FINAL DRAFT

North Santiam Watershed Drought Contingency Plan

Prepared for

North Santiam Watershed Drought Contingency Plan Task Force

April 2026

SANTIAM WATER CONTROL DISTRICT

CITY OF Salem AT YOUR SERVICE

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Introduction

Following an intense drought in 2015, entities with diverse interests in water issues in the North Santiam Watershed (NSW) came together to develop a Drought Contingency Plan (DCP) to protect their communities, economies, and ecosystems. The watershed's first DCP was funded in part through a Drought Contingency Planning WaterSMART grant from the Bureau of Reclamation (Reclamation) with matching contributions from multiple partners. The first DCP, approved by Reclamation in 2018, was intended to be a "living plan" that would be periodically reviewed and adjusted to increase its responsiveness to local needs and its effectiveness in preparing for and responding to drought.

Since the original plan was approved, the NSW has experienced additional episodes of drought, catastrophic wildfires, ice storms with accompanying widespread power outages, a record-breaking heat dome, and a pandemic. In 2023, interested parties in the NSW began meeting to develop an updated DCP, incorporating new data and building on their experiences with implementation. This updated DCP was also funded in part by a Drought Contingency Planning WaterSMART grant from Reclamation and addresses each of Reclamation's required planning elements.

The overarching goal of this DCP remains the same as the original goal defined in the 2018 DCP:

> *The goal for the NSW DCP is to build long-term resilience to drought in order to minimize impacts to the communities, local economies, and the critical natural resources within the watershed. The process will seek to develop consensus among stakeholders to manage water before and during drought.*

Planning Area

The planning area for the NSW DCP covers the entirety of the NSW as well as water users outside the watershed that obtain their water from the North Santiam River. The NSW is a watershed in the Willamette River basin covering approximately 766 square miles from the western slopes of the Cascade Range to the Willamette Valley floor. The NSW contains the small subbasin that drains a 12-mile reach of the mainstem Santiam River downstream of the confluence with the South Santiam River until it joins the Willamette River at River Mile 108. Together, the North Santiam River and the mainstem Santiam River are about 100 miles long. The NSW is mainly located in Linn and Marion Counties, with small portions in Clackamas and Jefferson Counties.

The watershed is characterized by steep forested uplands and flat alluvial lowlands. Detroit Reservoir (also sometimes referred to as Detroit Lake) formed by Detroit Dam, and its re-regulating structure, Big Cliff Dam, are major features of the watershed. The dams are operated by the US Army Corps of Engineers (USACE) as part of the Willamette Valley Project. Streamflow in the lower watershed is highly regulated by dam operations. Communities in the watershed are generally located close to the river. Water resources in the NSW provide drinking water for a population of about 213,506[1] including residents of the City of Salem, which obtains the majority of its water supply from the North Santiam River. Exhibit 1 shows the primary features of the planning area.

[1] Population based on estimates of customers served by water systems, available from Oregon Health Authority Drinking Water Data Online at https://yourwater.oregon.gov/wssearch.php?

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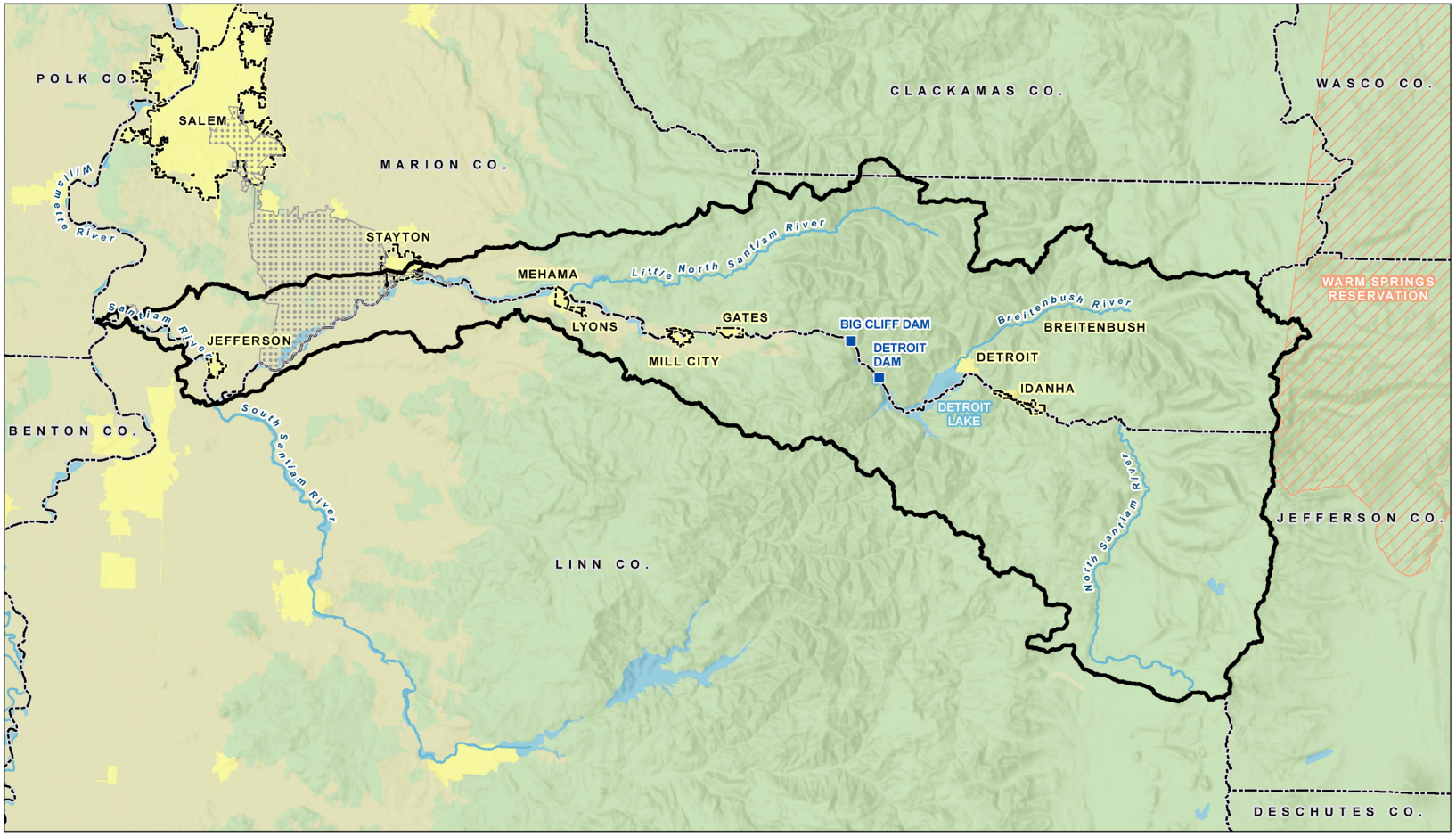
Exhibit 1. North Santiam Watershed Planning Area



LEGEND

- Dam
- North Santiam Watershed
- Santiam Water Control District Service Area
- City Boundary
- County Boundary
- Warm Springs Reservation
- Major Road
- Watercourse

Land Cover

- Forest and Woodland
- Agriculture
- Urban
- Water

EXHIBIT 1

North Santiam Watershed Planning Area

North Santiam Watershed Drought Contingency Plan Update

N

0 5 10

Miles

GSI Water Solutions, Inc.

Date: June 21, 2023
Data Sources: BLM, ESRI, ODOT, USGS, ONHP
Document Path: \\WMS\GIS_Files\0111_Salem\Source_Figures\022_Oncall_WRs\NSantiam_DroughtContingencyPlan\Exhibit1_WatershedMap.mxd, wkimmon

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Approach

Reclamation has identified six required elements for an approved DCP:

1. **Drought Monitoring** involves predicting and recognizing drought conditions.
2. **Vulnerability Assessment** identifies and evaluates the risks and impacts of drought.
3. **Mitigation Actions** reduce risks and impacts before drought.
4. **Response Actions** reduce impacts during drought.
5. **Operational and Administrative Framework** identifies roles and responsibilities for implementation of the DCP.
6. **Update Process** describes the evaluation of effectiveness and process for improving future implementation and drought response.

The following sections of this DCP address each required planning element. The update process was led by a Drought Planning Task Force and supported by Working Groups to develop updated planning element sections of the DCP. Working Groups met to discuss how implementation of each element of the 2018 DCP had been working, present new ideas, and propose changes for discussion, as well as to review and comment on initial updates to the planning elements The Drought Planning Task Force then reviewed and commented on the updated planning elements, and changes were incorporated into the full draft DCP. Ongoing feedback was solicited via an email list between meetings, and information about the update process was posted on DCP webpage on the North Santiam Watershed Council's website and promoted through community events and social media. A public meeting was held in February 2026 to increase awareness of the DCP process and watershed issues in the NSW and to give the public an opportunity to provide input on the draft DCP. The Task Force approved submittal of this updated DCP to Reclamation. Appendix A includes a list of individuals who participated in the Task Force and Working Groups.

Element #1: Drought Monitoring

This element of the DCP presents the revised Drought Monitoring Framework (Framework) that will be used to verify existing drought conditions and assess the likelihood of future drought development in the North Santiam watershed (NSW). The Framework includes data sources, indicators, thresholds, and stages of drought. Each stage of drought is linked to specific activities to reduce risk and losses, as described further in Element #4, Response Actions.

The first version of the Framework appeared in the 2018 Drought Contingency Plan (DCP) and was developed with input from the original Drought Monitoring Working Group, Task Force, and participants from the 2016 Basin Summit. The Framework provided an overview of watershed conditions including a variety of climatologic, hydrologic, environmental, and socioeconomic indicators, and it was accompanied by a series of tables and reporting forms to track and distribute key information to interested entities. As part of the DCP Update process (Element #6), the Framework has been adjusted in this DCP to incorporate new information and indicators of interest.

As with the previous iteration of the Framework, this is not intended to supersede monitoring conducted by other entities in the NSW; rather, interested entities should continue to monitor water availability and other conditions as required or desired by their own rules and guidance documents. Information contained in the DCP drought monitoring reports may be used to supplement existing monitoring efforts and provide context. Several of the indicators used in the framework rely on remotely sensed (e.g., satellite) data. Entities with site-specific "on-the-ground" data whose monitoring results differ markedly from data presented in the monthly reports are encouraged to communicate with the Drought Monitoring Working Group to better understand the sources of discrepancies and improve the Framework where possible.

Components of the Drought Monitoring Framework

The Bureau of Reclamation's (Reclamation) WaterSMART Drought Response Program guidelines describe the use of indices, indicators, triggers, and drought stages in a drought monitoring program (Reclamation, 2019). Consistent with this guidance, the following definitions are used in this DCP:

- **Indices** integrate multiple drought-related variables into a single number to describe the intensity of drought. Large-scale indices provide valuable context for regional trends but do not always adequately capture localized variations in drought conditions.
    - Examples: US Drought Monitor, US Standardized Precipitation Index
- **Indicators** are specific, measurable values that can be used to assess drought conditions. Each indicator describes the condition of a specific variable that can contribute to drought, and indicators can be used to establish triggers for particular response or mitigation actions.
    - **Examples**: precipitation, streamflow, reservoir levels, snowpack
- **Triggers** are values or value ranges of indicators that are used to designate drought stages or to initiate pre-determined response or mitigation actions.
    - **Examples**: specific reservoir levels on a certain date, streamflows falling below specified thresholds
- **Drought stages** are descriptions of the severity of drought, and each stage is associated with specified drought response actions as described further in Element #4. Drought stages can be assigned numeric values (e.g., Stages 1-4) or narrative descriptions (e.g., moderate, severe, extreme).

Monitoring Framework 1.0

Monitoring Framework 1.0, the version that appeared in the 2018 DCP, included a current drought conditions table, a future drought trends table, additional indicators and key information to consider, a reporting form, and a reporting schedule. Framework 1.0 used a set of 12 indicators and indices covering a range of climatic, hydrologic, environmental, and socioeconomic variables reflecting a range of short-term, mid-term, and long-term trends, as shown in Exhibit 2. These indicators and indices were selected based on a review of historical conditions and Task Force and Working Group member expertise.

Exhibit 2. Monitoring Framework 1.0 Current Condition Indicators and Indices

Type	Indicator or Index	Measurement	Location
National Indices	US Drought Monitor	Classification of drought stage	North Santiam watershed
Climate	Air temperatures	1 month departure from normal, °F	Santiam River basin
	Precipitation	Percent of normal for water year	Santiam River basin
Hydrologic	Snowpack	Percent of normal snow water equivalent	North Santiam watershed (median of 4 sites)
	Detroit Reservoir level	Percent above water control diagram	Detroit Reservoir
	Streamflow	USGS 7-day flow class and percentile	North Santiam River at Greens Bridge near Jefferson
			North Santiam River at Mehama
			North Santiam River below Boulder Creek
Environmental	Water temperature	Temperature above TMDL threshold, °C	North Santiam River at Greens Bridge near Jefferson
	Wildfire hazard	Oregon Department of Forestry/National Fire Danger Rating System	Willamette National Forest
Socioeconomic	Boat ramps served	Key elevations, feet	Detroit Reservoir
	Salem water supply availability	7-day average streamflow in cubic feet per second	USGS gage on the North Santiam River at Mehama

No individual indicators were weighted. Data sources for each indicator were specified and hyperlinked in the current drought conditions table. Most indicators were tracked year-round, with

the exception of snowpack (December 1 through May 1) and boat ramps served at Detroit Reservoir (April 1 through September 30). Streamflow is an important indicator of drought conditions in the watershed, but it is strongly influenced by managed releases from Detroit Reservoir in addition to natural streamflow. Therefore, streamflow from three gages along the North Santiam River were included as indicators: (1) Greens Bridge, at the lower end of the watershed near the confluence with the South Santiam River; (2) Mehama, below Detroit Reservoir; and (3) below the confluence with Boulder Creek, in the upper watershed above Detroit Reservoir.

Four stages of drought and a Stage 0 "No Drought" condition were defined for the NSW, as shown in Exhibit 3. This structure is similar to the four stages of drought commonly used in municipal and agricultural Water Management and Conservation Plan (WMCP) curtailment plans in the region.

Exhibit 3. Drought Stages

Stage	Description
Stage 0	No drought
Stage 1	Heads up – potential for drought
Stage 2	Moderate drought
Stage 3	Severe drought
Stage 4	Extreme drought

Each month, current indicator values were compared to threshold values and then aggregated to determine the drought stage. First, the number of indicators with values falling into each drought stage would be recorded. Next, the number of indicators in each stage would be multiplied by the number corresponding to that stage. These results would be summed up, and then finally divided by the total number of indicators recorded during the month and rounded to the nearest whole number to indicate the current drought stage. As an example, if the calculation was done in August, 11 of the 12 indicators would be tracked (no snowpack indicator). If three indicators were in Drought Stage 2, four indicators were in Drought Stage 1, and the remaining four indicators were in Drought Stage 0, the calculation would be done as follows:

Indicators x Stage Sum:
3 indicators x Stage 2 = 6
4 indicators x Stage 1 = 4
4 indicators x Stage 0 = 0
Sum: 6 + 4 + 0 = **10**
Number of indicators: **11**
Drought Stage: "Indicator x Stage Sum" ÷ "Number of indicators", **10** ÷ **11** = **0.91**, rounds to **Drought Stage 1**

The current drought conditions table in Framework 1.0 included a list of potential impacts that could occur at each drought stage. These descriptions generally followed the generic descriptions used by the US Drought Monitor. Potential impacts specific to the NSW are described further in Element #2, Vulnerability Assessment.

The table of future drought trends in Monitoring Framework 1.0 provided information regarding potential future conditions in the watershed, focusing on temperature and precipitation outlooks and forecasted inflows to Detroit Reservoir, as shown in Exhibit 4. Trends were classified as Improving (+1), Neutral or Mixed (0), or Worsening (-1).

Exhibit 4. Future Drought Trend Indicators

Indicator	Categorization	Timeframe
Temperature Outlook	Below, normal, or above mean temperatures predicted	1 month and 3 months
Precipitation Outlook	Below, normal, or above mean precipitation predicted	1 month and 3 months
Detroit Reservoir Inflow Forecast	Percent of median (>115%, 85-115%, <85%)	Current month through September

Temperature and precipitation outlooks were sourced from the National Weather Service Climate Prediction Center, and the Detroit Reservoir inflow forecast came from the Natural Resources Conservation Service's National Water and Climate Center monthly basin reports. These trends were included in the monthly drought monitoring reports but were not used to calculate drought stages. The combination of current drought stages, future trend indicators, and a brief summary narrative in the monitoring reports was intended to provide a solid collective understanding of drought conditions in the watershed.

Evaluation of Monitoring Framework 1.0

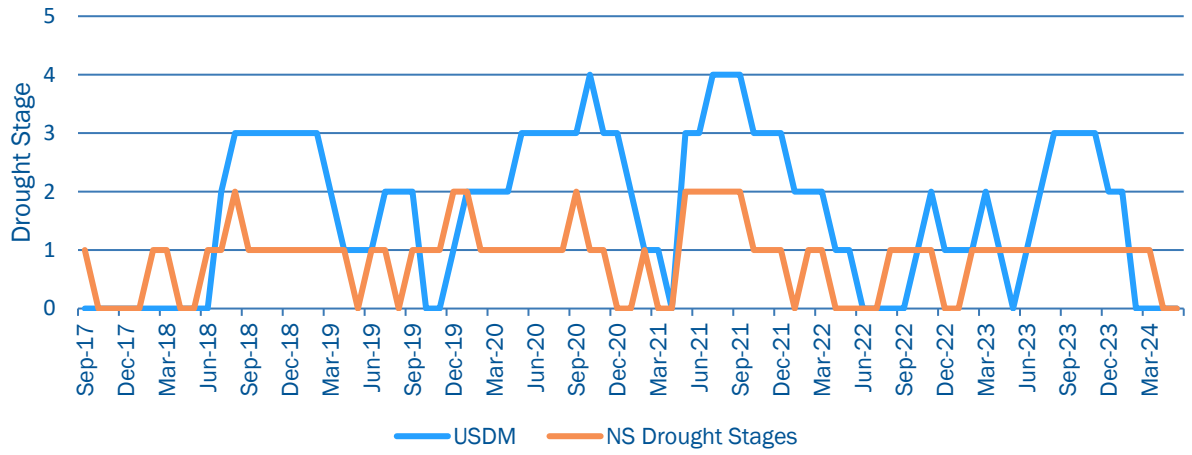
The Drought Monitoring Working Group met to evaluate the implementation of Framework 1.0 on February 6, 2024 and March 14, 2024. Participants also provided feedback and suggestions via email about what was working well and what could be improved.

In general, Framework 1.0 has been working well for interested entities in the NSW and has provided useful information about current conditions and trends in the watershed. Participants in the Working Group shared that they tended to look at the overall drought stage and then specific indicators depending on their area of interest, often using the links embedded in the monthly drought reports to find more details on particular indicators. Repeated testing of Framework 1.0 under different scenarios revealed that drought conditions were typically experienced in the upper watershed before they were experienced in the lower watershed, below Detroit Reservoir. A range of indicators was included in Framework 1.0 to help reflect watershed-wide conditions, and additional indicators have been added to Framework 2.0 based on the experience of implementing the DCP.

The following discussion highlights significant changes to the Framework as a result of the Working Group's evaluation.

US Drought Monitor. Participants generally expressed satisfaction with the thresholds used as triggers to designate drought stages; however, the drought stages calculated using Monitoring Framework 1.0 were frequently lower than the corresponding stages reported by the US Drought Monitor (USDM) for the same time periods, as shown in Exhibit 5. This may indicate that the USDM overestimates tangible drought impacts in the NSW. This discrepancy would be even more evident if the USDM were not included as an input in the Monitoring Framework 1.0 calculations. The USDM is a composite index that blends climate and hydrological data with reported drought impacts and climate scientists' professional expertise. While useful for understanding broad-scale regional conditions, the USDM is not intended to provide details about local conditions at the watershed scale. In addition, using it as an input for Framework 1.0 may have over-emphasized some indicators of drought that were common to both, such as precipitation patterns and snowpack.

Exhibit 5. Comparison of US Drought Monitor and North Santiam Drought Stages



USDM = US Drought Monitor NS = North Santiam

Streamflow. Participants appreciated having streamflow data from gages at multiple key locations in the watershed. The Boulder Creek gage provides insight into "baseline" conditions in the upper watershed, unaffected by the closely managed storage and releases from Detroit Reservoir. The Mehama gage, downstream of Detroit Reservoir, is critical for understanding these releases, as well as inflows from the Little North Santiam River. The Greens Bridge gage shows conditions in the lower watershed, downstream of the intakes for the City of Salem and the Santiam Water Control District.

Stream Temperature. Several stream segments in the North Santiam River and its tributaries are listed under Section 303(d) of the Clean Water Act as being impaired for temperature and were included in the North Santiam Subbasin Temperature Total Maximum Daily Load (TMDL) of the Willamette Basin TMDL completed by the Oregon Department of Environmental Quality (DEQ) in 2006. The TMDL set stream temperature targets for specific reaches and times of year to support salmon and steelhead spawning, rearing, migration, and core cold water habitat. DEQ recently revised the 2006 TMDL. New standards for the North Santiam River above Detroit Dam were adopted in September 2024, and new standards downstream of Detroit Dam were adopted in June 2025. Framework 1.0 included the water temperature measured instream at Greens Bridge, above the confluence with the mainstem Santiam River and downstream of major withdrawals, as an environmental indicator. Participants expressed interest in including additional stream temperature monitoring locations to better understand conditions in other areas of the watershed that have temperature impairments. Temperature TMDL thresholds vary throughout the year and by location in the watershed. Additional details of the calculation of drought stage thresholds are provided in Appendix B.

Precipitation. No individual indicators were weighted or adjusted seasonally under Framework 1.0. Working Group members suggested that adjusting the drought stage thresholds at certain times of year may be appropriate for precipitation, snowpack, and water level in Detroit Reservoir. For example, the departure from normal precipitation may be less consequential during the first few months of the water year (October 1 through September 30) because there is still time in the spring to catch up to normal levels. Later in the water year, low cumulative precipitation would signal stronger drought impacts. Working Group participants suggested capturing this seasonal significance by shifting the thresholds between drought stages starting in April, as shown in Exhibit 6.

Exhibit 6. Updated Precipitation Indicator Thresholds

	Stage 1	Stage 2	Stage 3	Stage 4
Precipitation (% of normal for water year) October through March	71-80%	61-70%	41-60%	40% or less
Precipitation (% of normal for water year) April through September	81-85%	71-80%	61-70%	60% or less

Snowpack. The snowpack indicator is monitored from December 1 through May 1. In the NSW, snow generally accumulates from December through March, begins to melt in March or April, and is completely melted out by May or June. Like the precipitation indicator, it is possible for snowpack to catch up to normal after an intense spring snowfall, even if snowpack in December and January was low. Continued low snowpack from February through May could suggest stronger drought impacts, either because snowpack has not caught up (a "dry" snow drought) or because unseasonably warm temperatures are causing precipitation to fall as rain instead of snow or are melting the existing snowpack early (a "warm" snow drought). Exhibit 7 shows the revisions to the snowpack indicator thresholds.

Exhibit 7. Updated Snowpack Indicator Thresholds

	Stage 1	Stage 2	Stage 3	Stage 4
Snowpack (% of normal for water year) December through February	61-70%	51-60%	21-50%	20% or less
Snowpack (% of normal for water year) March through May	71-85%	61-70%	51-60%	50% or less

Reservoir Level. USACE manages Detroit Reservoir based on a "rule curve" (also called a water control diagram) showing the maximum volume that can be stored at different times of year. Framework 1.0 used the percentage above the rule curve as an indicator of drought related to water storage. However, seasonal changes in reservoir management make this indicator more significant during the spring and summer. During the winter, Detroit Reservoir is managed primarily for flood control. By keeping the water elevation low from December through January, the reservoir maintains capacity for temporary storage of precipitation and snowmelt to prevent flooding downstream. While the reservoir level may spike during this time, water will be released to return to the rule curve, so it does not affect overall storage later in the year.

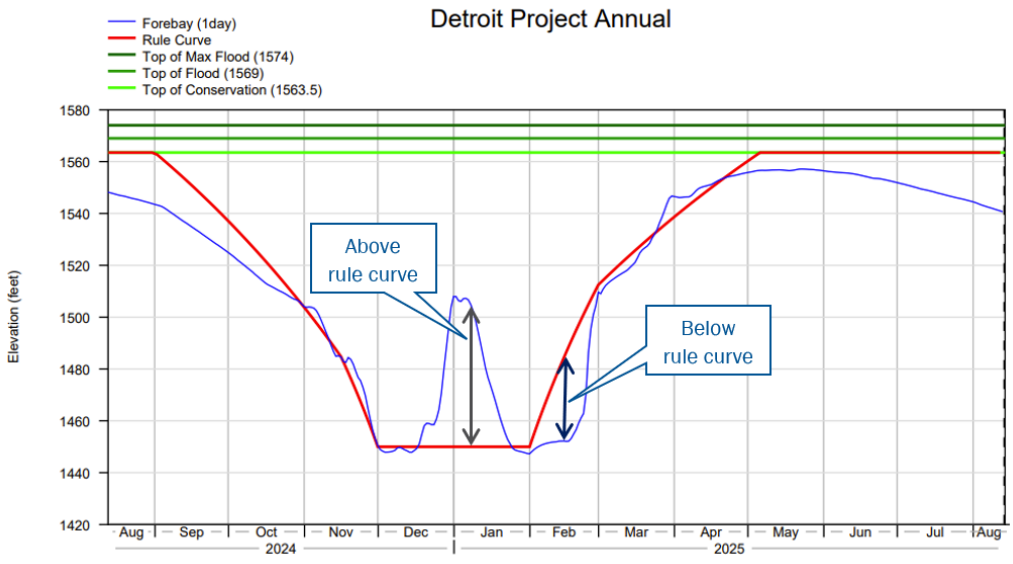
Beginning in February, the reservoir begins to fill, reaching its maximum elevation around early May. This is considered the "fill season." Currently, USACE releases an assessment of the water year by April 1 as "deficit," "insufficient," "adequate," or "abundant" based on a storage forecast for mid-May. During the summer, stored water is used for recreation at the reservoir, and some stored water is released to support instream needs for aquatic life and water quality, to produce hydropower, and to provide water for irrigation. USACE terms this the "conservation use season." Low water levels in the reservoir during the conservation season are stronger indicators of drought impacts since water is being used from the reservoir and it is unlikely to receive much more precipitation. Exhibit 8 shows the revisions to the Detroit water level indicator thresholds.

Exhibit 8. Updated Detroit Reservoir Water Level Indicator Thresholds

	Stage 1	Stage 2	Stage 3	Stage 4
Detroit Reservoir (% above rule curve) February through May (fill season)	-3 to -10	-11 to -30	-31 to -50	-51 or less
Detroit Reservoir (% above rule curve) June through October (conservation use season)	-3 to -10	-11 to -20	-21 to -35	-36 or less

The indicator uses the percentage above the rule curve because that is how USACE provides this data about reservoir levels; however, this means that the indicator will be a negative number if the reservoir level is below the rule curve. Exhibit 9 shows an example of the water level elevation at the reservoir forebay compared to the rule curve. In the example, the indicator would be a positive number in January and a negative number in February.

Exhibit 9. Reservoir Water Level and Rule Curve



Drought Mapping. In researching other regions' drought monitoring methods, the Upper Missouri River Basin's online Drought Indicator Dashboard mapping system, produced by the Montana Climate Office, stood out as a useful tool for presenting information visually. The webpage allows visitors to select an indicator of interest (e.g., snow water equivalent) and see a map of current conditions. By connecting with the Assistant State Climatologist of Montana to learn more, the Working Group was able to obtain a customized link to the dashboard that is zoomed and centered on the NSW, giving local entities an easy way to understand spatial variation in a variety of drought indicators at a glance. The dashboard is available at https://drought.climate.umt.edu/?name=NorthSantiam.

Monitoring Framework 2.0

Based on analysis of Framework 1.0 and feedback from Working Group members, Monitoring Framework 2.0 has been refined to better meet the needs of users in planning for and responding to drought. The four stages of drought in Framework 1.0 have been retained. Exhibit 10 provides updated descriptions of potential impacts that could occur at each drought stage. The impact descriptions include relevant themes from the US Drought Monitor drought stages and potential impacts specific to the NSW.

Exhibit 10. Drought Stages and Impacts

Drought Stage	Potential Impacts
1 (Heads Up)	Streamflow, Detroit Reservoir levels, and/or snowpack are below average for the time of year, indicating the potential for drought development.
2 (Moderate Drought)	Streamflow, Detroit Reservoir levels, and/or snowpack are low. Water shortages may be developing or imminent. Crops and pastures are beginning to experience impacts. Fish and wildlife are experiencing some stress. Fire danger is increasing. Recreation at Detroit Reservoir is beginning to be affected.
3 (Severe Drought)	Streamflow, Detroit Reservoir levels, and/or snowpack are very low. Water shortages are common, or alternative water sources are needed. Crop and pasture losses are likely. Fish and wildlife are experiencing considerable stress. Fire danger is very high. Some boat ramps at Detroit Reservoir are inaccessible. Salem's water supply is beginning to be affected.
4 (Extreme Drought)	Streamflow, Detroit Reservoir levels, and/or snowpack are extremely low. Shortages of water may create emergency conditions. Crop and pasture losses are widespread. Fish and wildlife are experiencing extreme stress. Fire danger is extreme. Boat ramps at Detroit Reservoir are inaccessible. Salem must initiate water curtailment measures.

Exhibit 11 presents an overview of Framework 2.0's indicators, how they are measured, the location of the measurements, and the timeframe during which the indicator is included in the calculation of drought stages. Exhibit 12 shows the threshold levels that define the drought stages for each indicator. Current data are obtained from existing monitoring sources for each indicator, compared to the threshold values, and then aggregated to determine the overall drought stage. The data

sources are hyperlinked in the table to their respective websites. Detailed instructions for calculating the drought stages are included in Appendix B.

Framework 2.0 takes into account the evaluation of Framework 1.0 and the modifications proposed by the Drought Monitoring Working Group. No changes were made to the indicators or drought stages for air temperature, streamflow, wildfire hazard, boat ramps served, or water supply for the City of Salem. Additional stream temperature monitoring locations were added to the Framework, and the US Drought Monitor was removed as an indicator. The current US Drought Monitor conditions will still be included in the monitoring reports alongside the Framework calculations for comparison. The indicator thresholds for precipitation, snowpack, and Detroit Reservoir levels have been modified to account for different seasonal weighting as described in the evaluation above.

Exhibit 11. Monitoring Framework 2.0 Indicators

Type	Indicator or Index	Measurement	Location	Timeframe
Climate	Air temperatures	1 month departure from normal, °F	Santiam River basin	Year-round
	Precipitation	Percent of normal for water year	Santiam River basin	Year-round Wet season thresholds: October-March Dry season thresholds: April-September
Hydrologic	Snowpack	Percent of normal snow water equivalent	North Santiam watershed (median of 4 sites)	December-May Early thresholds: December-February Late thresholds: March-May
	Detroit Reservoir level	Percent above water control diagram	Detroit Reservoir	February-October Fill season: February-May Conservation use season: June-October
	Streamflow	USGS 7-day flow class and percentile	North Santiam River at Greens Bridge near Jefferson	Year-round
			North Santiam River at Mehama	Year-round
			North Santiam River below Boulder Creek	Year-round

Type	Indicator or Index	Measurement	Location	Timeframe
Environmental	Water temperature	Temperature above TMDL threshold, °C	North Santiam River at Greens Bridge near Jefferson	Year-round Spawning thresholds: September 1–June 15 Core cold water habitat thresholds: June 16–August 31
		Temperature above TMDL threshold, °C	North Santiam River below Boulder Creek (above Detroit Reservoir)	Year-round
		Temperature above TMDL threshold, °C	Little North Santiam River above Evans Creek at Elkhorn	Year-round Spawning thresholds: September 1–June 15 Core cold water habitat thresholds: June 16–August 31
	Wildfire hazard	Oregon Department of Forestry/National Fire Danger Rating System	Willamette National Forest	Year-round
Socioeconomic	Boat ramps served	Key elevations, feet	Detroit Reservoir	April-September
	Salem water supply availability	7-day average streamflow in cubic feet per second	USGS gage on the North Santiam River at Mehama	Year-round

Exhibit 12. Framework 2.0 Indicator Thresholds

Drought Stage	Climate Indicators			Hydrologic Indicators							Environmental Indicators						Socioeconomic Indicators	
	Air temperature (1 month departure from normal, °F)	Precipitation (% normal for water year)		Snowpack (% normal snow water equivalent)		Detroit Reservoir level (% above water control diagram)		Streamflow (USGS 7-day flow class and percentile)			Water temperature (above TMDL threshold, °C)					Wildfire hazard (National Fire Danger Rating System)	Boat ramps served (Key elevations, feet)	Salem water supply 7-day average streamflow, cfs)
											Greens Bridge		Boulder Creek	Little North Santiam				
		Wet season	Dry season	Early season	Late season	Fill season	Conservation use season	Greens Bridge	Mehama	Boulder Creek	Spawning	Summer		Spawning	Summer			
0 (no drought)	<0.5	81 or greater	86 or greater	71 or greater	86 or greater	-3 or greater	-3 or greater	24 or greater	24 or greater	24 or greater	-1.0 or greater	-1.0 or greater	-1.0 or greater	-1.0 or greater	-1.0 or greater	Low	1,558 or greater	1,000 or greater
1	0 to 2	71 to 80	81 to 85	61 to 70	71 to 85	-3 to -10	-3 to -10	10-24 (below normal)	10-24 (below normal)	10-24 (below normal)	-1.0 to 0	-1.0 to 0	-1.0 to 0	-1.0 to 0	-1.0 to 0	Moderate	1,588 to 1,556	901 to 1,000
2	2 to 4	61 to 70	71 to 80	51 to 60	61 to 70	-11 to -30	-11 to -20	6-9 (moderate drought)	6-9 (moderate drought)	6-9 (moderate drought)	0.1 to 2.0	0.1 to 2.0	0.1 to 2.0	0.1 to 2.0	0.1 to 2.0	High	1,555 to 1,540	801 to 900
3	4 to 6	41 to 60	61 to 70	21 to 50	51 to 60	-31 to -50	-21 to -35	<=5 (severe drought)	<=5 (severe drought)	<=5 (severe drought)	2.1 to 4.0	2.1 to 4.0	2.1 to 4.0	2.1 to 4.0	2.1 to 4.0	Very High	1,539 to 1,450	701 to 800
4	6 or greater	40 or less	60 or less	20 or less	50 or less	-51 or less	-36 or less	New low (extreme drought)	New low (extreme drought)	New low (extreme drought)	4.1 or greater	4.1 or greater	4.1 or greater	4.1 or greater	4.1 or greater	Extreme	1,450 or less	700 or less

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In addition to the indicators of current conditions used in the calculation of the NSW drought stage, monitoring reports will continue to include information about anticipated future conditions in the watershed, including the 1-month and 3-month temperature and precipitation outlooks developed by the National Oceanic and Atmospheric Administration's Climate Prediction Center and the Natural Resources Conservation Service's Detroit Lake inflow forecast. Information about the future trend indicators, including links to the websites for data sources, is shown in Exhibit 13.

Exhibit 13. Future Trend Indicators

Trend	1-Month Temperature Outlook	3-Month Temperature Outlook	1-Month Precipitation Outlook	3-Month Precipitation Outlook	Detroit Lake Inflow Forecast[1]
Improving	Below mean temperatures predicted	Below mean temperatures predicted	Above mean precipitation predicted	Above mean precipitation predicted	>115 percent of average
Neutral or mixed	Normal temperatures predicted	Normal temperatures predicted	Normal precipitation predicted	Normal precipitation predicted	85 to 115 percent of average
Worsening	Above mean temperatures predicted	Above mean temperatures predicted	Below mean precipitation predicted	Below mean precipitation predicted	<85 percent of average

[1]Percent of average for current month through September

The combination of the current calculated drought stage, individual indicator data, and future trend indicators will give readers a good collective understanding of conditions in the NSW. Links to indicator data sources will continue to be included in all monitoring reports to enable readers to dig deeper into the information most relevant to them.

Additional Drought Information

Additional drought-related information that may be included in the summary narrative accompanying the drought monitoring reports includes:

- Burn restrictions issued by the Oregon Department of Forestry
- Fishing restrictions issued by the Oregon Department of Fish and Wildlife
- High arsenic levels monitored by Marion County Environmental Health Services
- Oregon Health Authority cyanobacteria advisories (harmful algal blooms)
- Specific references to Marion County or Linn County in the USDA Weekly Weather and Crop Bulletin or the Oregon Crop Progress & Condition Report.

The Drought Indicator Dashboard for the NSW described above provides maps of watershed conditions that are of interest to a variety of entities in the basin, including a vegetation index and information about soil moisture and shallow groundwater conditions. The Forest Drought Response Index (ForDRI) is a vegetation index developed by the National Drought Mitigation Center that can be viewed on the Drought Indicator Dashboard. ForDRI combines information on shallow and deep soil moisture conditions, precipitation and evaporation at four timescales, evaporative demand, vapor

pressure deficit, and the remotely sensed Normalized Difference Vegetation Index to create a summary of vegetation conditions focused on forested landscapes but also potentially relevant throughout the watershed. This vegetation index helps viewers understand likely impacts to native vegetation (e.g., whether native vegetation is drought-stressed) and agricultural conditions (e.g., whether newly planted seedlings are at risk).

Soil moisture and shallow groundwater condition maps provide valuable information for agriculture, forestry, and water supply management and are also available on the Drought Indicator Dashboard. Declining soil moisture can be an early signal of impending drought conditions even before other indicators begin to approach higher drought stage thresholds. Two National Aeronautics and Space Administration (NASA) products included in the Drought Indicator Dashboard mapping provide useful depictions of these conditions in the NSW. These are the Gravity Recovery and Climate Experiment (GRACE) satellite-based shallow groundwater drought indicator map and the Short-term Prediction Research and Transition Center (SPoRT) modelled soil moisture map. The link to the webpage for the Drought Indicator Dashboard map is now included with each monitoring report.

Drought Monitoring Reporting Process

The drought monitoring reporting process consists of the following steps:

1. Gather drought indicator data for the indicators shown in Exhibits 11 and 12.
2. Input the current indicator data into the Framework 2.0 spreadsheet. The spreadsheet will aggregate the data to calculate the current drought stage.
3. Develop a brief monitoring report, noting:
    a. Drought stage and trend
    b. Brief discussion of pertinent data, such as which indicator is faring the worst
    c. Any relevant drought-related information (e.g., any of the bulleted items in “Additional Drought Information” above)
    d. Future trend indicators
    e. Link to the NSW Drought Indicator Dashboard drought conditions map (https://drought.climate.umt.edu/?name=NorthSantiam)
4. Share monitoring report with the NSW DCP mailing list consistent with the Operational and Administrative Framework.
5. Repeat according to the schedule below.

Because of the complexity of the changing seasonal thresholds for several indicators under Framework 2.0, the Framework now includes a spreadsheet to compare the indicator data to the relevant thresholds and calculate the drought stage automatically. The spreadsheet also enables easier long-term tracking of drought trends.

The updated format for the monitoring report includes an abbreviated table of indicator information, which is drawn from the Framework 2.0 spreadsheet. The table in Exhibit 14 shows an example of how the data would look in the spreadsheet, including the data value for each indicator, the corresponding drought stage for that indicator, and the overall drought stage. For individuals seeking a deeper understanding of how the drought stage is calculated, the full indicator table (Exhibit 12) will be maintained on the DCP webpage on the North Santiam Watershed Council’s website, which is linked in the report. The written narrative in the monitoring report provides additional information about current and future indicator trends, non-indicator drought-related news like crop losses or

algal blooms, and relevant geographic information, such as noting differences in conditions in the upper and lower watershed.

Exhibit 14. Monitoring Report Indicator Table Example

Indicator	Value	Stage
Air temperature (departure from normal, °F)	1	1
Precipitation (% normal for water year)	85	1
Snowpack (% normal snow water equivalent)	85	1
Detroit Reservoir level (% above water control diagram)	-2	0
Streamflow at Greens Bridge (7-day flow percentile)	10-24	1
Streamflow at Mehama (7-day flow percentile)	10-24	1
Streamflow at Boulder Creek (7-day flow percentile)	>24	0
Water temperature at Greens Bridge (°C)	14	2
Water temperature at Boulder Creek (°C)	11	0
Water temperature at Little North Santiam (°C)	12	1
Wildfire hazard (National Fire Danger Rating)	Moderate	1
Boat ramps served (Key elevations, feet)	1557	1
Salem water supply (7-day streamflow at Mehama, cfs)	980	1
Overall drought stage		**1**

The monitoring reports will be archived on the North Santiam Watershed Council's website for reference.

Monitoring Schedule

Monitoring of indicators and calculation of the drought stage for the NSW will continue to be done year-round. During Stages 0-2, monitoring will be done monthly. Drought monitoring reports will be sent out during the first week of the month, once data for all of the indicators becomes available. Beginning in Stage 3 (severe drought), monitoring and reporting will be conducted biweekly to give interested entities timely and relevant information about drought affecting the watershed. More frequent reporting will assist with timing and coordinating drought response actions. As discussed in Element #5 (Operational and Administrative Framework), the DCP Administrative Team may also

recommend more frequent monitoring during Stages 1 or 2 if needed, such as if all of the future trend indicators point to a high likelihood of near-term drought development.

At the beginning of each new water year, the Lead Coordinator will encourage entities on the NSW mailing list to review the monitoring data recorded during the year and consider whether any adjustments are needed to the Framework. Because data will now be tracked in a spreadsheet, it will be easier to create summary graphs showing the monthly drought stage and indicator data, and entities will be able to reflect on past year and assess whether the calculated drought stage aligned with conditions experienced on the ground. This will be particularly important for evaluating the new seasonal thresholds for precipitation, snowpack, and reservoir levels, and adjusting them as needed. Additional details regarding monitoring responsibilities and communication protocols are described in Element #5.

Potential Challenges to Drought Monitoring in the Watershed

Framework 2.0 builds on the success of Framework 1.0 in keeping interested entities informed about drought conditions and ready to implement appropriate response actions. The additional water temperature monitoring locations and the new seasonal thresholds for several indicators will provide better data for decision-making, and the link to the watershed map of drought indicators will offer valuable spatial information about current conditions. Nonetheless, there are some potential challenges that entities viewing the data should be aware of regarding the monitoring framework:

- As the climate changes, indicators that are based on "percent of normal" or similar comparisons to historical conditions may become less valid, as past experience may no longer provide an accurate indication of expected future conditions. In addition, challenges may arise with identifying the difference between permanent changes (i.e., permanently shifted baseline conditions) and temporary anomalies.
- USACE water management decisions for Detroit and Big Cliff Dams have major impacts on storage reliability and streamflows in the North Santiam River. The public can anticipate some of these actions based on the rule curve and current reservoir levels, but during drought conditions, some decisions may be based on daily coordination between USACE and other federal regulatory agencies and may be difficult to predict.
    - USACE, Reclamation, and the State of Oregon are in the process of implementing an approved reallocation of stored water in the Willamette Valley System. In the future, this will affect the demand for water and timing of releases for agricultural irrigation, municipal and industrial use, and fish and wildlife flows. Uncertainty remains around the water management framework to be implemented, including how shortages might be shared among user groups and water right holders.
- Thresholds for several indicators are based on best professional judgment, and new seasonal thresholds for several indicators have been incorporated into Framework 2.0. These indicators and thresholds should be reviewed carefully at the end of each water year to evaluate their suitability.
- Like Framework 1.0, Framework 2.0 relies heavily on data provided by outside parties, including federal agencies. Data must continue to be readily available in a consistent manner for drought monitoring to be effective.

Element #2: Vulnerability Assessment

The first vulnerability assessment was developed by the Vulnerability Assessment Working Group as part of the original DCP approved in 2018 and has been updated to incorporate participants' input and lessons learned during implementation. The first Working Group used a qualitative four-step process to evaluate vulnerability in the NSW across diverse sectors and resources, as it determined that a quantitative assessment would require a prohibitive amount of time and resources to develop consistent metrics and to quantify and rank impacts for each asset in the watershed.

The 2018 DCP Working Group used the following four-step process to assess vulnerability:

1. Identified watershed assets and resources that could be at risk during a drought.
2. Inventoried the potential impacts of drought on these assets and resources.
3. Evaluated the extent to which each of the assets would be vulnerable to drought under current conditions and in the future based on anticipated changing conditions.
4. Examined underlying causes of vulnerability.

The Working Group identified watershed assets and resources in the NSW, grouped them into categories, and prioritized them based on research and discussion of the likely environmental, economic, and social consequences of drought impacts. Grouping assets within sectors, such as food crops, grass seed, and nursery crops in the agricultural sector, made the assessment more manageable, and Working Group members shared their expertise to adjust the prioritization as needed to differentiate among similar assets that could be affected differently by drought. The 2018 Working Group considered potential environmental, economic, and social consequences of the impacts of drought to each category of asset to prioritize the most critical resources to be protected in the event of a drought. The Working Group then conducted the vulnerability assessment update based on the anticipated consequences of potential impacts to the assets, and the assets' sensitivity to drought.

Finally, the Working Group used the vulnerability assessment, including the analysis of underlying causes of vulnerability, to inform development of mitigation and response actions (See Elements #3 and #4). Further details on the development of the original vulnerability assessment can be found in Appendix C of the 2018 DCP.

Evaluation of the Vulnerability Assessment

During the DCP update process, a Vulnerability Assessment Working Group was convened to evaluate the previous assessment. The new Working Group generally included representation from the same organizations and sectors as the original Working Group. Appendix A includes a list of Working Group members. The Working Group met on March 28, 2024 and April 23, 2024 to review the list and prioritization of watershed assets and resources, consider changes in conditions and underlying causes affecting vulnerability, and update the assessment of vulnerability for each asset. Based on implementation of the 2018 DCP, Working Group members found that the qualitative vulnerability assessment has performed well and required only minor refinements to continue meeting plan objectives.

The remainder of Element #2 presents the updated vulnerability assessment for the NSW.

Watershed Assets and Resources Prioritization

For the DCP update process, Working Group members did not identify any additional assets at risk that had been left out of the original vulnerability assessment, and the prioritization is still considered acceptable. Therefore, the Working Group proceeded with the same assets during the update. Exhibit 15 presents the prioritized grouped assets.

Exhibit 15. Prioritized Groups of Assets at Risk in the NSW

Municipal water uses
Instream natural resources
Commercial crop irrigation
Commercial and industrial uses
Fire suppression (municipal and non-municipal)
Individual domestic water use
Water-oriented recreation
Non-commercial irrigation
Hydropower
Upland natural resources
Other irrigation and watering

Vulnerability Assessment Framework

During the DCP update, the Working Group evaluated the consequences of drought and reduced water supply using the following criteria:

- Public health, safety, and welfare impacts
- Economic impacts
- Watershed health (environmental) impacts

These criteria are not weighted or in any priority order. The Working Group considered both direct and indirect drought impacts. Examples of direct consequences of drought include drinking water shortages, unhealthy conditions for fish and wildlife, loss of crops, insufficient water available for firefighting, loss of recreational opportunities, reduced hydropower generation, lack of food for wildlife in upland habitats, or stress to native vegetation. Drought can also have indirect consequences, such as reduced agricultural employment, increased wildfire risk, harmful algal blooms, or water quality issues resulting from increased concentration of contaminants like arsenic and pesticides.

Sensitivity to drought was evaluated using the following criteria:

- Alternative (backup) water source available
- Adaptability (existing adaptive capacity or programs in place to mitigate impacts)
- Seniority of water rights

Drinking water providers were considered less sensitive to drought in the NSW if they had alternative water sources available, such as groundwater or an emergency interconnection with another water provider. Sensitivity was considered higher for junior water right holders.

The Working Group used a matrix of asset groups with sensitivity mapped on the x-axis and consequences on the y-axis. Because this assessment is qualitative, assets are positioned relative to one another, and results should be interpreted in the context of neighboring assets on the matrix. For the DCP update process, the Working Group used the vulnerability assessment matrix from the 2018 DCP as a starting point and made minor modifications to the positioning of the assets relative to one another on the matrix as described below.

Vulnerability Results Under Current and Future Conditions

The vulnerability assessment considered the potential for physical water shortages caused by low streamflow and regulatory measures that could limit access for a water user. The possibility of regulation or curtailment of water rights was based on an assessment of historical streamflow conditions and priority dates of water rights in the NSW, focusing on large municipal and agricultural water right holders. The results of the assessment show that most assets have moderate to high vulnerability, indicating the need to develop robust mitigation and response actions to respond to drought.

Current Conditions

Municipal water suppliers were generally considered to experience the greatest consequences, because water shortages for domestic use and sanitation could affect public health and welfare. The municipal water suppliers' sensitivity varied depending on their access to alternative water sources, storage capacity, and water right seniority. Under current conditions, the water suppliers identified as most vulnerable were Detroit, Idanha, Lyons-Mehama, Gates, and Stayton. Since the previous DCP was approved, the City of Salem has decreased its sensitivity to drought by constructing groundwater collector wells near its surface water intake at Geren Island on the North Santiam River. The collector wells provide an additional source of supply when streamflows are too low for the surface water intake to operate efficiently, and in addition, the groundwater from the collector wells is protected from potential contamination with cyanobacteria. This has reduced the current sensitivity of Salem's water supply to low flows and increased its adaptability to drought.

Under the current regulatory framework and typical or even low streamflow conditions, it is unlikely that North Santiam surface water right holders would have their water rights curtailed (i.e., shut off by the OWRD watermaster) because of insufficient streamflow. There are currently no instream water rights on the mainstem North Santiam River below Detroit Reservoir, and the amount of water in the river has historically been sufficient to meet the needs of all out-of-stream water users, even during very low flow years. Excess releases of stored water from Detroit Reservoir that are not currently protected by instream water rights or other downstream water rights calling upon stored water are considered natural flow and potentially used by existing surface water right holders, reducing sensitivity.

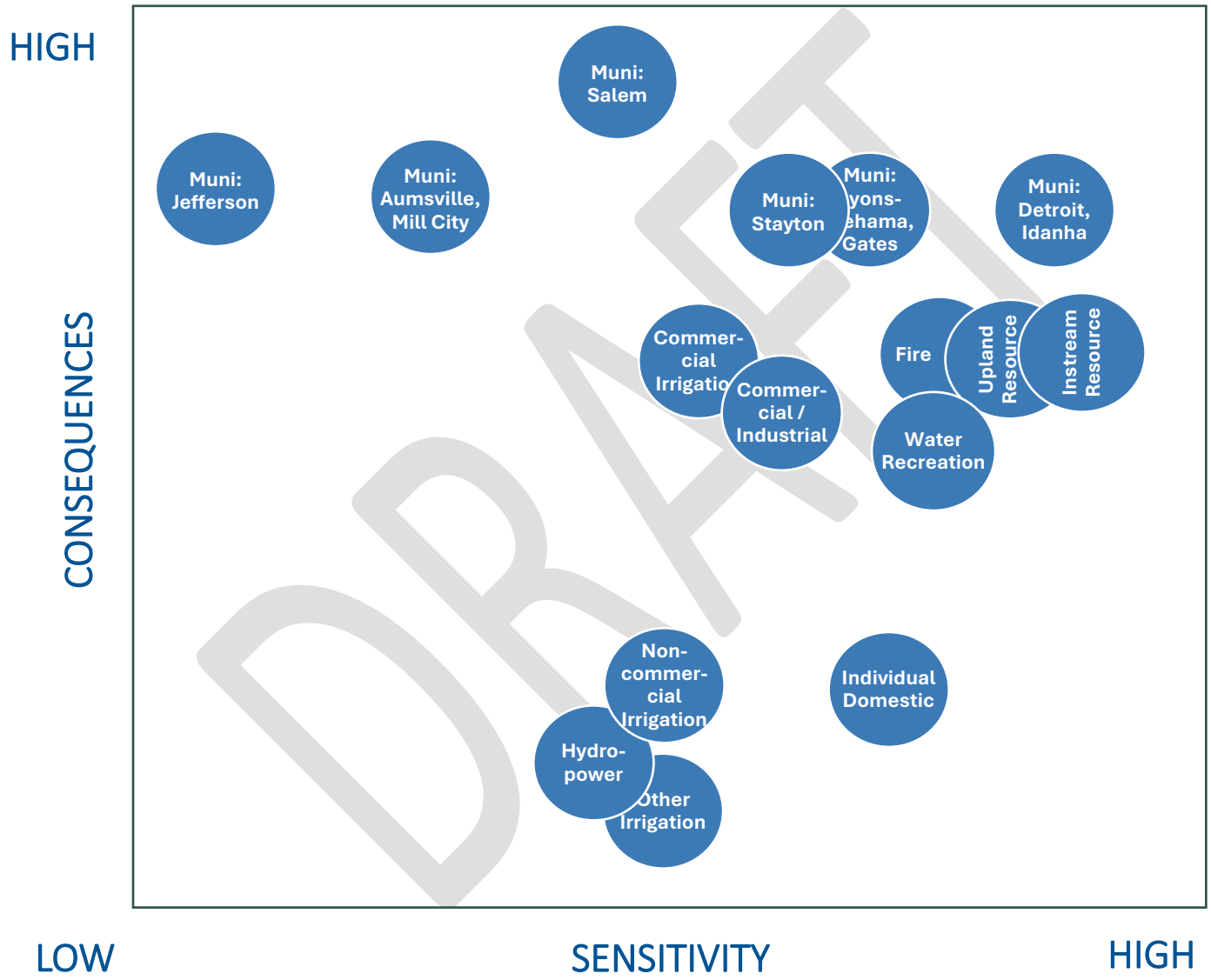
Catastrophic wildfires in 2020 affected the NSW communities, water systems, water quality, and habitats in the watershed. Based on lessons learned, the Working Group rated the consequences of drought for the "Fire suppression" and "Upland natural resources" assets higher. The North Santiam Watershed Council, US Forest Service, and other partners in the watershed have accomplished

significant reforestation and riparian planting, weed management, and streambank stabilization projects as part of the fire recovery efforts. Successful habitat restoration and enhancement projects increase the watershed's adaptability, helping slightly reduce the sensitivity of natural resources to drought.

Because of funding available through OWRD's new Well Abandonment, Repair, and Replacement Fund (WARRF), the sensitivity of individual domestic water use to drought was ranked lower during the DCP update. This program provides funding for low- to moderate-income households whose wells have gone dry or were damaged by wildfire to repair or replace the wells. Additional information is available at https://www.oregon.gov/owrd/programs/GWWL/WARRF/Pages/default.aspx.

Exhibit 16 presents the updated vulnerability assessment under current conditions. Each bubble represents a watershed resource or asset, with sensitivity mapped on the x-axis and consequences on the y-axis. As noted above, the vulnerability assessment is qualitative, and the positioning of the bubbles should be interpreted relative to surrounding assets.

Exhibit 16. Vulnerability Assessment: Current Conditions



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Future Conditions

Using the "current condition" locations of the assets on the vulnerability matrix as a starting point, the Working Group members considered potential future changes related to implementation of the Willamette Valley System reallocation, Environmental Impact Statement (EIS), and Biological Opinions (BiOps); climate change; and population growth. In general, this evaluation used a qualitative approach because of the uncertainties associated with future conditions and the potential for multiple factors to interact.

Implementation of Willamette Valley System reallocation, EIS, and BiOps

Following the listing of Upper Willamette River spring Chinook salmon and winter-run steelhead as threatened species under the federal Endangered Species Act, the National Marine Fisheries Service (NMFS) completed a Section 7 consultation with USACE and issued a BiOp in 2008 requiring certain actions to avoid jeopardizing the listed species during USACE's operations and management of the dams and reservoirs in the Willamette Valley System. NMFS and USACE completed a second consultation and BiOp in 2019 on the effects of the reallocation of storage space in the reservoirs to establish specific storage volumes for fish and wildlife, agricultural irrigation, and municipal and industrial uses.

The 2008 BiOp establishes flow objectives in the tributaries and Willamette mainstem to provide sufficient streamflow for fish, and USACE releases stored water from its reservoirs, including Detroit Reservoir, to supplement instream flows at certain times of year. This increases streamflows in the North Santiam River, and the availability of stored water provides a buffer against low streamflows during drought. While some releases of stored water are intended to benefit fish, these excess stored water releases are not currently protected by instream water rights or contracts, so downstream water users (e.g., municipal, irrigation, etc.) benefit from augmented water supply. The 2019 BiOp maintains the flow objectives established in the 2008 BiOp. Through future processes to implement the BiOps, instream flows will have additional protections, reducing the sensitivity of the "Instream Resources" asset to drought but potentially increasing the sensitivity of other assets. (For a more detailed discussion of these potential impacts, see GSI, 2013).

Following 6 years of study, USACE developed an updated EIS for operations and maintenance of the Willamette Valley System as a whole. The EIS describes USACE's preferred alternative for operation of the system, and NMFS issued a BiOp in December 2024 requiring additional actions to protect listed species. USACE incorporated the majority of these changes into the EIS, and the EIS became final in April 2025. The 2024 BiOp maintains the flow objectives from the 2008 BiOp until a new flow management plan is created by USACE, Reclamation, and NMFS. One 2024 BiOp requirement that was not included in the final EIS is particularly significant in the NSW, because it directs USACE to implement a very deep drawdown at Detroit Reservoir during the fall to comply with the Endangered Species Act and to support juvenile fish passage and migration. While deep drawdowns have been implemented at other reservoirs in the Willamette Valley System, such as Green Peter and Lookout Point Reservoirs, this has not been done at Detroit Reservoir. Drawdowns at other reservoirs have had significant negative impacts on water quality, and the extremely high turbidity caused by sediment moving out of the reservoirs damaged some municipal drinking water treatment facilities downstream.

To better address the potential impacts of the drawdowns at Detroit Reservoir on communities and water quality, USACE will complete a Supplemental EIS scheduled for 2026. The Supplemental EIS

will also analyze a second late addition to the EIS process, which requires USACE to evaluate an additional alternative considering deauthorization of hydropower operations throughout the system. These changes could also impact streamflows and water management in the NSW because of the hydropower operations currently conducted at Detroit and Big Cliff Dams.

Climate Change

Climate change projections for Marion County and Linn County, where most of the NSW is located, show that drought (and in particular, higher summer temperatures, lower spring snowpack, and lower summer streamflows) is likely to become more frequent and severe by the 2050s (OCCRI 2022, OCCRI 2023, USACE 2025). These trends will have consequences for many of the NSW assets, affecting instream resources through lower flows and higher stream temperatures and affecting the water supply available for out-of-stream uses and for river and reservoir recreation. Relative changes in temperature, precipitation, streamflow, and snowpack in the NSW are projected to be somewhat greater than in the Upper and Middle Willamette River subbasins (USACE 2025). The success of post-fire riparian recovery projects may mitigate this risk somewhat by increasing shading of streams and buffering temperature increases. Higher water needs and evapotranspiration rates in reforested uplands may increase the sensitivity of upland resources to drought in the future.

Snowpack acts as a natural reservoir that helps sustain streamflow through the dry summer months. Snowpack, measured by snow water equivalent, has been declining and it is expected that the upper NSW will become more rain-dominated than snow-dominated by the end of the century (USACE 2025). The projected loss of snowpack in the lower and mid-elevations, shorter snow season with earlier melt-out, and increased uncertainty about conditions from year to year mean that water users of all kinds will be at higher risk of shortages. This could lead to an increased need to rely more heavily on other water sources, such as groundwater, stored water, and water supply interconnections, or for water suppliers to seek ways to reduce their demands.

Population Growth

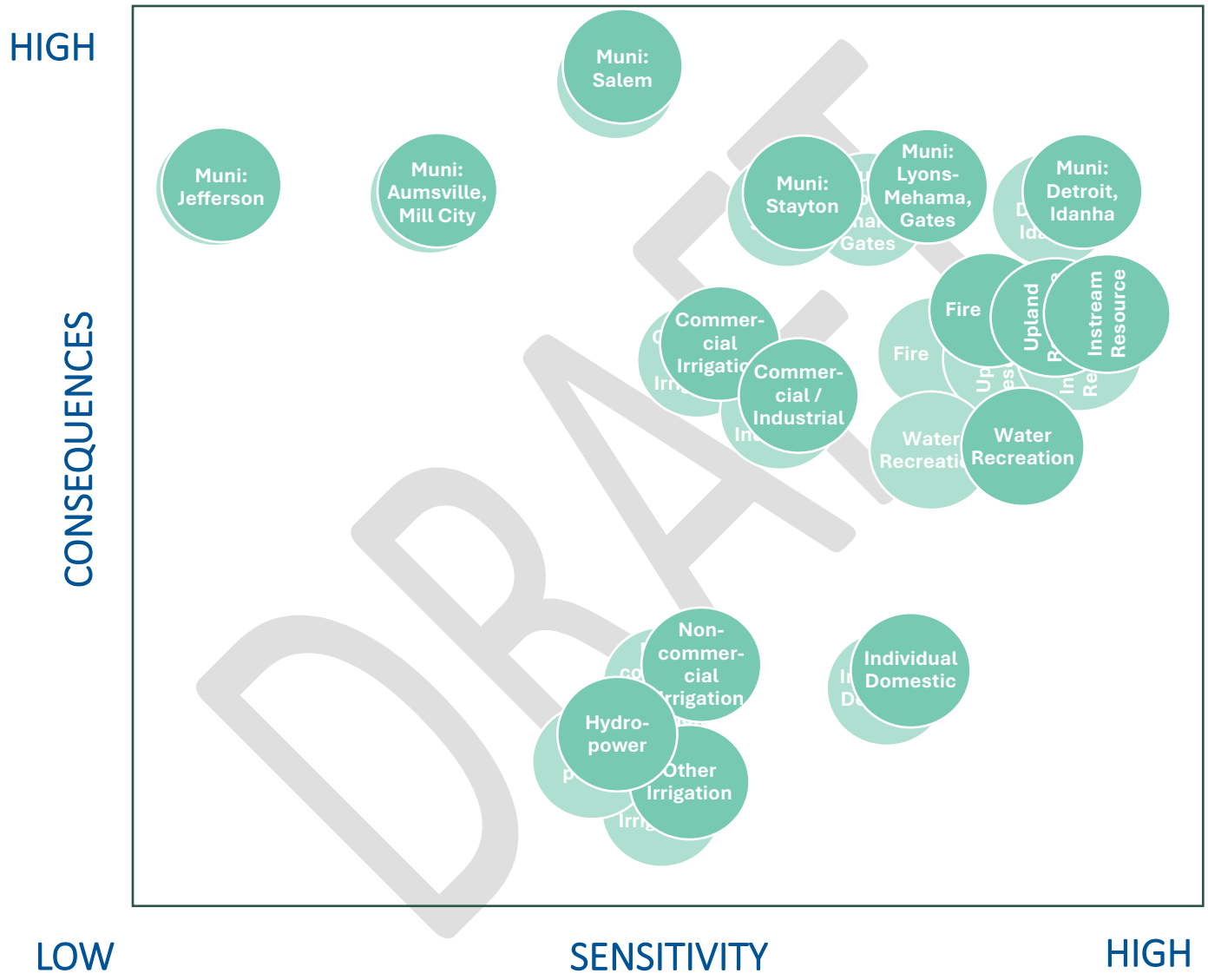
Population projections from Portland State University (PSU) show slow to moderate growth in the region, much of it coming from migration (PSU, 2025). Increases in population are associated with higher consequences for municipal water providers when drought occurs because more people are likely to be affected. Although Salem is located outside of the NSW, stronger projected population growth in this community also affects watershed vulnerability through increased water demand.

Assessment Results

The Working Group's discussions of the vulnerability assessment during the update process concluded that all assets will experience some increase in vulnerability, although some shifts have greater magnitude than others based on interactions of multiple variables. Overall, the most vulnerable assets under future conditions are the same as under current conditions.

Exhibit 17 shows anticipated changes in vulnerability under future conditions. The darker-colored bubbles show the future vulnerability for each asset, with the lighter-colored bubbles in the background showing vulnerability under current conditions.

Exhibit 17. Vulnerability Assessment: Future Conditions



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Underlying Causes of Vulnerability

Identifying the underlying causes of vulnerability is useful for developing appropriate mitigation and response actions. Detroit Reservoir forms a key feature of the NSW with mixed influences on vulnerability. Upstream of the reservoir, watershed assets must rely on natural precipitation and snowpack, with no buffer of stored water available. Downstream of the reservoir, releases of stored water may increase supply, but these are subject to the management decisions of USACE and vary throughout the year. Future management decisions and federal regulatory requirements may impact the likelihood of the reservoir filling each year, the timing and volume of releases, and water quality in the North Santiam River.

The most common underlying causes of vulnerability identified by the Working Group include reliance on a single source of water supply without sufficient backup options or interconnections with other water systems, infrastructure limitations, junior water rights[2], and location in relation to Detroit Reservoir (i.e., below the reservoir, managers of watershed assets need to react to reservoir operational decisions beyond their control; above the reservoir, watershed assets cannot benefit from releases of stored water). Exhibit 18 shows the underlying causes of vulnerability for each watershed asset. The most vulnerable assets are highlighted in blue.

[2] Oregon's water laws are based on prior appropriation, meaning that the water rights with the earliest priority dates (i.e., obtained first) are the last to be shut off in times of low streamflow. More recent or "junior" water rights are therefore considered more vulnerable.

Exhibit 18. Underlying Causes of Vulnerability

Asset	Underlying Causes
Municipal water – Salem	Below reservoir, large population, need for additional water supply redundancy and diversification (in progress), physical intake limitations at very low flows
Municipal water – Detroit, Idanha	Above reservoir, supply from small tributaries, single source of supply, infrastructure limitations at low flows
Municipal water – Lyons-Mehama	Below reservoir, single source of supply, junior water rights
Municipal water – Gates	Below reservoir, single source of supply, junior water rights
Municipal water – Stayton	Below reservoir, need for water supply redundancy and diversification (in progress), some junior water rights
Instream natural resources	Water releases not currently protected by instream water rights from out-of-stream diversions, precipitation as single "source" above reservoir
Upland natural resources	No backup (precipitation as single "source")
Fire protection	See individual municipal water supplier causes of vulnerability when considering use of water supply for fire protection; financial resources
Water recreation	Water not protected by instream water rights from out-of-stream diversions, subject to USACE decisions about refill and storage release priorities, precipitation as single "source" above reservoir, reservoir elevation infrastructure limitations (e.g., docks, boat ramps)
Commercial irrigation	Below reservoir, likely single source of supply
Commercial and industrial use	Below reservoir, likely single source of supply
Individual domestic water use	Likely single source of supply, potential intake limitations at low flows
Non-commercial and other irrigation	Below reservoir, likely single source of supply
Hydropower	USACE operations to implement BiOps and possible hydropower deauthorization, SWCD dams below reservoir

USACE = United States Army Corps of Engineers
BiOp = Biological Opinion
SWCD = Santiam Water Control District

Recommendations and Data Gaps

Multiple factors are likely to interact to affect future vulnerability, such as climate change, deep drawdowns in the fall at Detroit Reservoir, establishment of instream water rights, and funding availability for watershed and water supply enhancement projects. These uncertainties mean that water users and interests must prepare for a wide range of possible future conditions in order to improve resilience, and additional information will help with that preparation. The following recommendations are proposed to help fill data gaps and track ongoing processes for the benefit of the NSW.

- Continue tracking implementation of the Willamette Valley System stored water reallocation, operations and maintenance EIS, and associated BiOps to understand changes in reservoir operations, regulatory requirements, water rights, and future water supply reliability for existing water right holders.
    - Track related processes, including any proposed changes to the rule curve to adjust to future conditions and implementation of Forecast-Informed Reservoir Operations (FIRO), described further in Section 3.
- Develop a centralized system for tracking quantitative data on the impacts of drought on watershed assets, such as economic losses, community needs for curtailment or voluntary water conservation requests, water quality impacts, and salmonid redd (spawning nest) survival, among others. As a starting point, consider reporting drought-related information to the tracker maintained by the National Integrated Drought Information System available at https://droughtimpacts.unl.edu/Tools/ConditionMonitoringObservations.aspx.
- Develop a better understanding of groundwater-surface water interactions in the NSW and potential effects of drought on domestic well users.
- Connect with regional planning efforts, such as the Partners of the North Santiam Resiliency Action Planning Process, to learn more about natural resource assessments that may be used to evaluate drought effects on watershed health. More information is available at https://northsantiam.org/portfolio-items/partners-of-the-north-santiam/.
- Continue tracking population growth forecasts and economic development outlooks within the Santiam canyon to understand potential impacts on water use.
- Continue tracking watershed and water supply project implementation and their benefits for resilience in the NSW as described in the Mitigation and Response elements of this DCP.

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Element #3: Mitigation

The Mitigation planning element identifies, evaluates, and prioritizes actions to conserve water and improve the resilience of the critical assets identified in Element #2 (Vulnerability Assessment) *before* drought conditions occur. In particular, mitigation actions are designed to address the underlying causes of vulnerability to the extent feasible. By implementing recommended projects and activities proactively, mitigation actions reduce the impacts of future droughts on the watershed and the need for emergency response actions.

For the DCP Update, the Mitigation Working Group reviewed the mitigation goals, actions, and recommendations presented in the 2018 DCP and provided updated information about completed, ongoing, and planned projects in the NSW that are anticipated to provide drought mitigation benefits. The Mitigation Working Group met on June 27, 2024 and July 30, 2024 to review and discuss updates to Element #3.

Mitigation Action Goals

The Task Force for the first DCP developed goals to guide development and evaluation of mitigation actions. During the DCP Update, the Working Group confirmed that the overarching goal and sector-specific goals remain valid and important to the participating organizations, and only made minor revisions to wording of the goals. The following is the updated overarching goal:

> *Through a combination of individual and collective mitigation actions, NSW DCP mitigation actions will:*
>
> - Reduce the severity of potential drought risks and impacts, thereby decreasing sector vulnerabilities and the need for response actions
> - Lay the groundwork for effective responses to drought should they need to occur
> - Consist of short-term and long-term activities carried out by individual organizations according to each entity's needs and abilities
> - Assist watershed-wide programs, such as monitoring, messaging, and funding of important key watershed actions

Exhibit 19 presents the updated goals for each vulnerable sector identified by the Working Group. Additional information about the development of the original goals can be found in Appendix D of the 2018 DCP.

Exhibit 19. Sector Mitigation Goals

Sector	Goals for Sector
Instream natural resources	Address the key limiting factors affecting native fish and wildlife, water quality, and flows in the basin by conserving and enhancing the ecological processes upon which they rely
Water-dependent recreation	Provide opportunities for water-dependent (river and reservoir) recreation to meet current levels of socioeconomic need during drought
Irrigation	Provide opportunities for irrigated agriculture to meet current levels of socioeconomic need during drought
Municipal water supply	Provide opportunities for municipal water providers to meet current levels of socioeconomic need for health, safety, and welfare during drought
Commercial and industrial	Provide opportunities for industrial and commercial users to meet current levels of socioeconomic need during drought
Multi-sector	Establish partnerships within the watershed to promote public awareness of the interconnections of water resources Provide opportunities to address drought vulnerability in the watershed

Mitigation Actions

The 2018 DCP provided an inventory of mitigation actions that entities in the NSW were conducting at the time or proposing to undertake. From this list of actions, the Working Group members prioritized the key actions to be carried out by their organizations as part of their contribution to the DCP efforts, and collective multi-sector actions were reviewed and prioritized. For each individual project or group action, prioritization for inclusion on the DCP priorities list was ultimately based on group consensus following a discussion of drought resilience benefits, project costs, technical and regulatory complexity, community support, and potential co-benefits. The DCP update process used the same prioritization approach.

To facilitate implementation of multi-sector water supply management tools identified in the 2018 DCP, Task Force members developed a Joint Mitigation Actions Implementation Plan (JMAP) as a separate document. The JMAP outlines the purpose, process, recommended implementation steps, potential funding sources, and schedule to complete each joint action. While some progress has been made on the joint actions, limited resources and other emergencies (e.g., 2020 wildfires, COVID pandemic, 2021 ice storm, etc.) have prevented full implementation. Several of the recommended actions remain important to entities in the NSW and have been included in the updated DCP.

During the DCP update process, a Mitigation Working Group was formed and met twice to review the prioritized project list, discuss implementation progress, and refine priorities. The Working Group members also provided extensive feedback outside of meetings on projects that had been completed and new projects that are planned. Examples of projects and actions that are in progress or have been completed to benefit drought resilience in the NSW include:

- Santiam Water Control District developed its System Improvement Plan (SIP). The SIP includes strategic recommendations for water delivery system improvements and reducing water losses.
- Santiam Water Control District, Farmers Conservation Alliance, and NRCS are developing a Watershed Plan – Environmental Assessment to boost water efficiency, improve stormwater and

drainage water management, and increase drought resilience. The plan includes a list of projects that are eligible to be funded by federal agencies. Detailed analyses are being conducted for potential piping or lining of the Middle Main Canal and Collier Lateral. These projects could conserve an estimated 2,680 acre-feet of water annually.

- The City of Salem evaluated the condition of two transmission lines and conducted repairs to reduce system leakage. The City also relocated a portion of a leaking transmission line and continues to conduct leak detection activities and repairs.
- The City of Salem developed an educational virtual tour of the NSW hosted on the City's website. The tour highlights the water treatment process, monitoring sites, drought information, and restoration and water conservation projects.
- The City of Salem constructed groundwater collector wells to provide at the Geren Island facility to provide an additional source of water that is protected from low flows, cyanobacteria, and high turbidity during storm events.
- The City of Detroit replaced and upgraded many waterlines around the community and completed an assessment of the water system infrastructure and leak repairs following the 2020 wildfires.
- The City of Gates replaced two aging and leaking mainlines to stop water waste.
- The Partners of the North Santiam (PNS)[3] developed a Resiliency Action Plan in 2018, and since that time, member entities have implemented restoration projects that are helping to make the NSW more resilient to drought, such as floodplain reconnection, riparian plantings, and wetland enhancements. The PNS Resiliency Action Plan Supplemental, completed in 2024, describes PNS initiatives, presents a theory of change depicting how watershed restoration strategies can improve watershed conditions, outlines a project prioritization process, presents a monitoring framework, and describes a public engagement strategy and a funding strategy.
- Multiple watershed restoration projects have occurred around the watershed, such as the Wilderness Park riparian enhancement project. This project involved a collaborative effort of the North Santiam Watershed Council, City of Stayton, Santiam Water Control District, and Marion Soil and Water Conservation District.
- The BLM Cascades field office staff installed beaver dam analogs and undertook some beaver translocations in headwater wetlands to improve water quality and quantity, retain wetland vegetation, increase soil moisture, and prevent conifer encroachment. Large wood was placed in streams to direct flows into side channels and off-channel habitat for winter rearing for juvenile salmonids, and several projects enhanced historic side channels and ponded areas.
- The BLM completed instream habitat improvement projects in and around the Little North Fork, Sinker Creek, and Elkhorn Creek. Post-wildfire restoration included 100 acres of plantings to connect vegetated patches of habitat, support pollinators, and provide a connectivity corridor for late successional species over the next 50 years or more.
- Multiple forestry improvement projects and irrigation improvement projects have been funded by the NRCS in the basin.
- Reclamation and OWRD installed a new AgriMet weather station near Sublimity in 2024. The station is north of the NSW but provides weather information that is similar to conditions in the lower NSW nearby, complementing the AgriMet station at Detroit Reservoir.

[3] https://northsantiam.org/portfolio-items/partners-of-the-north-santiam/

Through these and other efforts during the DCP implementation phase, many lessons have been learned and information is being gathered that will benefit future mitigation plans. In addition to the ongoing and completed projects described above, new efforts are underway in the NSW that will further contribute to drought mitigation. The North Santiam Watershed Council is undertaking a post-fire watershed resource assessment and prioritization plan that will evaluate the "state of the watershed" in fire-impacted areas with a focus on the Little North Fork and Breitenbush River sub-basins. The project will involve synthesizing monitoring data from several entities, conducting field studies, and modeling to identify new ecological limiting factors and prioritize areas to focus restoration projects and outreach. This information will help build projects that address multiple factors, including drought resilience, wildfire recovery, post-fire salvage logging effects, fish passage, heat dome impacts, invasive species (e.g., emerald ash borer), and climate change.

Several Working Group members involved in habitat restoration described difficulties with post-fire restoration due to dry conditions. For example, North Santiam Watershed Council staff observed that it has been difficult to establish vegetation on south-facing slopes due to heat, and they have added mulching to support plant establishment. Marion Soil and Water Conservation District also observed high post-fire planting mortality and has had to increase the level of maintenance and replanting to ensure tree establishment. Because invasive plants often thrive in drought conditions, more invasive weed treatments have been necessary. Following the 2020 wildfires, the BLM planted western red cedar, black cottonwood, red osier dogwood, and willows in riparian areas and north-facing slopes, while incense cedar and ponderosa pine were planted on south-facing slopes and dry areas. Douglas-fir was not replanted because these trees can reseed up to 1,000 feet away from living trees, and post-fire surveys showed promising levels of natural reseeding. Additional plantings of Oregon white oak saplings are planned for south-facing slopes with shallow soils.

The BLM's Resource Management Plan for Western Oregon protects wetlands and seeps with no-treatment buffers, riparian reserves, and retention of wetland-associated species. The riparian reserve system on BLM-managed lands protects buffers adjacent to perennial streams, promotes riparian overstory vegetation, and maintains shaded cold water refugia. The BLM's forestry program has begun to proactively replant with drought-tolerant species. Slope stabilization remains important for keeping sediment out of streams, not only to reduce turbidity, but also because sediment buildup makes the streams shallower and warmer.

The Little North Fork Santiam River has long been recognized as an important cold-water stream and source of cold water to the North Santiam River. While it remains a valuable spawning habitat for winter steelhead, juvenile steelhead now tend to migrate downstream into the North Santiam River because the Little North Fork Santiam River no longer provides sufficient cold-water refuge during the hot summer months. Widespread intense burning during the 2020 wildfires severely affected the sub-basin, and the loss of riparian vegetation has increased stream temperatures, impacting salmonids. Similarly, loss of riparian vegetation and increased stream temperatures have affected a previous cold-water refuge near Niagara, just downstream of Big Cliff dam. These areas present opportunities for riparian enhancement to restore cold-water habitat. The Native Fish Society identified five existing cold-water refugia used by winter steelhead below Rock Creek, above Upper Bennett Dam, below Stout Creek, below Minto Creek, and a deep pool below Cow and Walker Creeks, which could be protected through future projects to support steelhead. The North Fork Breitenbush River is also a designated priority watershed for the USFS Detroit Ranger District.

During the update, the Mitigation Working Group expressed support for integrating the DCP and Marion County's Multi-Jurisdictional All-Hazards Mitigation Plan (HMP). When the HMP was updated in 2023, it referenced the 2018 DCP. Drought Mitigation Action #1 in the HMP calls for Marion County to participate in the next DCP update, and Marion County Emergency Management was represented in the Mitigation Working Group (Marion County Emergency Management, 2023). Marion County maintains an electronic

spreadsheet of specific mitigation actions and their implementing entities, many of which support drought resilience and are included in this DCP's recommended mitigation actions.

Several local partnerships and coalitions whose goals support drought resilience exist in the NSW.

- Implementation of the Partners of the North Santiam Resiliency Action Plan will support a variety of restoration activities around the watershed. More information is available at https://northsantiam.org/portfolio-items/partners-of-the-north-santiam/.
- The Council of Water Leaders provides a forum for sharing information about water issues in the basin. More information is available at https://www.santiamwater.gov/council-of-water-leaders.
- The Mid-Willamette Beaver Partnership is a regional group that promotes restoration of beaver habitat, coexisting with beaver and managing beaver-human conflicts, and educating the public about the benefits of beavers in the ecosystem. The North Santiam Watershed Council, USFS, BLM, and some individual forest landowners in the area are participants in the Mid-Willamette Beaver Partnership and are seeking areas that may be suitable for beaver restoration. More information is available at www.mwbeaverpartnership.org.
- Resilient Headwaters is a community-led coalition of residents, businesses, and organizations supporting outdoor recreation as a long-term fire recovery strategy (community, ecological, and economic). The Resilient Headwaters Concept Plan outlines a series of recreation projects and programs to rebuild and enhance the watershed's trail systems, parks, and water access opportunities. More information is available at https://www.travelsalem.com/industry/resilient-headwaters/.

Exhibit 20 provides an updated inventory of current and planned prioritized drought mitigation actions and projects in the watershed, including individual and joint mitigation actions. More detail on the joint mitigation actions is available in the original JMAP, which is provided as Appendix H of the 2018 DCP.

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Exhibit 20. Drought Mitigation Actions and Implementing Entities

Mitigation Action	Lead Entity and Partners	Description	Short/Long Term Action
Watershed Plan - Environmental Assessment	Santiam WCD, Farmers Conservation Alliance, NRCS	Develop a Watershed Plan - Environmental Assessment outlining projects eligible to be funded by federal agencies to increase water efficiency, improve water management, and support drought resilience. Conduct detailed analyses for piping or lining of the Middle Main Canal and Collier Lateral.	Short term = develop plan Long term = pursue funding for implementation
Santiam WCD SCADA Phase 2	Santiam WCD	Measure and better manage water withdrawal and delivery through the Santiam WCD system. Complete automation upgrades with new headgates at eight sites, including Coates Lateral, Marion Ditch, Collier Ditch, Wallace Pump, and four others to be selected.	Short term = planning Long term = implementation
Santiam WCD WMCP Update	Santiam WCD	Maintain updated WMCP, including incorporation of NSW DCP monitoring and other relevant elements.	Short term = planning Long term = implementation
Soil Moisture Monitoring Program	Santiam WCD	Establish a program for monitoring soil moisture conditions in agricultural areas. Information will be used to improve irrigation efficiency.	Short term = planning Long term = implementation
Upper and Lower Bennett Dams Improvements	Santiam WCD, City of Salem	Improve diversion and intakes to allow for low flow operation. Improve fish passage at Lower Bennett Dam.	Short term = planning Long term = construction
Wilderness Park Riparian Enhancement	Santiam WCD, City of Stayton, NSWC, Marion SWCD	Native plant revegetation and riparian enhancement.	Short term = planning Long term = implementation
Salem Water System Master Plan Update	City of Salem	Complete plan update, including recommendations for system improvements, securing alternative water sources, improving system efficiency, and reducing system water loss.	Short term = plan update Long term = projects prioritized in the plan
Partners of the North Santiam Resiliency Action Plan	Partners of the North Santiam	Support implementation of restoration projects that benefit drought resilience. Projects are tracked on a Smartsheet online database system. Examples of projects include Chahalpam floodplain reconnection; Chankawan reforestation; native plant re-establishment in Little Sweden, Bird Haven Slough, Dieckman Slough, Hatch Side Channel, and Snake-Deford; Bear Branch and Queener-Sander beaver-based restoration; floodplain reconnection at John Neal County Park; Upper North Santiam-Idanha side channel reconnection; stream enhancement on Rock Creek, Mad Creek, Little Rock Creek, and Minto Creek; Detroit Flats shoreline enhancement; USFS fish passage and culvert replacement projects.	Short term = support existing projects Long term = initiate new projects
Resilient infrastructure	City of Detroit	Implement water system upgrades for resilience, including reservoir storage, leak detection and repair, and reducing backwash waste at the water treatment plant.	Short term = planning Long term = construction
Public outreach	City of Detroit	Provide multi-hazard public outreach on mitigation, preparedness, and resources to residents.	Short term = planning Long term = implementation
Detroit Lake Master Recreation Plan	City of Detroit, Detroit Lake Recreation Area Business Association	Maintain updated master plan with a focus on economic resilience during drought.	Short term = planning Long term = implementation
Resilient infrastructure	City of Idanha	Improve community understanding of water usage and opportunities to increase efficiencies. Conduct leak detection surveys for the water system to prevent water loss and improve efficiency. Develop water storage tanks to hold treated water for municipal use.	Short term = planning Long term = implementation
Resilient infrastructure	City of Jefferson	Construct additional wells to supplement the City's water supply.	Short term = planning Long term = implementation
Resilient infrastructure	City of Mill City	Secure backup generator for critical City facilities. Improve community understanding of water usage and opportunities to increase efficiencies. Collaborate with Marion County to connect to a more resilient regional water and sewer system.	Short term = planning Long term = implementation
Public outreach	City of Mill City	Provide multi-hazard public outreach on mitigation, preparedness, and resources to residents.	Short term = planning Long term = implementation

Mitigation Action	Lead Entity and Partners	Description	Short/Long Term Action
Resilient infrastructure	City of Stayton	Implement water system upgrades for resilience, including facility improvements, acquisition of a portable water filtration system, and considering hazards in future facility master plan updates.	Short term = planning Long term = implementation
Public outreach	City of Stayton	Provide multi-hazard public outreach on mitigation, preparedness, and resources to residents.	Short term = planning Long term = implementation
Habitat restoration and enhancement	Bureau of Land Management	Implement habitat restoration and enhancement projects, such as large wood placement, beaver dam analogs, floodplain and riparian enhancements, instream habitat improvements, and planting drought-tolerant plants where appropriate.	Short term = planning Long term = implementation
Cold water refugia	Native Fish Society, NSWC, landowners	Implement projects to protect and restore cold water refugia, such as riparian vegetation plantings. Identified refugia include locations above Upper Bennett Dam, below Rock Creek, below Stout Creek, below Minto Creek, a deep pool below Cow and Walker Creek, the Little North Fork Santiam, and Niagara.	Short term = planning Long term = implementation
Hazard Mitigation Plan integration	Marion County Emergency Management	Coordinate with water providers on preparedness and response plans for water shortages. Maintain information about mitigation actions and implementing entities.	Short term = maintain database Long term = continue coordination
Detroit Lake low water recreation projects	Oregon Parks and Recreation Department, Marinas, USFS	Improve recreational access to Detroit Lake during low water periods through excavating around marinas and maintaining floating boat ramps.	Short term = planning Long term = implementation
On-farm water efficiency projects technical assistance	Marion SWCD, Santiam WCD	Promote and provide technical assistance for agricultural producers to implement on-farm water efficiency projects.	Short term = compile resources Long term = outreach
Industrial water use and reuse education	SEDCOR	Conduct education on wastewater treatment for industrial use, industrial reuse projects, and improving water usage efficiency for industrial purposes.	Short term = planning Long term = implementation
Resilient Headwaters Concept Plan	Resilient Headwaters	Support implementation of the Resilient Headwaters Concept Plan to support trail systems, parks, water access, and other recreational opportunities.	Short term = planning Long term = implementation
DCP Education and Outreach Partnership	DCP Task Force	Establish a partnership to develop and implement outreach and common messaging (i.e., templates), prepare news releases, and engage the media. Create common "brand" for watershed-wide dissemination of drought stages and voluntary conservation efforts. Tell the story of the good things the community is doing.	Short term
Water Supply Option Agreements	DCP Task Force	Evaluate feasibility of using water supply option agreements. If deemed feasible, then a program will be developed.	Short term = study Long term = implementation
Water Rights Management Program	DCP Task Force	Evaluate feasibility of establishing a water rights management program (e.g., leasing, transfers). If deemed feasible, then a program will be developed.	Short term = study Long term = implementation
NSW Water Budget Study	DCP Task Force	Prepare a study to improve baseline understanding of water movement through the watershed, including surface water and groundwater movement, withdrawals and returns, which could inform a water management framework, including impacts on water availability and regulation. Potential synergies exist with USACE's Planning Assistance to States program and the USGS Integrated Water Science basin study of the Willamette River Basin.	Short term = scoping and pursuing funding Long term = study
Expand emergency drought tool usage	DCP Task Force	Support legislation and administrative rules that allow the use of OWRD Emergency Drought Tools when a DCP has been approved for the watershed.	Short term = planning Long term = advocacy

The mitigation actions presented in Exhibit 20 support the sector mitigation goals outlined in Exhibit 19. In general, the mitigation actions are expected to help achieve the following objectives:

- Improve understanding of water system risks, inefficiencies, and potential water waste to help target improvements
- Increase water system efficiencies, support water conservation, and promote resilient infrastructure
- Improve natural system and habitat resilience
- Improve resilience of water-dependent recreation providers
- Reduce economic losses due to drought
- Protect public health, safety, and welfare during drought
- Support collective multi-sector efforts to prepare for drought
    - Public education programs
    - Preparing for response actions
    - Securing funding for priority collective actions

Uncertainties and Future Mitigation Actions

A variety of uncertainties have been recognized throughout the original DCP development and the update process, including those described in the Vulnerability Assessment that may interact to affect future conditions and watershed vulnerabilities. Likewise, some mitigation actions are intended to benefit specific water users or sectors but could also affect other users and sectors, beneficially or adversely. Some of the uncertainties and data gaps that should be taken into consideration as mitigation actions are planned and implemented include the following:

- Effects of lining or piping irrigation canals on groundwater recharge, hydraulically connected wetlands, and nearby wells and properties
- How to support involvement of small communities in mitigation action planning and implementation, and involvement in future DCP updates
- Impacts of drought on public health in communities throughout the watershed, including effects of water quality, heat, and air quality issues
- Ecological limiting factors in the watershed post-wildfire
- Impacts of changes in operations of Detroit Dam and Reservoir by USACE following the 2024 NMFS BiOp 2025 systemwide operations and maintenance EIS, and anticipated 2026 Supplemental EIS to include deep drawdowns of Detroit Reservoir

When considering future mitigation actions related to water use and drought management, the Working Group expressed support for coordinating actions with existing local and regional plans to achieve synergies and avoid duplication of effort. This includes agricultural and municipal WMCPs, the North Santiam Resiliency Action Plan, the Marion County HMP, and the Resilient Headwaters Concept Plan.

Additional resources for drought mitigation actions include:

- Oregon State University Extension Service's 2023 report "Beating the Heat: A Statewide Assessment of Drought and Heat Mitigation Practices (and Needs) with Oregon Farmers and Ranchers"
- USFS Office of Sustainability and Climate's 2017 report "Fisheries: Responding to Drought and Water Challenges"
- National Integrated Drought Information System's 2023 report "Drought and Public Health: A Roadmap for Advancing Engagement and Preparedness"

Working Group member organizations may consider how the recommendations in these reports may support refinements of their proposed mitigation actions to maximize drought resilience and co-benefits.

Element #4: Response

Response actions are intended to reduce the impacts on critical watershed assets and resources when a drought occurs. Response actions are planned in advance to address known vulnerabilities and are implemented sequentially based on the drought stages identified in the monitoring framework. Reclamation's WaterSMART Drought Response Program Framework provides guidance on the distinction between mitigation and response actions, and between drought response actions and emergency response actions. For the purpose of this DCP, actions taken in advance to prepare for drought are considered mitigation, and actions taken during a drought are considered response actions. During Stage 1 (Heads up – potential for drought), response actions are interrelated with mitigation actions, which aim to conserve water and improve resilience before drought conditions intensify. For example, developing a public outreach program is a mitigation action, while implementing the program and conducting outreach messaging about current drought conditions is a response action. Emergency response actions, in contrast, are crisis-driven actions taken in response to unanticipated circumstances. Emergency responses are not pre-planned activities triggered by the drought monitoring stages, but rather specific activities identified to respond immediately to disasters to preserve health and safety. Exhibit 21 summarizes the differences among these action types.

Exhibit 21. Relationship of Mitigation, Response, and Emergency Response

	Mitigation	Response	Emergency Response
Goal	Decrease watershed and sector vulnerabilities	Decrease severity of immediate drought impacts	Protect life, public health, and safety
Trigger	Pre-drought agreements and projects	Stages in the drought monitoring framework	Immediate crisis

The original 2018 DCP established a goal for implementation of response actions, and the Response Working Group during the update process retained this goal for this iteration of the DCP:

> *Drought response actions in the North Santiam watershed will be implemented on a collaborative, voluntary, and watershed-wide basis. Response efforts will be directed by the overarching operational framework outlined in the DCP. It is the intent that all sectors and local water users, regardless of vulnerability, will participate in the response actions identified in this DCP to reduce impacts to the health, safety, and welfare of communities, economies, and critical natural resources within the watershed.*

The Response Working Group met on August 22, 2024 and September 18, 2024 to review the 2018 DCP's response actions, evaluate progress, and update Element #4. The Working Group chose to maintain the focus on collaborative, voluntary, watershed-wide actions to emphasize the interconnectedness of the various sectors in the watershed and to encourage residents to look out for one another and protect the critical natural resources in the watershed during drought. Response actions in this DCP do not include numeric objectives for water conservation (e.g., 10 percent reduction in water use). This was a conscious decision made by the 2018 DCP Task Force and affirmed during the update process because of lack of enforcement capacity (even if objectives are voluntary), political and budgetary reasons, inability to quantify certain types of benefits, and uneven ability for different sectors and water users to measure baseline use and changes accurately.

Response actions presented here are intended to provide flexibility for water users to link implementation to their existing plans, such as Water Management and Conservation Plans.

Evaluation of Response Element

The original Response Working Group identified, evaluated, and prioritized actions to improve resilience during drought in the NSW. The 2018 DCP presented a matrix of response actions linked to each of the Monitoring Framework 1.0's progressive stages of drought. Response actions were divided into five categories:

- **Public education and outreach**: watershed-wide messaging to promote awareness of drought conditions and encourage water conservation
- **Monitoring and evaluation**: tracking and reporting drought indicators and impacts, including socioeconomic and environmental impacts of drought
- **Water rights and resources management**: coordinated changes in water management among water users, such as leasing water rights instream or pursuing drought emergency water right tools
- **Water conservation**: implementing strategies in Water Management and Conservation Plans to encourage conservation or curtail usage when water supply is inadequate
- **Emergency response**: disaster response and recovery actions, including seeking local, state, and federal assistance

Each category included one or more actions to be taken at different stages of drought. While emergency response actions are intended to respond to crisis conditions, and the appropriate actions for a given situation cannot always be determined in advance, the Working Group considered it prudent to include some general guidance on addressing water shortage emergencies in the DCP. Affected entities will identify and implement additional emergency response actions as needed during a crisis.

Since the DCP was approved in early 2018, the NSW frequently experienced Stage 1 (heads up – potential for drought) conditions, and experienced Stage 2 (moderate drought) conditions four times based on the Monitoring Framework 1.0 from the 2018 DCP. Overall, entities that participated in implementation of the 2018 DCP found that coordination of response actions outlined in the DCP could be more cumbersome than anticipated, and some actions did not appear necessary based on observed conditions. In addition, non-drought crisis situations occurred several times since 2018, requiring time and resources to be allocated away from DCP implementation.

Based on Monitoring Framework 1.0, Stage 2 drought conditions occurred in August 2018, December 2018–January 2019, September 2020, and June–September 2021. As noted in the updated Monitoring Element of this DCP, Framework 1.0 included the US Drought Monitor as an indicator in its calculations, duplicating some inputs and inflating the drought stages. If the drought stages had been calculated without the US Drought Monitor as an input during the four identified Stage 2 periods, only December 2018 and July–August 2021 would still have been classified as Stage 2; the other months would have been downgraded to Stage 1. This inflation of the drought stages meant that the conditions observed in the watershed did not always appear to warrant a significant response. For example, the City of Salem has only found it necessary to implement its

curtailment plan because of cyanotoxins detected in the water source, not because of a drought-related shortage. During the DCP update process, Working Group members shared that they needed to prioritize other activities over responding to drought in some instances. In particular, the Labor Day 2020 wildfires caused widespread destruction in the NSW, and ongoing recovery efforts have required substantial time, energy, and resources. Coordination among entities was also limited during the pandemic.

Response Actions

During the DCP update, the Response Working Group discussed previous implementation needs and challenges related to the response actions specified in the 2018 DCP. This section presents the updated response actions matrix and associated action descriptions. The response actions matrix (Exhibit 22) identifies specific actions, the relevant sectors implementing them, and the drought stage trigger for each action. Implementation may correspond to one or more stages of drought. Actions are numbered for ease of reference only, and do not suggest an order of implementation. Each of the actions is discussed in more detail following the table below.

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Exhibit 22. Response Actions Matrix

		Triggers			
Actions	**Sectors**	**Stage 1: Heads Up**	**Stage 2: Moderate Drought**	**Stage 3: Severe Drought**	**Stage 4: Extreme Drought**
Public Education and Outreach					
1. Drought response messaging	Municipal, Agriculture, Natural Resource Managers, Recreation, Emergency Management	X	X	X	X
2. Share information about drought emergency resources	Municipal, Agriculture, Emergency Management		X	X	X
Monitoring and Evaluation					
3. Continue to track and report drought monitoring framework indicators	Municipal, Agriculture	X	X	X	X
4. Compile data about socioeconomic and environmental impacts of drought	Municipal, Agriculture, Natural Resource Managers, Recreation, Commercial and Industrial		X	X	X
Water Rights and Resources Management					
5. Forbear water use	Municipal, Agriculture	Planning	X	X	X
6. Switch to an alternative water source	Municipal, Agriculture, Commercial and Industrial	Planning	X	X	X
7. Instream leases (full season or split season)	Municipal, Agriculture, Commercial and Industrial		X	X	X
8. Transfers (permanent or temporary)	Municipal, Agriculture		X	X	X
9. Allocations of conserved water	Agriculture	Planning	X	X	X
10. Drought emergency water right tools	Municipal, Agriculture			X	X
Water Conservation					
11. Coordinate among water providers, managers, and users to promote voluntary withdrawal reductions	Municipal, Agriculture, Natural Resource Managers, Commercial and Industrial	Planning	X	X	X
12. Implement strategies in Water Management and Conservation Plans for voluntary conservation or curtailment, depending on conditions	Municipal, Agriculture	X (Agriculture)	X	X	X
Emergency Response					
13. Seek local, state, and federal assistance	Municipal, Agriculture, Natural Resource Managers, Recreation, Emergency Management			X	X
14. Implement Disaster Recovery Plans	Municipal, Emergency Management			X	X
15. Water hauling	Municipal				X
16. Dredge intakes and/or alter diversions	Municipal, Agriculture				X

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Public Education and Outreach

Action 1: Drought response messaging
Sectors: Municipal, Agriculture, Natural Resource Managers, Recreation, Emergency Management
Drought Stages: 1-4

Municipalities, agricultural producers, natural resource managers, recreation managers, and County emergency planners will collaborate on and benefit from this action. These entities will develop response action messages in advance as a mitigation action, and then implement the planned communications as a response based on the NSW's calculated drought stage. Watershed-wide messaging will be coordinated in a common, branded manner to ensure it is recognizable and consistent throughout the watershed. Working Group members recommended translating messaging into multiple languages and choosing easy-to-read fonts. To amplify messages across organizations, collaborating entities will use several methods, such as community newsletters, radio, news releases, websites, social media, and printed materials available at park reader boards, municipal facilities, and local businesses.

Key messages include: (1) upstream[4] areas of the watershed will likely experience drought conditions before downstream areas, (2) all types of water users are conserving water (i.e., "shared sacrifice"), (3) information about current conditions, including instream flow, water supply, and any observed impacts, and (4) why water conservation is important. While the 2018 DCP suggested messaging promoting the concept that "we all rely on one river," this concept has been broadened in this DCP to "we all rely on the North Santiam watershed." This recommendation is based on Working Group feedback to acknowledge the importance of various tributaries, groundwater, lakes, and ponds. As a drought progresses in severity, messaging will build upon previous stages. Examples of messages at different stages include:

- The watershed is in Stage 1/Heads Up: Potential for Drought. Many people—residents, businesses, farmers, and recreationists—depend on the North Santiam watershed. Practice using water wisely. Here's how: [provide examples].
- The watershed is in Stage 2/Moderate Drought. Some areas are experiencing drought impacts [e.g., recreation access is limited because reservoir levels are low; green bean yield is low because growers are irrigating less]. Practice using water wisely. Here's how: [provide examples].
- The watershed is in Stage 3/Severe Drought. All areas in the watershed are experiencing drought [e.g., vegetation is dry and wildfire risk is high]. Conservation is important for our shared water resources. Practice using water wisely. Here's how: [provide examples].
- The watershed is in Stage 4/Extreme Drought. Water conservation is critical for our shared water resources. Practice using water wisely. Here's how: [provide examples, or request that people only use water for defined essential purposes in the case of a water shortage emergency].

[4] "Upstream" and "downstream" areas are designated in relation to Detroit Reservoir.

Action 2: Share information about drought emergency resources
Sectors: Municipal, Agriculture, Emergency Management
Drought Stages: 2-4

In conjunction with the public education and outreach about drought conditions and water conservation under Action 1, municipal and agricultural water providers and County emergency management staff will begin providing additional information about drought emergency resources starting in Stage 2. If drought conditions coincide with extreme heat, communities and emergency management agencies will also conduct outreach to inform the public about health risks, symptoms of heat-related illness, resources for utility assistance, and cooling center locations. Marion County Health and Human Services provides information about extreme heat safety and public health on its website, including links to Oregon Health Authority resources in multiple languages.

Drought can be a contributing factor to harmful algal blooms as water becomes stagnant. Marion County Emergency Management and the City of Salem have webpages dedicated to providing information about harmful algal blooms and cyanotoxin monitoring results. If a water quality advisory becomes necessary, notifications are sent through Marion-Polk Community Alert System along with outreach through news outlets and social media.

When water shortages occur during drought or other circumstances, the Santiam Water Control District implements a rotational system for water delivery to its patrons. When notifying water users about the need to apportion water during a drought, the District may also provide information about agricultural assistance programs, such as the US Department of Agriculture's disaster assistance programs for crop loss, farmland damage, and livestock grazing loss compensation.

During drought, increased groundwater pumping combined with reduced recharge can result in low well yields and dropping groundwater levels. OWRD's Well Abandonment, Repair, and Replacement Fund may be able to help low- to moderate-income households whose wells have gone dry due to drought or related issues, such as wildfires. Availability of future funding for the program will depend on appropriations from the state legislature.

Monitoring and Evaluation

Action 3: Continue to track and report drought monitoring framework indicators
Sectors: Municipal, Agriculture
Drought Stages: 1-4

Using the DCP Monitoring Framework 2.0 to track the drought stage is critical to coordinating implementation of actions. Coordination is necessary to prepare for and implement watershed-wide response actions and to promote voluntary water conservation to benefit all sectors in the watershed.

Action 4: Compile data about socioeconomic and environmental impacts of drought
Sectors: Municipal, Agriculture, Natural Resource Managers, Recreation, Commercial and Industrial
Drought Stages: 2-4

Compiling detailed local data to quantify drought impacts continues to be a data gap. Lack of a centralized location to report impacts has hindered impact tracking during implementation of the 2018 DCP. Interested parties can voluntarily report drought impacts through the US Drought Monitor, and the Oregon Water Resources Department hosts a dry well complaint database for

individual well owners to report problems. Collecting data on drought conditions in the NSW and impacts on each sector will help refine future iterations of the DCP, improve outreach messaging, identify more effective actions to build resilience, and provide stronger evidence in grant applications to obtain funding to implement these actions. Economic development agencies, such as SEDCOR, can play a key role in aggregating data from various sectors. Starting in Stage 2, drought monitoring reports will include a request for recipients to respond with information about impacts they have observed.

Water Rights and Resources Management

Action 5: Forbear water use
Sectors: Municipal, Agriculture
Drought Stages: Planning for this action during Stage 1, implementation during Stages 2-4

Water users have the ability to forbear, or voluntarily stop or reduce their water use, to leave more water instream during critical periods to protect vulnerable instream natural resources, such as state and federally listed fish species. When a drought appears to be developing and the watershed experiences Stage 1 conditions, municipal and agricultural water right holders may consider planning for forbearance during more severe drought stages if they occur. While forbearance may benefit instream resources, it is not a formal water right management tool, and water not used by the water right holder is not legally protected instream by the Oregon Water Resources Department. Thus, this water is available for diversion by downstream water right holders.

Action 6: Switch to an alternative water source
Sectors: Municipal, Agriculture, Commercial and Industrial
Drought Stages: Planning for this action during Stage 1, implementation during Stages 2-4

Some water users in the NSW may be able to switch to the use of a legally authorized alternative water source, such as groundwater or stored water, in order to leave more water instream in the North Santiam River or its tributaries. This response action provides similar benefits to forbearing water use, and the water is also not legally protected instream and is available for diversion by other water right holders. Depending on the location of the alternative water source, other impacts may occur. For example, increased groundwater withdrawals could impact water levels in neighboring wells or reduce groundwater contributions to streamflow. Therefore, the Working Group recommended that water users considering this option consult with local natural resources managers to learn more about how this response action might work on a case-by-case basis. Water users would begin planning for this response action and consulting with natural resources managers during Stage 1 prior to implementation during more severe stages of drought.

Action 7: Instream leases (full season or split-season)
Sectors: Municipal, Agriculture, Commercial and Industrial
Drought Stages: 2-4

Although this option has not frequently been used in the NSW, holders of certificated water rights can lease the rights instream using OWRD's instream lease process. During the term of the lease, the water is legally protected instream and cannot be diverted by other water users. Water right holders can lease all or a portion of a water right instream. For example, an agricultural producer could decide not to irrigate a portion of the authorized place of use and then lease instream the associated rate and volume for that portion of the irrigation right. An irrigation district can pool the

water rights associated with several landowners as part of a district instream lease. Supplemental irrigation water rights cannot be used while the associated primary irrigation right is leased instream.

Leasing provides a voluntary opportunity to leave water instream to protect natural resources while protecting the water rights from forfeiture due to non-use. Instream leases can be requested for a period of 1 to 5 years. The water right automatically reverts to its previous use when the lease expires unless the lease is renewed. Following the end of the lease, the water rights retain their priority date and remain available for future out-of-stream beneficial use.

Water rights can be leased instream for a full season or split season. For a full season lease of irrigation rights, the lease must be associated with a specific number of acres not irrigated, not simply reduced water use on all authorized acres. Full season lease applications must be submitted before the irrigation season starts for irrigation rights or before October 1 for other types of water rights authorizing year-round use. Irrigation rights can also be leased instream for a split season, meaning that water is used for irrigation during part of the season and then leased instream for the remainder. Split-season leases require measurement and reporting of the instream and out-of-stream uses. For seasonal uses like irrigation, split-season lease applications must be submitted by July 1. Split-season leases allow growers to maintain production earlier in the year when more water may be available while preserving water instream later in the summer.

Although water is considered "leased" instream, there is no payment to the lessor for the instream flow benefits. However, the Oregon Watershed Enhancement Board (OWEB) offers grants through its water acquisition program to support planning and implementation of projects that increase instream flow. Grant funding can be used to support a variety of project types, including instream leases (full season or split-season), permanent or time-limited instream transfers, and allocations of conserved water, described further below.

Action 8: Transfers (permanent or temporary)
Sectors: Municipal, Agriculture
Drought Stages: 2-4

"Transfers" of water rights refer to changes in a certificated water right's authorized place of use, point of diversion (surface water) or appropriation (groundwater), or type of use. In addition to the drought-specific emergency transfers described further below under Action 10, permanent transfers can be used at any time to help water right holders manage their water resources and/or protect instream natural resources, including but not limited to salmon and steelhead. For example, municipal and agricultural water right holders could use transfers to add or change a point of diversion, use water for a different beneficial purpose, or move water rights around for crop rotations. Temporary transfers allow water users to temporarily change the place of use, such as irrigating different locations, for a period of up to 5 years. Under a temporary transfer, the point of diversion or appropriation can be changed if it is necessary to convey the water to the new place of use.

A permanent instream transfer can protect water instream by changing the type of use of an existing water right to instream use while retaining the original water right's priority date. A time-limited instream transfer is similar to an instream lease but can be in place for longer durations than the maximum 5 years allowed under a lease. A water right holder could also complete a permanent transfer to move their point of diversion farther downstream, allowing water to stay instream over a longer reach before it is diverted.

Action 9: Allocations of conserved water
Sectors: Agriculture
Drought Stages: Planning for this action during Stage 1, implementation during Stages 2-4

Water right holders who find ways to reduce their water use while accomplishing the same beneficial use can apply to OWRD for an allocation of conserved water. This strategy is typically used by agricultural producers who have reduced conveyance leakage by piping or lining canals, or who have implemented on-farm efficiency upgrades, such as switching from wheel line to drip irrigation. An allocation of conserved water allows 75 percent of the water conserved through these measures to be used by the water right holder for additional purposes, such as irrigation of new acreage, while the remaining 25 percent is protected under a new instream water right. While this water right tool has not been used frequently in the NSW, it holds potential for protecting instream flow while rewarding water conservation. These projects often require long-term planning and may also be considered mitigation actions when undertaken prior to drought conditions.

Action 10: Drought emergency water right tools
Sectors: Municipal, Agriculture
Drought Stages: 3-4

During a Governor-declared drought emergency, there are a variety of water right tools with streamlined application processes available to assist water users. In Oregon, drought declarations are typically issued at the county level. An affected county submits a request based on the drought impacts they are experiencing to Oregon's Water Supply Availability Committee and Drought Readiness Council, which makes a recommendation to the Governor about whether to issue an executive order declaring a drought emergency. This declaration opens up additional short-term water right tools as well as other forms of state and federal assistance. Examples of drought emergency water right tools include:

- Emergency water use drought permit: a temporary water right to replace water that is unavailable under an existing right; most commonly used to access groundwater to replace an existing surface water right
- Temporary drought transfer: an expedited process for changing the type of use, place of use, or point of diversion for up to 1 year or the duration of the drought declaration, whichever is shorter
- Temporary drought instream lease: a temporary change of all or a portion of a water right to instream use for up to 1 year or the duration of the drought declaration, whichever is shorter
- Temporary substitution: a temporary authorization to use a supplemental groundwater right instead of a primary surface water right
- Special option agreement: an agreement authorizing the use of water at a different location, point of diversion, or for a different use than what is authorized by the water right; this can be developed in advance as an agreement among parties to provide others with water supply options in the event that a drought occurs
- Limited license: a short-term authorization for the use of water; while not normally used to authorize irrigation, limited licenses can be granted during drought conditions to extend the

irrigation season to prevent irreparable damage to crops (e.g., a crop needs water outside of the authorized May 1–September 30 irrigation season)

In addition to these tools, legislation passed in Oregon in 2023 provides that a year during which the Governor has declared a drought emergency does not count toward the 5-year period of non-use for forfeiture of water rights in the county where the drought was declared.

Water Conservation

Action 11: Coordinate among water providers, managers, and users to promote voluntary withdrawal reductions
Sectors: Municipal, Agriculture, Natural Resource Managers, Commercial and Industrial
Drought Stages: Planning for this action during Stage 1, implementation during Stages 2-4

Municipal, agricultural, natural resource managers, and commercial and industrial water users will work together to promote water conservation for the benefit of all sectors in the watershed. Many entities already have policies in place to promote conservation and discourage water waste. Coordination will support other response actions, including public education and outreach about water conservation, compilation of drought impact information, and increasing awareness of water right management tools and emergency assistance programs that may be available to water users in the NSW who are experiencing negative effects of drought, including ways to protect vulnerable instream resources during low flows.

Planning for coordinated response actions may begin during Stage 1, with implementation following as warranted by developing drought conditions. Long-range planning may also benefit water conservation goals. To better understand the costs and benefits of a proposed activity, project proponents may consider applying for an OWRD Feasibility Study Grant. These grants can provide up to 25 percent of the cost to assess the feasibility of projects related to water use efficiency, water reuse, water conservation, aquifer recharge, aquifer storage and recovery, and streamflow restoration and protection. OWRD's Water Project Grants and Loans program provides funding to implement water conservation and infrastructure projects that have economic, environmental, and social or cultural benefits.

Action 12: Implement strategies in Water Management and Conservation Plans for voluntary conservation or curtailment, depending on conditions
Sectors: Municipal, Agriculture
Drought Stages: Stages 1-4

Under certain circumstances, OWRD requires municipal and agricultural water suppliers to prepare Water Management and Conservation Plans (WMCP), and several entities in the NSW have developed these plans, such as the City of Stayton, Santiam Water Control District, and the City of Salem. WMCPs include curtailment plans that identify certain response actions that the entity will take at each level of water shortage. Given the advance planning required for agricultural producers to use less water, the decision to implement actions outlined in a WMCP will likely need to occur sooner than for some other large water users to ensure that crops are not damaged. Therefore, agricultural water suppliers may choose to begin implementing relevant portions of their WMCPs during Stage 1, while municipal water suppliers may not need to do so until Stage 2 or later.

Examples of WMCP-related response actions for irrigated agriculture include:

- Delaying delivery to users to conserve water for the peak consumptive use period, based on a shortened estimated water delivery season
- Engaging Oregon State University Extension and NRCS to provide technical assistance on how to reduce on-farm water use, including during critical plant water use periods

Municipal water suppliers' WMCP curtailment plans may include actions related to the municipality's own water use or use by its customers. The curtailment stages in these plans may not exactly align with watershed-wide DCP drought stages but would likely begin implementation during DCP Stage 2 drought conditions depending on the supplier's source of water, storage capacity, and alternative supply options. Examples of WMCP-related response actions for municipalities include:

- Reduce or stop watering of parks or landscaping at City facilities
- Discontinue operation of decorative public fountains that do not recirculate water
- Limit hydrant and water line flushing
- Reduce or stop use of water for washing sidewalks, streets, and public facilities, except where necessary for public health or safety
- Request or require that water customers reduce outdoor water use, such as lawn watering and car washing
- Provide water conservation information with customer water bills

Emergency Response

Action 13: Seek local, state, and federal assistance
Sectors: Municipal, Agriculture, Natural Resource Managers, Recreation, Emergency Management
Drought Stages: Stages 3-4

During Stages 3-4, entities in the NSW may need to seek financial or other assistance to respond to severe drought conditions. Information about emergency resources and assistance programs will be shared as part of Action 2 above.

Local: At the local level, water providers encountering emergency needs during drought will coordinate with Marion County Emergency Management or Linn County Sheriff's Office, which is responsible for Linn County's emergency management program. These County programs may be able to assist with identifying and securing alternative drinking water supplies, providing emergency response messaging for radio and other platforms, identifying contractors and vendors for emergency supplies, and coordinating with state agencies.

The Cities of Salem, Mill City, Gates, Detroit, and Idanha are members of the Oregon Water/Wastewater Agency Response Network (ORWARN). ORWARN is a network of utilities that participate in mutual aid agreements and coordinate emergency response. For example, they may be able to share trained personnel or specialized water infrastructure parts during an emergency under previously arranged agreements.

State: At the state level, a Governor-declared drought emergency unlocks the water right management tools outlined above along with other potential assistance through the Oregon Department of Emergency Management (OEM), such as grant programs and disaster recovery funding. OEM's State Preparedness and Incident Response Equipment (SPIRE) grants provide equipment to local governments for emergency preparedness, including water purification systems that could be used after a wildfire or during a drought-related algal bloom. OEM acquires large equipment as a state asset that local entities can then operate when needed. During an emergency, the Department of Administrative Services may authorize public entities to make purchases without competitive bidding in order to expedite projects, and may purchase emergency supplies or equipment on behalf of local entities.

Federal: When the US Drought Monitor shows that a county has been experiencing D2 Severe Drought conditions for 8 consecutive weeks, a drought declaration may be granted at the federal level, and several federal drought benefits may be available. Examples of benefits from federal agencies include:

- Natural Resources Conservation Service: technical and financial assistance to agricultural producers
- Farm Service Agency: loan programs to establish wells, compensation for crop and grazing losses, emergency loans to recover from production or physical losses due to drought
- Rural Development: loan programs to alleviate water shortages in rural areas, disaster recovery grants and loans
- American Red Cross: technical assistance to distribute water and first aid from central sites to the municipal sector
- Department of Defense: transport of water for up to 30 days and drilling wells for human consumption (after all other assistance is exhausted)
- Department of Health and Human Services: technical, medical, and financial assistance programs

Action 14: Implement disaster recovery plans
Sectors: Municipal, Emergency Management
Drought Stages: Stages 3-4

Emergency Operations Plans for Marion and Linn Counties outline disaster recovery procedures. Short-term procedures focus on restoring basic services (including water supply) to protect public health and safety, while long-term recovery focuses on restoring the community to its previous or improved condition. These plans include information about emergency management actions, logistics, protection of public health, provision of food and water, and protection of agriculture and natural resources. Incident Annex IA-2 of Marion County's plan provides information on drought, including a recommendation for the County to support and participate in the NSW DCP.

Action 15: Water hauling
Sectors: Municipal
Drought Stages: Stage 4

In the event of extreme water shortages or loss of a source of water supply, municipalities may need to implement water hauling programs to meet basic health and safety needs. Municipalities will determine the need for water hauling and implement any measures in their own curtailment plans and emergency management plans as needed. Local governments may request emergency water hauling from the Oregon Department of Forestry (nonpotable), Oregon Department of Transportation, Oregon Department of Fish and Wildlife, and the National Guard.

Action 16: Dredge intakes and/or alter diversions
Sectors: Municipal, Agricultural
Drought Stages: Stage 4

Poor water quality resulting from low flows can promote the growth of algae that foul intakes, and low streamflow itself may render intakes and other water diversions unusable. Municipal and agricultural water suppliers may need to dredge the areas around intakes or otherwise alter diversions to allow them to access water during very low flows in Stage 4. Because these activities involve in-water work, they require permits and consultations with federal and state agencies. They may be considered as emergency actions or planned and permitted in advance to address known issues and protect health, safety, and welfare. During the previous implementation period, the City of Salem completed infrastructure upgrades to improve access to water during low flows at the Geren Island intake. Upgrading the Upper and Lower Bennett Dams for irrigation and flow maintenance is a related mitigation action.

Additional Considerations for Response Actions

As noted in the vulnerability assessment, it is unlikely that water right holders on the North Santiam River would have their water use curtailed under the current regulatory framework. Even during years with very low streamflow, the amount of natural streamflow combined with releases of stored water from Detroit Reservoir has historically been sufficient to meet the needs of out-of-stream water users, and there are no instream water rights on the mainstem below the reservoir. These conditions may change in the future, however, and the response actions proposed in this DCP proactively anticipate potential responses needed for more severe drought conditions. Junior water right holders could be at risk of curtailment by the OWRD watermaster or could see reduced water releases for stored water contracts based on several factors, such as:

- Multiple years of severe drought
- Detroit Reservoir unable to refill, either from extended drought or deep drawdowns
- Climate change leading to generally drier conditions
- Conversion of minimum perennial streamflows to instream water rights
- Issuance of instream water rights to protect water released from Detroit Reservoir for fish and wildlife purposes

The factors listed above could reduce the amount of water available to meet instream and out-of-stream needs. Water-dependent businesses and natural resources above Detroit Reservoir do not benefit from releases of stored water, so they are likely to experience drought impacts sooner than areas lower in the watershed. While water shortages and ecological drought conditions will not affect all water users and sectors simultaneously, the DCP Task Force and the Response Working Group

strongly support collaborative, watershed-wide response actions for the benefit of all of the NSW's communities, economies, and natural resources.

Another consideration for future water management in the NSW is USACE's planned implementation of forecast-informed reservoir operations (FIRO) throughout the Willamette Valley Project, including operations at Detroit Reservoir. The USACE Directorate of Civil Works has committed to a multi-year public-informed viability study of FIRO in the Willamette Valley System to better understand the flood risks and benefits of different alternatives. The outcome of the study will be a non-binding recommendation for updating the water control plan, which USACE may choose to pursue in a formal request to Congress while ensuring that all regulatory requirements are met. The recommended FIRO alternative to the current Willamette Valley System master water control plan is anticipated during the 2029-2030 fiscal year.

The goals of FIRO are to improve outcomes for water supply, fish and wildlife, hydropower, and recreation without increasing flood risk. To do this, USACE water managers would use improved weather and streamflow forecasts to make more informed decisions about refilling the reservoirs and the timing and volume of releases of stored water. FIRO provides more flexibility in this decision-making process compared to strictly following the reservoir's rule curve. For example, if reservoir levels are above the rule curve while the reservoir is still filling in the spring, but very dry conditions are forecast over the coming months, FIRO could allow USACE to retain more water in the reservoir instead of releasing it to bring levels back down to meet the rule curve. Retaining the stored water would increase the likelihood that the reservoir would be able to fill by the end of the storage season. Because the forecast shows a low probability of precipitation, retaining the stored water "early" in the season would not significantly increase flood risk. Although USACE is responsible for stored water management decisions and these decisions are not subject to recommendations from the DCP Task Force or Working Groups, the goals and potential outcomes of FIRO are supportive of multi-sector drought mitigation benefits in the NSW.

Uncertainties and Future Response Actions

Uncertainties remain related to the future management of Detroit Reservoir, some of which could increase drought vulnerability (e.g., deep drawdowns during fall) and some of which could improve resilience (e.g., FIRO). Additional uncertainties include the future availability of various funding sources to implement mitigation and response actions, the effects of climate change on instream and upland natural resources in the watershed, and population and demographic shifts in communities in the region. Drought impact tracking has been a data gap, and improved tracking is expected to provide important information to guide development of future response actions.

Several potential response actions may be beneficial but require additional time and resources to develop. The Working Group contemplated the following options for consideration in future iterations of the DCP:

- Municipalities could encourage large outdoor water users in their service areas to move residential irrigation demands to off-peak hours, potentially offering them a discounted water rate for making this change.
- Municipalities could pool resources to develop jointly branded water conservation outreach materials, support education and outreach at public events, and obtain bulk discounts on water conservation items (e.g., water-efficient showerheads) to offer to their customers.

- Agricultural producers could support each other during drought through a program similar to the Idaho Rangeland Drought Task Group's Cover Crop Pasture Exchange. Under this program, farmers grow forage cover crops where they lack adequate water supply to grow other crops, and ranchers who lack forage (as a result of drought or wildfire) graze their livestock on the cover crop acreage. This system reduces economic losses for both types of producers while helping prevent erosion compared to fallowing.

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Element #5: Operational and Administrative Framework

The Operational and Administrative Framework goals are (1) to clarify the ongoing roles and responsibilities for the DCP and (2) to facilitate a quick and efficient response to drought conditions. This section of the DCP describes the roles of the DCP administrative team (AT), the lead coordinator, and the planning element groups, and how these entities will work together to implement the DCP and recommend formal drought declarations when needed.

Although entities representing diverse sectors strongly supported implementation of the DCP, the Operational and Administrative Framework in the 2018 DCP was more cumbersome to implement than anticipated. Through the update process, the Operational and Administrative Framework Working Group focused on streamlining processes to improve agility for implementation, along with integrating drought planning and response with other regional plans and programs.

Evaluation of the Operational and Administrative Framework

The 2018 DCP Operational and Administrative Framework included the DCP AT, technical advisory Task Force, and four planning element groups related to the Monitoring, Mitigation, Response, and Update elements. The remaining two DCP elements, the Vulnerability Assessment and the Operational and Administrative Framework itself, were considered more "static" and their respective working groups did not need to meet during implementation as changes in these areas could be tracked through the Update Group.

The Operational and Administrative Framework Working Group during the DCP update process included representatives of organizations that had participated in the original DCP along with additional entities interested in promoting drought resilience in the NSW. Participants in the Working Group shared a variety of observations during implementation of the DCP:

- During non-drought years, it is difficult to maintain interest and participation outside of a core group of participants.
- Staff turnover and the need for repeated education of new staff has been a barrier to sustained participation for some entities.
- Unprecedented crisis events (e.g., 2020 wildfires, 2021 ice storm and heat dome, etc.) and associated recovery efforts have necessarily taken precedence over non-emergency drought planning efforts when staff capacity is limited.
- The Operational and Administrative Framework called for the establishment of multiple groups and sub-groups that were, in practice, staffed by the same people.

Based on these observations, the Working Group recommended combining some roles, streamlining processes, and setting triggers to form sub-groups that did not need to meet regularly outside of drought conditions.

Updated Operational and Administrative Framework

Administrative Team

Under the revised framework, the DCP AT will be responsible for most implementation functions. While membership may change depending on staffing resources, the DCP AT is initially expected to include representatives from the Santiam Water Control District, City of Salem, North Santiam Watershed Council, Marion County Emergency Management, and SEDCOR. The DCP AT will have the following roles and responsibilities:

- Evaluate monitoring reports and recommend response actions depending on the drought stage.
    - Determine whether more frequent monitoring reports are needed during Drought Stages 1-2.
- Coordinate and track implementation of joint actions.
- Review drought messaging outreach templates and revise as needed.
- Coordinate recommendations for drought declarations to County/public officials.
- Review proposed changes and approve periodic updates to the DCP.
- Provide fiscal oversight for the Lead Coordinator.

Lead Coordinator

The Lead Coordinator is intended to be a paid position, depending on funding availability, which supports the DCP AT with implementation and coordination among the interested entities in the NSW. The Lead Coordinator's roles and responsibilities include:

- Provide administrative assistance to the DCP AT, including maintaining contact information lists for organizations interested in DCP implementation.
- Compile monitoring data in the Monitoring Framework 2.0 spreadsheet, prepare the monitoring report, and send the report to the DCP email list. Post the latest report online.
    - During Drought Stages 0-2, the Lead Coordinator will prepare and distribute monitoring reports on a monthly basis, unless the AT recommends more frequent reporting based on a high likelihood of near-term drought development.
    - Beginning in Stage 3, reporting frequency will increase to every 2 weeks. The Lead Coordinator will include outreach materials (based on pre-developed templates) with the reports for organizations to distribute to their constituents.
- Maintain the DCP website.
- Collect environmental and socioeconomic data for use in drought declaration recommendations, funding applications, and future updates of the DCP.

- Track and report on the implementation and effectiveness of mitigation and response actions.
- Assist the DCP AT with coordinating the drought declaration recommendation process.
- Track funding sources for implementing mitigation and response actions. Pursue grants, as feasible.
- Lead the DCP update process.

In the event that the Lead Coordinator position is not fully funded in the future, the DCP AT will meet to determine which of these responsibilities may be taken on by their organizations.

During the update process, Working Group members expressed support for maintaining a DCP website to build public awareness of the plan, help interested entities in the NSW track drought conditions, and provide resources for more information. The website may be a standalone site maintained by the Lead Coordinator, or a webpage hosted by one of the DCP AT members, depending on funding and staffing availability. The website is anticipated to include the drought monitoring reports, plan information, links to information about the drought declaration process and emergency resources, outreach templates, information about mitigation projects and partners, and a list of potential funding sources.

Tracking implementation progress and results is key to understanding and increasing the effectiveness of the DCP in improving drought resilience in the NSW. Using the list of mitigation projects and actions in Exhibit 20 of the DCP, the Lead Coordinator will periodically reach out to project proponents to ask about implementation status and outcomes observed. These check-ins will also provide the Lead Coordinator with the opportunity to share information about potential funding sources, project partners, and technical assistance if difficulties arise during implementation of mitigation projects. Similarly, the Lead Coordinator will track implementation of response actions during drought, including any information available about their effectiveness. The Lead Coordinator will communicate with Marion County Emergency Management to align efforts to track drought mitigation and response activities that are included in Marion County's Multi-Jurisdictional Hazard Mitigation Plan.

Response Group

The Lead Coordinator will convene a Response Group when drought conditions in the watershed reach Drought Stage 2 or higher. Membership will depend on staff capacity but is anticipated to include representatives from the organizations on the DCP AT along with other potentially affected entities and sectors, such as additional water suppliers, fire departments, or recreation providers. Representatives of state and federal agencies may be invited to provide technical assistance and information about local water management issues (e.g., need to regulate off junior water right holders) and plans (e.g., USACE water management decisions). The Response Group's roles and responsibilities include:

- Assist with coordination and tracking of response actions.
- Recommend that the DCP AT request countywide drought declarations from the County and the Governor's Office.

Annual Implementation Schedule: Non-Drought Conditions

Based on feedback during the update process, the Working Group streamlined the annual schedule for implementing the DCP under non-drought conditions. This includes Drought Stage 0 (no drought) and Stage 1 (heads up – potential for drought). Exhibit 23 shows the simplified schedule and responsible entities for each activity.

Exhibit 23. Non-Drought Annual Schedule

Annual Activities	Responsible Entity
Annual meeting	Administrative Team
Update contact list	Lead Coordinator
Review outreach templates and update as needed	Administrative Team
Quarterly Activities	**Responsible Entity**
Check status of mitigation actions	Lead Coordinator
Update website	Lead Coordinator
Compile information for future updates	Lead Coordinator
Monthly Activities	**Responsible Entity**
Drought stage monitoring and reporting	Lead Coordinator

The Working Group supported hosting an annual meeting to discuss progress and implementation needs, share information about basin activities and drought impacts, and connect with other organizations in the region. The NSW is fortunate to have a variety of networks already in place to support these connections, and the Working Group recommended combining the proposed annual meeting with the existing efforts of the Council of Water Leaders. The Council of Water Leaders meets quarterly to provide a forum for learning and coordination among decision makers to improve water management in the NSW. Participants involved in both efforts recommended including DCP implementation progress as a standing agenda item at the November meeting of the Council of Water Leaders.

Implementation During Drought

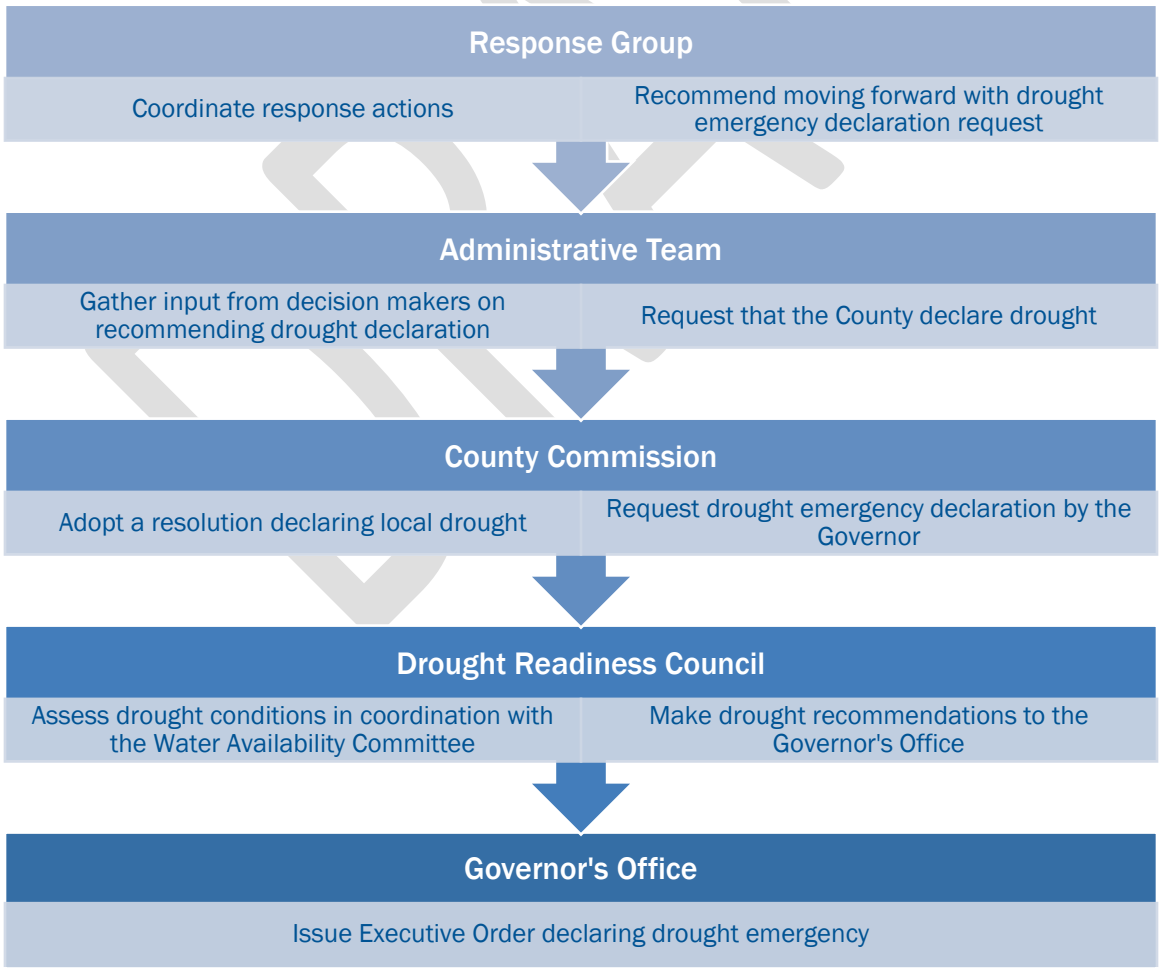
The second goal of the Operational and Administrative Framework is to facilitate a quick and efficient response to drought conditions. When the monthly monitoring report shows that the watershed is in Drought Stage 2 (moderate drought) or higher, the Lead Coordinator will convene a Response Group to discuss coordination of response actions and the potential need for recommendation of a drought declaration. The Response Group will determine whether to hold monthly or more frequent meetings based on drought conditions and staff capacity.

Although drought impacts may not appear severe until Stage 3 or 4, the Response Group may consider the future conditions forecast, time of year, and any information about the sectors the

members represent to determine if it may be prudent to recommend a drought declaration during Stage 2. A declaration "earlier" in a drought can open access to certain water right tools and disaster funding sources, as described in Element #4. When the Response Group determines that recommending a formal drought declaration would be beneficial, it will recommend that the DCP AT coordinate this request. The DCP AT members will provide their respective boards, councils, or commissions with the most recent drought monitoring report and seek their input on whether to recommend moving forward with a drought declaration. If these entities agree to move forward, the DCP AT will provide the monitoring report to the County officials and request that the County declare a drought at the local level and petition the Governor to declare a state of drought emergency in the County.

To secure a state of drought emergency declaration from the Governor, the County Commission submits a request to the Drought Readiness Council, which is co-chaired by OWRD and the Department of Emergency Management. The Water Availability Committee, chaired by OWRD, evaluates the water supply conditions and provides recommendations to the Drought Readiness Council related to drought declaration requests. The Drought Readiness Council assesses the impact of drought conditions and makes recommendations to the Governor's Office on declaring a state of drought emergency in the area. The Governor then issues an Executive Order declaring a drought emergency in the affected county. Exhibit 24 outlines the steps in the drought declaration process.

Exhibit 24. Drought Declaration Process



If the County decides not to request a drought declaration from the Governor, individual cities may declare drought within their own communities, which enables them to qualify for hazard mitigation funding from County emergency management programs. Local jurisdictions may also declare a water supply state of emergency if a severe water supply shortage threatens public health and safety.

Implementation Schedule: Drought Conditions

When the NSW drought monitoring reports show that the watershed is in Drought Stage 2 or higher, the Response Group will convene monthly to assess conditions in the region and the need for a drought declaration, as described above. Once a drought has been declared, the Response Group will determine how frequently to meet to coordinate response actions, which is anticipated to be at least monthly. Depending on the time of year when a drought is declared, participating entities may be able to connect with existing watershed-wide efforts. For example, if a drought declaration seems likely early in the year, participants could discuss response options at the Council of Water Leaders first quarterly meeting in early spring. This could allow agricultural producers to make early decisions about planting, pasture management, and irrigation plans. Later in the year, participants could provide updates at the North Santiam Basin Summit, typically held in April or May.

Starting in Drought Stage 3, the Lead Coordinator will develop and distribute drought monitoring reports every 2 weeks. The Lead Coordinator will also distribute water conservation and drought response outreach materials based on the pre-approved templates for recipients to distribute to their networks as needed. If desired and resources are available, the Lead Coordinator may also assist with developing outreach materials tailored to specific groups. Entities participating in implementation of the DCP will undertake response actions (e.g., outreach, water right tools, emergency actions) and will provide information about their activities to the Lead Coordinator. When sending out the monitoring report, the Lead Coordinator will request information about response actions, their effectiveness in responding to drought, and any observed impacts of drought in the NSW. Exhibit 25 provides an overview of the implementation schedule during drought. The activities shown are in addition to the activities on the annual non-drought implementation schedule, such as keeping the website and contact list updated.

Exhibit 25. Implementation Schedule During Drought

Monthly Activities	Responsible Entity
Coordinate response actions	Response Group and Lead Coordinator
Assess conditions and effectiveness of response actions	Response Group
Coordinate with Oregon Department of Emergency Management and other agencies as needed	Administrative Team
Biweekly Activities	**Responsible Entity**
Drought stage monitoring and reporting	Lead Coordinator
Track response actions and effectiveness	Lead Coordinator
Distribute outreach materials	Lead Coordinator
Track drought impacts (ecological, socioeconomic, etc.)	Lead Coordinator

Post-Drought Evaluation

When drought conditions improve and intensive coordination is no longer needed, the Response Group will hold a final meeting to debrief on the drought response effort. The DCP AT, Lead Coordinator, and organizations that implemented response actions will be invited to attend and provide feedback on what was actually implemented and why, any metrics tracked, lessons learned, and areas where difficulties were encountered. The Lead Coordinator will track information discussed at the post-drought evaluation meeting for use in future updates of the DCP.

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Element #6: Update Process

Element #6 of the DCP presents a recommended annual evaluation process to identify new information, assess post-drought response, and suggest ways to improve effectiveness. Every 5 years or as determined by the DCP AT, annual results will be reviewed and the DCP AT will convene an Update Task Force to revise the DCP.

The goal of the DCP update process is to periodically evaluate and revise the DCP to respond to changing conditions and improve the DCP's effectiveness. Updates are necessary to incorporate new science, regulations, legislation, and other information; reassess the vulnerability of critical resources as watershed conditions change; incorporate improvements in drought monitoring; track completion and effectiveness of mitigation and response actions; and add new mitigation and response actions based on participant plans and lessons learned.

Post-Drought Evaluation

As noted in Element #5 (Operational and Administrative Framework), the Response Group that is convened during drought is responsible for conducting a post-drought evaluation. The Response Group will conduct the evaluation through a meeting (in-person or virtual) including the DCP AT, Lead Coordinator, and entities that implemented response actions during the drought. Attendees will provide information about response actions and their outcomes and metrics tracked. The Lead Coordinator will compile information from these meetings for use during the DCP update process.

DCP Update Process and Schedule

To facilitate compilation of data for DCP updates, the Lead Coordinator will issue an annual request for information to all DCP participants on the contact list. The contact list includes individuals representing all sectors in the NSW. The information request will include questions about environmental and socioeconomic impacts of drought if any were observed during the year, mitigation and response actions taken and their outcomes, and any new regulatory or technical information that the DCP AT should be aware of when considering future drought planning and response. The DCP AT will review all of the information collected to evaluate the effectiveness of the DCP and make future adjustments. The schedule for the process may be adjusted to align with updates of the Marion County Multi-Jurisdictional Hazard Mitigation Plan. If a drought occurred during the year, the annual information request may be merged with the post-drought evaluation process. Every 5 years, the DCP AT will review the annual evaluations and convene an Update Task Force to recommend updates to the DCP. Exhibit 26 presents an overview of the update process, responsible entities, and estimated schedule. A template for the annual process kickoff email to the contact list is provided in Appendix C.

Exhibit 26. Update Process and Estimated Annual Schedule

Schedule	Update Activities	Responsible Entity
By November 1	Send an email request to the DCP contact list requesting annual review information	Lead Coordinator
By November 15	Provide annual review information: ▪ Environmental, economic, and community impacts of drought in the NSW ▪ New regulations, legislation, climate change data, and population growth data that may affect water supply resilience for the member's sector ▪ New technology or research that may be useful to consider in DCP updates	Members of the DCP contact list
By December 15	Evaluate drought monitoring indicators, process for data collection, and effectiveness, and recommend changes to Monitoring Framework 2.0 if needed: ▪ Revisions to indicator data sources if data are no longer publicly available, or new data sources become available ▪ Comparison of calculated drought stage to observed drought impacts in the watershed	Lead Coordinator and Administrative Team
By December 15	Compile information to be used in updating the vulnerability assessment, table of mitigation actions, and table of response actions	Lead Coordinator
By January 15	Evaluate how the operational and administrative framework is functioning, and develop recommendations for changes if needed	Lead Coordinator and Administrative Team
By January 30	Document results of annual evaluation	Lead Coordinator
Every 5 years	Review annual evaluation documentation for the past 5 years and convene an Update Task Force for a formal DCP update	Administrative Team

This schedule is intended to align with the Council of Water Leaders basin efforts. The Lead Coordinator will send out the annual request for information prior to the winter meeting of the Council of Water Leaders (typically in November), where the annual review of DCP implementation progress will be a standing agenda item as noted in Element #5. The Lead Coordinator or DCP AT representatives may then share the results of the annual evaluation and any plans for a formal DCP update at the Council of Water Leaders' early spring meeting (typically in February).

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Appendix A

Task Force and Working Group Participants

Task Force Participants

- Les Bachelor, Natural Resources Conservation Service
- Chelsea Blank, Marion Soil and Water Conservation District
- Jeff Buskirk, City of Jefferson
- Marie Heuberger, North Santiam Watershed Council
- Brandin Hilbrandt, North Santiam Watershed Council
- Mike Hintz, Marion County
- Michael Keuler, Marion County Public Health
- Kip Morris, SEDCOR
- Alyssa Mucken, Oregon Water Resources Department
- Debra Paul, Linn Soil and Water Conservation District
- Becky Pineda, Marion Soil and Water Conservation District
- Jason Pulley, City of Salem
- Brent Stevenson, Santiam Water Control District
- Kathy Warner, US Army Corps of Engineers
- Cesar Zamora, Marion Soil and Water Conservation District

Working Group Participants

Element 1: Drought Monitoring

- Traci Archer, City of Gates
- Chelsea Blank, Marion Soil and Water Conservation District
- Michael Bradley, City of Stayton
- Jeff Buskirk, City of Jefferson
- Brandin Hilbrandt, North Santiam Watershed Council
- Mike Hintz, Marion County
- Nate Humphrey, Native Fish Society
- Matt Knudsen, Marion County
- Kip Morris, SEDCOR
- Alyssa Mucken, Oregon Water Resources Department
- Jessica Peters, Bureau of Reclamation
- Becky Pineda, Marion Soil and Water Conservation District
- Jason Pulley, City of Salem
- Cesar Zamora, Marion Soil and Water Conservation District

Element 2: Vulnerability Assessment

- Les Bachelor, Natural Resources Conservation Service
- Chelsea Blank, Marion Soil and Water Conservation District
- Salina Hart, Army Corps of Engineers
- Brandin Hilbrandt, North Santiam Watershed Council
- Mike Hintz, Marion County
- Michael Keuler, Marion County
- Lance Ludwick, City of Stayton
- Alyssa Mucken, Oregon Water Resources Department
- Debra Paul, Linn Soil and Water Conservation District
- Jason Pulley, City of Salem
- Mark Richardson, US Forest Service
- Brent Stevenson, Santiam Water Control District
- Greg Taylor, Army Corps of Engineers
- Cesar Zamora, Marion Soil and Water Conservation District

Element 3: Mitigation

- Traci Archer, City of Gates
- Les Bachelor, Natural Resources Conservation Service
- Greg Benthin, City of Gates
- Chelsea Blank, Marion Soil and Water Conservation District
- Julia Hajduk, City of Stayton
- Brandin Hilbrandt, North Santiam Watershed Council
- Mike Hintz, Marion County Emergency Management
- Peter Kauss, Bureau of Land Management
- Michael Keuler, Marion County Public Health
- Kip Morris, SEDCOR
- Alyssa Mucken, Oregon Water Resources Department
- Becky Pineda, Marion Soil and Water Conservation District
- Jason Pulley, City of Salem
- Brent Stevenson, Santiam Water Control District
- Cesar Zamora, Marion Soil and Water Conservation District

Element 4: Response

- Les Bachelor, Natural Resources Conservation Service
- Chelsea Blank, Marion Soil and Water Conservation District
- Jeff Buskirk, City of Jefferson
- Brandin Hilbrandt, North Santiam Watershed Council
- Mike Hintz, Marion County Emergency Management
- Michael Keuler, Marion County Public Health
- Kip Morris, SEDCOR
- Alyssa Mucken, Oregon Water Resources Department
- Debra Paul, Linn Soil and Water Conservation District
- Becky Pineda, Marion Soil and Water Conservation District
- Brent Stevenson, Santiam Water Control District
- Jim Trett, Mayor of Detroit

Element 5: Operational and Administrative Framework, and Element 6: Update Process

- Michael Bradley, City of Stayton
- Jeff Buskirk, City of Jefferson
- Brandin Hilbrandt, North Santiam Watershed Council
- Michael Keuler, Marion County Public Health
- Kip Morris, SEDCOR
- Alyssa Mucken, Oregon Water Resources Department
- Jason Pulley, City of Salem
- Brent Stevenson, Santiam Water Control District
- Cesar Zamora, Marion Soil and Water Conservation District

Appendix B

Drought Stage Calculation

Calculation of Drought Stages

The Lead Coordinator (or an entity selected by the Administrative Team) uses the Drought Stage Calculator spreadsheet to calculate the current drought stage and prepare the drought monitoring reports. In Stages 0 through 2, the Lead Coordinator (or selected entity) sends out the report on a monthly basis, unless the Administrative Team recommends more frequent reporting based on a high likelihood of near-term drought development. Beginning in Stage 3, reporting frequency increases to every 2 weeks.

Data Acquisition

Exhibit 1 provides the data sources for the indicators used in Monitoring Framework 2.0. Website information is current as of early 2026.

Exhibit 1. Drought Monitoring Data Sources

Indicator	Data Source
Air temperature (1 month departure from normal, °F)	https://www.nwrfc.noaa.gov/water_supply/wy_summary/wy_summary.php?tab=6
Precipitation (% normal for water year	https://www.nwrfc.noaa.gov/water_supply/wy_summary/wy_summary.php?tab=4
Snowpack (% normal snow water equivalent)	https://www.wcc.nrcs.usda.gov/ftpref/nwcc/basin-rpt/
Detroit Reservoir level (% above water control diagram)	https://www.nwd-wc.usace.army.mil/nwp/teacup/willamette/
Streamflow (USGS 7-day flow class and percentile)	https://waterwatch.usgs.gov/index.php?mt=pa07d_dry&usst=or&ushuc=&go=GO&st=or&id=wwgmap_viewer
Water temperature (above TMDL threshold, °C)	Greens Bridge: https://waterdata.usgs.gov/monitoring-location/USGS-14184100/#period=P7D&dataTypeId=continuous-00010-0&showFieldMeasurements=true Boulder Creek: https://waterdata.usgs.gov/monitoring-location/14178000/#parameterCode=00010&period=P7D&showMedian=false Little North Santiam: https://waterdata.usgs.gov/monitoring-location/14181900/#parameterCode=00010&period=P7D&showMedian=false
Wildfire hazard (National Fire Danger Rating System)	https://www.fs.usda.gov/main/willamette/fire
Boat ramps served (key elevations, feet)	https://www.nwd-wc.usace.army.mil/nwp/teacup/willamette/

Indicator	Data Source
Salem water supply (7-day average streamflow, cfs)	https://waterwatch.usgs.gov/index.php?id=pa07d&sid=w__gmap&r=or

USGS = United States Geological Survey TMDL = total maximum daily load
cfs = cubic feet per second

The Lead Coordinator (or selected entity) enters the data for the current month into the Drought Stage Calculator spreadsheet, which has been structured to calculate the drought stage for each indicator based on the threshold values described in Element 1 (Drought Monitoring) of the Drought Contingency Plan.

Calculation of Current Stage

Exhibit 2 shows the Excel table in which the data are entered are the "Value" column and the resulting calculated drought stage is shown in the "Stage" column. The month must be entered at the top of the table as a numeral (i.e., January = 1) to enable the formulas to calculate the drought stage for indicators with thresholds that are not the same year-round.

Exhibit 2. Drought Indicator Entry Table

Month:

Indicator	Value	Stage
Air temperature (departure from normal, °F)		
Precipitation (% normal for water year)		
Snowpack (% normal snow water equivalent)		
Detroit Reservoir level (% above water control diagram)		
Streamflow at Greens Bridge (7-day flow percentile)		
Streamflow at Mehama (7-day flow percentile)		
Streamflow at Boulder Creek (7-day flow percentile)		
Water temperature at Greens Bridge (°C)		
Water temperature at Boulder Creek (ºC)		
Water temperature at Little North Santiam (ºC)		
Wildfire hazard (National Fire Danger Rating)		
Boat ramps served (Key elevations, feet)		
Salem water supply (7-day streamflow at Mehama, cfs)		
Overall drought stage		

The overall drought stage is calculated by adding all of the values in the "Stage" column, dividing by the number of indicators tracked during the reporting period (note that not all indicators are tracked year-round), and rounding to the nearest whole number.

Appendix C

Annual Request for Information Template

Annual Request for Information

To facilitate compilation of data for periodic updates of the Drought Contingency Plan, the Lead Coordinator will issue an annual request for information to all participants on the contact list. The email request will be sent by November 1 each year, requesting information by November 15.

Request for Information Template

Thank you for your interest in supporting implementation of the North Santiam Watershed Drought Contingency Plan. To help us evaluate the effectiveness of the plan, please provide any information that you have about the following topics.

- Did you observe any environmental, social, or economic impacts of drought this year?
- Did you or your organization implement any drought mitigation actions this year?
  - If yes, please describe the actions (e.g., projects or activities), locations, partners, associated budget, timeline, and expected benefits.
- Did you or your organization implement any drought response actions this year?
  - If yes, please describe the actions, partners, and outcomes observed.
- Are you aware of any new information that we should be aware of when considering future drought planning or response? This may include:
  - New regulations or legislation
  - Climate change projections or observations
  - Population growth data or projections
  - New technology or research that may be useful to consider
  - Other factors that may affect water supply resilience