The Emergency Management website also includes information specific to seniors and vulnerable populations and encourages citizens to have a plan for their animals in case they need to evacuate.

4.4. Financial Assessment

The City has access to or is eligible to potentially use the following funding resources for hazard mitigation initiatives:

- Capital improvements project funding
- Fees for water, sewer, gas, and/or electric services
- Impact fees for new development
- Transportation utility fees

- Incurrence of debt through general obligation bonds and/or special tax bonds
- Incurrence of debt through private activities
- Federal funding sources, including the Community Development Block Grant, Urban Areas Security Initiative, Building Resilient Infrastructure and Communities, and Hazard Mitigation Assistance Grants
- State funding programs, including the State Homeland Security Program

4.5. Capability Expansion and Improvement

Actions that can expand and improve existing authorities, plans, policies, and resources for mitigation include continuing to update City plans as necessary to ensure they are current and reflect the needs of the community; further developing warning systems and messaging; increasing dedicated grant writing staff; creating and implementing additional public education and outreach offerings and increasing the volume of translated materials; and ensuring grant opportunities are capitalized upon to meet goals.

5. Mitigation Strategy

(In compliance with 44 CFR §201.6(c)(3)(i), §201.6(c)(3)(i), §201.6(c)(3)(ii), §201.6(c)(3)(iv), §201.6(c)(3)(iii), and §201.6(c)(4)(ii))

The mitigation strategy serves as the long-term blueprint for reducing the potential losses identified in the risk assessment. The Robert T. Stafford Disaster Relief and Emergency Assistance Act (Stafford Act) directs local mitigation plans to describe hazard mitigation actions and establish a strategy to implement those actions. Therefore, all other requirements for a local mitigation plan lead to and support the mitigation strategy.

5.1. Mitigation Goals

The City of North Plains did not participate in the 2017 Washington County NHMP; therefore, the Steering Committee reviewed and evaluated goals from the 2017 Washington County NHMP, 2020 City of Beaverton NHMP, 2011 Cities of Cornelius and Forest Grove NHMPs, and 2020 State of Oregon NHMP. The goals from each plan were grouped by topic and then synthesized to create the seven goals detailed in Volume I, Section 3. These goals are the basis of this plan and summarize what the Steering Committee will accomplish by implementing this plan.

5.2. Plan Incorporation and Integration into Existing Planning Mechanisms

Based on mitigation plan requirement 44 CFR §201.6(c)(4)(ii), the vulnerability and capabilities assessment for the City was carefully reviewed and considered when developing the mitigation actions for this plan. The City's Technical Committee will establish a process in which the mitigation strategy, goals, objectives, and actions outlined in this plan will be incorporated into the existing local planning strategies.

Once the plan is adopted, the committee will coordinate implementation with the responsible parties in the City and with external stakeholders as needed. The primary means for integrating mitigation strategies will be through the revision, update, and implementation of plans and regulations, such as comprehensive plans, capital improvement plans, and land development regulations, as feasible.

The members of the City's Technical Committee will remain charged with ensuring that the goals and strategies of new and updated local planning documents for their jurisdictions and special districts are consistent with the goals and actions in the NHMP and will not contribute to increased hazard vulnerability.

5.2.1. Comprehensive Plan

The goals in the City's Comprehensive Plan align with the Oregon Statewide Planning Goals and include the goals related to land use planning; natural resources and open spaces; air, water, and land resources quality; and natural hazards. Through a coordinated strategy, the City will focus on objectives and policies that will protect people and property from natural hazards and improve resiliency in the community. The most recent plan update was completed on April 20, 2022. Additional details about hazard mitigation will be added to the plan when it is updated, as applicable.

5.2.2. Building and Zoning Codes

Title XV, Land Usage, Chapter 155, Zoning and Development, of the City's Code of Ordinances addresses the area's comprehensive building and zoning codes. Updates to this chapter and addition of hazard mitigation strategies to other code sections can be made during future amendment efforts, as appropriate.

5.2.3. Public Engagement, Education, and Outreach

The City's emergency management personnel will continue public engagement campaigns during National Preparedness Month. The City's website will continue to be updated with preparedness information for individuals, families, populations at higher risk, businesses, and schools.

5.2.4. Land Development Regulations

Title XV, Land Usage, Chapter 155, Zoning and Development, of the City's Code of Ordinances addresses land development regulations. This includes the floodplain and significant natural resources overlay districts, subdivision ordinances, and design review requirements. Updates to this chapter and addition of hazard mitigation strategies to other code sections can be made during future amendment efforts, as appropriate.

5.2.5. Floodplain Management Program and/or National Flood Insurance Program

The City Manager and Community Development Department will continue to review the City's compliance with NFIP program requirements and will incorporate any new findings into the City's mitigation strategy, as appropriate.

The City's floodplain management program is implemented through Chapter 155 of the City's Code of Ordinances. Updates to this chapter can be integrated into future amendment efforts, as necessary and appropriate.

5.2.6. Stormwater Management Plans

The City of North Plains has a Stormwater Management Plan. This plan includes information on floodplains, watersheds, and drainage basins and proposes water quality, stormwater detention, and

aquatic habitat enhancement improvements. Additional details about hazard mitigation will be added to the plan when it is updated, as applicable. Additionally, the City works with Clean Water Services on stormwater-related issues.

5.2.7. Emergency Plans That Address Evacuation and Sheltering

Evacuation and sheltering are addressed in the City's Emergency Operations Plan, and the City works with the Washington County Sherriff's Office and Tualatin Valley Fire & Rescue on sheltering and evacuation efforts as needed. The City Manager and Public Works Director will review and update this section of the Emergency Operations Plan as needed to meet the needs of the City and its residents.

5.2.8. Enforcement of Existing Polices

The City will continue to enforce the policies that are in place and include hazard mitigation elements, including building and zoning codes, land development regulations, and NFIP regulations.

5.2.9. Funding Opportunities

The City Manager and the City's Public Works Director will continue to monitor local, state, and federal funding opportunities that could be utilized for hazard mitigation. This includes Hazard Mitigation Assistance opportunities and non-traditional mitigation funding sources.

6. Actions Items

Action items for the 2023 NHMP were determined by the City's Technical Committee based on the review of its risk assessment and its existing capabilities. This comprehensive range of actions includes local plans and regulations, structure and infrastructure projects, natural systems protections, and education and awareness programs. A summary of these actions and full action item planning worksheets are provided in Sections 6.1 and 6.2 below. Additional information about how these actions were developed, evaluated, and prioritized is in Volume I, Section 3.

6.1. City of North Plains Action Items: 2023 Washington County NHMP

Table 198: City of North Plains Action Items

Action Item Number	Action Item Description	Hazard(s) Addressed	Priority
1	Potable Water Tank Pillows	Dam failure, earthquake	Medium
2	Aquifer Storage and Recovery	Dam failure, earthquake	Medium
3	JWC Supply Pipeline Joint Strengthening	Dam failure, earthquake	Medium
4	Participate in programs that provide advance warning to the public of imminent natural hazard events that will impact the people of the City, such as the National Weather Service's StormReady Program, USGS' ShakeAlert, National Weather Service HeatRisk, and others.	All hazards	Medium
5	Develop partnership strategy for the City to foster natural hazard program coordination and collaboration with infrastructure owners including public and private utility providers in the City of North Plains.	All hazards	Medium

6.2. Mitigation Action Information Worksheets

Table 199: Portable Water Tank Pillows

Mitigation Action Information			
Title of action	Portable Water Tank Pillows		
Type of action	Plans/regulations ☐ Structure and infrastructure project ☒		Natural systems protection ☐ Public education/awareness ☐
Action description	Procure water-related equipment and materials needed to provide emergency water.		
Hazard(s) addressed	Dam failure ☒ Drought ☒ Earthquake ☒ Extreme heat ☒	Flood ☒ Landslide ☒ Volcanic ash ☒ Wildland fire ☒	Windstorm, incl. tornado ☒ Winter storm ☒
How does the action address identified current or future risks and vulnerabilities?	Per the City's Water System Master Plan Update, the key seismic vulnerability for the City is the loss of supply from the JWC water supply transmission main. This could result in the City being without water for weeks or months, depending on the degree of damage and the availability of repair materials and labor. To mitigate this vulnerability, it is suggested that two 10,000-gallon potable water pillow tanks at a total cost of $25,000 be purchased to store water from Well No. 1 in the case of an emergency. This would allow the City additional backup storage in the case that Well No. 3 became unusable.		
Mitigation Action Integration			
Alignment with NHMP goals	Goal 1 ☒ Goal 2 ☒ Goal 3 ☐	Goal 4 ☐ Goal 5 ☐ Goal 6 ☒	Goal 7 ☐
Integration into other initiatives	To be determined.		
Alignment with existing plans and policies	City of North Plains Emergency Operations Plan City of North Plains Water System Master Plan Update		
Mitigation Action Implementation Plan			
Priority	Low ☐	Medium ☒	High ☐
Lead position, office, department, or division responsible for implementation	City Manager		

Potential Funding Sources	
Non-Federal Funding Sources	**Federal Funding Sources**
General Fund	BRIC grants through FEMA
Estimated Cost	$25,000

Estimated Benefit	
Primary Benefit(s)	**Financial Benefit(s) (Est. Cost x 6)**
Provides the City additional backup storage in the case that Well No. 3 became unusable due to any natural hazard event.	$150,000

Project Timeline
Expected Timeline for Completion
Short-term ☐ Mid-term ☒ Long-term ☐ Ongoing ☐

Implementation Progress Report for Plan Maintenance	
Date	
What progress in implementation has been made to date?	
What challenges in implementation have been experienced?	
What are the next steps in implementation?	

Table 200: Aquifer Storage and Recovery

Mitigation Action Information			
Title of action	Aquifer Storage and Recovery (ASR)		
Type of action	Plans/regulations ☐ Structure and infrastructure project ☒		Natural systems protection ☐ Public education/awareness ☐
Action description	Complete an ASR feasibility study. Based on study results, implement an ASR facility that could store water and supply the City with seasonal independence from the JWC supply pipeline.		
Hazard(s) addressed	Dam failure ☒ Drought ☐ Earthquake ☒ Extreme heat ☐	Flood ☐ Landslide ☐ Volcanic ash ☐ Wildland fire ☐	Windstorm, incl. tornado ☐ Winter storm ☐
How does the action address identified current or future risks and vulnerabilities?	Per the City's Water System Master Plan Update, the key seismic vulnerability for the City is the loss of supply from the JWC water supply transmission main. This could result in the City being without water for weeks or months, depending on the degree of damage and the availability of repair materials and labor. To mitigate this vulnerability, it is recommended that the City implement an Aquifer Storage and Recovery facility that could store water and supply the City with seasonal independence from the JWC supply pipeline.		
Mitigation Action Integration			
Alignment with NHMP goals	Goal 1 ☒ Goal 2 ☒ Goal 3 ☐	Goal 4 ☐ Goal 5 ☐ Goal 6 ☒	Goal 7 ☒
Integration into other initiatives	To be determined.		
Alignment with existing plans and policies	City of North Plains Emergency Operations Plan City of North Plains Water System Master Plan Update		
Mitigation Action Implementation Plan			
Priority	Low ☐	Medium ☒	High ☐
Lead position, office, department, or division responsible for implementation	City Manager		
Potential Funding Sources			
Non-Federal Funding Sources		**Federal Funding Sources**	
General Fund		BRIC grants through FEMA	
Estimated Cost	$6,100,000 (per Water System Master Plan Update)		

Estimated Benefit	
Primary Benefit(s)	**Financial Benefit(s) (Est. Cost x 6)**
Water storage that would supply the City with seasonal independence from the JWC supply pipeline and provide water in case of a dam failure or earthquake event.	$36,600,000
Project Timeline	
Expected Timeline for Completion	
Short-term ☐ Mid-term ☐ Long-term ☒ Ongoing ☐	
Implementation Progress Report for Plan Maintenance	
Date	
What progress in implementation has been made to date?	
What challenges in implementation have been experienced?	
What are the next steps in implementation?	

Table 201: Joint Water Commission Supply Pipeline Joint Strengthening

Mitigation Action Information			
Title of action	Joint Water Commission Supply Pipeline Joint Strengthening		
Type of action	Plans/regulations ☐	Natural systems protection ☐	
	Structure and infrastructure project ☒	Public education/awareness ☐	
Action description	The JWC Pipeline crosses McKay Creek between NW Wren Road and NE Evergreen Road and the alignment is adjacent to the McKay Creek tributary and wetland near the 314 St Vault. It is expected that this area will also have increased liquefaction potential and lateral displacement issues due to the high ground water table, slopes, and soft soils. It is likely that increased pipeline displacements will occur in these areas, increasing the likelihood of breakage. It is recommended that site-specific lateral displacements be evaluated in these areas to ensure the JWC pipeline can accommodate the displacements expected. The JWC water transmission main has unrestrained pipe joints that could pull apart during an earthquake, particularly if permanent ground deformation occurs. A mitigation project to improve seismic resiliency could involve retrofit installation of split harnesses to restrain the currently unrestrained joints. A rough estimate of the number of joints to be strengthened is 688.		
Hazard(s) addressed	Dam failure ☒	Flood ☐	Windstorm, incl. tornado ☐
	Drought ☐	Landslide ☐	Winter storm ☐
	Earthquake ☒	Volcanic ash ☐	
	Extreme heat ☐	Wildland fire ☐	
How does the action address identified current or future risks and vulnerabilities?	Per the City's Water System Master Plan Update, the JWC water transmission main has unrestrained pipe joints that could pull apart during an earthquake, particularly if permanent ground deformation occurs. A mitigation project to improve seismic resiliency could involve retrofit installation of split harnesses to restrain the currently unrestrained joints.		
Mitigation Action Integration			
Alignment with NHMP goals	Goal 1 ☒	Goal 4 ☐	Goal 7 ☒
	Goal 2 ☒	Goal 5 ☐	
	Goal 3 ☐	Goal 6 ☒	
Integration into other initiatives	To be determined.		
Alignment with existing plans and policies	City of North Plains Emergency Operations Plan City of North Plains Water System Master Plan Update		
Mitigation Action Implementation Plan			
Priority	Low ☐	Medium ☒	High ☐
Lead position, office, department, or division responsible for implementation	City Manager		

Potential Funding Sources	
Non-Federal Funding Sources	**Federal Funding Sources**
General Fund	BRIC grants through FEMA
Estimated Cost	$1,430,000 (per Water System Master Plan Update)

Estimated Benefit	
Primary Benefit(s)	**Financial Benefit(s) (Est. Cost x 6)**
Preservation of the JWC supply pipeline so it continues to provide water in case of a dam failure or earthquake event.	$8,580,000

Project Timeline
Expected Timeline for Completion
Short-term ☐ Mid-term ☐ Long-term ☒ Ongoing ☐

Implementation Progress Report for Plan Maintenance	
Date	
What progress in implementation has been made to date?	
What challenges in implementation have been experienced?	
What are the next steps in implementation?	

Table 202: Advance Warning Systems Programs

Mitigation Action Information			
Title of action	Advance Warning System Programs		
Type of action	Plans/regulations ☒		Natural systems protection ☐
	Structure and infrastructure project ☐		Public education/awareness ☒
Action description	Participate in programs that provide advance warning to the public of imminent natural hazard events that will impact the people of the City, such as the National Weather Service's StormReady Program, USGS' ShakeAlert, National Weather Service HeatRisk, and others.		
Hazard(s) addressed	Dam failure ☒	Flood ☒	Windstorm, incl. tornado ☒
	Drought ☒	Landslide ☒	Winter storm ☒
	Earthquake ☒	Volcanic ash ☒	
	Extreme heat ☒	Wildland fire ☒	
How does the action address identified current or future risks and vulnerabilities?	Working through the application and implementation process by participating in advance warning programs will help in identifying additional mitigation opportunities prior to the event occurring as well as providing early warning for responses and public notifications.		
Mitigation Action Integration			
Alignment with NHMP goals	Goal 1 ☒	Goal 4 ☐	Goal 7 ☐
	Goal 2 ☒	Goal 5 ☒	
	Goal 3 ☒	Goal 6 ☒	
Integration into other initiatives	NWS early warning programs USGS early warning programs		
Alignment with existing plans and policies	City of North Plains Emergency Operations Plan		
Mitigation Action Implementation Plan			
Priority	Low ☐	Medium ☒	High ☐
Lead position, office, department, or division responsible for implementation	City Manager		
Potential Funding Sources			
Non-Federal Funding Sources		**Federal Funding Sources**	
General budget		BRIC and FMA grants through FEMA	
Estimated Cost	$5,000		

Estimated Benefit	
Primary Benefit(s)	**Financial Benefit(s) (Est. Cost x 6)**
Incorporates program elements into preparedness and response plans.	$30,000
Project Timeline	
Expected Timeline for Completion	
Short-term ☐ Mid-term ☒ Long-term ☐ Ongoing ☐	
Implementation Progress Report for Plan Maintenance	
Date	
What progress in implementation has been made to date?	
What challenges in implementation have been experienced?	
What are the next steps in implementation?	

Table 203: Develop Partnership Strategy for Public/Private Infrastructure Owners and Managers

Mitigation Action Information			
Title of action	Develop Partnership Strategy for Public/Private Infrastructure Owners and Managers		
Type of action	Plans/regulations ☒		Natural systems protection ☐
	Structure and infrastructure project ☐		Public education/awareness ☒
Action description	Develop partnership strategy for the City to foster natural hazard program coordination and collaboration with infrastructure owners including public and private utility providers in the City of North Plains.		
Hazard(s) addressed	Dam failure ☒	Flood ☒	Windstorm, incl. tornado ☒
	Drought ☒	Landslide ☒	Winter storm ☒
	Earthquake ☒	Volcanic ash ☒	
	Extreme heat ☒	Wildland fire ☒	
How does the action address identified current or future risks and vulnerabilities?	This will improve the City's relationships with water providers, wastewater treatment agency, electrical service providers, communications providers, solid waste programs and others to connect them to funding sources for mitigation and infrastructure hardening and construction projects.		
Mitigation Action Integration			
Alignment with NHMP goals	Goal 1 ☒	Goal 4 ☐	Goal 7 ☒
	Goal 2 ☒	Goal 5 ☒	
	Goal 3 ☒	Goal 6 ☐	
Integration into other initiatives	To be determined.		
Alignment with existing plans and policies	City of North Plains Comprehensive Plan		
Mitigation Action Implementation Plan			
Priority	Low ☐	Medium ☒	High ☐
Lead position, office, department, or division responsible for implementation	City Manager		
Potential Funding Sources			
Non-Federal Funding Sources		**Federal Funding Sources**	
General Fund		BRIC and FMA grants through FEMA Rural Development Assistance, USDA	
Estimated Cost	$10,000		

Estimated Benefit	
Primary Benefit(s)	**Financial Benefit(s) (Est. Cost x 6)**
Identifying funding resources for infrastructure projects; improving relationships for planning and emergency response	$60,000
Project Timeline	
Expected Timeline for Completion	
Short-term ☐ Mid-term ☐ Long-term ☒ Ongoing ☐	
Implementation Progress Report for Plan Maintenance	
Date	
What progress in implementation has been made to date?	
What challenges in implementation have been experienced?	
What are the next steps in implementation?	