

North Santiam Watershed Drought Contingency Plan

Prepared for
**North Santiam Watershed
Drought Contingency Plan Task Force**
April 2018

Prepared by



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AND ASSOCIATES INC.**

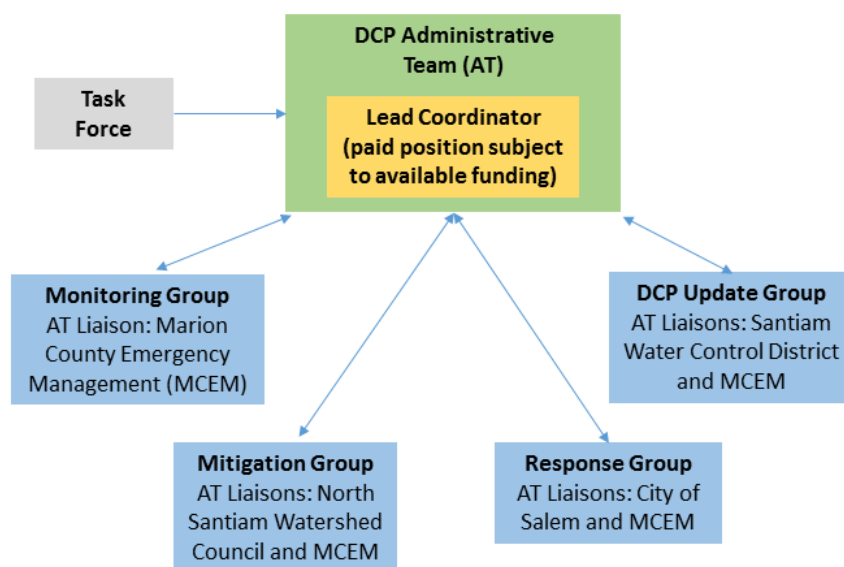
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Executive Summary

This Drought Contingency Plan (DCP) was developed by the North Santiam Watershed (NSW) Task Force to foster a collaborative approach to drought planning and response within the watershed. The DCP is intended to be a “living plan” that should be reviewed and adjusted on the basis of new information and how well it serves the needs of decision makers and their constituents. The DCP was funded in part by a Drought Contingency Planning WaterSMART grant from the U.S. Bureau of Reclamation (Reclamation). It follows Reclamation’s guidance for DCP preparation, as well as the NSW DCP Work Plan approved by Reclamation in March 2016.

The overarching goal of this DCP is to build long-term resiliency 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.

The NSW DCP addresses Reclamation’s six required planning elements. Each requirement was developed and completed as part of a collaborative process, and will be implemented as designated in the NSW DCP Operational and Administrative Framework (shown below and discussed in Chapter 6).



An overview of each planning element, and the annual schedule for implementation under this DCP, are summarized as follows:

1. **Chapter 2 – The Drought Monitoring Framework** is used to calculate and recognize four stages of drought; the results are used to identify which response actions should be used to reduce impacts during each of these four stages. The Framework includes a current drought conditions table, a future drought trends table, a reporting form, and a monthly schedule. These tables, forms, and schedule are presented in Chapter 2, with instructions for gathering the necessary data to complete them **on a monthly basis (or weekly starting in Stage 2)**.

2. **Chapter 3 – The Vulnerability Assessment** identifies and evaluates the potential impacts of drought on the assets and other resources within the watershed, under current and future conditions. The underlying causes of impacts are also identified. The assessment was used to identify mitigation and response actions that would help reduce impacts on the assets. The results of the assessment are presented in Chapter 3, and are scheduled to be evaluated **on an annual basis** during the DCP Update Process.
3. **Chapter 4 – Mitigation Actions** reduce risks and impacts before drought. They are projects and programs implemented and other actions taken by individual organizations within the watershed, or collectively by the Task Force. All proposed mitigation actions, their lead entities, and a schedule, are listed in Chapter 4. They are **implemented on an ongoing basis by the designated responsible party, and evaluated on an annual basis** during the DCP Update Process. Recommended steps for implementing eight of the mitigation actions that are identified as collective mitigation actions are provided in a separate document entitled, *Joint Mitigation Actions for Water Supply Resiliency - Implementation Plan* (JMAP); the steps are expected to be completed in the first 2 years of DCP implementation.
4. **Chapter 5 – Response Actions** reduce impacts during each of the four stages of drought. They are actions and programs that are implemented on a collaborative, voluntary, and watershed-wide basis. Response actions and the drought stage in which they are recommended for implementation, are described in Chapter 5. They are **implemented during each drought stage, and evaluated on an annual basis** during the DCP Update Process.
5. **Chapter 6 – Operational and Administrative Framework.** This DCP provides a process for facilitating a quick and efficient response to drought. When monitoring results are reported on a monthly basis, communication to the watershed community is triggered as a response action. In addition, if advanced stages of drought are identified, county and public officials will be involved to request a drought declaration from the Governor. This process is discussed in Chapter 6, and **evaluated on an annual basis** during the DCP Update Process.
6. **Chapter 7 – The DCP Update Process** conducts an **annual evaluation** of each of the planning elements to ensure effectiveness and improve future implementation and response. This process is presented in Chapter 7.

These planning elements are discussed in detail in the DCP chapters that follow. A checklist indicating the planning elements that need to be completed at each drought stage, and a figure summarizing the flow of planning elements are provided on the following pages. Additional information about development of the elements, background research, and the public input process, are provided in the appendices.

NSW DCP Checklist

In All Drought Stages: Monitoring and Response	
	Lead coordinator prepares a monthly monitoring report for submittal to the Monitoring Group during the first week of the month. Starting in Stage 2, monitoring will be conducted weekly, unless advised by the DCP Administrative Team to begin during Stage 1. (See Section 6.2.1)
	After review, the Monitoring Group forwards the report to the DCP Administrative Team with recommendations. (See Section 6.2.1)
	DCP Administrative Team evaluates the monitoring report, and submits the evaluation and recommendations to the Response Group by the 15 th of the month. (In Drought Stages 3 and 4, see Additional Response below.)
	Response Group initiates public messaging (See Section 6.2.2) and response actions corresponding to drought stage detailed in Table 9 and Section 5.1.4.
In Drought Stages 3 and 4: Additional Responses	
	Complete all preceding steps.
	In Stages 3 and 4, the DCP Administrative Team will confer with decision makers (e.g., boards, councils, commissioners) within 72 hours as to whether to recommend an Oregon Revised Statute (ORS) 536 drought declaration. (See Section 6.2.2)
	If decision makers recommend, county/public officials will pursue a drought declaration from the Governor.
	Emergency response actions identified in Table 9 and individual water management plans will be implemented.
Ongoing and Annual Actions	
	Mitigation actions identified in Table 8 will be implemented and completed on an ongoing basis by the Mitigation Group or individual Task Force members.
	By November 1 of each year, the DCP Update Group will commence the annual DCP Update Process by sending an information request email to the Task Force. (See Figure 6, Table 10, and draft email in Appendix G)
	By November 15 of each year, the Task Force will submit requested information to the DCP Update Group. (See Figure 6, Table 10)
	By November 22 of each year, the DCP Update Group will review and update the Vulnerability Assessment with information provided by the Task Force. (See Figure 6, Table 10)
	By December 1, the Monitoring, Mitigation and Response Groups will evaluate and recommend changes regarding their respective planning elements to the DCP Administrative Team. (See Figure 6, Table 10)
	By December 15 of each year, the DCP Administrative Team will compile and document recommendations in an annual report. Task Force feedback may be solicited. (See Figure 6, Table 10)
	Every 5 years, The DCP Update Group will compile the annual reports and update the DCP document. (See Figure 6, Table 10)

NSW DCP Process Overview

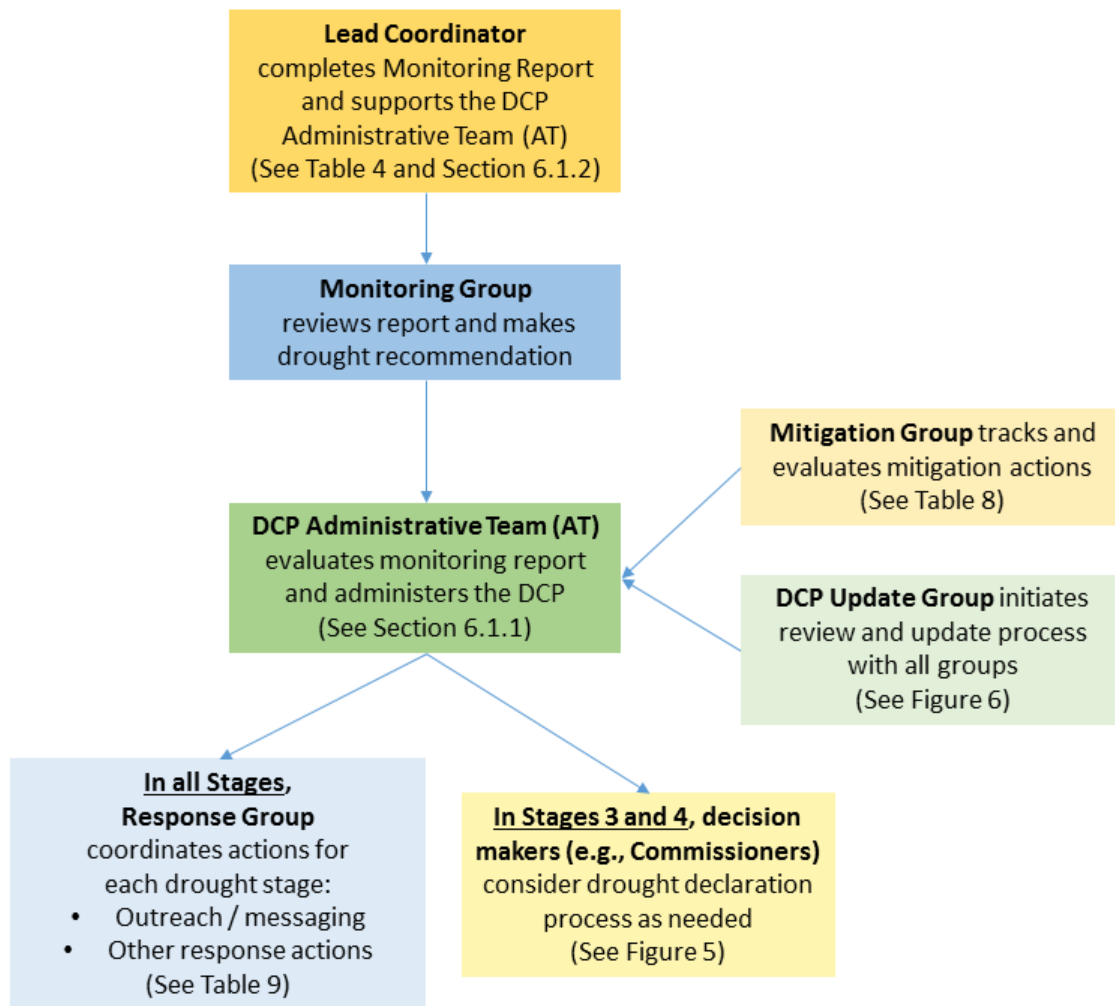


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1 INTRODUCTION

This Drought Contingency Plan (DCP) was developed by the North Santiam Watershed (NSW) Task Force to foster a collaborative and non-regulatory approach to drought planning, monitoring, and response within the watershed. The DCP is intended to be a “living plan” that should be reviewed and adjusted on the basis of new information and how well it serves the needs of decision makers and their constituents. The DCP was funded in part by a Drought Contingency Planning WaterSMART grant from the U.S. Bureau of Reclamation (Reclamation). It follows Reclamation’s guidance for DCP preparation, as well as the NSW DCP Work Plan approved by Reclamation in March 2016.

The overarching goal of this DCP, as defined by the Task Force is as follows:

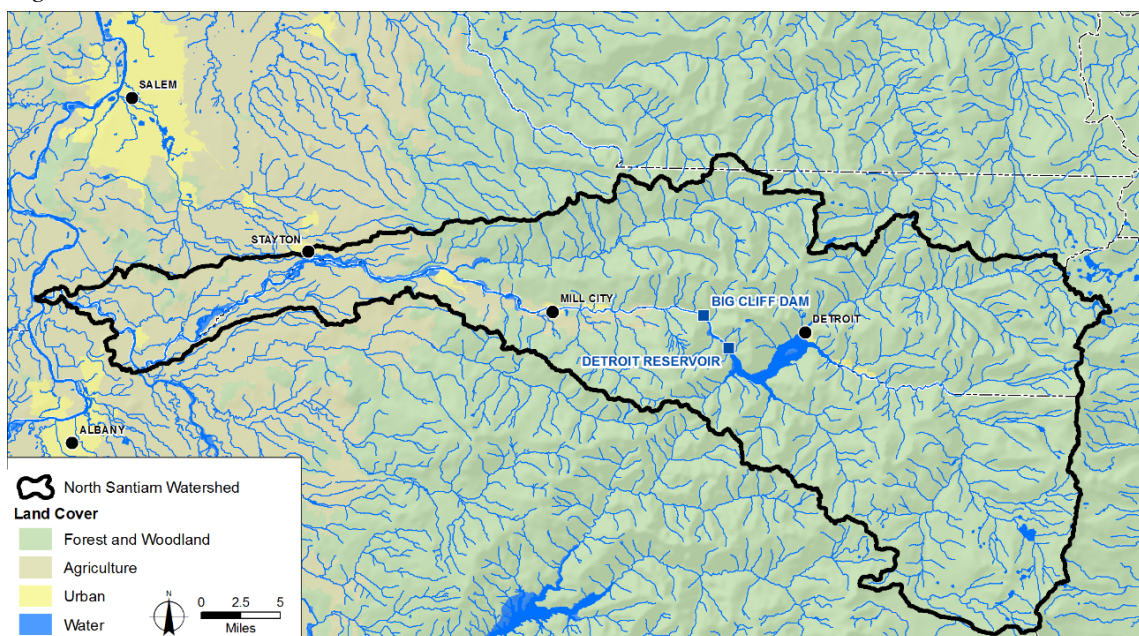
“Build long-term resiliency to drought in order to minimize impacts to the communities, local economies, and the critical natural resources within the watershed. The process will seek to develop consensus among stakeholders to manage water before and during drought.”

1.1 PLANNING AREA

The NSW DCP addresses the entirety of the NSW as well as water users outside the NSW basin (Figure 1) that obtain their water from the NSW, such as the City of Salem. Communities, businesses, and threatened fisheries (Upper Willamette River Chinook and winter steelhead) inside and outside of the watershed depend upon the North Santiam River for drinking water, commercial uses, irrigation, instream flows, and water quality needs (e.g., temperature management).

A major feature of the NSW is Detroit Reservoir (also known as Detroit Lake), formed by Detroit Dam and its re-regulating structure Big Cliff Dam. These facilities are operated by the U.S. Army Corps of Engineers (USACE) as part of the Willamette Basin project (Contracts #140510W0675 and #140510W1118).

Figure 1. North Santiam Watershed



Geographically, the NSW is a watershed within the Willamette River Basin. It covers approximately 766 square miles (approximately 500,000 acres) from the western slopes of the Cascade Range to the Willamette Valley floor. The North Santiam River flows westerly, and below the confluence with the South Santiam River, joins 12 miles of the mainstem Santiam River before reaching the Willamette River. Together, the North Santiam River and the mainstem Santiam River are approximately 100 miles long and enter the Willamette River at River Mile 108. The NSW is characterized by steep forested uplands and flat alluvial lowlands.

For the most part, large water users in the NSW use surface water, including the City of Salem, Sydney Irrigation Cooperative, and the Santiam Water Control District. Groundwater use in the NSW is mostly from small, domestic wells. These wells are typically exempt from the requirement to obtain a water right and do not have water use reporting requirements. This makes it difficult to monitor and track water use from domestic wells. The Oregon Water Resources Department (OWRD) has 32 monitoring wells in Marion County, however water levels are not taken frequently, so real-time monitoring data is not available. A spatially explicit understanding of the contribution of groundwater to surface water is not currently available. Also, groundwater resources in the NSW are very site-specific, depending on well depth and aquifer type and thickness. For example, OWRD has designated two Groundwater Limited Areas in the NSW: the Kingston Ground Water Limited Area south of the City of Stayton and the Stayton-Sublimity Ground Water Limited Area. For these reasons, and because there is a focus on surface water use in the NSW due to instream needs for chinook salmon and winter steelhead, this DCP focuses primarily on surface water. The NSW Task Force recognizes the need for improved information on groundwater resources and integration of groundwater conditions into the DCP when possible.

1.2 NSW DROUGHT CONTEXT

In 2015, the headwaters of the NSW experienced “severe drought,” and the western portion of the watershed experienced “moderate drought.” The Governor declared a state of drought emergency for both counties that comprise the watershed (Linn and Marion Counties) because of drought, low snowpack levels, and low water conditions (Executive Orders 15-11 and 15-19). In June 2015, Detroit Lake levels were 60 feet below normal, and storage was 33 percent of normal. Also in 2015, air temperatures were approximately 5 to 10 degrees Fahrenheit (°F) above normal at the beginning of the year, and the warmest on record for June (7.7 °F above average).

The Oregon Climate Change Research Institute (2013) predicts continuing temperature increases through 2100 in the Oregon Cascades, where the NSW is located. Annual precipitation patterns are expected to change, resulting in winters with more rainfall and higher intensity rainfall, reduced winter snowpack, and longer dry seasons.

Releases from Detroit Lake are managed according to federally mandated regulations that provide for flood protection and control of flows to foster recovery of salmon and steelhead listed as threatened under the Endangered Species Act. As a result, most stakeholders have little control over the amount of water stored or available downstream of Detroit Lake. This lack of control over water availability creates significant uncertainty. Changes in reservoir storage and releases during drought conditions could impact many stakeholders.

It should be noted that this DCP does not supersede Oregon water law. Under Oregon law, water is publicly owned, and most uses must be authorized through a water right issued by OWRD. Under OWRD's administration of these water rights, in times of shortage, the earlier obtained water rights (senior rights) must be fully satisfied before the recently obtained water rights (junior rights) can take water. The DCP works within this framework and recommends voluntary actions to build resiliency and minimize impacts of drought.

1.3 APPROACH

1.3.1 Planning Process

This DCP addresses Reclamation's six required elements necessary to complete a 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 this DCP.
6. **DCP Update Process** conducts evaluation to ensure effectiveness and improve future implementation and response.

The chapters that follow address each planning element. Additional details are provided in the appendices.

1.3.2 Collaboration and Review

A two-part project structure was used to complete each DCP element:

- A **Drought Planning Task Force** (Task Force) composed of individuals with interest and technical expertise led the process.
- **Working Groups** supported development of the individual planning element chapters of the DCP.

Volunteers from the Task Force participated in the Working Groups. For each DCP element, Working Group members provided technical and "on the ground" knowledge by participating in two in-person workshops for each planning element, and also provided feedback on each draft DCP planning element chapter (Appendices). After completion of every two DCP elements, results were presented to the larger Task Force for feedback and concurrence. Ongoing feedback was solicited in person and via email after each workshop and Task Force meeting. The process was supported by a consultant team, which prepared for and facilitated each workshop and Task Force meeting, prepared the chapters, and incorporated feedback from participants. The Task Force and Working Group members are listed by DCP element in Appendix A.

A compiled draft version of the DCP was circulated, and a joint Task Force and Basin Summit (including the public) was convened to provide feedback. After this joint meeting, feedback was incorporated and the final draft DCP was circulated. Task Force members were asked for concurrence to submit the final draft document to Reclamation.

1.3.3 Joint Mitigation Actions Implementation Plan

Several mitigation actions were identified for the Task Force as part of the Mitigation Actions planning element. To support implementation of these actions, a *Joint Mitigation Actions for Water Supply Resiliency - Implementation Plan* (JMAP) was prepared as a separate document. The JMAP includes detailed recommendations for carrying out the the joint actions. The JMAP is discussed further in Chapter 4 and is located in Appendix H.

1.3.4 Communications and Outreach Plan

A Communication and Outreach Plan was included in the NSW DCP Work Plan, which identified the opportunities for stakeholders, including the general public, to seek information and provide input during the DCP planning process. Information was provided to a broader range of stakeholders within the planning area that are not necessarily represented by the Task Force and Working Groups. Tools used include a website, emails, newsletter articles, conference presentations, NSW Watershed Council meeting updates and a mailed annual report, and the 2016 and 2017 North Santiam Basin Summits.

During the 2017 Basin Summit, a tabletop exercise was conducted to practice the monitoring and response program elements and receive substantive feedback from stakeholders. Some of the comments that influenced this DCP include:

- Consider removing the Greens Bridge gage from monitoring because of a lack of data. It had been added to represent conditions downstream of Salem and the Santiam Water Control District. The gage was not removed, but this may be re-evaluated for future updates (see Table 1).
- Change the period for monitoring the boat ramps from “all year” to the recreation season (see Table 1).
- Add flexibility to begin weekly monitoring during Drought Stage 1 if needed.
- Consider adding groundwater levels as a monitoring indicator to assess drought conditions.
- Provide flexibility on when/whether to begin messaging during Drought Stage 1.
- Clarify that Response Group members can communicate monitoring results to specific constituents (e.g., farmers), if watershed-wide messaging is not yet needed.
- Add a reference to the Oregon Revised Statute (ORS) 401 drought declaration, in addition to ORS 536 drought declaration.

2 ELEMENT #1: DROUGHT MONITORING

This chapter presents the Drought Monitoring Framework (Framework) that will be used to confirm existing drought and assess the likelihood of future drought in the NSW. The Framework defines the data sources and indices, thresholds, and stages of drought. The stages will be used to define which mitigation actions (Chapter 4) and response actions (Chapter 5) should be implemented at any given time specifically for the NSW DCP area.

The Framework provides a streamlined, common view of watershed conditions, based upon discussions among the Working Group, Task Force, and 2016 Basin Summit participants that comprise a variety of climatologic, hydrologic, environmental, and socioeconomic indicators. It consists of a series of tables and reporting forms, which are discussed in the following sections. It is not intended to supersede monitoring conducted by individual stakeholders within the NSW. Each entity should continue to monitor water availability conditions as required or desired by their own rules or guidance documents. As part of the annual DCP Update Process (Chapter 7), the Framework may be adjusted with new or more useful information.

A full description of the collaborative Monitoring Working Group and Task Force review process, existing monitoring processes used in the watershed, and current data sources, used to provide background for this planning element are provided in Appendix B.

2.1 DROUGHT MONITORING ELEMENTS

To develop an effective Framework, an entity needs to identify and integrate the use of indices, indicators, and triggers to define drought stages (Reclamation, 2015).

Indices effectively integrate drought variables into a single index number. At a minimum, a primary index should be chosen or developed for drought monitoring. However, the trend is to rely on multiple drought indices to trigger mitigation and response actions, which are calibrated to various intensities of drought. Commonly used indices include the U.S. Standardized Precipitation Index and the U.S. Drought Monitor; however, these are typically used for planning across large geographic extents and may not be entirely useful at the scale of the NSW DCP.

Indicators are specific measures that can be used to assess drought conditions. They are dependent on local climate and data availability. Example indicators include precipitation, streamflows, reservoir levels, groundwater levels, and snowpack. Indicators are used to establish triggers. Repeated testing of the Framework under different scenarios revealed that drought conditions were experienced in the upper watershed before they were experienced in the lower watershed, below Detroit Dam. This resulted in including a range of indicators in the Framework, as well as a narrative reporting form, to reflect watershed-wide conditions.

Triggers are indicator threshold values or ranges that can be used to define the drought stage, or to trigger a specific response or mitigation action. Example triggers include specific reservoir levels on certain dates, streamflows falling below certain levels, etc.

Drought stages represent the severity of drought (e.g., moderate, severe, extreme; Stages 1-4). Defining drought stages is a crucial step to later implementing drought response actions.

2.2 NSW DCP PROPOSED MONITORING FRAMEWORK, VERSION 1.0

The NSW DCP Monitoring Framework consists of a current drought conditions table (Table 1), a future drought trends table (Table 2), additional indicators and key information to consider, a reporting form, and a schedule. Table 1, the current conditions table, is presented below, with instructions for gathering the necessary data to complete it.

2.3 STAGES, INDICES/INDICATORS, AND THRESHOLDS FOR THE NSW DCP FRAMEWORK

Four stages of drought have been developed for the NSW DCP. As a comparison, many of the NSW DCP stakeholders include four stages of drought as part of their Water Management and Conservation Plans (WMCPs) water curtailment programs. The early “heads up” warning stage was also considered beneficial for planning purposes. The drought stages are listed in the first column of Table 1 (Heads up, moderate, severe and extreme drought).

The second column of Table 1, “Definition/Possible Impacts,” defines the drought stages based on potential impacts that could occur at each stage. These descriptions generally follow the generic descriptions used by the U.S. Drought Monitor. A detailed review of potential impacts specific to the NSW is provided in the Vulnerability Assessment (Attachment B to Appendix C).

The majority of Table 1 reflects the indices/indicators (across the top of Table 1) selected to measure drought, and the threshold triggers (within the cells of Table 1) that define the drought stage. The threshold triggers are based on a review of historical conditions as further described in Appendix B. The indicators cover a range of climatic, hydrologic, environmental, and socioeconomic (including agriculture) aspects of drought, as well as to cover a range of short-term, mid-term, and long-term data trends. No individual indicator is weighted at this time. Indicator data are gathered from the Internet and compared to the trigger values, and then aggregated to determine drought stage. The indicators are hyperlinked to their respective websites in Table 1.

Table 1. NSW DCP Current Conditions Monitoring Table

Date:		Indicators and Indices											
		National Indices	NSW Climate Indicators		NSW Hydrologic Indicators					NSW Environmental Indicator		NSW Socioeconomic Indicator	
NSW Drought Stage	Definition/Possible Impacts	US Drought Monitor (Weekly Update)	Air Temperatures (1 month departure from normal, °F)	Precip. (% of Normal for Water Year)	Snowpack (% normal SWE)	Detroit Reservoir (Percent above water control diagram)	USGS 7-day Flow (drought), N. Santiam @ Greens Bridge near Jefferson (Class, Percentile)	USGS 7-day Flow (drought), N. Santiam @ Mehama (Class, Percentile)	USGS 7-day Flow (drought), N. Santiam @ Below Boulder Creek (Class, Percentile)	Stream Water Temp, N. Santiam @ Greens Bridge near Jefferson (°C above TMDL threshold, Sept 1 – June 15 = 13.0°C June 16 – Aug 31 = 16.0°C)	Wildfire Hazard (ODF/National Fire Danger Rating System)	Detroit Reservoir --Boat Ramps Served (key elevations, feet)	Salem Water Supply Availability (7-day discharge in cfs at Mehama gauge)(also record percent of normal-mean as supplemental info)
	Indicator Monitoring Period	All Year	All Year	All Year	Dec 1 – May 1	All Year	All Year	All Year	All Year	All Year	All Year	April 1- Sept 30	All Year
	Enter Data in This Row												
(Stage 0) No Drought	Indicator is not in a drought condition	none	<0.5	>80	>70	>-3	>24	>24	>24	<-1.0	Low	>1,558	>1,000 cfs
(Stage 1) Heads Up – Potential for Drought	Current conditions (e.g., low snowpack) point to the potential for upcoming drought conditions.	DO	0 to 2	80 to 71	70 to 61	-3 to -10	Below Normal (24 to 10)	Below Normal (24 to 10)	Below Normal (24 to 10)	-1.0 to 0.0	Moderate	1,558 to > 1,556 (based on 2 ft above highest boat ramp elevation --State Park Boat Ramp D)	<=1,000 cfs
(Stage 2) Moderate Drought	Some damage to crops, pastures Streams, reservoirs, or wells low. Some water shortages developing or imminent Voluntary water-use restrictions may be requested Some stress to fish and wildlife	D1	2 to 4	70 to 61	60 to 51	-11 to -30	Moderate Hydrologic Drought (9 to 6)	Moderate Hydrologic Drought (9 to 6)	Moderate Hydrologic Drought (9 to 6)	0.1 to 2.0	High	1,555 to1,540 (State Park Boat Ramp D to Mongold East Boat Ramp	<= 900 cfs
(Stage 3) Severe Drought	Crop or pasture losses likely Water shortages common Water restrictions imposed Considerable stress to fish and wildlife	D2	4 to 6	60 to 41	50 to 21	-31 to -50	Severe Hydrologic Drought (<=5)	Severe Hydrologic Drought (<=5)	Severe Hydrologic Drought (<=5)	2.1 to 4.0	Very High	1,539 to 1,450 (Mongold main boat ramp to State Park Boat Ramp G)	<= 800 cfs
(Stage 4) Extreme Drought	Widespread crop/pasture losses Shortages of water in reservoirs, streams, and wells creating water emergencies Extreme stress to fish and wildlife	D3 or 4	6 or greater	40 or less	20 or less	-51 or less	Extreme hydrologic drought (New low)	Extreme hydrologic drought (New low)	Extreme hydrologic drought (New low)	4.1 or greater	Extreme	<= 1,450 (below Mongold low-water boat ramp)	<= 700 cfs
Note: Most indicator headings are hyper-linked to take you to the appropriate website. Hovering over each indicator heading will provide instructions for gathering the relevant information from the associated website.													

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Table 2 provides information regarding potential future conditions within the watershed. The combination of the overall drought stage, future trend indicator, plus the supporting individual data points should provide monitoring results that give a good collective understanding of conditions within the watershed.

Table 2. Future Trend Indicators Table

Category	Description	<u>1-Month Temp. Outlook</u>	<u>3-Month Temp. Outlook</u>	<u>1-Month Precip. Outlook</u>	<u>3-Month Precip. Outlook</u>	<u>NRCS Summary Report, Detroit Lake Inflow Forecast (Current month thru September, % Avg)</u>
+1	Trend Improving	Below mean temps predicted	Below mean temps predicted	Above mean precip predicted	Above mean precip predicted	>115
0	Trend Neutral or Mixed	Normal temps predicted	Normal temps predicted	Normal precip predicted	Normal precip predicted	115 to 85
-1	Trend Worsening	Above mean temps predicted	Above mean temps predicted	Below mean precip predicted	Below mean precip predicted	<85

The websites used to populate the drought monitoring tables for current and future conditions are provided in Table 3. Detailed instructions for how to acquire data from these websites for the indices/indicators are provided in Appendix B. Appendix B also contains background information about the rationale for selecting each indicator and how the triggers were developed.

Table 3. Indicators and Source Data Website for Thresholds

Indicator	Website
Current Conditions	
U.S. Drought Monitor Index	http://droughtmonitor.unl.edu/
Air Temperature (1 month departure from normal)	http://www.nwrhc.noaa.gov/water_supply/wy_summary/wy_summary.php?tab=6
Precipitation (% of normal for the Water Year)	http://www.nwrhc.noaa.gov/water_supply/wy_summary/wy_summary.php?tab=4.
Snowpack (% of normal Snow Water Equivalent)	http://www.wcc.nrcs.usda.gov/basin.html
Detroit Lake (% above water control diagram)	http://www.nwd-uc.usace.army.mil/nwp/teacup/willamette/

Indicator	Website
Current Conditions	
USGS 7-day Flow (drought) Measured on North Santiam River at Greens Bridge near Jefferson, Mehama, and Below Boulder Creek	http://waterwatch.usgs.gov/index.php?mt=pa07d_dry&usst=or&ushuc=&go=GO&st=or&id=wwgmap_viewer
Stream Water Temperature at Greens Bridge near Jefferson (°C above key threshold)	http://waterdata.usgs.gov/nwis/uv?cb_00010=on&format=gif_stats&site_no=14184100
Wildfire Hazard (Oregon Department of Forestry rating based on National Fire Danger Rating System)	http://nfdrs.smkmgmt.com/sfp/ODF_Significant_Fire_Potential.htm
Detroit Reservoir Elevations Relative to Boat Ramps and Marinas	http://www.nwd-wc.usace.army.mil/nwp/teacup/willamette/
Salem Water Supply Availability (7-day discharge at Mehama)	http://waterwatch.usgs.gov/index.php?id=pa07d&sid=wwgmap&r=or
Future Conditions	
One- and Three-Month Temperature and Precipitation Outlooks	http://www.cpc.ncep.noaa.gov/
NRCS Summary Report, Detroit Lake Inflow Forecast (% Average, Current month – September)	http://www.wcc.nrcs.usda.gov/basin.html

2.3.1 Additional Indicators to Consider

In addition to the indicators in Tables 1 and 2 above, basin stakeholders also may choose to consider the following water supply factors. Other factors also may be considered as determined by the Monitoring Group or DCP AT, such as groundwater levels.

2.3.1.1 Willamette Project System Forecasts and Water Year Determination

Operational planning for the Willamette Project's conservation release season begins with the USACE's January forecast and continues through October. The conservation release season plan identifies flow and storage needs for each tributary and reservoir in the Willamette Basin, based on the anticipated total system storage in mid-May, from the April forecast. The plan is fine-tuned in early June after spring refill.

The Willamette Basin Project Biological Opinion (Bi-Op) characterizes water year types based on historical data (USACE, BPA, and BOR, 2007). The USACE uses this information to meet mainstem

Willamette River flow objectives based on the mid-May system-wide storage forecast. If the storage forecast results in a water year type designation of “insufficient” or “deficit,” then there is the potential for flow releases in the Willamette system to be modified, including from Detroit Lake, which may be of concern to NSW DCP stakeholders.

2.3.1.2 Detroit Lake Inflows and Outflows

Detroit Lake inflows and outflow data can be found at the Willamette Project’s website (see teacup diagrams). If lake outflows are notably greater than inflows and lake water surface elevations are below the rule curve, then this could be of concern particularly during the conservation storage and conservation release seasons.

2.3.1.3 Big Cliff Dam Outflows Relative to Bi-Op Minimum Flow Requirements

Big Cliff Dam outflow data can be found in a similar manner as described above for Detroit Lake inflows and outflows. If Big Cliff Dam outflows are below the minimum outflows specified in the Bi-Op, then this could be of concern.

2.3.1.4 Other Relevant Data

In addition to the above listed additional indicators, other relevant information may be reviewed. Such information may include formal or informal reporting of crop losses, recreation impacts, or other environmental and socioeconomic impacts that may be experienced.

2.3.2 Drought Monitoring Reporting Steps

The NSW DCP Monitoring Framework consists of the following steps:

1. Gather drought indicator data (as explained above) and fill out the current conditions and future trend monitoring tables (Table 1 and Table 2, respectively).
2. Aggregate the current conditions data and the future trend data, as described in Table 4, to arrive at a NSW DCP drought stage and trend for the current monitoring period.
3. Gather the additional indicator described in Section 2.3.1.
4. Develop a brief monitoring report noting the drought stage and trend, along with a brief discussion of pertinent individual data points from Table 1 and Table 2, and the additional indicators and provide a Summary Statement, which is a written narrative that would be included with the monitoring report.
5. Share results among NSW DCP stakeholders consistent with the Operational and Administrative Framework (Chapter 7).
6. Repeat according to the schedule in Section 2.3.3.

Table 4 shows the Drought Stage Calculator, which takes the current conditions data recorded for each indicator that has been included for the monitoring period and aggregates them to arrive at an aggregated drought stage. The aggregated drought stage is accompanied by a written narrative that distinguishes between drought conditions in the upper and lower watershed and explains future trends, and can be used in news releases and other communications to expand upon the aggregated drought stage number. Table 4 provides an example written narrative, which is referred to as a NSW DCP Summary Statement. The future trends data (Table 2) can be aggregated by adding the plus, neutral, or minus values recorded for each indicator and then recording if the trend is positive, neutral, or negative.

Table 4. Drought Stage Calculator

Column 1	Column 2	Column 3
Drought Stage	Enter # of Indicators Per Stage from Table 1	Multiply Column 1 x Column 2
0		
1		
2		
3		
4		
(a) Total of Column 3		=
(b) #of indicators recorded this monitoring period		=
Divide (a) by (b) and then round to whole number		= Aggregated Drought Stage

EXAMPLE: NSW DCP Summary Statement for [insert date] Monitoring Period:

- NSW DCP monitoring stage is at Stage 1-Heads Up Potential for Drought.
- Indicators fairing the worst for drought include:
 - a. Detroit reservoir levels in general, and also as they relate to recreational facilities.
 - b. Wildfire hazard is high.
 - c. Stream temperature in the North Santiam is moderately above TMDL threshold; however, temperatures appear to be trending in a positive direction.
- Future trend indicators continue to point to the potential for drier conditions ahead.

The most recent Monitoring Framework tables and report will be posted on the North Santiam Watershed Council website for reference at <http://northsantiam.org/projects/north-santiam-drought-contingency-planning-2016-2017/>. However, this information should be one factor in stakeholder planning and decision making, not the sole factor.

2.3.3 Monitoring Schedule and Responsibilities

Monitoring is intended to occur on a monthly basis during the first week of the month, given that some of the indicators are reported on the first of each month. Beginning in Stage 2, monitoring should be conducted weekly, unless advised by the DCP AT to begin during Stage 1. The proposed monitoring frequency is based in part on polling during the 2016 and 2017 NSW Basin Summits that showed a clear preference for year round monitoring, and flexibility to begin weekly monitoring as needed.

It is also recommended that at the beginning of each new water year the stakeholders look back at the monitoring data that were recorded and inquire whether any adjustments are needed to the Framework. For example, should any indicators be removed, new indicators added, or threshold values shifted up or down. Additional details regarding monitoring roles and responsibilities, communication protocols, and framework revisions are provided in Chapter 7.

2.4 POTENTIAL CHALLENGES TO DROUGHT MONITORING IN THE STUDY AREA

The NSW DCP study area is fortunate to have a wealth of information to support drought monitoring. However, the following are some potential challenges that stakeholders should keep in mind when applying the Monitoring Framework:

- Flows in the North Santiam River are highly dependent on management of Detroit and Big Cliff Dams. Management decisions are partly based on clear indicators, such as the rule curve and the Willamette Project water year determination; however, particularly during drought conditions, management decisions typically are based on daily meetings/conversations between the USACE and resource and regulatory agencies as they review conditions at a given moment.
- Late season large snow or heavy rain events during the critical Detroit Lake filling period can notably improve hydrologic conditions.
- As climate changes, indicators that are based on percent of normal or similar comparisons to historical conditions may become outdated or less valid if they look too far back into the past.
- Thresholds for several indicators were noted as being based on informal review of data or based on best professional judgment. These indicators in particular should be reviewed closely at the end of each water year to assess suitability of the thresholds.
- The NSW DCP monitoring Framework and the DCP stakeholders are highly reliant on the availability of data provided by others, particularly federal agencies such as U.S. Geological Survey (USGS) and National Oceanic and Atmospheric Administration (NOAA). It is important that the data continue to be readily available in a consistent and easy-to-interpret manner.
- Real-time groundwater level data are lacking in this watershed and would be useful as an additional factor to consider in assessing drought conditions. Close coordination with the OWRD watermaster for the area is recommended. Data are available here:
http://apps.wrd.state.or.us/apps/gis/kmlviewer/Default.aspx?title=Marion%20County%20Observation%20Wells&backlink=http://www.oregon.gov/owrd/pages/gw/well_data.aspx&kmlfile=http://filepickup.wrd.state.or.us/files/Publications/obswwells/OWRD_Observation_Wells_MARI.kml

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3 ELEMENT #2: VULNERABILITY ASSESSMENT

The Vulnerability Assessment provides the necessary information to inform future mitigation and response actions that will improve resiliency to drought. To assess vulnerability, watershed assets and other resources at risk in the event of water shortage, and the impacts that may occur, were inventoried. Then the extent to which the assets are vulnerable to drought now and into the future was evaluated. Finally, the underlying causes of the vulnerability were examined.

A full description of the collaborative Working Group and Task Force review process, the asset/resource and impacts inventory, evaluation, and prioritization for this planning element is provided in Appendix C.

3.1 WATERSHED ASSETS/RESOURCES PRIORITIZATION

Assets and other resources (assets) for the NSW were identified, grouped, and prioritized based on research and Working Group discussion of the environmental, economic and social consequences of drought impacts. Prioritized grouped assets are presented in Table 5 (see Appendix C for a detailed list of assets and potential impacts, and discussion about the prioritization process). The current and future vulnerability of prioritized grouped assets were assessed as described in Section 3.2 below.

Table 5. Prioritized NSW Grouped Assets at Risk as a Result of Drought

- Municipal water uses
- Instream natural resources
- Commercial crop irrigation
- Commercial/industrial uses
- Fire suppression
- Individual domestic water
- Water oriented recreation
- Non-commercial irrigation
- Hydropower
- Upland natural resources
- Other irrigation/watering

Note: “Fire suppression” represents municipal fire suppression and non-municipal fire suppression (i.e., agricultural ponds).

3.2 VULNERABILITY ASSESSMENT FRAMEWORK

The vulnerability of NSW prioritized grouped assets was evaluated using a risk management matrix¹ weighing two factors: consequences of potential impacts and sensitivity. These risk factors and their criteria are presented in Table 6. (These criteria also were used to prioritize the assets and resources in Table 4.) The criteria were not weighted or placed in any priority order.

¹ Matrix format was used for evaluation based upon communication with E. Flick, Marion County Emergency Manager (2016).

Table 6. Vulnerability Assessment Risk Evaluation Factors and Criteria

Matrix Location	Risk Factors	Evaluation Criteria
Y-axis	Environmental, economic and social consequences of impacts	<ul style="list-style-type: none"> • Public health, safety, and welfare impacts • Economic impacts • Watershed health (environmental) impacts
X-axis	Sensitivity of asset/resource	<ul style="list-style-type: none"> • Is there a backup water source? • Is there adaptability? • Is there (assumed) importance to the public?

3.3 VULNERABILITY NOW AND IN THE FUTURE

As a baseline exercise, water rights information from OWRD for the North Santiam River (surface water/natural flow/priority dates) was used to identify possible regulatory measures that could create vulnerability for municipal water providers and irrigators, two of the main water users in the NSW. Findings indicated that under current conditions (e.g., current reservoir management and regulatory framework, and typical or low streamflows), it is unlikely that North Santiam surface water rights holders would be regulated (i.e., use curtailed or shut off by the OWRD watermaster) because of insufficient flow. There are two reasons for this: (1) there are no instream water rights on the mainstem North Santiam River below Detroit Lake, and (2) the majority of the stored water being released from Detroit Lake is not covered by a water right and, therefore, is available for appropriation by existing water right holders. Therefore, the amount of water in the river (even during low flows) has been sufficient to meet the demands of all out-of-stream users.

3.3.1 Current Vulnerability Results

Baseline water conditions (i.e., current water rights and regulatory structure) and input from the Working Group and Task Force members knowledgeable about environmental, economic, and social drought impacts, were used to evaluate current vulnerability. The grouped and prioritized list of assets and resources (Table 5) was used as a starting point to qualitatively rank consequences of drought. Then, the sensitivity of the assets was distributed on the vulnerability matrix based upon the criteria in Table 6. This positioning of the assets relative to one another was adjusted based upon Working Group discussion of the criteria.

Results indicate that most assets are either higher in consequences or higher in sensitivity, which results in an overall moderate to high vulnerability. A few assets are within the moderate range for both consequences and sensitivity, which results in an overall moderate vulnerability. No assets are considered low consequences and low priority (i.e., low vulnerability). Results are shown in Figure 2, which indicates that the most vulnerable assets under current conditions are:

- Municipal water users: Detroit, Idanha, Lyons-Mehama, Gates, Stayton, and Salem
- In-stream natural resources (e.g., endangered species, water quality, and wetlands)
- Commercial irrigation

- Municipal-supplied commercial/industrial use
- Water-oriented recreation

3.3.2 Future Vulnerability Results

Future conditions that could impact water availability in the future include:

- Willamette Project Bi-Op implementation
- Willamette Basin Review (reallocation of stored water)
- Population growth
- Climate change

Uncertainties can produce a range of future conditions, such as how regulatory decisions will be implemented, or how multiple factors interact within the North Santiam Basin to produce a specific change. Background information used to evaluate each of these future conditions is provided in Appendix B. Generally speaking, the evaluations used a qualitative approach as opposed to a more intensive quantitative approach.

The “current condition” locations of the assets on the vulnerability matrix were used as the starting point, and shifted to show the change in consequence and sensitivity as future conditions arise. For example, under the Bi-Op implementation and stored water reallocation scenario, municipal water rights with priority dates junior to 1964 may be subject to regulation, and therefore, the asset becomes more sensitive. As a consequence, a “less certain” water supply is likely to have public health, welfare, and economic impacts on a community, therefore, the consequences become higher. Conversely, actions that may result in protecting more of the released stored water instream (and converting administratively established Minimum Perennial Streamflows [MPSF] to instream water rights with a 1964 priority date) would provide more certain flow for instream natural resources (e.g., endangered species, water quality, and wetlands) that are downstream of the dam. However, climate change may have higher watershed health consequences on upstream flow and other instream assets because of warmer water, changes in timing of flow, etc., so these assets also shift under future conditions.

The future condition scenarios that potentially affect watershed assets are noted within the circles in Figure 3. Results indicate that almost all assets become more sensitive and vulnerable, though some shifts have a slightly greater magnitude than others (predominantly resulting from interactions of multiple variables). Emphasis was placed on those assets that are directly reliant on water in the North Santiam River and where the implementation of actions can reduce drought vulnerability. Overall, the most vulnerable assets under future conditions are the same as under current conditions.

Figure 2. Vulnerability Assessment - Current Conditions

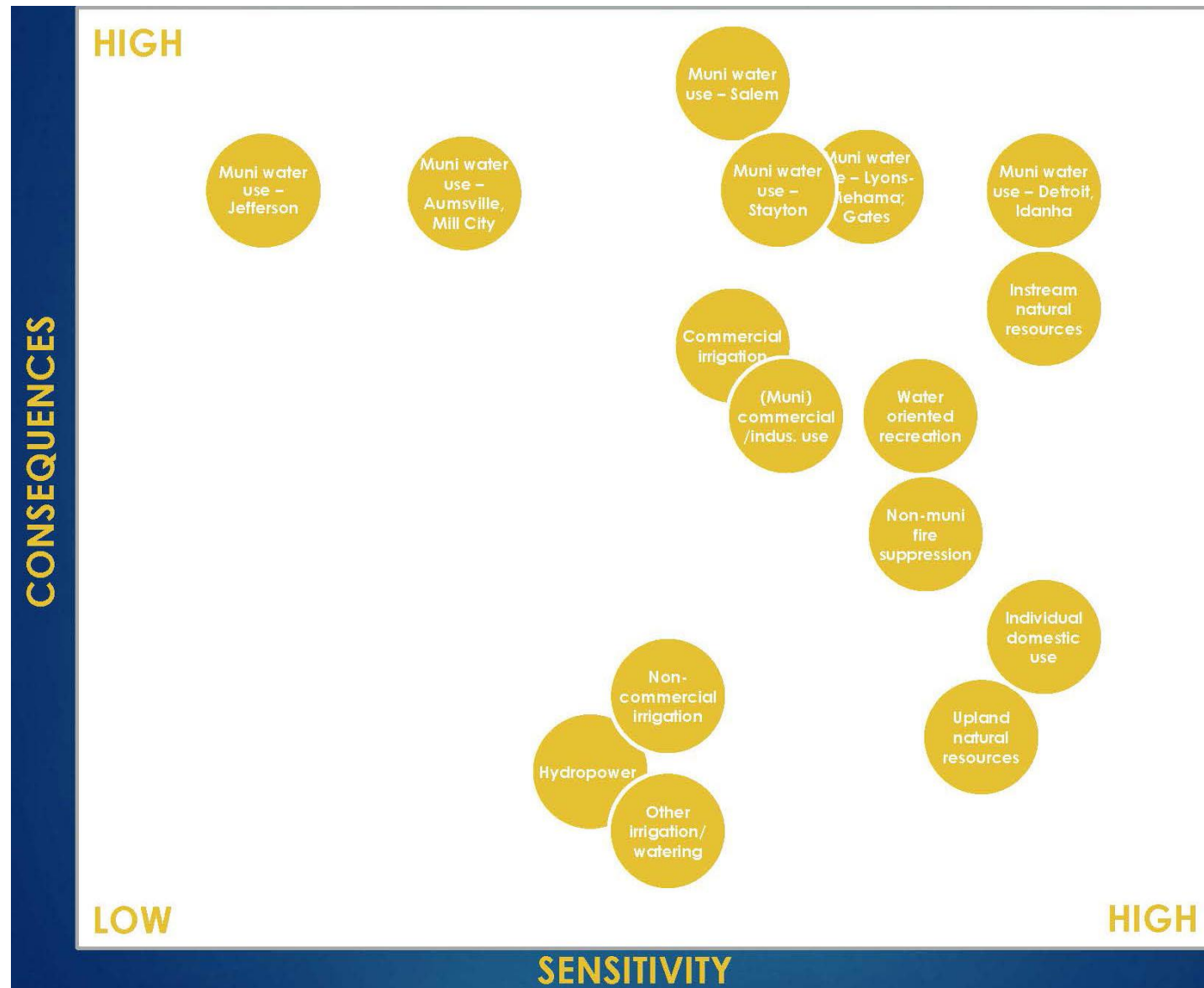
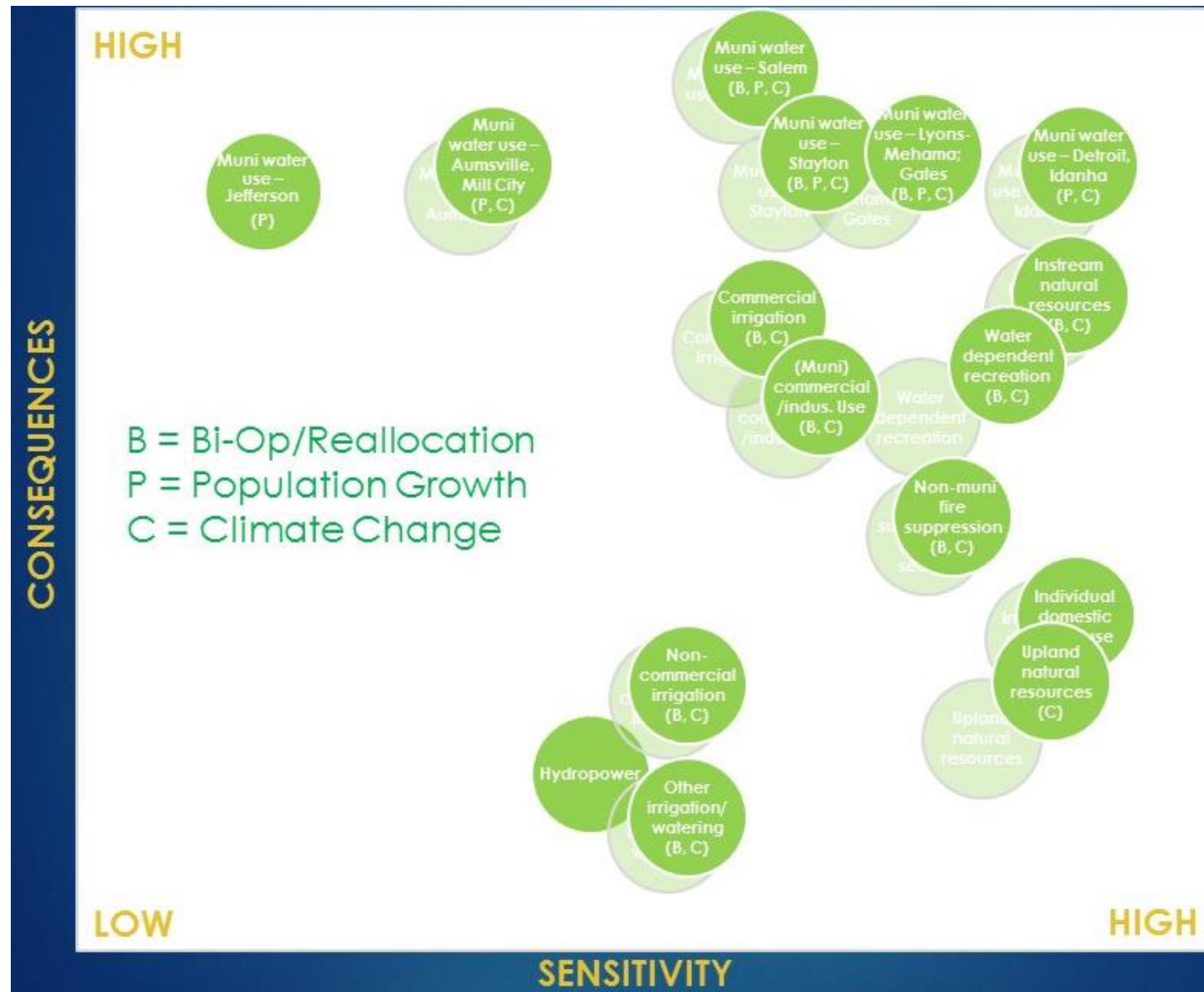


Figure 3. Vulnerability Assessment - Future Conditions



3.3.3 Evaluate Underlying Causes of Vulnerability

Every prioritized asset showed some level of current and/or future vulnerability, therefore, each was evaluated to detail the underlying causes of vulnerability. The most vulnerable assets are highlighted in blue (Table 7). For the municipal water users (including municipal fire suppression), underlying causes of vulnerability were generally related to having a single source of water that may be inadequate under future conditions. Municipal water intakes at Salem, Detroit, and Idanha could experience difficulties receiving sufficient water at low flow.

Table 7. Underlying Causes¹

Asset/Resource	Underlying Causes
Municipal water – Salem	Below reservoir, intake limitations, insufficient backup, reliant on single source to large degree
Municipal water – Lyons-Mehama ²	Below reservoir, single source, no backup, no interconnection, all water rights junior to large downstream water users
Municipal water – Gates	Below reservoir, all but 0.10 cfs junior to potential future instream water right, all water rights junior to large downstream water users, no interconnection
Municipal water – Detroit, Idanha	Above reservoir, supply from small tributaries, single source, no backup, no interconnections
Instream natural resources ³	Below reservoir, subject to prior out of stream appropriation, no backup, “single source”
Food crop production	Below reservoir, insufficient backup
Muni commercial/industrial use ³	Below reservoir, insufficient backup, potentially subject to municipal curtailment
Water-oriented recreation - River boating/fishing ³	Below reservoir, subject to prior out of stream appropriation, no backup, “single source”
Water-oriented recreation - Reservoir recreation	USACE operations (i.e., rule curve/Bi-Op implementation), infrastructure limitations (e.g., parks, ramps, docks)
Municipal water – Aumsville	No backup, no interconnections, single source (groundwater)
Municipal water – Jefferson	Single source, no interconnections
Upland natural resources	Insufficient precipitation/ “single source”
Individual domestic use	Likely no backup, no interconnections, likely single source
Muni fire suppression	(See individual municipal water supplier causes)
Other commercial irrigation; Other irrigation/watering	Below reservoir, insufficient backup
Hydropower	USACE operations (i.e., rule curve/Bi-Op implementation), SWCD dams below reservoir

¹ The most vulnerable assets are highlighted in blue.

² Junior water rights are prior to 1964 minimum perennial stream flows, and junior to Salem and SWCD water rights.

³ These assets may also be located above the reservoir, but actions to address water resiliency in these areas are limited.

3.4 RECOMMENDATIONS AND DATA GAPS

Uncertainties exist that could interact to produce a range of future conditions, such as how regulatory decisions will be implemented to affect each asset, or how multiple future scenarios interact within this watershed to produce a specific change. The following recommendations are made to document and account for these uncertainties and address them within future iterations of this vulnerability assessment.

- Track the Willamette Project Bi-Op implementation and stored water reallocation efforts to understand changes in regulatory structure, water rights, and future availability of water to existing water right holders.
- Track USACE decision making regarding altering the rule curve to adjust to future conditions (i.e., to capture water earlier).
- Begin to gather quantitative data to assess the consequences of drought on watershed assets as they specifically relate to the underlying causes, such as gathering information on economic losses, community responses to manage water supply, and impacts on watershed resources, such as water quality or salmonid redd (spawning nest) survival.
- Examine and agree upon how groundwater interacts with surface water in this watershed, and the effects the interaction may have on low summer flow and individual domestic well users.
- Track the natural resource assessment in the geographic information system (GIS) being conducted by the Partners of the North Santiam Resiliency Action Planning Process to see how it may be used to evaluate future potential drought effects on watershed health (e.g., current cold water refugia, predicted change in mean August temperature).
- Track future population growth forecasts, specifically with respect to future economic development within the Santiam canyon.
- Track adaptive responses and their successes.

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4 ELEMENT #3: MITIGATION

The Mitigation planning element identifies, evaluates, and prioritizes actions to conserve water and improve resiliency before drought conditions, for the critical assets identified during the vulnerability assessment.

A full description of the mitigation action development process and collaborative Working Group and Task Force review process is provided in Appendix D.

4.1 NSW DCP MITIGATION ACTION GOALS

The following goal was established by the Task Force to inform the general types of mitigation actions and roles and responsibilities of participants.

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 response 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.*

In addition to the overall goal provided above, goals have been developed for each vulnerable sector. These goals are included in Appendix D.

4.2 DCP MITIGATION ACTIONS

A brainstormed list of current and future potential mitigation actions for each sector was compiled, and is included in Appendix D Table D-1. Generally speaking, mitigation actions fell into the following categories:

- Improve understanding of an organization's system risks and inefficiencies (i.e., by understanding the system as a whole, improvements can be made strategically to gain greatest benefit per dollar).
- Improve system efficiencies (i.e., implementing specific projects as opposed to studies).
- Increase natural system resiliency (i.e., adaptability and functionality).
- Improve resiliency of water-dependent recreation providers.
- Develop and implement collective or multi-sector efforts:
 - Drought monitoring.
 - Public education programs.

- Preparing for response actions (i.e., messaging and mechanisms in place so they are ready when drought occurs).
- Securing funding for priority collective actions and NSW DCP organizational structure.

From the list of current and future potential actions provided in Appendix D Table 1, key actions were prioritized by the respective organization(s) for the short term (i.e., 1 to 3 years) and for the long term (equal to or greater than 4 years), that will be implemented by those organizations. Combined, the individual actions cover the range of vulnerable sectors identified in the watershed. Similarly, eight joint (i.e., multi-sector) actions were identified as important tools that do not currently exist in a programmatic form specific to this basin. These are discussed in Section 4.3.

Group consensus was used to review and confirm that each action included in the priority list should be included as a priority. Discussion about each project focused on factors including costs relative to drought resiliency benefits, technical and regulatory complexity, community support, and potential co-benefits (e.g., developing an alternate municipal water source also would provide resiliency to earthquake hazard). Resulting priority short- and long-term mitigation actions are provided in Table 8.

4.3 JOINT MITIGATION ACTIONS IMPLEMENTATION PLAN

Eight new joint water supply management tools (i.e., mitigation actions) were identified and prioritized that currently do not exist within the watershed. These actions, which are the last eight actions shown in Table 8, will be developed and implemented cooperatively by Task Force members representing many different sectors, and therefore are considered a joint responsibility. To facilitate their development and implementation, a separate document, the JMAP was developed to provide recommended steps for establishing the new joint actions (see Appendix H). The JMAP identifies the purpose, process, and steps, as well as potential funding sources and a schedule, to complete each joint action.

The joint actions will be developed before drought, and therefore are considered mitigation. The resulting programs (e.g., education and outreach, water rights management tools) will be used during drought, and are also discussed in Chapter 5, Response.

4.4 RECOMMENDATIONS AND DATA GAPS

Uncertainties exist that could interact to produce a range of future conditions. Likewise, there is currently some uncertainty as to how some mitigation actions intended to benefit one water user could also affect other water users, beneficially or adversely. During preparation of this DCP, several entities were in the midst of their organizational planning processes that will prioritize their future actions including those related to water use and drought management. The following are some of the uncertainties or data gaps that should be taken into consideration as mitigation actions are planned for and implemented:

Uncertainties:

- How will lining or piping irrigation canals affect groundwater recharge, hydrologically connected wetlands, and nearby wells and properties?
- How might stakeholders receive recognition for their actions during future Bi-Op updates and other potential regulatory negotiations?

- How can small communities be supported to ensure involvement in future iterations of this DCP?

Adding future actions:

- If needed to improve prioritization efforts, a draft (qualitative) screening criteria matrix was developed. The draft matrix is provided in Appendix D.
- The City of Salem is conducting its Water Supply Master Plan update, which will be completed in 2018. Priority projects for the City will result from this effort. Several anticipated projects have been included in this DCP.
- The North Santiam River Watershed Council is leading the Partners of the North Santiam Resiliency Action Plan, to be completed by the end of 2017. Priority actions will result from this plan.

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Table 8. Priority Drought Mitigation Actions by Entity ¹

Mitigation Actions	Reclamation Drought Funding Objectives Directly Addressed ²	Lead Entity and Partners	Brief Description	Short/Long Term Action
Marion Canal Piping Project	<ul style="list-style-type: none"> - reliability of water supplies and sustainability - increase water management and operational flexibility - increase natural system resiliency (e.g., habitat improvements) 	Santiam WCD	Design and construct Marion Canal piping project to reduce system water loss. Design analysis should review potential changes to groundwater recharge that results from the existing unlined canal and potential effects of piping on nearby wells. Also, canal return flow feeds Marion Creek, which is 303d listed for temperature.	Short term = planning and design Long term = construction
Coates Canal Piping Project	<ul style="list-style-type: none"> - reliability of water supplies and sustainability - increase water management and operational flexibility - increase natural system resiliency (e.g., habitat improvements) 	Santiam WCD	Design and construct Coates Canal piping project to reduce system water loss.	Short term = planning and design Long term = construction
Santiam WCD SCADA Phase 2	<ul style="list-style-type: none"> - increase water management and operational flexibility 	Santiam WCD	Measure and better manage water withdrawal and delivery through the SWCD system. Phase 1 is underway. Phase 2 would expand the system.	Short term
Santiam WCD WMCP Update	<ul style="list-style-type: none"> - reliability of water supplies and sustainability - increase water management and operational flexibility 	Santiam WCD	Update SWCD WMCP, including incorporation of NSW DCP monitoring and other relevant elements.	Short term = planning and design Long term = construction
Santiam WCD System Improvement Plan	<ul style="list-style-type: none"> - reliability of water supplies and sustainability - increase water management and operational flexibility - benefits for fish and wildlife and the environment 	Santiam WCD	Review SWCD water delivery system as a whole to strategically make improvements, including reducing system losses. The study also would evaluate potential effects to adjacent interests, including the environment.	Short term = planning and design Long term = construction
Soil Moisture Monitoring Program	<ul style="list-style-type: none"> - reliability of water supplies and sustainability - increase water management and operational flexibility 	Santiam WCD	Establish program for monitoring soil moisture conditions in agricultural areas. Information to be used to improve irrigation efficiency.	Short term = planning and design Long term = implementation
Upper Bennett Dam Diversion Improvements	<ul style="list-style-type: none"> - reliability of water supplies and sustainability - increase water management and operational flexibility 	Santiam WCD, Salem, NSWC	Improve diversion facility to allow for low water operation. Improve/modify intakes to provide for low water operation.	Short term = planning and design Long term = construction
Lower Bennett Dam Diversion Improvements	<ul style="list-style-type: none"> - reliability of water supplies and sustainability - increase water management and operational flexibility 	Santiam WCD, Salem, NSWC, ODFW	Improve diversion facility to allow for low water operation. Improve/modify intakes to provide for low water operation and allow for fish passage.	Short term = planning and design Long term = construction
Salem Water Supply Master Plan Update	<ul style="list-style-type: none"> - reliability of water supplies and sustainability - increase water management and operational flexibility 	Salem	Complete master plan update in 2018. This will recommend system improvements that may include securing alternate water sources, improving system efficiency, and reducing system losses.	Short term = plan update Long term = projects prioritized in plan
Salem Water Transmission Line Main Evaluation	<ul style="list-style-type: none"> - reliability of water supplies and sustainability 	Salem	Evaluate lining a leaking water main that was built in the 1930s.	Short term
Salem Geren Island Intake Evaluation	<ul style="list-style-type: none"> - reliability of water supplies and sustainability - increase water management and operational flexibility 	Salem	Evaluate alternatives to the City's Geren Island intake to facilitate low water withdrawals	Long term

Mitigation Actions	Reclamation Drought Funding Objectives Directly Addressed ²	Lead Entity and Partners	Brief Description	Short/Long Term Action
Salem Geren Island Groundwater Enhancement Evaluation	<ul style="list-style-type: none"> - reliability of water supplies and sustainability - increase water management and operational flexibility 	Salem	Evaluate the opportunity to enhance groundwater use at City's Geren Island facility that could be an alternative to surface water diversion during low flows or inoperable surface water intake.	Long term
Detroit Lake Low Water Marina Excavation Project	<ul style="list-style-type: none"> - increase water management and operational flexibility 	Marinas, Detroit Lakes Federal Lakes Comm., Marion County, USACE, USFS	Excavate the area around existing marinas to allow their use during low water periods. The existing marinas at Detroit Lake become unusable when managed lake levels get too low. This results in loss of recreational opportunities and associated economic activity. The USACE has limited flexibility to manage lake levels for recreation use given other requirements (i.e., flood control and ESA requirements).	Short term = planning and design Long term = implementation
Mongold State Park Floating Boat Ramp	<ul style="list-style-type: none"> - increase water management and operational flexibility 	OPRD, Detroit Lakes Federal Lakes Comm., Marion County, USACE, USFS	Improve recreational access to Detroit Lake during low water periods.	Short term
Detroit Lake Recreation Master Plan	<ul style="list-style-type: none"> - increase water management and operational flexibility 	OPRD, Detroit Lakes Federal Lakes Comm., Marion County, USACE, USFS, others	Prepare plan to evaluate potential improvements and expansion of recreational facilities associated with Detroit Lake, including providing for opportunities during periods of low lake levels.	Long term
Partners of the North Santiam Resiliency Action Plan	<ul style="list-style-type: none"> - benefits for fish and wildlife and the environment (e.g., water quality, groundwater recharge) 	Partners of the North Santiam	Incorporate restoration projects identified in this plan (upon completion in 2017) that would support drought resiliency, such as floodplain reconnection, and riparian and wetland enhancements.	Short term = plan completion Long term = implement projects prioritized in plan
Establish Drought Contingency Plan Task Force ³	<ul style="list-style-type: none"> - all Reclamation Drought Objectives 	NSW DCP Task Force ³	Establish a formal group to oversee implementation of the NSW DCP.	Short term
NSW DCP Education and Outreach Partnership	<ul style="list-style-type: none"> - all Reclamation Drought Objectives 	NSW DCP Task Force ³	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	<ul style="list-style-type: none"> - systems to facilitate the voluntary sale, transfer, or exchange of water 	NSW DCP Task Force ³	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	<ul style="list-style-type: none"> - systems to facilitate the voluntary sale, transfer, or exchange of water 	NSW DCP Task Force ³	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
WMCPs for Small Communities and Large Water Users	<ul style="list-style-type: none"> - reliability of water supplies and sustainability - increase water management and operational flexibility 	NSW DCP Task Force ³	Work with small communities and water users to seek funding and technical assistance to complete WMCPs to improve their understanding of water usage and opportunities to increase efficiencies.	Short term = funding and WMCPs Long term = projects prioritized in WMCPs

Mitigation Actions	Reclamation Drought Funding Objectives Directly Addressed ²	Lead Entity and Partners	Brief Description	Short/Long Term Action
Critical Infrastructure Improvements for Small Cities	- reliability of water supplies and sustainability	NSW DCP Task Force ³	Work with small communities to identify and implement water system infrastructure improvement projects that improve drought resiliency, including reducing system water losses.	Short term = study Long term = implementation
NSW Water Budget Study	- all Reclamation Drought Objectives	NSW DCP Task Force ³	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.	Short term = funding and scoping Long term = conduct study
Incorporate NSW DCP Efforts into Future Willamette Basin Project Bi-Op Reviews	- all Reclamation Drought Objectives	NSW DCP Task Force ³	Engage the Willamette Basin Project and associated regulatory agencies. Goal is to get NSW DCP Partners' mitigation actions recognized in future Willamette Basin Project Bi-Op updates.	Short term = early engagement Long term = recognition in updated Bi-Op
Expand Emergency Drought Tool Usage	- all Reclamation Drought Objectives	NSW DCP Task Force ³	Support legislation and administrative rules that allow the use of OWRD Emergency Drought Tools when a DCP has been approved by the state	Short term
<p>¹ Note that several of the mitigation actions listed in this table, particularly those with NSF DCP Task Force noted as lead, are intended to lay the ground work for response actions. The link between mitigation and response actions is detailed in the Response chapter of this report.</p> <p>² Although all projects listed meet at least one of Reclamation's drought funding objectives, not all projects listed would necessarily qualify for funding under Reclamation's drought program.</p> <p>³ The NSW DCP Task Force listed in this table refers to a permanent task force to be developed as an outcome of this project. It does not refer to the current NSW DCP Task Force that is supporting development of this plan; however, it is anticipated that many of the same entities will be part of the permanent task force.</p>				

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5 ELEMENT #4: RESPONSE

Response actions reduce risks to critical assets and other resources by identifying, evaluating, and prioritizing actions to improve resiliency during drought conditions. Response actions are planned actions that are implemented in a step-wise manner, based on the specific stages of drought identified in the monitoring framework. They are not intended to be crisis driven (i.e., in response to unanticipated circumstances); such actions are implemented by emergency response programs. In the pre-drought stage (Stage 1 – “Heads up”), response actions are interrelated with mitigation actions, which conserve water and improve resiliency before drought conditions. This relationship between mitigation and response, the process used to identify the NSW DCP response actions, and the final response actions matrix, are described in more detail in this chapter.

A full description of the response action development process and collaborative Working Group and Task Force review process is provided in Appendix E.

5.1 RESPONSE ACTIONS

5.1.1 Goal

The following goal was established by the Task Force for implementing response actions:

As participants of the NSW 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 Chapter 7 of 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 the critical natural resources within the watershed.

Currently, the possibility of regulatory action by OWRD to curtail existing water right holders is small because a sufficient amount of “public water” is available to all water users. Stored water released from Detroit Lake without an associated water right is considered “public water” and available for appropriation by downstream water right holders. However, junior water right holders could be at risk for regulation in favor of senior water right holders in the event of multiple years of drought, and water-dependent businesses above the reservoir experience drought conditions sooner than lower areas in the watershed. In the future, the amount of “public water” is likely to be reduced after the issuance of water rights to protect stored water releases from Detroit Dam and the conversion of minimum perennial streamflows to instream water rights. In the longer-term future, climate change and population growth are expected to exacerbate these conditions and impact everyone to varying degrees. “We all rely on one river” is a possible message to help explain that residents must all look out for one another and protect the critical natural resources within the watershed during drought.

5.1.2 Objectives

All response actions will be implemented on an as needed, collaborative, voluntary, and watershed-wide basis. For example, if additional streamflow is needed in Drought Stages 3 or 4, a water rights holder may voluntarily forbear (i.e., stop) water use, or switch to an alternate source. Response actions included in this DCP do not include numeric objectives for water conservation (e.g., 10 percent reduction at a specific

flow measurement location). This was a conscious decision by the Task Force members for the following reasons: political, budgetary, lack of enforcement capacity (even if objectives are voluntary), inability to quantify the benefits, and insufficient infrastructure to currently measure baseline withdrawal accurately for some water users. Ongoing collaboration with state and federal natural resource managers is needed to provide guidance on the appropriate numeric objectives for meaningful conservation. As an alternative, voluntary reduction objectives will be included in outreach messaging (see Step 4, Stages 2, 3 and 4). If voluntary measures do not increase resiliency, numeric objectives may be considered in future plan iterations.

5.1.3 Response Actions

Response actions were grouped into five major categories. The response actions matrix (Table 9) identifies these five categories of response actions that are prioritized based upon the Monitoring Framework's progressive stages of drought (i.e., public education begins in Stage 1, whereas emergency response begins in Stages 3 and 4):

- Public education and relations
- Monitoring and evaluation
- Water rights management
- Water conservation
- Emergency response

Each category includes specific response actions, and identifies the relevant sectors, and relevant stage of implementation for each action. Implementation of each response action may correspond to one or more stages of drought.

Response actions focus on those actions that can be conducted on a watershed-wide basis, and provide flexibility for water users to continue to use their existing plans. For example, one NSW DCP response action is to "Practice 'wise water use.'" For the SWCD, this may mean "Decreasing operation and management spills to near zero," whereas for the City of Salem, this may mean "Discontinuing operation City decorative fountains that do not recirculate water." For those entities that do not have existing response plans, their final local response actions should be determined by their planning and governing bodies with the specific intent to conserve water and protect vulnerable assets and resources within the watershed.

Some of the response actions, such as education and outreach, are also noted as mitigation actions. In Stage 1, response actions are interrelated with mitigation actions. For the purpose of this DCP, the distinction is drawn between preparing for drought (mitigation) and implementing response actions. For example, the education and outreach program is developed as a mitigation action, but is also implemented as a response action for all drought stages.

5.1.4 Response Actions Descriptions

The response actions presented in Table 9 are discussed in more detail in this section.

Table 9. Actions and Triggers for Watershed-Wide Coordinated Drought Response

Actions	Related Multi-Sector Mitigation Action	Sectors	Triggers			
			Stage 1: Heads Up	Stage 2: Moderate Drought	Stage 3: Severe Drought	Stage 4: Extreme Drought
Conservation Messaging, Public Education, and Outreach						
Carry out response messaging (as developed during mitigation) (e.g., newspapers, websites)	NSW DCP Education and Outreach Partnership	Municipal, Agriculture, Natural Resource Mgrs., Recreation, Marion County Emergency Mgt.	x	x	x	x
Monitoring and Evaluation						
Continue to track and report drought monitoring framework indicators	Establish DCP Group	Municipal, Agriculture, Natural Resource Mgrs.	x	x	x	x
Coordinate among North Santiam Watershed water providers, managers, and users to promote voluntary withdrawal reductions		Municipal, Agriculture, Recreation, Natural Resource Mgrs., Commercial/Industrial	x	x	x	x
Compile socioeconomic and environmental impacts of drought (i.e., local data) for use in funding applications, messaging, and refinement of the vulnerability assessment		Municipal, Agriculture, Recreation, Natural Resource Mgrs.		x	x	x
Water Rights Management						
Forbear use (e.g., stop using during the season)	Water Rights Management Program Expand Emergency Drought Tool Usage	Municipal, Agriculture, Natural Resource Mgrs.	x (Planning step for this response)	x	x	x
Switch to an alternate water source (e.g., wells)		Municipal, Agriculture, Commercial/Industrial	x (Planning step for this response)	x	x	x
Lease water rights for instream use		Municipal, Agriculture, Natural Resource Mgrs.	x (Full or split-season)	x (Full or split-season)	x (Split-season)	x (Split-season)
Full lease (1 year)						
Split-season lease (less than 1 year, need to measure)						
Implement drought emergency water rights tools (e.g., transfers, permits; extension of the irrigation season) available during Governor-declared drought		Municipal, Agriculture			x	x
Water Conservation						
Implement strategies identified in Water Management and Conservation Plans (WMCPs) for voluntary conservation and to implement curtailment when water supply is inadequate	WMCPs for Small Communities and Large Water Users	Public water providers	x	x	x	x

			Triggers			
Actions	Related Multi-Sector Mitigation Action	Sectors	Stage 1: Heads Up	Stage 2: Moderate Drought	Stage 3: Severe Drought	Stage 4: Extreme Drought
Emergency Response						
Seek local, state, and federal assistance		Municipal, Agriculture, Natural Resource Mgrs., Recreation, Marion County Emergency Mgt.			x	x
Implement Marion County Disaster Recovery Plan		Municipal			x	x
Carry out water hauling programs		Municipal				x
Dredge intakes, move diversions		Municipal, Agriculture				x

Stage 1: Heads Up

Response Category: Conservation messaging, public education, and outreach

- **Action 1: Carry out response action messaging for each drought stage.**

Watershed-wide response action messaging (developed as part of JMAP) will be communicated in a stylized, branded manner (also developed as a mitigation action), using partner websites, newspapers, and news releases. The following ideas are key to communicate with messaging: (1) upstream areas of the watershed will be in drought before downstream areas, (2) all residents within the watershed are conserving water (e.g., “shared sacrifice”), and (3) why conservation is important. Specific examples are useful for supporting these key ideas. Both instream flow and supply may be communicated, as well as potential effects on well owners. If messaging is recommended by the DCP AT, example messages include:

- The watershed is in Stage 1/Heads up drought.
- Many people—residents, businesses, farmers, and recreationists—depend on the North Santiam River.
- Here’s how others in the watershed are affected by drought. Practice using water wisely.
- Here’s how. (Provide examples of wise water use).

Municipal, agricultural, natural resource managers, and recreation owners will collaborate on² and benefit from this response action. Marion County Emergency Management, Marion County department public information officers (PIOs), and City emergency response managers will participate in this effort as they already engage in hazard mitigation, preparedness, response, and recovery. Resulting messages will be shared with other agencies and sectors within the watershed.

Response Category: Monitoring and evaluation

- **Action 1: Continue to track and report drought monitoring framework indicators.**
- **Action 2: Coordinate among North Santiam Watershed water providers, managers, and users.**

Both of these response actions are critical for preparing for and responding to drought by using the appropriate response actions for each drought stage. Using the NSW DCP Monitoring Framework to track drought stage is critical to triggering coordinated implementation of actions. Coordination is necessary to prepare for and implement response actions watershed wide, and promote voluntary withdrawal reductions to reduce vulnerability to key assets. Municipal, agricultural, natural resource managers, recreation and commercial/industrial users are expected to collaborate on these response actions to benefit all water users in the watershed.

² A detailed approach to developing this messaging and branding, with news release templates, is provided in the *Joint Mitigation Actions Implementation Plan*.

Response Category: Water rights management

- **Action 1: Forbear use**

Water rights owners currently have the ability to forbear use of any portion of their water at any time. That is, they can voluntarily stop or reduce their water use during the season to leave more water instream during critical periods to protect vulnerable instream natural resources. In early drought stages, this action is most likely a planning step to prepare for implementation in more severe drought stages, and may not apply to all sectors at the same time.

- **Action 2: Switch to an alternate water source**

A separate, or complimentary, option that is currently available is to leave water instream and switch to an alternate water source, such as groundwater or impounded water. This response action provides the same benefits as forbearing use, though in certain areas, groundwater withdrawals also could impact water levels in neighboring wells or reduce groundwater contributions to instream flow. It may be best to implement this response action only after consulting local natural resources managers (i.e., Natural Resources Conservation Service [NRCS], watershed council). In early drought stages, this action will most likely be a planning step to prepare for implementation in more severe drought stages, and may not apply to all sectors at the same time.

- **Action 3: Lease water rights (full or split-season leases)**

An option that is currently available, but not used often in the NSW is leasing instream of certificated water rights. Water rights leasing provides water right holders with a voluntary opportunity to leave water instream to protect natural resources when needed, but still protect rights for future beneficial out-of-stream use. (Leasing a water right instream is considered a beneficial use and protects the water right from forfeiture due to non-use.) There are two different types of water rights leases: full and split-season. As part of the full lease, a water rights owner would indicate a specific number of acres and voluntarily elect not to irrigate them for the full season. A split-season lease requires an owner to measure the amount of water used so that the amount of water remaining for instream use can be quantified.

Municipal, agricultural, natural resource managers, and commercial/industrial users are expected to collaborate³ on and benefit from this response action. Developing and seeking funding to incentivize a water rights leasing program is a high priority mitigation action in this plan.

Response Category: Water conservation [Note: Municipal WMCPs were moved to Stage 2. This action is specific to Agriculture WMCPs]

- **Action 1: Implement strategies identified in Water Management and Conservation Plans (WMCPs) - Irrigation**

³ A detailed approach to developing a leasing program is provided in the *Joint Mitigation Actions Implementation Plan*.

As discussed in Section 2.2.3, WMCPs for water users include curtailment plans that identify their own response actions for implementation at each curtailment stage. Given the advance planning required for agriculture to use less water, implementing WMCP actions would be triggered for this sector sooner than for some other large water users, so that crops are not damaged. Examples of local response actions for irrigated agriculture include:

Potential WMCP actions

- Delay delivery to users to conserve water for the peak consumptive use period based on a shortened estimated water delivery season.
- Engage Oregon State University and NRCS in providing technical assistance to users on how to reduce on-farm water use, including critical plant water use periods.

Stage 2: Moderate Drought

All Stage 1 response actions should be implemented in Stage 2. The following additional actions also can be implemented:

Response Category: Conservation messaging, public education and outreach [Note that this action also is conducted in Stage 1. This section explains messaging specific to Stage 2.]

- **Action 1: Carry out response messaging (as developed during mitigation action development), using partner websites, newspapers, and news releases.** Messaging will convey how upstream areas of the watershed may be in drought before downstream areas, how all residents within the watershed are conserving water, and why conservation is important. More information is provided in Stage 1 above. Example messages in Stage 2 could include:
 - The watershed is in Stage 2/Moderate drought.
 - Some areas in the watershed are experiencing drought and drought impacts (e.g., recreation is reduced because reservoir levels are low; green bean yield is low because growers are irrigating less).
 - Here's how everyone is saving water (provide examples).
 - Please voluntarily reduce water by 5 percent. Here's how you can do it (provide examples).

Response Category: Monitoring and evaluation

- **Action 3⁴: Compile socioeconomic and environmental impacts of drought (i.e., local data) for use in funding applications, messaging, and refinement of the vulnerability assessment**

As noted in the Vulnerability Assessment (Appendix C), local data quantifying impacts of drought on each of the sectors are a data gap. This information is needed to refine the assessment, as well as for messaging, identifying future effective actions to build resiliency, and “making the case” in grant

⁴ Note that this is the third action under the Monitoring and Evaluation category.

applications to obtain funding to implement these actions. Municipal, agricultural, natural resource managers, and the recreation sector (the most vulnerable sectors) would be expected to collaborate on and benefit from this response action.

Response Category: Water conservation [Note: this action was moved from Stage 1 for municipalities]

- **Action 1: Implement strategies identified in Water Management and Conservation Plans (WMCPs) - Municipalities**

This action at Stage 2 is specific to municipalities. Municipal WMCPs include curtailment plans that identify their own response actions for implementation at each curtailment stage. Actions may be for the entity itself and/or its customers. Though entity-defined curtailment stages may not exactly align with watershed-wide defined DCP drought stages, some parallels can be drawn. One suggested mitigation action is to align stages in curtailment plans with the DCP monitoring framework stages.⁵ Examples of local response actions from the City of Salem curtailment plan include:

City actions

- Reduce watering at City facilities and/or parks as determined by the City Manager.
- Discontinue operating City decorative fountains that do not recirculate water.
- Limit City hydrant and water line flushing to essential needs for safety and human health.
- Prohibit City-staff from washing sidewalks, walkways, streets, driveways, parking lots, or other hard surfaces except where necessary for public health or safety.
- Discontinue washing City vehicles.

Water customer actions

- Request that City water customers voluntarily reduce outdoor water uses such as lawn watering, car washing, patio cleaning, etc.

Stage 3: Severe Drought

All Stage 1 and Stage 2 response actions can be implemented in Stage 3. The following additional actions also can be implemented:

Response Category: Conservation messaging, public education and outreach [Note that this action is conducted in both Stages 1 and 3. This section explains messaging specific to Stage 3.]

- **Action 1: Carry out response messaging (as developed during mitigation action development), using partner websites, newspapers, and news releases.** More information is provided in Stages 1 and 2 above. Example messages in Stage 3 could include:
 - The watershed is in Stage 3/Severe drought.
 - All areas in the watershed are experiencing drought and drought impacts.
 - Conservation is important to help prevent Stage 4.

⁵ An approach is provided in the *Joint Mitigation Actions Implementation Plan*.

- Here's how everyone is saving water (provide examples).
- Please voluntarily reduce water by 10 percent. Here's how you can do it (provide examples).

Response Category: Water rights management

- **Action 4: Implement drought emergency water rights tools (i.e., temporary transfers of water rights, emergency water use permits, and use of existing right option/agreement) available during a Governor-declared drought**

A Governor's drought declaration enables water users within the subject county to benefit from emergency streamlined water rights programs, groundwater usage, and other programs.⁶ These programs include the ability to obtain: an emergency water use permit to replace water not available under an existing water right; temporary drought transfers to temporarily change water rights type of use, place of use and point of diversion; temporary drought instream leases; and temporary substitution of a supplemental groundwater right for a primary surface water right. In addition, under a Governor's drought declaration, it is possible to exercise a pre-approved agreement or option for moving water use from one location to another or for use by another entity. Municipal and agricultural sectors are expected to collaborate on⁷ and benefit from this response action. The ability to use these tools prior to a Governor's drought declaration (and based on having an approved DCP) is a mitigation action.

Response Category: Emergency response

- **Action 1: Seek state and federal assistance for emergency response actions**

Federal. Drought declaration may be granted at the federal level if the U.S. Drought Monitor (<http://droughtmonitor.unl.edu/>) indicates that a county is under intensity value D2 (Severe Drought) for 8 consecutive weeks. The following federal drought benefits may be granted:

- NRCS – Technical and financial assistance
- Farm Services – Loan program to establish wells and overcome financial difficulties
- Rural Development – Loan programs to alleviate water shortages in rural areas
- American Red Cross – Technical assistance to distribute water and first aid from central sites to the municipal sector
- Department of Defense – Transport water for 30 days, drill wells for human consumption (after all other assistance is exhausted)
- Department of Health and Human Services – Technical, medical, and financial assistance
- Small Business Administration – Loans to homeowners and businesses to restore damaged property

⁶ https://www.oregon.gov/OMD/OEM/fin_rec/docs/drought/drought_procedures.pdf (2014)

⁷ An approach is provided in the *Joint Mitigation Actions Implementation Plan*.

State. Drought declaration may be granted at the state level when:

- County commissioners request by letter that the Governor declare a “drought emergency” “due to severe and continuing drought conditions.”
- Copies of county requests then are forwarded to the Office of Emergency Management, which forwards them to the State Drought Council to provide recommendations and action.
- A State Drought Council meeting is held to discuss climate and water conditions and to make a recommendation on the county request. Recommendations then are submitted to the Governor to approve or deny, or continue monitoring.

Assistance requests at the state level should be directed to the Oregon Emergency Management office in Salem (503-378-6377), or OWRD (503-378-8455). The Department of Administrative Services may authorize agencies to purchase without competitive bidding, and may purchase emergency supplies or equipment on behalf of agencies.

Additional details about federal and state agencies, and the assistance they can provide, is found at: https://www.oregon.gov/OMD/OEM/fin_rec/docs/drought/drought_info_sheet_OEM.pdf

Local. Ultimate responsibility for providing water service to citizens lies with the local water providers. Each jurisdiction is responsible for its own water supplies and maintenance of facilities. Assistance from the county and state will be in the form of personnel and equipment as requested by the affected area. Examples of emergency response assistance at the county level include:

- Submitting a request for emergency/disaster declaration.
- Identifying and securing alternative drinking water supplies.
- Providing emergency response messaging for radio and television.
- Identifying contractor and vendors.
- Coordinating with state and local supporting agencies.

Assistance requests at the local level should be directed to Marion County Emergency Management Services (503-588-5108) or Linn County Sheriff’s Office (541-967-3950), which is responsible for the Emergency Management Program.

- **Action 2: Implement Marion County Disaster Recovery Plan**

Marion County is working on completing a Disaster Recovery Plan that comprises the short- and long-term steps the County will take after an emergency to restore government function and community services to levels existing prior to the emergency. Short-term operations seek to restore vital services to the community and provide for the basic needs of the public (e.g., power, communications, water, and sewer service) to an acceptable standard while providing for basic human needs (e.g., life safety, food, clothing, and shelter). Once stability is achieved, long-term recovery efforts focus on restoring the community to a normal or improved state of affairs. Currently, the County’s Emergency Action Plan Annex ESF-18, Community Recovery and Economic Stabilization summarizes specific procedures and plans to support recovery, mitigation, and economic stabilization following a disaster.

Stage 4: Extreme Drought

All Stage 1 through 3 response actions can be implemented in Stage 4. The following additional actions also can be implemented:

Response Category: Conservation messaging, public education and outreach

- **Action 1: Carry out response messaging (as developed during mitigation), using partner websites, newspapers, and news releases.** More information is provided in Stages 1 and 2 above. Example messages in Stage 4 could include:

- The watershed is in Stage 4/Extreme drought.
- Here's how everyone is saving water (provide examples).
- Only use water for essential purposes (provide examples).

Response Category: Emergency response

- **Action 3: Carry out water hauling programs**

Assistance requests at the local level should be directed to Marion County Emergency Management Services. Local governments may request emergency water transportation from the following state departments: Department of Forestry (nonpotable), when not being used for firefighting, Department of Transportation, Department of Fish and Wildlife, Military Department (National Guard). The municipal sectors are expected to benefit from this response action.

- **Action 4: Dredge intakes, alter diversions**

Municipal water supplies are sourced from the North Santiam by intakes; agricultural water supplies are sourced by intakes and diversions. Poor water quality (i.e., algae) resulting from low water may foul intakes; low water itself may disable both intakes and diversions. Dredging intakes and altering diversions may allow them to access water at lower flow. Because these activities are in-water actions, permits and consultations with federal and state agencies are required, and should only be considered as emergency actions or permitted in advance, such as to protect health, safety, and welfare.

Municipal and agricultural sectors are expected to collaborate on and benefit from this response action. Two related projects are long-term mitigation actions in this plan: Seeking funding for the design and implementation of upgrades to the Upper and Lower Bennett Dams (for irrigation and flow maintenance), and evaluating alternatives to the Geren Island intake to access water at low flow (City of Salem).

5.2 RECOMMENDATIONS AND DATA GAPS

Marion County Emergency Management is working with the University of Oregon to inventory drought (and other threats and hazards) concerns of the smaller cities within the watershed. The Marion County Multijurisdictional Hazard Mitigation Plan will identify action items for future implementation, including

infrastructure upgrades. Actions and projects in the County plan should be evaluated for inclusion as mitigation or response actions in this DCP.

6 ELEMENT #5: OPERATIONAL AND ADMINISTRATIVE FRAMEWORK

The objectives of the NSW DCP Operational and Administrative Framework are to “clarify the ongoing roles and responsibilities for the DCP, and to facilitate a quick and efficient response to drought conditions.” Section 6.1 explains the roles and responsibilities for the DCP AT, Task Force, a lead coordinator, and four planning element groups, as well as how these groups will work together to carry out the DCP. Section 6.2 explains the ongoing process to efficiently monitor, evaluate, and respond to drought conditions to ensure resiliency within the watershed.

Background research, and a full description of the collaborative Working Group and Task Force review process for this planning element are provided in Appendix F.

6.1 NSW DCP FRAMEWORK, ONGOING ROLES AND RESPONSIBILITIES

The ongoing NSW DCP Operational and Administrative Framework consists of a DCP AT, technical advisory Task Force, and four planning element groups (Figure 4). In the short term, the Framework will include a Lead Coordinator to facilitate efficient operation and updates to the DCP. Each group will include one or two liaison(s) to/from the DCP AT, to ensure thorough communications and ongoing development of the DCP. More information about each group is provided in the following sections.

6.1.1 DCP Administrative Team

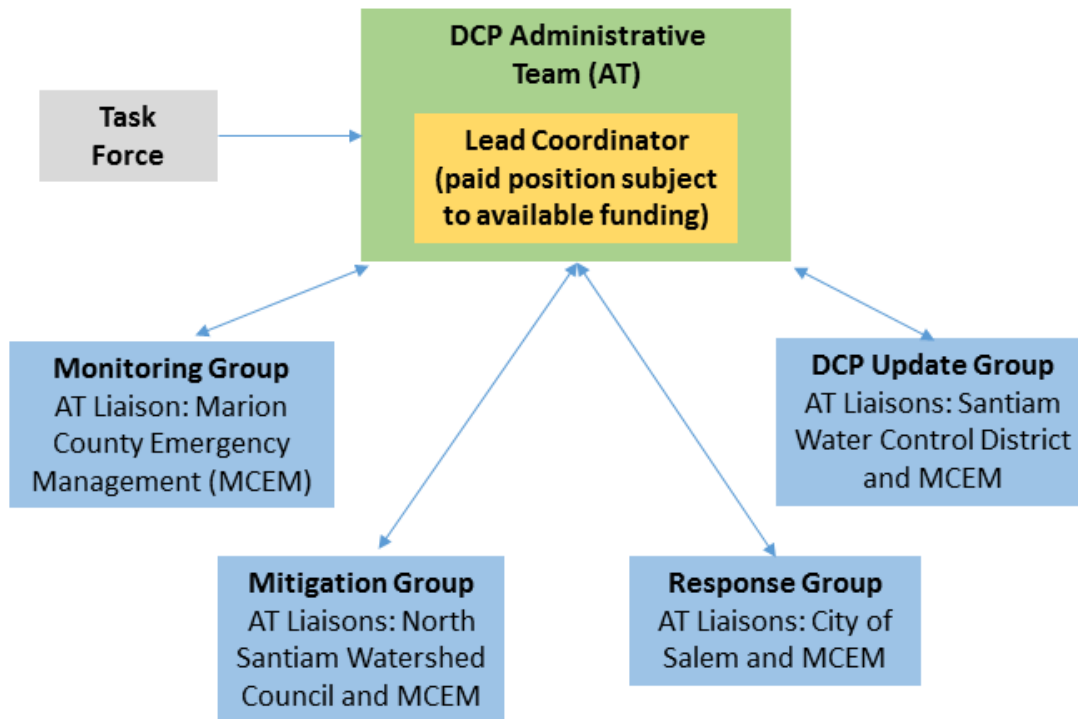
The DCP AT is responsible for the overall administration of the DCP, and is anticipated to be convened monthly at least for the first year of the DCP, and have the following roles and responsibilities:

- Evaluate monitoring reports and recommend messaging and response actions to the Response Group. Depending upon drought stage, submit recommendations regarding drought declaration to County/Public officials. Additional detail is provided in Section 6.2.
- Ensure that progress is being made on the Joint Actions Implementation Plan.⁸
- Review proposed changes to monitoring, vulnerability assessment, mitigation, and response actions, and approve periodic updates to the DCP.
- Coordinate with the Governor’s Water Supply Availability Committee.
- Provide annual updates to the Task Force.
- Provide fiscal oversight of Lead Coordinator and joint actions.

Initially, the DCP AT is proposed to consist of representatives from North Santiam Watershed Council, City of Salem, Santiam Water Control District, and Marion County Emergency Management.

⁸ A *Joint Actions for Water Supply Resiliency Implementation Plan* was developed to describe the scope for the joint Task Force mitigation and response actions described in the DCP.

Figure 4. DCP Operational and Administrative Framework



6.1.2 Lead Coordinator

The Lead Coordinator is paid position (based on available funding) to support the DCP AT with coordination of the Framework groups and processes. The roles and responsibilities of the Lead Coordinator are to:

- Collect monitoring data and complete the monthly monitoring report. Submit the report to Monitoring Group. Train Monitoring Group member to continue monthly monitoring reporting function in the event the Lead Coordinator position is not funded. (Additional detail provided in Figure 5.)
- Coordinate monitoring and drought declaration recommendations process (discussed in Section 6.2).
- Collect environmental and socioeconomic data for use in periodic updates to the vulnerability assessment.
- Track and report on effectiveness of individual and joint mitigation actions to Mitigation Group.
- Track and report on effectiveness of response actions to Response Group.
- Make recommendations to the DCP AT for how to incorporate new information into the DCP. Lead the DCP Update Process.
- Implement the Joint Action Implementation Plan and report progress to the DCP AT.

- Track funding sources for implementing actions and pursue grants, as feasible. Track grants being pursued for all Mitigation Action projects, and reports to the DCP AT (and Task Force as needed).
- Provide administrative assistance to the DCP AT.

6.1.3 Task Force

The Task Force will provide technical input to the DCP AT or groups as requested. It is anticipated that this group will be convened at least annually to receive updates from the DCP AT, and will be composed of the same local, state, and federal agencies; municipalities; and stakeholders that comprised the Task Force during development of the DCP.

6.1.4 Monitoring Group

The Monitoring Group will support the DCP AT and fulfill the following roles and responsibilities:

- Compile monthly monitoring report (Lead Coordinator to conduct initially, with responsibility eventually transitioned to the Monitoring Group). Starting in Stage 2, monitoring would be conducted weekly, unless advised by the DCP AT to begin during Stage 1.
- Review monthly monitoring report and make drought stage recommendations for the DCP AT review.
- Revise report based upon the DCP AT evaluation, if needed.
- Communicate results to specific constituents, if needed (e.g., small municipalities in the upper watershed or farmers planning for crop plantings) This could occur in Stage 1 “Heads Up”, if the Response Group determines watershed-wide outreach is not yet needed.
- Provide review of monitoring efficacy at the end of each water year and makes recommendations for DCP Update.

The liaisons to the DCP AT will be: Marion County Emergency Management.

6.1.5 Mitigation Group

The Mitigation Group will support the DCP AT and fulfill the following roles and responsibilities:

- Coordinate with other groups on the Joint Action Implementation Plan and provide support as needed for implementation of mitigation actions.
- Provide periodic review of other DCP mitigation actions.
- Provide periodic review of the status and effectiveness of joint mitigation actions and other mitigation actions and make recommendations for DCP Update.

The liaisons to the DCP AT will be: North Santiam Watershed Council and Marion County Emergency Management.

6.1.6 Response Group

The Response Group will support the DCP AT and fulfill the following roles and responsibilities:

- Distribute monitoring stage information and messaging to the public.

- Coordinate on existing response actions, and those to be developed under the Joint Action Implementation Plan and provide support as needed, such as to update NSW DCP Education and Outreach communication tools.
- Provide periodic review of the status and effectiveness of response actions and make recommendations for the DCP Update.

The liaisons to the DCP AT will be: City of Salem and Marion County Emergency Management.

6.1.7 DCP Update Group

The DCP Update Group will support the DCP AT and fulfill the following roles and responsibilities:

- Track new technology, research, and legal requirements for periodic updates to the DCP and its actions.
- Track environmental, social, and economic consequences of local drought to identify strengths and weaknesses in response for potential changes to the DCP.

The liaisons to the DCP AT will be: Santiam Water Control District and Marion County Emergency Management.

6.2 EFFICIENT RESPONSE TO DROUGHT CONDITIONS

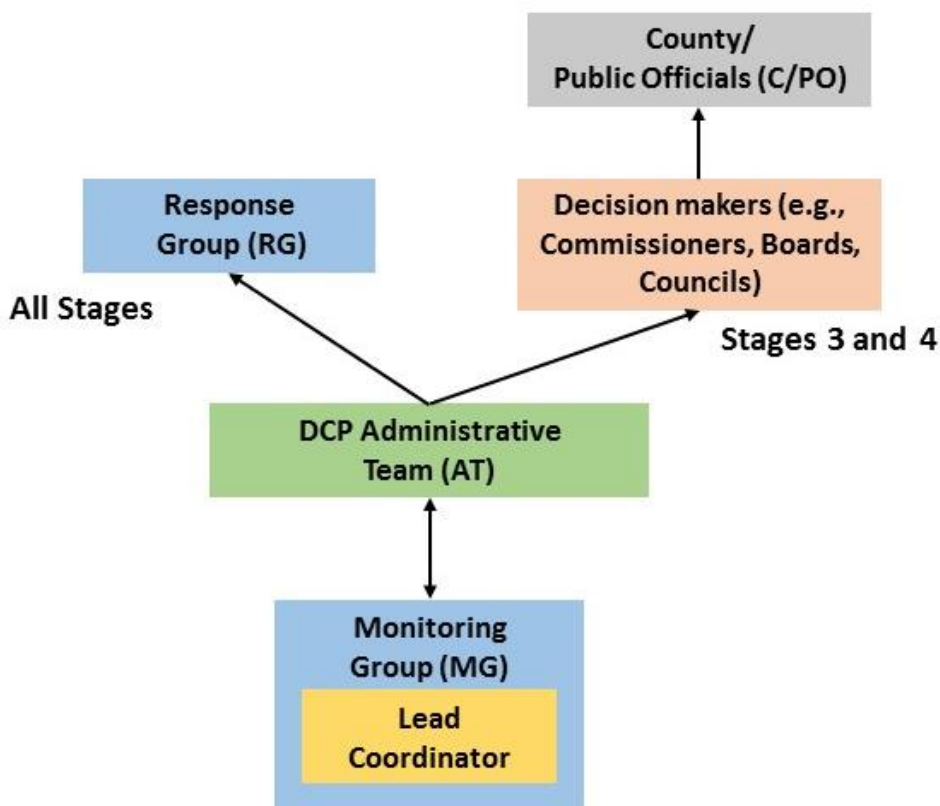
The second objective of the NSW DCP Operational and Administrative Framework is to facilitate a quick and efficient response to drought conditions. Therefore, the DCP AT, Monitoring Group, and Response Groups will be part of an ongoing process to evaluate and respond to drought conditions to ensure preparedness within the watershed. In advanced stages of drought, county and public officials will be involved to request a drought declaration of the Governor (Figure 5). More information about the monitoring process and recommendation for a drought declaration is provided in the following sections.

6.2.1 Monitoring and Reporting

The Lead Coordinator, Monitoring Group, DCP AT, and Response Group will perform the following actions (coordinated by the Lead Coordinator) on at least a monthly basis:

- Using the monitoring framework developed in Chapter 2 of this DCP, the Lead Coordinator (or trained Monitoring Group member) will prepare a monitoring report during the 1st week of each month and submit it to the Monitoring Group. Starting in Stage 2, monitoring will be conducted weekly, unless advised by the DCP AT to begin during Stage 1.
- After review, the Monitoring Group will forward the report to the DCP AT with recommendations.
- The DCP AT will review the report and make changes or comments if needed. The DCP AT may consult one or more members of the Task Force for technical input.
- The DCP AT then will submit the monitoring report to the Response Group by the 15th of each month.
- The Response Group will issue the monitoring report for broader communications to the public in accordance with the DCP Education and Outreach Partnership (See Joint Action Implementation Plan in Appendix H).

Figure 5. Communications and Drought Declaration Recommendation Process



6.2.2 Response and Drought Declaration Recommendations

The findings of the monthly monitoring report will trigger one of the following two processes, depending upon the recommended drought stage in the report:

- At all Drought Stages, the Monitoring Group will forward the monthly monitoring report to the Response Group for action, as appropriate (Figure 5) (see Chapter 5, Response).
- If the Drought Stage = 3 or 4, then the DCP AT members will submit the monthly monitoring report to, and seek input from, its council/commissioners/boards, etc. within 72 hours, as to whether to recommend an ORS 536 drought declaration. It is also possible the subject decision makers may seek an emergency declaration under ORS 401.
- If DCP AT council/commissioners/boards recommend an ORS 536 drought declaration, they will request that County/Public Officials review the monthly monitoring report and pursue a drought declaration from the Governor (Figure 5). County/Public Officials and state agencies⁹ also may provide messaging guidance to the DCP AT for outreach to stakeholders. The DCP AT also will

⁹ OWRD is the lead state agency for coordinating and communicating information regarding water supply shortages. Other state agencies also can contribute information or guidance, such as ODFW, ODF, Oregon Parks and Recreation Department, and the Oregon State Marine Board. These agencies, for example, will inform the public of any fishing restrictions, parks-related closures or operational changes, boater and recreational access to waterbodies, and any fire-related restrictions, closures, or general information. State agencies will develop or routinely update their communications plan to help alleviate drought-related risks (Oregon Drought Annex, 2016).

submit the resulting County/Public Officials decisions and guidance to the Response Group for action.

If the County does not elect to request a drought declaration from the Governor, cities are able to declare drought within their communities. Local declarations enable cities to obtain hazard mitigation funding from their county emergency management programs.

7 ELEMENT #6: DCP UPDATE PROCESS

The NSW DCP Update Process is to “evaluate and update the DCP on an ongoing basis to ensure its effectiveness.” Updates are necessary to incorporate new science, regulations, legislation, and stakeholder information; reassess vulnerability of critical resources; and incorporate improvements in monitoring, mitigation and response actions. Post-drought evaluation ensures that pre-drought planning was effective, and identifies and corrects issues to improve future implementation and response. Section 7.1 presents an annual evaluation process to identify new information, assess post-drought response, and suggest ways to improve effectiveness. Every 5 years or as determined necessary by the DCP AT, annual results will be reviewed and the DCP document will be revised.

Background research and a full description of the collaborative Working Group and Task Force review process are provided in Appendix G.

7.1 NSW DCP UPDATE PROCESS

To begin the Update Process, in November of each year, the DCP Update Group will request information from Task Force members that will be used to help review the effectiveness of the DCP and make future adjustments. The Task Force members represent all sectors and are knowledgeable about changes in their respective fields that may affect future drought planning and response. Members will submit environmental and socioeconomic drought impact information from the preceding year, as well as new regulatory and technical information, to the DCP Update Group. The DCP Update Group will use this information to review the Vulnerability Assessment, and recommend any changes in vulnerability to the DCP AT and the Monitoring, Mitigation, and Response Groups. (After the first year, the DCP Update group also will review this process.) The groups then will consider this information in their annual evaluations of their respective drought planning elements, and send recommended changes to the DCP AT. The DCP AT will review, evaluate, and compile update recommendations from the groups and may seek feedback from the Task Force. Every 5 years, the DCP Update Group will review the annual evaluations, and recommend updates to the DCP document for DCP AT comment and formal revision.

An overview of this process is provided in Figure 6. Greater detail is presented in Table 10, which includes the timeline, responsible parties (as identified in the Operational and Administrative Framework), and more responsibilities needed to complete annual/post-drought evaluation and 5-year plan revision. The schedule for the process may be adjusted to align with the Marion County Multijurisdictional Hazard Mitigation Planning process. A suggested process kickoff email from the DCP Update Group to the Task Force is provided in Appendix G.

Figure 6. Overview of DCP Update Process

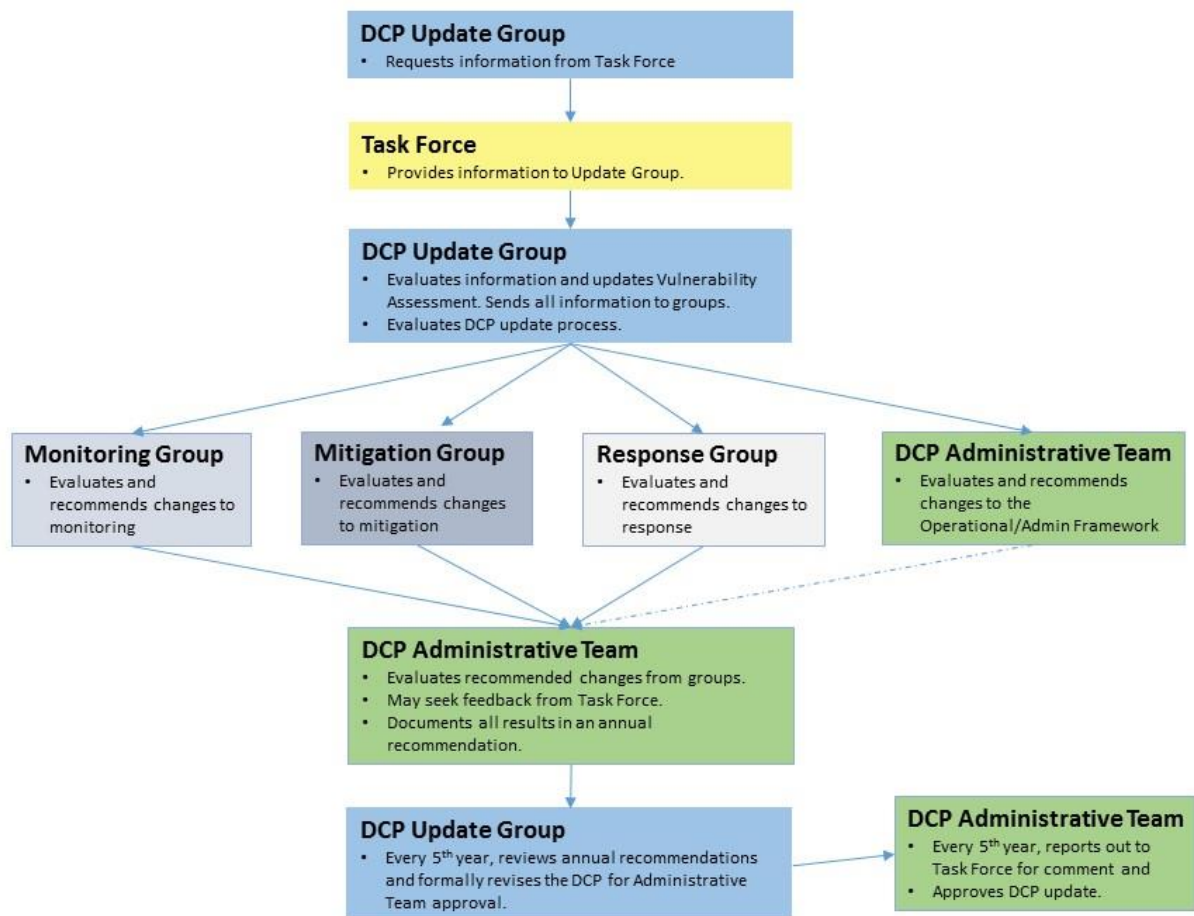


Table 10. DCP Update Process

NSW DCP Update Process: Conduct the following tasks annually/post-drought:			
Timeline	Responsible Group	Responsibilities	Provide information annually to
By Nov. 1	DCP Update Group	<ul style="list-style-type: none"> Send an email to the Task Force requesting annual review information for their areas of expertise. 	N/A
By Nov. 15	Task Force members (by email or meeting)	<ul style="list-style-type: none"> Communicate the following watershed-specific annual review information: <ul style="list-style-type: none"> Environmental, economic and social impacts of drought within the NSW. Address each sector to the extent information is available. New regulations and legislation (e.g., Bi-Op/Reallocation), climate change data and population growth data that may affect water supply resiliency for each sector. New technology or research that may be useful. 	DCP Administrative Team and DCP Update Group
By Nov. 22	DCP Update Group	<ul style="list-style-type: none"> Update the Vulnerability Assessment <ul style="list-style-type: none"> Gather and review watershed-specific annual review information from the Task Force. Update the Vulnerability Assessment as needed, document findings, and communicate to the Monitoring, Mitigation, and Response Groups for use in their evaluations. Evaluate how the DCP Update Process is functioning. <p>Note additional DCP Update Group responsibilities on following page.</p>	DCP Administrative Team and groups
By Dec. 1	Monitoring Group	<ul style="list-style-type: none"> Evaluate existing indicators and triggers at each stage, and add new or replace if needed. Incorporate new science or watershed information as necessary. Evaluate process for data collection and monthly reporting to the DCP Administrative Team. 	DCP Update Group
By Dec. 1	Mitigation Group	<ul style="list-style-type: none"> Evaluate information from the DCP Update Group regarding new regulations and legislation, and changes in vulnerability that may affect mitigation needs in the watershed. Track status and update each DCP Table 2 Priority Mitigation Action. As Priority Mitigation Actions are completed, evaluate Table 1 Potential Mitigation Actions to elevate to priority status. Identify lead entity, funding sources, etc. Gather information from all sectors to identify new Table 1 Potential Mitigation Actions. 	DCP Update Group

NSW DCP Update Process: Conduct the following tasks annually/post-drought:			
Timeline	Responsible Group	Responsibilities	Provide information annually to
By Dec. 1	Response Group	<ul style="list-style-type: none"> Evaluate information from the DCP Update Group regarding new regulations and legislation, and changes in vulnerability that may affect response needs in the watershed. Review each DCP Figure 3 Response Action and evaluate effectiveness at improving resiliency in the watershed. Gather information from all sectors. Propose new, changes, or removal of actions as needed. Identify lead entity, funding sources, etc. 	DCP Update Group
By Dec. 15	DCP Administrative Team	<ul style="list-style-type: none"> Evaluate how the Operational and Administrative Framework is functioning. Review and evaluate all group recommendations for the vulnerability assessment, monitoring, mitigation, response and the DCP update process. Consult Task Force if needed. Document results in annual evaluation. <p><i>Note additional DCP Administrative Team responsibilities below.</i></p>	DCP Update Group
By Dec. 15	DCP Update Group	<ul style="list-style-type: none"> Every 5 years, evaluate annual documentation for the last 5 years and prepare updated DCP document. Identify funding needs for the next update cycle so that the necessary resources are in place in advance of the update year. Coordinate with Lead Coordinator to pursue and track funding. 	DCP Administrative Team
By Jan. 15	DCP Administrative Team	<ul style="list-style-type: none"> Every 5 years, present updated DCP to the Task Force for comment, receive comments, and revise/approve the DCP. 	DCP Update Group and Task Force

8 REFERENCES

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APPENDICES

APPENDIX A

Stakeholders

APPENDIX A:

Task Force Members

Joe Arbow – Oregon Department of Forestry
Lauri Aunan – Governor’s Office
Les Bachelor – USDA Natural Resource Conservation Service
Dwayne Barnes – City of Salem
Brenda Bateman – Oregon Water Resources Department
Greg Benthin – City of Gates
Randy Bentz – Norpac Food, Inc.
Andy Bryant – NOAA/NWS
Gary Butler – Santiam Water Control District
Dave Carpenter – Outdoor Excursions
Jack Carriger – Stayton Fire
Cpt. Duffy Cavanaugh – US Army Corps of Engineers
Jane Dalglish- US Army Corps of Engineers
Joe Deardorff – North Santiam Watershed Council
Patricia Farrell – City of Salem
Danette Faucera – Oregon Department of Fish & Wildlife
Sharyl Flanders – City of Detroit
Ed Flick – Marion County
Robert Gentry – US Forest Service
Mike Gotterba – City of Salem
Meredith Hoffman – Marion Soil & Water Conservation District
Mark Hughs – Lyons/Mehama
Steve Human – City of Jefferson
Genoa Ingram – Marion County Farm Bureau
David Johnson – Portland General Electric
Keith Johnston – Sidney Irrigation District
Kim Kagelaris – City of Albany
Elise Kelley – Oregon Department of Fish and Wildlife
Mike Kennedy – Siletz Tribe
Jane Keppinger – Marion Soil & Water
Katherine Kihara – Bureau of Reclamation
Jennifer Knoellinger – Bonneville Power Administration
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Chris Kowitz – City of Salem
Kim Kraft – National Marine Fisheries Service
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Megan Montague – US Bureau of Reclamation
Alyssa Mucken – Oregon Water Resources Department
Dean O'Donnell – Detroit Lake Business Association
Darren Olsen – Olsen Farms
Debbie Paul – Linn Soil & Water Conservation District
Christine Pavoni – City of Detroit
Clay Penhollow - Confederated Tribes of Warm Springs
Chuck Perino – Department of State Lands
Tresa Peters – Santiam Water Control District
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Erik Petersen – US Army Corp of Engineers
Kristin Preston – City of Albany
Jason Pulley – City of Salem
Terry Riley – Marion County Fire District
Brenda Sanchez – Marion Soil & Water Conservation District
Steve Sarner – City of Silverton
David Sawyer – City of Turner
Mary Karen Scallion – US Army Corps of Engineers
Lawrence Schwabe – Confederated Tribes of Grand Ronde
Kevin Seifert – Linn Soil & Water Conservation District
Tim Sherman – City of Salem
Kathleen Silva – Marion County
Kendra Smith – Bonneville Environmental Foundation
Mark Steele – Norpac Foods, Inc.
Brent Stevenson – Santiam Water Control District
Roger Stevenson – City of Salem
Heather Tugaw – Oregon Department of Environmental Quality
Kelly Warren – Confederated Tribes of Warm Springs
Dave White – Federal Lakes Recreation Committee Detroit Lake

Working Group Members

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- Joe Arbow – Oregon Department of Forestry*
 - Libby Barg – Barney and Worth, Inc. on behalf of City of Salem
 - Dwayne Barnes – City of Salem
 - Randy Bentz – Norpac Foods, Inc*
 - Andy Bryant – NOAA/NWS*
 - Jane Dalglish – US Army Corps of Engineers*
 - Caitlin Esping – Marion County
 - Patricia Farrell – City of Salem
 - Ed Flick – Marion County
 - Robert Gentry – US Forest Service*
 - Meredith Hoffman – Marion SWCD*
 - Elise Kelley – Oregon Department of Fish and Wildlife
 - Chris Kowitz – City of Salem
 - Brandin Krempasky – City of Salem*
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 - Rebecca McCoun – North Santiam Watershed Council*
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 - Roger Stevenson – City of Salem
- *Members moving forward

Element #2: Vulnerability Assessment Working Group attendees include:

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- Brandon Coville – US Forest Service
- Jane Dalglish- US Army Corps of Engineers
- Patricia Farrell – City of Salem
- Ed Flick – Marion County
- Lacey Goeres Priest – City of Salem
- Chris Kowitz – City of Salem
- Margaret Matter – Oregon Department of Agriculture
- Mike McCord – Oregon Water Resources Department
- Rebecca McCoun – North Santiam Watershed Council
- Chuck Perino – Department of State Lands
- Joel Plahn – Oregon Water Resources Department
- Kathleen Silva – Marion County
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- Roger Stevenson – City of Salem
- Heather Tugaw – Oregon Department of Environmental Quality
- Dave White – Federal Lakes Recreation Committee Detroit Lake

Element #3: Mitigation Actions Working Group attendees include:

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- Libby Barg – Barney and Worth, Inc. on behalf of City of Salem
- Dwayne Barnes – City of Salem
- Dustin Bengtson – US Army Corps of Engineers
- Randy Bentz – Norpac Food, Inc.
- Jane Dalglish- US Army Corps of Engineers
- Tim Ernster – US Army Corps of Engineers
- Andrea Faber – Oregon Department of Agriculture
- Patricia Farrell – City of Salem
- Ed Flick – Marion County
- Lacey Goeres Priest – City of Salem*

- Meredith Hoffman – Marion SWCD*
- Katherine Kihara – Bureau of Reclamation
- Margaret Matter- Oregon Department of Agriculture
- Rebecca McCoun – North Santiam Watershed Council*
- Jason Pulley – City of Salem
- Brenda Sanchez – Marion Soil & Water Conservation District
- Kathleen Silva – Marion County*
- Kendra Smith – Bonneville Environmental Foundation
- Brent Stevenson – Santiam Water Control District*
- Roger Stevenson – City of Salem*
- Heather Tugaw – Oregon Department of Environmental Quality
- Dave White – Federal Lakes Recreation Committee Detroit Lake

*Members moving forward

Element #4: Response Action Working Group attendees include:

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- Dwayne Barnes – City of Salem
- Randy Bentz – Norpac Food, Inc*
- Jane Dalglish- US Army Corps of Engineers
- Patricia Farrell – City of Salem
- Ed Flick – Marion County
- Robert Gentry – US Forest Service*
- Lacey Goeres Priest – City of Salem*
- Mike Gotterba – City of Salem*
- Karen Hans – Oregon Department of Fish and Wildlife
- Jan Irene – North Santiam Watershed Council
- Brandin Krempasky – City of Salem*
- Lance Ludwick – City of Stayton
- Rebecca McCoun – North Santiam Watershed Council*
- Alyssa Mucken – Oregon Water Resources Department
- Tyler Pedersen – North and South Santiam Watershed Council

- Jason Pulley – City of Salem
 - Terry Riley – Marion County Fire District*
 - Mary Karen Scallion – US Army Corps of Engineers*
 - Kathleen Silva – Marion County*
 - Brent Stevenson – Santiam Water Control District*
 - Roger Stevenson – City of Salem*
 - Heather Tugaw – Oregon Department of Environmental Quality
- *Members moving forward

Element #5: Operational and Administrative Working Group attendees include:

- Patricia Farrell – City of Salem**
 - Margaret Matter – Oregon Department of Agriculture
 - Rebecca McCoun – North Santiam Watershed Council**
 - Jason Pulley – City of Salem
 - Kathleen Silva – Marion County**
 - Brent Stevenson – Santiam Water Control District**
 - Roger Stevenson – City of Salem
- ** Entities moving forward

Element #6: Plan Update Process Working Group attendees include:

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 - Margaret Matter – Oregon Department of Agriculture*
 - Rebecca McCoun – North Santiam Watershed Council*
 - Kathleen Silva – Marion County*
 - Brent Stevenson – Santiam Water Control District*
 - Roger Stevenson – City of Salem*
- *Members moving forward

APPENDIX B

Monitoring Framework

1 INTRODUCTION

The objective of this chapter is to establish a framework that uses available information and tools to confirm existing drought and assess the likelihood of future drought in the area. The framework provided in this chapter defines the data sources and indices, thresholds, and stages of drought to be used to define the mitigation actions (Chapter 4) and response actions (Chapter 5) for the North Santiam Watershed (NSW) Drought Contingency Plan (DCP) study area.

The framework that is developed in this chapter is intended to serve as a starting point for collaborative drought monitoring in the NSW study area. Overtime, the framework should be reviewed and adjusted based on how well it serves the needs of decision makers and their constituents.

2 DROUGHT MONITORING PROCESS

The US Bureau of Reclamation (BOR) Drought Response Program Framework: WaterSMART Program (May 2015) provides the following discussion regarding the drought monitoring process:

“Drought monitoring includes the analysis of data to monitor near and long term water availability, and a framework to predict the probability of drought or to characterize the severity of an existing drought. Monitoring is achieved through the collection and analysis of water availability and other types of data (e.g., precipitation, temperature, and streamflow levels, among other indicators related to different types of resources), and the use of drought indices, thresholds, and stages of drought to characterize drought conditions. To develop an effective monitoring process, an entity needs to identify and integrate the use of indices, indicators, and triggers to define drought stages.

Indicators are specific measures that can be used to assess drought conditions. Indicators are dependent on local climate and data availability. Example indicators may include precipitation quantities, streamflows, reservoir levels, groundwater levels, snow pack, temperature, vegetation health, and soil moisture. Indicators are used for the establishment of triggers.

Indices effectively integrate drought variables into a single index number. At a minimum, a primary index should be chosen or developed for drought monitoring. However, the trend is to rely on multiple drought indices to trigger mitigation and response actions, which are calibrated to various intensities of drought. Commonly used indices include the U.S. Standardized Precipitation Index, the U.S. Drought Monitor, Crop Moisture Index, Surface Water Supply Index, and Palmer Indices. [Note that the indices listed here are typically used for planning across large geographic extents and may not be entirely useful at the scale of the NSW DCP].

A **trigger** is an indicator threshold value or range that can be used to define the drought stage, or to trigger a specific response or mitigation action. Example triggers include specific reservoir levels on certain dates, streamflows falling below certain levels, etc.

Drought stages represent the severity of drought and are classified in several ways (e.g., moderate, severe, extreme, Stages 1-4, watch, warning, or emergency). Defining drought stages is a crucial step to later implementing drought response actions.”

3 EXISTING STATE AND LOCAL DROUGHT MONITORING PROCESSES AND REQUIREMENTS

This section provides a summary of drought monitoring processes and requirements at the state and local stakeholder level. Information contained here is derived from existing water management plans, regulations, and input provided by stakeholders during the NSW DCP planning process.

3.1 STATE OF OREGON

The State of Oregon Emergency Operations Plan (EOP) --Drought Annex, January 2016 provides the following description of the state's drought monitoring process:

“Oregon Revised Statute (ORS) Chapter 536 identifies authorities available during a drought. To trigger specific actions from the Water Resources Commission and the Governor, a “severe and continuing drought” must exist or be likely to exist. Oregon relies upon two inter-agency groups to evaluate water supply conditions, and to help assess and communicate potential drought-related impacts. The Water Supply Availability Committee (WSAC) is a technical committee chaired by the Oregon Water Resources Department (OWRD). The other group—the Drought Readiness Council—is a coordinating body of state agencies co-chaired by the OWRD and the Office of Emergency Management.

The WSAC consists of state and federal agencies that meet early and often throughout the year to evaluate the potential for drought conditions. If drought development is likely, monthly meetings occur shortly after release of Natural Resources Conservation Service (NRCS) Water Supply Outlook reports for that year (second week of the month beginning as early as January) to assess conditions.

The following are indicators used by the WSAC for evaluating drought conditions:

- Snowpack
- Precipitation
- Temperature anomalies
- Long range temperature outlook
- Long range precipitation outlook
- Current streamflows and behavior
- Spring and summer streamflow forecasts
- Ocean surface temperature anomalies (El Nino, La Nina)
- Storage in key reservoirs
- Soil and fuel moisture conditions
- NRCS Surface Water Supply Index

Currently, Oregon does not have a formal framework defining different stages of drought, including the term “severe and continuing drought” that is referred to in ORS Chapter 536 (Mucken pers. comm. 2016). That is, the state does not have a formal means of compiling the above listed indicators to consistently conclude that a severe and continuing drought is occurring or is likely to occur. Instead, the state relies on a formal process of communications between technical and policy committees that interpret the above sources of information, to inform state drought declarations. The state is currently working on a new framework that will define different stages of drought and associated data sources, indices, and thresholds (Mucken pers. comm. 2016).

3.2 DETROIT DAM AND LAKE AND BIG CLIFF DAM MANAGEMENT

Detroit Lake, a reservoir formed by Detroit Dam and its re-regulating structure Big Cliff Dam, is operated by the U.S. Army Corps of Engineers (USACE) as part of the Willamette River Basin Flood Control project (Willamette Project). The Big Cliff Dam is used to smooth out the power generation water

releases from Detroit Dam and to control downstream fluctuations in river level. Currently, the USACE manages Detroit Lake, primarily for flood control, according to federally mandated regulations. As a result, most stakeholders have little control over the amount of water stored and available downstream of Detroit Lake.

Detroit Lake is a regionally significant recreation destination that is federally designated for recreation use. The U.S. Forest Service manages recreation areas on national forest lands, which borders much of the lake. Detroit Lake State Recreation Area also provides several campgrounds and boat ramps along the north shore. The Oregon Legislature has directed the OWRD, when discussing seasonal operations of impoundments with USACE, to specify that the State has determined Detroit Lake to be an important recreational resource, and to encourage USACE to place Detroit Lake as the highest priority recreational use lake in the Willamette Basin reservoir system (Oregon Revised Statute 536.595). Various boat ramps and marinas are situated around the lake, and may become inoperable below certain lake elevations. Table 1 provides a list of these resources and their critical elevations as provided by USACE's tea cup monitoring data for Detroit Dam (USACE 2016a).

Table 1 Detroit Lake Elevations for Various Boat Ramps and Marinas (USACE 2016a)

Water Surface Elevation	Boat Ramp/Marina
1556	State Park Boat Ramp D
1546	Kane's Marina (min. elev. for moorage)
1543	Hoover Boat Ramp
1542	South Shore Boat Ramp
1541	Cove Creek Boat Ramp
1540	Mongold East Boat Ramp
1534	Mongold Main Boat Ramp
1530	State Park Boat Ramp G
1450	Mongold Low-water Boat Ramp

As part of the 2008 *Endangered Species Act (ESA) Section 7(a)(2) Consultation Biological Opinion for the Willamette River Basin Flood Control Project* (Willamette BiOp), flow targets were established for several Willamette River tributaries, including the North Santiam River (Table 2), and the mainstem Willamette River. The USACE is required to manage water releases from Detroit and Big Cliff Dams to address these flow targets, however watershed specific conditions are taken into account in weekly consultations between regulatory agency representatives. In drought or low water conditions flow targets may not be met or are adjusted.

Table 2 Minimum Tributary Flow Objectives below Big Cliff Dam on North Santiam River (USACE, BPA, and BOR 2007)

Period	Primary Use	Minimum Flow (cfs)¹	Chance of Not Meeting Flow
Sept 1 – Oct 15	Chinook spawning	1,500	17%
Oct 16 – Jan 31	Chinook incubation	1,200	5%
Feb 1 – Mar 15	Rearing/adult migration	1,000	2%
Mar 16 – May 31	Steelhead spawning	1,500	0%
Jun 1 – Jul 15	Steelhead incubation	1,200 ²	0%
Jul 16 – Aug 31	Rearing	1,000	1%

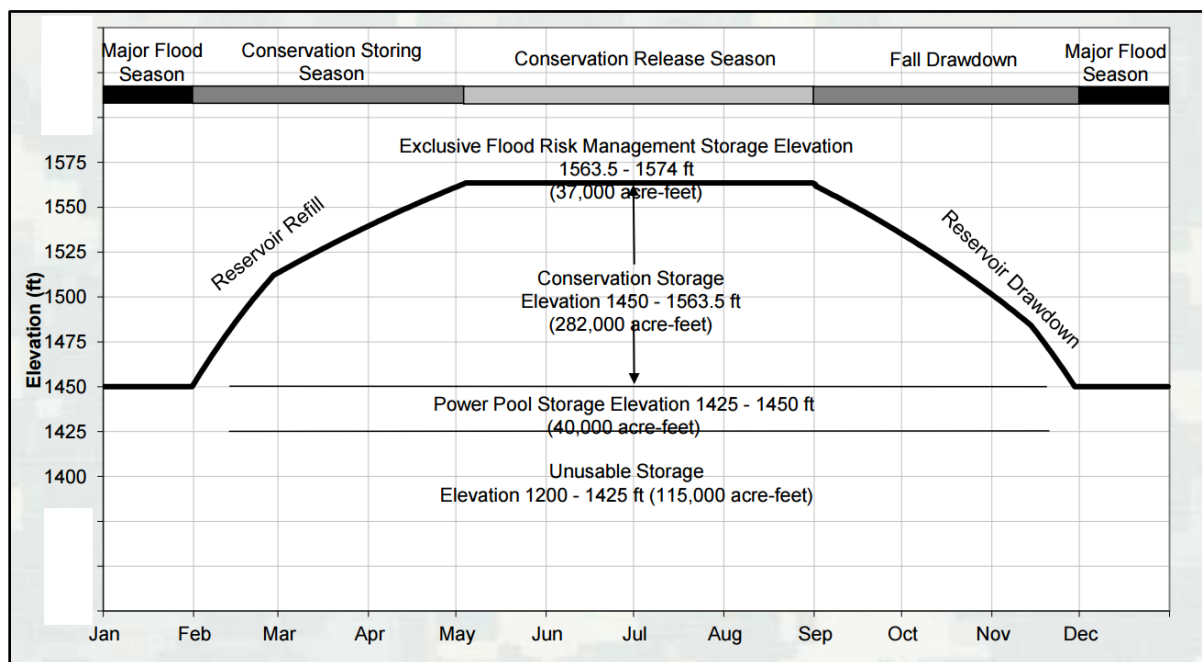
¹ Minimum flow will equal inflow or Congressionally authorized minimum flows, whichever is higher, when the reservoir is at a minimum conservation pool elevation. This avoids drafting the reservoir below minimum conservation pool and, where applicable, into the power pool.

² When feasible, incubation flows should be no less than ½ the maximum 72-hour average discharge observed during the preceding spawning season. Efforts will be made to avoid prolonged releases in excess of the recommended maximum spawning season discharge to avoid spawning in areas that would require high incubation flows that would be difficult to achieve and maintain throughout the incubation period.

The USACE manages flows from Detroit Lake based on the flood risk management rule curve provided in Figure 1. The rule curve specifies that fall drawdown start around September 1 to be ready for the flood season starting December 1. The lake is maintained at low levels throughout the flood season, which ends on January 31. An exception is during flood management periods, in which case water may be stored to prevent downstream flooding.

The conservation storage season begins on February 1, where the lake is again allowed to refill. This continues until the beginning of May. February through April is the key period for lake refill. It is important to note that high amounts of precipitation in the form of rain prior to this period may have limited ability to fill the lake during the conservation storage season, since most of the associated runoff is allowed to pass through the system. Should the precipitation fall as snow prior to the storage season, then this would become more available for lake storage if melt off occurs during the storage season. Likewise, if quality rain events occur during the February through March time period, then the associated runoff could also be captured.

Figure 1 Detroit Lake Flood Risk Management Rule Curve (source: USACE2016b)



3.3 CITY OF SALEM

The primary water source for the City of Salem (Salem) and its drinking water customers is the North Santiam River. Salem has very senior North Santiam River water rights, with priority dates dating back to the 1850s and 60s. Salem's "Water Management and Conservation Plan" (WMCP) (GSI 2014) describes its approach to drought within the Municipal Water Curtailment Element chapter. The plan notes that future curtailment episodes could occur as a result of significant drought affecting North Santiam River flow, failure of aging infrastructure, and other potential causes such as catastrophic events. Salem's initiating conditions focus on a minimum available storage (85 million gallons), and a descending supply to demand ratio. If minimum available storage falls below 85 million gallons, the curtailment stages are triggered based upon the supply to demand ratio as provided in Table 3.

Table 3 Curtailment Levels (Water Management and Conservation Plan, City of Salem, (GSI 2014))

Curtailment Stages	Initiating Conditions: if minimum available storage is below 85 million gallons and there is a:
Level 1: Alert	Rolling 5 day average when supply is 90 to 95% of demand
Level 2: Voluntary Curtailment	Rolling 5 day average when supply is 80 to 89% of demand
Level 3: Mandatory Curtailment	Rolling 5 day average when supply is 70 to 79% of demand
Level 4: Severe Curtailment	Rolling 5 day average when supply is below 69% of demand

Other than Table 3 above, the City's WMCP does not provide a specific drought monitoring protocol. However, Salem does regularly monitor the various NSW gages, weather reports, lake level, and forecasts to track the potential for low water conditions. Stored water releases and natural flows from tributaries above its Geren Island intake location are most critical for determining potential water scarcity issues (Pers. comm. Farrell May 3, 2016). In addition, geomorphic changes within the channel and water quality issues such as turbidity or algal blooms also affect water availability at Salem's intakes (Pers. comm.

Farrell May 3, 2016). As part of this DCP preparation, Salem identified the monitoring planning stages and initiating conditions shown in Table 4 as being particularly important to their understanding of water supply security.

Table 4 City of Salem Drought Monitoring Planning Stages and Initiating Conditions

Planning Stages	Initiating Conditions:
Heads Up	<ul style="list-style-type: none"> Weather patterns (low precipitation, low snowpack, high temperatures, drought indicator map, weather forecasts, low river levels) USACE rule curve for Detroit Lake during refill not being met USACE initiates Flow Management conference calls early due to drought or water management concerns NRCS Water Supply and Detroit Lake Storage April report indicates below average stream flow predicted for the summer
Moderate Concern	USGS Mehama gage at 900 cfs
Severe Concern	USGS Mehama gage at 800 cfs
Extreme Concern	USGS Mehama gage at 700 cfs

3.4 CITY OF STAYTON

The City of Stayton's (Stayton) WMCP (Keller Associates 2006) describes their approach to monitoring and managing drought as follows: "Stayton's primary source of water originates from the North Santiam River. Because this source is surface water, it is more susceptible to seasonal fluctuations, turbidity problems, and contamination, as well as the potential for natural disaster. Stayton has four reservoirs and emergency interconnection to Salem's water supply system, which provide some resilience during periods of low water supply."

Stayton's curtailment plan contains four stages of drought. These stages, associated triggers, and goals are provided in Table 5. Note that the triggers are based on a determination of condition by the public works director; however, no numeric criteria are provided.

Table 5 Summary of City of Stayton Drought Monitoring Stages, Triggers, and Goals

Stage	Trigger	Goal
Mild	Determination made by the public works director that a potential for a water shortage exists	Public awareness and 5% reduction in consumption
Moderate	Determination made by the public works director that water shortage exists	10% reduction in consumption
Critical	Determination made by the public works director that there is a critical water supply shortage that threatens the City's ability to deliver water supplies	15% reduction in consumption
Emergency	Water plant failure resulting in loss of production capacity	50% reduction in consumption

3.5 MARION COUNTY

Marion County provides a review of drought vulnerabilities, risks, and action items as part of its Natural Hazards Mitigation Plan (Marion County 2011). However, drought monitoring is not described. Nevertheless, the county does review many of the same information resources as mentioned for the State of Oregon and Salem, and coordinates with local stakeholders to understand the impacts of drought conditions.

3.6 LINN COUNTY

Linn County addresses drought in its Emergency Operations Plan (EOP) by including a drought incident checklist that includes action items to be carried out in advance of drought, during drought, and post-drought. However, drought monitoring is not described. The county does review many of the same information resources as mentioned for other local entities, and coordinates with local stakeholders to understand the impacts of drought conditions.

3.7 SANTIAM WATER CONTROL DISTRICT

The Santiam Water Control District's (SWCD) WMCP (SWCD undated) describes their approach to monitoring and managing drought as follows. The primary water source for SWCD is the North Santiam River, exercising its senior water rights dating back to the early 20th century. In 1987 the District obtained supplemental water rights authorizing the use of stored water from Detroit Lake to help meet irrigation needs. Under current water allocation conditions, the SWCD can provide adequate water delivery except in excessive deficit situations. The SWCD WMCP does not define "excessive deficit" situations, but notes that "if a condition occurred where stream flow and storage were not available (or partially lost), curtailment and allotment procedures would be followed."

The SWCD Board of Directors meets regularly to review current issues pertaining to irrigation water, including supply availability. SWCD staff track streamflow at the Mehama gage and water storage in Detroit Lake by monitoring the USACE website. Staff also keeps in close communication with the USACE relating to water releases from the lake.

The WMCP includes three stages of drought, which include a "heads up" stage, "this is serious" and a "this is drought" stage. The SWCD WMCP also acknowledges that changing weather patterns may correct a drought situation before it becomes critical (i.e., above average spring and early summer rains and lower than normal temperatures, may alleviate the effect of a dry winter).

Table 6 provides a summary of the different SWCD drought stages and their associated triggers and potential actions.

Table 6 Summary of SWCD Drought Monitoring Stages, Triggers, and Potential Actions

Stage	Triggers	Potential Actions
Heads Up	Triggered on January 1 st if below average precipitation and snow pack conditions and projections have been made.	This initiates discussions between SWCD and the USACE between January and April regarding projected flow condition

This is Serious	A caution for a possible drought condition exists when storage in Detroit Lake does not meet the established fill curve by March 1 and low runoff is projected.	Forthcoming crop mix and acres to be planted discussions are initiated between District staff, cannery personnel and SWCD board members
It is Drought	A drought condition exists when Detroit Lake fails to fill by May 1 and below normal runoff is projected.	The SWCD Board will provide a detailed self-evaluation of the potential irrigation season water supply for potential reduced delivery, taking into consideration all of the available and pertinent “triggering” factors

During the preparation of this DCP, SWCD noted that, starting around April 1, they pay close attention to the data provided through the Northwest River Forecast Center, Water Supply Forecasts, particularly the Mehama gage along the North Santiam River (gage ID: 14183000). If the gage reads below 75 percent of normal, then they begin to watch it weekly and also monitor many of the other gages and forecasts for the NSW. The USACE’s teacup diagram for Detroit Lake was noted as a key information source. Also, the National Weather Service Climate Prediction Center website was highlighted as a useful tool to monitor future conditions.

3.8 OREGON DEPARTMENT OF FISH AND WILDLIFE (MID-WILLAMETTE FISH DISTRICT)

As part of the NSW DCP process, the Oregon Department of Fish and Wildlife’s (ODFW) Mid-Willamette Fish District noted the following indicators and information sources as being particularly helpful in tracking potential low water conditions (Personal communications, Elise Kelley 2016) (see Table 7). During the winter the most important indicators are reservoir levels, precipitation levels, and snowpack. Although it can be difficult to determine specific numeric thresholds during different types of drought, two indicators are of particular concern by January: if typical storms and precipitation events are not occurring, and if snowpack does not reach 100 percent of normal. Also of considerable concern is if Detroit Reservoir Lake is not at or above the rule curve starting February 1.

Table 7 Typical Info Used by ODFW to Monitor Drought Conditions in the NSW (Pers. Comm. Kelley 2016)

Indicator	Metric	Source	Key Dates
Detroit Res Level	Rule curve	USACE Teacup dia.	January 1; Feb 1
Precipitation	% of norm	NOAA Water Supply Outlook; NOAA NW River Forecast Center	Dec. 1; Jan 1
Snowpack	% of norm	USDA/NRCS	Jan 1.

3.9 NORTH SANTIAM RIVER TOTAL MAXIMUM DAILY LOAD (TMDL)

The Willamette Basin Total Maximum Daily Load (TMDL) prepared by the Oregon Department of Environmental Quality (DEQ) notes that the NSW has stream segments listed under section 303(d) of the federal Clean Water Act (CWA) that exceed water quality criteria for temperature. Listed stream segments include the North Santiam River as well as several of its tributaries. The TMDL provides the following water temperature criteria for the lower North Santiam River.

- Salmon and steelhead spawning : Sept 1 – June 15, criteria = 13.0 °C
- Core cold water habitat: All times of year criteria 16.0 °C

4 REVIEW OF DROUGHT MONITORING DATA SOURCES (I.E., POTENTIAL INDICATORS AND INDICES)

There are many on-line information resources that provide data regarding meteorological and hydrological conditions within the NSW DCP study area. The data range from coarse scale national to regional drought forecasting to site specific snowpack, precipitation, and river gages within the NSW. The following list of resources was found to be particularly useful and are already used by many of the stakeholders.

4.1 NATIONAL TO REGIONAL SCALE INFORMATION

National Drought Mitigation Center US Drought Monitor weekly update

<http://droughtmonitor.unl.edu/>

The U.S. Drought Monitor is a weekly map based on measurements of climatic, hydrologic and soil conditions as well as reported impacts and observations from more than 350 nation-wide contributors . It provides weekly drought monitoring mapping updates for the country and reviewers may click on individual states.

National Weather Service Climate Prediction Center (NWS-CPC)

<http://www.cpc.ncep.noaa.gov/products/Drought/>

The Climate Prediction Center provides links to maps showing the National Drought Monitor map noted above, as well as Monthly and Seasonal Drought Outlook maps. The latter two maps are produced by the NWS-CPC.

Oregon Water Resources Department –Weekly Drought Updates

http://apps.wrd.state.or.us/apps/wr/wr_drought/current_updates.aspx

This report provides a compilation of water supply monitoring data for, with data provided at national to Oregon basin scale (e.g., Willamette River Basin). Although website states “weekly” updates, it appears to be published biweekly.

4.2 REGIONAL TO LOCAL SCALE INFORMATION

NRCS National Water and Climate Center

<http://www.wcc.nrcs.usda.gov/basin.html>

This is an excellent resource that creates reports of monitoring gage data broken down by watersheds for the selected state. Reports are provided for precipitation, snowpack, reservoirs, and forecasts. Actual and percent of normal information is provided. Information pertinent to the NSW is included under either the Willamette River Basin heading and/or the North Santiam Basin heading.

NRCS National Water and Climate Center

<http://www3.wcc.nrcs.usda.gov/webmap/index.html>

An excellent on-line map tool that provides gage data within the NSW DCP study area. Follow link and zoom into study area. Data for snowpack, precipitation, reservoir storage, and stream flow volume can readily be obtained. Allows data to be summarized based on various statistics (e.g., percent of official

average, percentile, maximum, and minimum values) and time periods. Clicking on individual gages provides additional detailed information.

NRCS Water Supply and Reservoir Storage Reports

http://www.nrcs.usda.gov/wps/portal/nrcs/detail/or/snow/?cid=nrcs142p2_048083

The site provides an excellent summary report prepared each month by NRCS. A statewide overview and summary reports are provided for each Oregon basins. The reports include snow pack, precipitation, streams, and reservoirs information. NSW data is highlighted in a few places.

USACE Willamette Project Teacup Diagrams

<http://www.nwd-wc.usace.army.mil/nwp/teacup/willamette/>

This site provides teacup diagrams for USACE reservoirs in the Willamette Basin. Reviewers may click on individual dams to get more detailed info about water elevations, flows, and management levels (e.g., max conservation pool, water control diagram).

USGS WaterWatch Streamflow Map

http://waterwatch.usgs.gov/index.php?mt=real&usst=or&ushuc=&go=GO&st=or&id=wwgmap_viewer

This on-line map tool provides stream flow gages color coded by various selectable flow statistics (real-time, 7-, 14-, and 28-day flow). Data can be classed by flow percentiles that cover the full range from below normal to above normal, or drought classification percentiles. Clicking on gages provides summary data, hydrograph, and stream forecast.

USGS National Water Information System: Mapper

<http://maps.waterdata.usgs.gov/mapper/index.html?state=or>

This on-line map tool provides USGS gage stations. Click on a gage to access the gages info and data.

Northwest River Forecast Center Water Supply Forecast

<http://www.nwrfc.noaa.gov/ws/index.html?version=20150727v1>

This on-line map tool provides water supply forecast data for various Northwest stream gages. The North Santiam River at Mehama is the only gage provided within the NSW DCP study area.

5 NSW DCP PROPOSED MONITORING FRAMEWORK, VERSION 1.0

5.1 FRAMEWORK OVERVIEW

The monitoring framework included in this DCP is intended to provide a simple common view of conditions in the watershed, based upon discussions among the various stakeholders, that will be used to initiate implementation of mitigation and response actions discussed in Chapters 4 and 5. This framework is not intended to supersede monitoring conducted by individual stakeholders within the NSW DCP study area. Each entity should continue to monitor water availability conditions as required or desired by their own rules or guidance documents.

It is intended that the indicators and thresholds included in this DCP framework be viewed as a starting point for collaborative communications. However, stakeholders are encouraged to bring additional relevant information to the discussions and should not feel limited to the few indicators included in this

framework. Over time, perhaps at the end of each water year, the framework should be adjusted to represent the indicators and thresholds most relevant to the collective conversation.

This framework was developed based on the monitoring concepts, processes and requirements, and data sources discussed earlier in this chapter. It is also based on input from the NSW DCP Monitoring Working Group and from basin stakeholders that took part in a polling exercise during the NSW 2016 Annual Summit.

The following criteria/objectives were developed to inform what a successful NSW DCP Monitoring Framework should entail:

- Provide a common language that is clear and informative to stakeholders
- Develop early warning indices (i.e., heads-up stage)
- Explain how others are being affected/provide indices important to different stakeholders
- Be adaptive (i.e., use the monitoring framework to develop tracking information/data that can be reviewed from year to year and adjusted in future years if needed)
- Assist our understanding of the vulnerabilities
- Provide an understanding of natural flow vs. stored water
- Support stakeholder conversations regarding local drought declaration decision making, with potential to feed up to state and federal processes
- Monitoring should occur year-round

5.2 FRAMEWORK COMPONENTS

The NSW DCP monitoring framework consists of the following components, with details of each component discussed thereafter.

1. Drought stage definitions
2. Drought indicators and associated thresholds
 - a. Current condition indicators
 - b. Future trend indicators
3. Additional Indicators and Key Information
4. Drought monitoring results
5. Drought monitoring schedule

Stages, indicators and thresholds are compiled in the current conditions drought monitoring table provided in Table 8, covering climatic, hydrologic, environmental, and socioeconomic (including agriculture) aspects of drought. This information is then aggregated to define an overall drought stage for the NSW DCP participants.

The drought stages include a heads up/potential for drought (Stage 1), moderate drought (Stage 2), severe drought (Stage 3), and extreme drought (Stage 4). The “Definition/Possible Impacts” column in Table 8 defines the drought stages based on potential impacts that could occur at each stage. These descriptions generally follow the generic descriptions used by the US Drought Monitor. A detailed review of potential impacts specific to the NSW is provided in Chapter 3 of the DCP.

Table 9 provides information regarding potential future conditions within the watershed. The combination of the overall drought stage, future trend indicator, plus the supporting individual data points should provide monitoring results that give a good collective understanding of conditions within the watershed.

5.2.1 Drought Stage Definitions

Four stages of drought have been developed for the NSW DCP. As a comparison, many of the NSW DCP stakeholders include four stages of drought as part of their WMCP water curtailment programs.

Table 8 NSW DCP Current Conditions Monitoring Table

Date:		Indicators and Indices											
		National Indices	NSW Climate Indicators		NSW Hydrologic Indicators					NSW Environmental Indicator		NSW Socioeconomic Indicator	
NSW Drought Stage	Definition/Possible Impacts	US Drought Monitor (Weekly Update)	Air Temperatures (1 month departure from normal, °F)	Precip. (% of Normal for Water Year)	Snow Pack (% normal SWE)	Detroit Reservoir (Percent above water control diagram)	USGS 7-day Flow (drought), N. Santiam @ Greens Bridge near Jefferson (Class, Percentile)	USGS 7-day Flow (drought), N. Santiam @ Mehama (Class, Percentile)	USGS 7-day Flow (drought), N. Santiam @ Below Boulder Creek (Class, Percentile)	Stream Water Temp, N. Santiam @ Greens Bridge near Jefferson (°C above TMDL threshold, Sept 1 – June 15 = 13.0°C June 16 – Aug 31 = 16.0°C)	Wildfire Hazard (ODF/National Fire Danger Rating System)	Detroit Reservoir --Boat Ramps Served (key elevations, feet)	Salem Water Supply Availability (7-day discharge in cfs at Mehama gage)(also record percent of normal-mean as supplemental info)
	Indicator Monitoring Period	All Year	All Year	All Year	Dec 1 – May 1	All Year	All Year	All Year	All Year	All Year	All Year	All Year	All Year
	Enter Data in This Row												
(Stage 1) Heads Up – Potential for Drought	Current conditions (e.g., low snowpack) point to the potential for upcoming drought conditions.	DO	0 to 2	80 to. 71	70 to 61	-3 to -10	Below Normal (24 to 10)	Below Normal (24 to 10)	Below Normal (24 to 10)	-1.0 to 0.0	Low	1,558 to > 1,556 (based on 2 ft above highest boat ramp elevation --State Park Boat Ramp D)	<=1,000 cfs
(Stage 2) Moderate Drought	Some damage to crops, pastures Streams, reservoirs, or wells low. Some water shortages developing or imminent Voluntary water-use restrictions may be requested	D1	2 to 4	70 to 61	60 to 51	-11 to -30	Moderate Hydrologic Drought (9 to 6)	Moderate Hydrologic Drought (9 to 6)	Moderate Hydrologic Drought (9 to 6)	0.1 to 2.0	Moderate	1,555 to1,540 (State Park Boat Ramp D to Mongold East Boat Ramp	<= 900 cfs
(Stage 3) Severe Drought	Crop or pasture losses likely Water shortages common Water restrictions imposed	D2	4 to 6	60 to 41	50 to 21	-31 to -50	Severe Hydrologic Drought (<=5)	Severe Hydrologic Drought (<=5)	Severe Hydrologic Drought (<=5)	2.1 to 4.0	High	1,539 to 1,450 (Mongold main boat ramp to State Park Boat Ramp G)	<= 800 cfs
(Stage 4) Extreme Drought	Widespread crop/pasture losses Shortages of water in reservoirs, streams, and wells creating water emergencies	D3 or 4	6 or greater	40 or less	20 or less	-51 or less	Extreme hydrologic drought (New low)	Extreme hydrologic drought (New low)	Extreme hydrologic drought (New low)	4.1 or greater	Very high or Extreme	<= 1,450 (below Mongold low-water boat ramp)	<= 700 cfs
Note: Most indicator headings are hot linked to take you to the appropriate website. Hovering over each indicator heading will provide instructions for gathering the relevant information from the associated website.													

The drought stages include a heads up/potential for drought (Stage 1), moderate drought (Stage 2), severe drought (Stage 3), and extreme drought (Stage 4). The “Definition/Possible Impacts” column in Table 8 defines the drought stages based on potential impacts that could occur at each stage. These descriptions generally follow the generic descriptions used by the US Drought Monitor. A detailed review of potential impacts specific to the NSW is provided in Chapter 3 of the DCP.

Table 9 Future Trend Indicators Table

Category	Description	Future Trend Indicators				
		<u>1-Month Temp. Outlook</u>	<u>3-Month Temp. Outlook</u>	<u>1-Month Precip. Outlook</u>	<u>3-Month Precip. Outlook</u>	<u>NRCS Summary Report, Detroit Lake Inflow Forecast (Current month thru September, % Avg)</u>
+1	Trend Improving	Below mean temps predicted	Below mean temps predicted	Below mean precip predicted	Below mean precip predicted	>115
0	Trend Neutral or Mixed	Normal temps predicted	Normal temps predicted	Normal precip predicted	Normal precip predicted	115 to 85
-1	Trend Worsening	Above mean temps predicted	Above mean temps predicted	Above mean precip predicted	Above mean precip predicted	<85

5.3 INDICATORS AND THRESHOLDS

The following discussion of indicators and thresholds follows the column headings provided in Table 8 and The drought stages include a heads up/potential for drought (Stage 1), moderate drought (Stage 2), severe drought (Stage 3), and extreme drought (Stage 4). The “Definition/Possible Impacts” column in Table 8 defines the drought stages based on potential impacts that could occur at each stage. These descriptions generally follow the generic descriptions used by the US Drought Monitor. A detailed review of potential impacts specific to the NSW is provided in Chapter 3 of the DCP.

Table 9. The indicators were chosen to reflect a wide breath of climatological, hydrologic, environmental, and socioeconomic characteristics, as well as to cover a range of short-term, mid-term, and long-term data trends. This section also provides instruction for acquiring data from the indices and populating the drought monitoring table for future conditions.

5.3.1 US Drought Monitor Index

Rationale: The US Drought Monitor Index provides national drought mapping that is relevant at a regional scale. It is often used to support drought declarations at the federal, state and local levels. The US Drought Monitor uses a series of data points, including professional judgment, to prepare the drought indicator maps that display the various levels of drought throughout the country.

Threshold values: The US Drought Monitor Index uses threshold values of D0 through D4 for the five stages of drought; these will be used in the NSW DCP monitoring framework.

Data acquisition: Data are available at <http://droughtmonitor.unl.edu/>. Enter the drought “intensity” class shown on the map that overlaps with the NSW DCP. Note that you can zoom into the state level view by progressively clicking on the state of Oregon. If no drought info is shown, then enter “none.”

5.3.2 Air Temperature (1 month departure from normal)

Rationale: This indicator is intended to capture recent mid-term (e.g., one-month duration) temperature conditions within the study area. Specifically, this indicator will record one-month departure from normal temperature data for the Santiam River Basin.

Threshold values: The threshold values were developed specifically for this DCP and are based on an informal review (i.e., statistical analyses not conducted) of data for late winter/early spring of 2016, in which unseasonably high temperatures occurred. Data are in degrees Fahrenheit in order to match the source data reporting.

Data acquisition: Data is provided by the “monthly temperature table” provided on the NOAA Northwest River Forecast Center website at http://www.nwrfc.noaa.gov/water_supply/wy_summary/wy_summary.php?tab=6. Scroll down to “Western Oregon--Santiam River Basin” and record the last full month's data.

5.3.3 Precipitation (% of normal for the Water Year)

Rationale: This indicator is intended to capture long-term precipitation trends within the study area. The indicator will record percent of normal precipitation for the water year, beginning October 1, for the Santiam River Basin.

Threshold values: The threshold values were developed specifically for this DCP and are based on best professional judgment.

Data acquisition: Data are provided at http://www.nwrfc.noaa.gov/water_supply/wy_summary/wy_summary.php?tab=4. Scroll down to “Western Oregon--Santiam River Basin” and record the percent of normal value.

5.3.4 Snow Pack (% of normal Snow Water Equivalent)

Rationale: This indicator is intended to capture snow pack development relative to historic normal, specifically the snow water equivalent (SWE) within the snow pack. Data is provided by the NRCS and is specific to the four SNOTEL gages within the NSW, which range in elevation from 2,590 to 4,020 feet. This indicator will only be used during the NRCS reporting period (December 1 through June 1).

Threshold values: Threshold values were developed specifically for this DCP and are based on an informal review (i.e., statistical analyses not conducted) of data for water years 2014/2015 and 2015/2016. Water year 2014/2015 experienced record low snowpack throughout the Oregon Cascades, while water year 2015/2016 experienced near normal snow pack during mid-winter but quickly diminished in spring.

Data acquisition: Data are provided at <http://www.wcc.nrcs.usda.gov/basin.html>. Query for the most recent Oregon SnowPack report. Then scroll to "North Santiam" and record value for percent median Basin Index.

5.3.5 *Detroit Lake (percent above water control diagram)*

Rationale: Detroit Lake is a major regulator of water storage and associated flow management in the North Santiam River. Note that the indicator is listed as the "percent above water control diagram" instead of "below" and therefore, values below the water control diagram or rule curve will be negative. This is intentional in order to match the USACE reporting method.

Threshold values: Threshold values were developed specifically for this DCP and are based on an informal review (i.e., statistical analyses not conducted) of data for the very low 2014/2015 water year. Specifically, the USACE's *Willamette Basin Year in Review for Water Year 2015* report (USACE 2016) was reviewed. The report detailed that Detroit Lake filled to elevation 1,506 feet by May 3, which is roughly 57.5 feet (51 percent) below the rule curve for this date. This is the lowest summer refill level on record (USACE 2016).

Data acquisition: Data are provided at <http://www.nwd-wc.usace.army.mil/nwp/teacup/willamette/>.

Enter the second value shown on the Detroit tea cup diagram.

5.3.6 *USGS 7-day Flow (drought) measured on North Santiam River at Greens Bridge near Jefferson, Mehama, and Below Boulder Creek*

Rationale: This indicator is intended to show the average streamflow conditions for the past seven days for the North Santiam River downstream and upstream of the dams, as well as below the points of diversion of the primary water users (i.e. Salem and SWCD). The Mehama gage is affected by flow releases by the dams as well as inflows from the Little North Santiam River. The Below Boulder Creek gage is situated just upstream of the inflow into Detroit Lake. The Greens Bridge gage near Jefferson is located downstream of Salem and SWCD's intakes. The USGS provides the data in the form of a drought class ranking based on the percentile flow value. The same information source also provides percent of normal flow and other flow statistics; however, the "drought" indicator was chosen in order to tie into an existing drought classification system.

Threshold values: The threshold values are based directly on the drought classifications provided by USGS.

Data acquisition: Data are provided at the USGS Water Watch website:

[http://waterwatch.usgs.gov/index.php?mt=pa07d_dry&usst=or&ushuc=&go=GO&st=or&id=wwgmap_viever](http://waterwatch.usgs.gov/index.php?mt=pa07d_dry&usst=or&ushuc=&go=GO&st=or&id=wwgmap_viewer). Check that the "map type" is set to "7-day Flow (drought)", then zoom in and click on the Mehama gage. Enter the "class" and "percentile" values. Follow the same steps for the Below Boulder Creek gage.

5.3.7 Stream Water Temperature at Greens Bridge near Jefferson (°C above key threshold)

Rationale: This indicator is intended to provide stream temperatures as they relate to the TMDL requirements for the North Santiam River. The Greens Bridge near Jefferson gage is located shortly before the confluence of the North Santiam River and the Santiam River mainstem. The Mehama gage, located further upstream, does not provide temperature data.

Threshold values: The threshold values were developed specifically for this DCP and are based on best professional judgment.

Data acquisition: Data is provided by the USGS at http://waterdata.usgs.gov/nwis/uv?cb_00010=on&format=gif_stats&site_no=14184100. Review temperature graph, check that past 7-days is showing. Average the daily highs and lows (degrees Celsius) over the past 7 days and subtract the TMDL threshold (for appropriate time of year) from this value.

5.3.8 Wildfire Hazard (Oregon Department of Forestry rating based on National Fire Danger Rating System)

Rationale: This indicator is intended to provide a sense of wildfire hazard risk in the basin. The data source is Oregon Department of Forestry's (ODF) mapping of Significant Fire Potential, which is based on the National Fire Danger Rating System (NFDRS).

Threshold values: The threshold values are based on ODF/NFDRS five classes of fire potential, which were then assigned to the four levels of drought included in the NSW DCP.

Data acquisition: Data are provided by ODF at http://nfdrs.smkmgt.com/sfp/ODF_Significant_Fire_Potential.htm. Navigate to the map and then record fire hazard class shown for the NSW DCP study area.

5.3.9 Detroit Reservoir Elevations Relative to Boat Ramps and Marinas

Rationale: This indicator is intended to track water surface elevations in Detroit Lake relative to the surrounding boat ramps and marinas. These recreational resources become inoperable at various water surface elevations as provided in Table 1.

Threshold values: The threshold values are based on the elevations provided in Table 1 and were set so that an increasing number of boat ramps and marinas drop out of use with each successive stage of drought, with all inoperable at extreme drought.

Data acquisition: Data are provided at <http://www.nwd-wc.usace.army.mil/nwp/teacup/willamette/>. Hover over the Detroit dam symbol (not the tea cup diagram) and record the elevation shown.

5.3.10 Salem Water Supply Availability (7-day discharge at Mehama)

Rationale: This indicator is intended to show the seven day average stream flow discharge in cubic feet per second (cfs) at the Mehama gage, which is located shortly upstream of the City's water supply intake

on the North Santiam River. This indicator ties directly to the discharge levels provided by the City that would put their intake at risk of inoperability.

Threshold values: The threshold values are based on those identified by the City.

Data acquisition: Data are provided at the USGS Water Watch website:

http://waterwatch.usgs.gov/index.php?id=pa07d&sid=w_gmap&r=or. Check that the “map type” is set to “7-day Flow”, then zoom in and click on the Mehama gage. Record the discharge value. It is also recommended that the “percent normal (mean)” value also be recorded for general tracking purposes, but it is not necessary.

5.3.11 One- and Three-Month Temperature and Precipitation Outlooks

Rationale: These indicators are included as future trend indicators (The drought stages include a heads up/potential for drought (Stage 1), moderate drought (Stage 2), severe drought (Stage 3), and extreme drought (Stage 4). The “Definition/Possible Impacts” column in Table 8 defines the drought stages based on potential impacts that could occur at each stage. These descriptions generally follow the generic descriptions used by the US Drought Monitor. A detailed review of potential impacts specific to the NSW is provided in Chapter 3 of the DCP.

Table 9). They provide mid- to slightly longer range views of future climatic conditions. The data is provided in clear and easy to read maps.

Threshold values: The threshold values are based on the general classes of future conditions provided by the data source.

Data acquisition: Data are available from the NOAA National Weather Service Climate Prediction Center at <http://www.cpc.ncep.noaa.gov/>. Click on the appropriate indicator to pull up the associated map and enter data accordingly.

5.3.12 NRCS Summary Report, Detroit Lake Inflow Forecast (% Average, Current month –September)

Rationale: This indicator is included as a future trend indicator (The drought stages include a heads up/potential for drought (Stage 1), moderate drought (Stage 2), severe drought (Stage 3), and extreme drought (Stage 4). The “Definition/Possible Impacts” column in Table 8 defines the drought stages based on potential impacts that could occur at each stage. These descriptions generally follow the generic descriptions used by the US Drought Monitor. A detailed review of potential impacts specific to the NSW is provided in Chapter 3 of the DCP.

Table 9). It gives an estimate for the inflow into Detroit Lake to experience typical conditions.

Threshold values: The threshold values are based on a general view of whether the forecasted value is positive, negative, or roughly neutral. Note that for the 2014/2015 water year, which was generally considered a drought year, the NRCS Summary Report listed a percent of average for the June through September period at the Detroit Lake inflow to be 67 percent.

Data acquisition: Data are provided at <http://www.wcc.nrcs.usda.gov/basin.html>. Query for the most recent Oregon Forecast report (i.e., select Forecast from the drop down menu). Then scroll to "Detroit Lake Inflow" and record the value for "percent average".

5.4 ADDITIONAL INDICATORS

This section provides additional indicators and key information that stakeholders may choose to consider when evaluating drought conditions in the NSW. These were not included in the previous tables in order to keep the tables at a manageable size and because the information contained in this section cannot be easily incorporated.

5.4.1 Willamette Project System Forecasts and Water Year Determination

Operational planning for the Willamette Project's conservation release season begins with the USACE's January forecast and continues through October (USACE 2015). The conservation release season plan identifies flow and storage needs for each tributary and reservoir in the Willamette Basin, based on the anticipated total system storage in mid-May, from the April forecast. The plan is fine-tuned in early June after spring refill.

The Willamette BiOp characterizes water year types based on historic data (USACE, BPA, and BOR 2007). The USACE uses this information to meet mainstem Willamette River flow objectives based on the mid-May system-wide storage forecast. If the storage forecast results in a water year type designation of "insufficient" or "deficit" then there is the potential for flow releases in the Willamette system to be modified, including at Detroit Lake, which may be of concern to NSW DCP stakeholders.

Table 10 Characterization and Historic Frequency (N=64; 1936-1999) of Water Year Types in the Willamette River Basin (USACE, BPA, BOR 2007)

Characteristics of Water Year Types	Abundant	Adequate	Insufficient	Deficit
Mid-May Storage (MAF) ¹	≥ 1.48	1.20 to 1.47	0.90 to 1.19	< 0.90
Frequency	58%	17%	9%	16%
Meet All Mainstem Flow Objectives?	Yes	Yes	No	No
Alternative Flow Targets below Objectives	N/A	N/A	Linear sliding scale based on flow targets used during 2001 water year ²	Balance seasonal flows to retain some control ² of discharge ²
Likely Status of Priority Recreational Reservoirs ³	Full throughout most or all of recreation season	Full through most of recreation season	May fill; unlikely to remain full throughout season	Unlikely to fill
Likely Status of Other Reservoirs	Likely to fill; drafted as necessary to meet mainstem flows	May fill; unlikely to remain full throughout season	Unlikely to fill	Unlikely to fill
¹ Forecasted useable system-wide reservoir storage accumulated by May 10-20 in millions of acre-feet (MAF). ² Reservoir-specific draft limits will be used to ensure projects can meet minimum flows through the fall. ³ Detroit, Fern Ridge, and Foster are considered the high-priority reservoirs. "Full" designation means that the project is at an acceptable level for recreation, but physically may not be at maximum conservation pool, or normal summer levels.				

5.4.2 Detroit Lake Inflows and Outflows

Detroit Lake inflows and outflow data can be found at the Willamette Project's teacup diagrams website (see Section 5.3.9 for link) and hovering over the symbol for Detroit Lake. If lake outflows are notably greater than inflows and lake water surface elevations are below the rule curve, then this could be of concern particularly during the conservation storage and conservation release seasons.

5.4.3 Big Cliff Dam Outflows Relative to BiOp Minimum Flow Requirements

Big Cliff Dam outflow data can be found in a similar manner as described above for Detroit Lake inflows and outflows. If Big Cliff Dam outflows are below the minimum outflows specified in the BiOp (Table 2), then this could be of concern.

5.4.4 Other Relevant Data

In addition to the above listed additional indicators, other relevant information may be reviewed. Such information may include formal or informal reporting of crop losses, recreation impacts, or other environmental and socioeconomic impacts that may be experienced.

5.5 FRAMEWORK STEPS

The NSW DCP monitoring framework consists of the following steps:

1. Gather drought indicator data (as explained above) and fill out the current conditions and future trend monitoring tables, Table 8 and The drought stages include a heads up/potential for drought (Stage 1), moderate drought (Stage 2), severe drought (Stage 3), and extreme drought (Stage 4). The “Definition/Possible Impacts” column in Table 8 defines the drought stages based on potential impacts that could occur at each stage. These descriptions generally follow the generic descriptions used by the US Drought Monitor. A detailed review of potential impacts specific to the NSW is provided in Chapter 3 of the DCP.
2. Table 9 respectively.
3. Aggregate the current conditions data and the future trend data, as described below, to arrive at a NSW DCP drought stage and trend for the current monitoring period.
4. Gather the additional indicator and key information described in Section 5.4.

Develop a brief monitoring report noting the drought stage and trend, along with a brief discussion of discussion of pertinent individual data points from Table 8 and The drought stages include a heads up/potential for drought (Stage 1), moderate drought (Stage 2), severe drought (Stage 3), and extreme drought (Stage 4). The “Definition/Possible Impacts” column in Table 8 defines the drought stages based on potential impacts that could occur at each stage. These descriptions generally follow the generic descriptions used by the US Drought Monitor. A detailed review of potential impacts specific to the NSW is provided in Chapter 3 of the DCP.

5. Table 9, and the additional indicators noted in Section 5.4.
6. Share results among NSW DCP stakeholders.

The current conditions data (Table 8) can be aggregated by using Table 11 below, which essentially provides the aggregated drought stage value recorded for each indicator that has been included for the monitoring period. The future trends data (The drought stages include a heads up/potential for drought (Stage 1), moderate drought (Stage 2), severe drought (Stage 3), and extreme drought (Stage 4). The “Definition/Possible Impacts” column in Table 8 defines the drought stages based on potential impacts that could occur at each stage. These descriptions generally follow the generic descriptions used by the US Drought Monitor. A detailed review of potential impacts specific to the NSW is provided in Chapter 3 of the DCP.

Table 9) can be aggregated by adding the plus, neutral, or minus values recorded for each indicator and then recording if the trend is positive, neutral, or negative.

Table 11 Drought Stage Calculator

Drought Stage	Enter # of Indicators Per Stage from Table 7	Multiply Column 1 x Column 2
0		
1		
2		
3		
4		

(a) Total of Column 3 =

(b) #of indicators recorded this monitoring period =

Divide (a) by (b) and then round to whole number = Drought Stage _____

5.6 MONITORING SCHEDULE AND RESPONSIBILITIES

Monitoring is intended to occur on a monthly basis. It is recommended that Table 8 NSW DCP Current Conditions Monitoring Table 8 and The drought stages include a heads up/potential for drought (Stage 1), moderate drought (Stage 2), severe drought (Stage 3), and extreme drought (Stage 4). The “Definition/Possible Impacts” column in Table 8 defines the drought stages based on potential impacts that could occur at each stage. These descriptions generally follow the generic descriptions used by the US Drought Monitor. A detailed review of potential impacts specific to the NSW is provided in Chapter 3 of the DCP.

Table 9 be filled out during the first week of the month, since some of the indicators are reported on the first of each month. The proposed monitoring frequency is based in part on polling during the 2016 NSW Basin Summit that showed a clear preference for year round monitoring.

It is also recommended that at the beginning of each new water year the stakeholders look back at the monitoring data that was recorded and inquire whether any adjustments are needed to the framework. For example, should any indicators be removed, new indicators added, or threshold values shifted up or down. Additional details regarding monitoring roles and responsibilities, communication protocols, and framework revisions are provided in Chapter 6 of the DCP.

5.7 POTENTIAL CHALLENGES TO DROUGHT MONITORING IN THE STUDY AREA

The NSW DCP study area is fortunate to have a wealth of information to support drought monitoring. However, the following are some potential challenges that stakeholders should keep in mind when applying the monitoring plan:

- Flows in the North Santiam River are highly dependent on management of Detroit and Big Cliff Dams. Management decisions are partly based on clear indicators such as the rule curve and the Willamette Project water year determination; however, particularly during drought conditions management decisions are typically based on daily meetings/conversations between the USACE and resource and regulatory agencies as they review conditions at a given moment.
- Late season large snow or heavy rain events during the critical Detroit Lake filling period can notably improve hydrologic conditions.
- As climate changes, indicators that are based on percent of normal or similar comparisons to historic conditions may become outdated or less valid if they look too far back into the past.
- Thresholds for several indicators were noted as being based on informal review of data or based on best professional judgment. These indicators in particular should be reviewed closely at the end of each water year to assess suitability of the thresholds.
- The NSW DCP monitoring framework and the DCP stakeholders are highly reliant on the availability of data provided by others. It is important that the data be readily available in a consistent and easy to interpret manner.

6 REFERENCES

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APPENDIX C

Vulnerability

1 INTRODUCTION

The objective of the NSW DCP vulnerability assessment is to provide the necessary information to inform future mitigation and response actions that will improve resiliency to drought. To assess vulnerability, watershed assets and resources¹ that are at risk in the event of water shortage, and the impacts that may occur, were inventoried. Then the extent to which the assets are vulnerable to drought now and into the future was evaluated. Finally, the underlying causes of the vulnerability were assessed. These causes then become the starting point for Elements #3 and #4 of the DCP process, and will be used to develop mitigation and response actions to minimize drought impacts. This process is described in more detail in this chapter.

This DCP is intended to initiate ongoing, collaborative drought planning in the NSW study area. Over time (i.e., during a recurring period to update the DCP), the vulnerability assessment should be reviewed and adjusted based on new information, and how well it serves the needs of decision makers and their constituents. Some of this new information is discussed in Section 3 of this chapter.

2 VULNERABILITY ASSESSMENT

2.1 BACKGROUND

2.1.1 National Drought Mitigation Center definition

National Drought Mitigation Center preparedness planning materials recommend completing several tasks prior to identifying mitigation and response actions. These tasks include: conducting an impact assessment, ranking the impacts, and conducting the vulnerability assessment (Wilhite et al. 1991). An impact assessment examines the environmental, economic and social consequences of a given event or change. Ranking involves prioritizing impacts according to what work group members consider to be the most important, recognizing that quantifying the impacts can be very difficult. The vulnerability assessment then “bridges the gap between impact assessment and policy formulation by directing policy attention to the underlying causes of vulnerability, rather than to the result, the negative impacts....” (Wilhite et al. 1991).

2.1.2 Other DCPs

While ranking impacts and conducting a vulnerability assessment are recommended, these tasks are not often conducted, most likely due to the effort involved. The National Drought Mitigation Center website has a compilation of state, local and watershed level drought plans, though almost none undertake these tasks (<http://drought.unl.edu/Planning/DroughtPlans/StateDroughtPlans/CurrentStatePlans.aspx>). Of notable exception, the state of Colorado prepared a vulnerability assessment as part of their Drought Mitigation and Response Plan in 2013. The state used Federal Emergency Management Act risk assessment guidance to evaluate impacts to public and private sector assets for each county. Colorado’s Plan is 736 pages; the technical “backup” information for its vulnerability assessment is over 400 pages, indicating the very lengthy, detailed process that is involved in completing these tasks. (<http://cwcbweblink.state.co.us/WebLink/ElectronicFile.aspx?docid=173111&searchid=45a1d11c-9ccf-474b-bed4-2bccb2988870&&&dbid=0>).

¹ Hereinafter referred to as “assets”.

2.1.3 Concepts in the Literature

The literature includes quite a bit of academic information on drought vulnerability assessments worldwide, from India, to the McKenzie River watershed in Oregon. Most of this information is investigating the vulnerability of systems to climate change, or as part of the risk assessment process. B.L. Turner et al. (2003) provides a framework for vulnerability analysis in sustainability science that explains exposure, sensitivity and resilience are at the core of “multifaceted coupled system with connections operating a different spatiotemporal scales and commonly involving stochastic and nonlinear processes” (Turner et al. 2003, page 8076). Farley et al. (2011) makes Turner’s complex system more manageable by evaluating vulnerability in terms of how sensitivity and response capacity affect adaptability. These concepts were adapted into the NSW DCP vulnerability assessment.

2.2 NSW DCP 4-STEP PROCESS

A Working Group of resource management professionals was convened to review and provide feedback on the NSW DCP vulnerability assessment process. Meetings were held on April 28 and May 26, 2016 to discuss draft materials and provide feedback. Additional input and participants were solicited via phone and email to ensure adequate sector representation. The final list of Working Group participants is provided in Appendix A of the DCP.

Due to the amount of time and resources that it would have taken to develop a quantitative assessment (ie., consistent metrics and scores to quantify and rank impacts for each asset within the watershed), a qualitative five-step vulnerability assessment process was developed and implemented. An overview of this process and the results of each step are presented in this section.

2.2.1 Step 1 - Assess assets/resources and potential impacts of drought

Sectors were identified to organize and inventory the watershed assets that would be affected by drought, as well as the potential direct and indirect impacts that could occur. Documents identified in the Work Plan were reviewed, and feedback obtained from the Working Group to develop the list of assets within the NSW, and the environmental, economic and social impacts that could occur. The complete list of assets and impacts are provided in Attachment A to this chapter. As a result of the variety of assets within each sector, general groupings were identified to manage the amount of information to carry forward in this assessment (Table 1).

Table 1. Asset Sectors and General Asset Groups

Sector	General Asset/Resource Groups
Agriculture	Commercial crop irrigation ² Non-commercial irrigation ² Other irrigation/watering Non-municipal fire suppression ³
Municipal supplied water	Municipal water use (drinking water / sanitation / fire suppression, water needed for public health, safety, and welfare) ² Commercial/industrial use

² These general assets were re-defined during the May 26 meeting.

³ Non-municipal fire suppression was added to this sector during the May 26 meeting.

Sector	General Asset/Resource Groups
Self-supplied domestic water	Individual domestic water supply
Energy	Hydropower
Forestry	Upland natural resources
Environmental	Instream natural resources
Recreation	Water dependent recreation
Socio-economic	Jobs/aesthetics

2.2.2 Step 2 - Prioritize assets/resources according to environmental, economic and social consequences of drought

Based on discussion and feedback provided in Step 1, the Working Group was asked to prioritize the assets, to see if there were any easily-identifiable breaks in priority based on the environmental, economic and social consequences of the impacts. Results also provided focus for follow-up steps in this assessment. Voting members of the Working Group included representatives from all sectors, with the exception of the self-supplied domestic. Results are provided in Table 2.

Table 2. Initial Priority of General Assets in the Watershed

General Asset/Resources	Priority
Municipal water uses	16
Instream natural resources	13
Commercial crop irrigation	10
Commercial/industrial uses	6
Fire suppression ⁴	6
Individual domestic water	6
Water dependent recreation	5
Non-commercial irrigation	4
Hydropower	3
Upland natural resources	1
Other irrigation/watering	0

2.2.3 Step 3 - Evaluate vulnerability now and in the future

Step 3 in the assessment process involved evaluating vulnerability of the assets to drought under current conditions and future scenarios. This evaluation is summarized in the following sections.

2.2.3.1 Vulnerability - Current conditions

Baseline water conditions

To establish current baseline water conditions, GSI conducted preliminary water rights research using information from the Oregon Water Resources Department (OWRD) for the North Santiam River (surface water/natural flow/priority dates). This information was used to identify possible regulatory measures that could be implemented and create vulnerability for a water user. Findings indicated that under current conditions (e.g. current regulatory frame work and typical or low streamflows), it is unlikely that North Santiam surface water rights holders would be regulated (i.e., use curtailed or shut off by the OWRD Watermaster) due to insufficient flow. There are no instream water rights on the mainstem

⁴ During voting, this asset represented municipal fire suppression. After the May 26 meeting, non-municipal fire suppression was added as an asset to specify that agricultural ponds are also used for this purpose.

North Santiam River below Detroit Reservoir, which typically account for a large share of the available water supply and the amount of water in the river (even during very low flows) has been sufficient to meet the demands of all out-of-stream users.

Current Conditions - Vulnerability Assessment

Based on the experience and professional judgement of the Working Group, the vulnerability of watershed assets was evaluated using two factors: consequences of impacts and sensitivity. Consequences of drought and reduced water supply were evaluated using the following criteria. The criteria were not weighted and are not in any priority order:

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

Information gathered in Step 2 was initially used to define the consequences of these impacts, and position the assets on the y-axis of a matrix⁵. On the x-axis of the matrix, sensitivity was evaluated using the following criteria:

- Is there a backup water source?
- Is there adaptability?
- Is there (assumed) importance to the public?

Baseline water conditions (i.e., current water rights and regulatory structure) and communication with working group members were used to define the sensitivity of the assets, and initially position the assets on the current conditions matrix. Assets were positioned relative to one another, and results should be viewed within the context of neighboring assets on the matrix. The results of the exercise indicate that most assets are either higher in consequences or higher in sensitivity, with a few in the moderate ranges of vulnerability. No assets are considered low consequences and low priority (ie., low vulnerability). Discussion at the May 26, 2016 Working Group meeting moved some positions of the assets on the matrix. Results from that meeting are shown in Figure 1, which indicates that the most vulnerable assets under current conditions are:

- Municipal water users: Detroit, Idanha, Lyons-Mehama, Gates, Stayton, and Salem
- In-stream natural resources (e.g, endangered species, water quality and wetlands)
- Commercial irrigation
- Municipal-supplied commercial/industrial use
- Water dependent recreation

2.2.3.2 Vulnerability - Future conditions

Future conditions were evaluated for each of the assets by considering the following likely impacts on water availability:

⁵ Matrix format was utilized for evaluation based upon communication with E. Flick, Marion County Emergency Manager.

- Willamette Project Biological Opinion (Bi-Op) implementation
- Willamette Project stored water reallocation
- Population growth
- Climate change

It should be noted that for each of the above-listed factors, uncertainties exist that could produce a range of future conditions, such as how regulatory decisions will be implemented, or how multiple factors interact within the North Santiam basin to produce a specific change. It has even been suggested that USACE may alter its rule curve for filling Detroit Reservoir to adjust to future conditions (ie., to capture water earlier). Long-term and short-term (ie., multiple year droughts) adaptive responses may differ, and experience different consequences. Therefore, this future conditions evaluation was qualitative and based upon the most probable changes, as determined by best professional judgement of the resource users and managers within the watershed (ie., the working group). Background information for each of these future conditions is discussed in the following sections.

Future Condition #1: Willamette Project Biological Opinion implementation and stored water reallocation

Under the Willamette Bi-Op implementation and stored water reallocation scenario, stored water releases from Detroit Dam could be protected instream under an instream water right in order to meet Bi-Op objectives and requirements⁶. (Under the 2008 Bi-Op, USACE currently releases between 1000 and 1500 cfs of stored water from Detroit Reservoir depending on the time of year.) In addition, it is anticipated that OWRD will convert existing natural flow Minimum Perennial Streamflows (MPSF) established for the North Santiam to instream water rights. Once converted, these MPSFs would likely have a water right priority date of June 22, 1964 for the protection of “natural streamflow”.⁷ In this scenario, stored water releases are “protected” instream (i.e. not available to natural flow water right holders) and the natural flow is protected instream under a 1964 priority date instream water right. Consequently, under low-flow conditions, surface water/natural flow water rights holders with priority dates junior to 1964 could be regulated when the natural streamflow drops below the flows in the instream water right (converted MPSF).

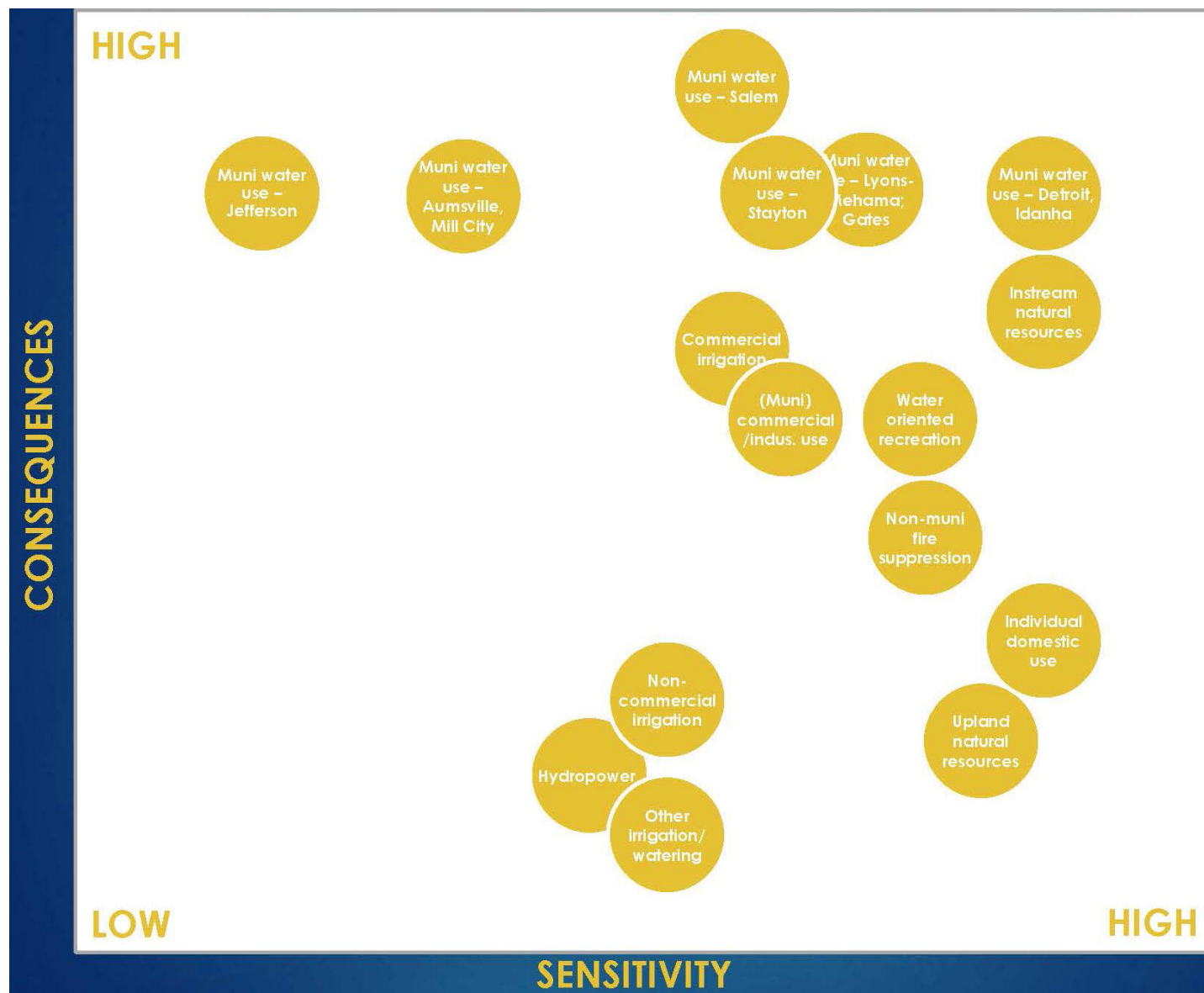
GSI estimated future water conditions using OWRD’s Water Availability Reporting System, which estimates natural flows⁸ for each month at multiple locations within a watershed. A comparison of this estimate of natural flow to the MPSF that will be converted to an instream water right shows that under this future scenario, surface water/natural flow water rights holders with priority dates junior to June 22, 1964 are vulnerable to regulation, especially from July to September in dry years.

⁶ These instream water rights would be for stored water and would be regulated as a separate and distinct source of water from surface water/natural flow. Currently, once stored water is released from Detroit Reservoir, it is considered surface water/natural flow. This would change.

⁷ Beginning in the 1960s, the Oregon Water Resources Board adopted MPSFs in the Willamette Basin to protect stream flows for aquatic life and reduce pollution. The MPSFs were established by administrative rule and are not water rights. As part of the 1987 legislation establishing instream water rights, the Oregon Legislature created a process to “convert” the MPSFs to instream water rights.

⁸ This estimate of flow does not take into account the release of stored water and is a good surrogate for assuming all the released stored water is “protected” instream. It should also be noted that the OWRD natural flow estimate is based on an 80% exceedance flow, which would be an over-estimate of flow in a very dry year.

Figure 1. Vulnerability Assessment - Current Conditions



Future Condition #2: Population growth

Most of the cities in the North Santiam basin are located within Marion County, though Lyons (population 1,160) is in Linn County. Current populations range from approximately 140 people in Idanha, to approximately 189,000 in and served by Salem. The State Office of Economic Analysis estimates that the annualized growth rate in Marion County will reach 1.15% by 2030 and then drop to 0.93% by 2050 (State, 2013). The current total population of the County is approximately 332,000, and the total population of the cities within the watershed is approximately 187,000, or 56% of the county population. The County is expected to grow by approximately 167,000 people, which indicates an estimated 94,000 new watershed residents by 2050.

Most of this growth would be expected to occur within urban Salem and surrounding areas. However, Marion County and the Mid-Willamette Valley Council of Governments are working to stimulate development in the region, specifically in the Santiam Canyon. This group is exploring federal and state grant and loan opportunities to support identified economic development projects in the communities of Detroit, Gates, Idanha, and Mill City. Therefore, the population growth scenario is anticipated to affect communities from Salem through the Canyon.

Future Condition #3: Climate change

Climate models vary with the amount of carbon dioxide projected to occur in the atmosphere; however, most models project warmer, drier summers for Oregon. The Oregon Natural Hazards Mitigation Plan (2015) utilizes mean projected seasonal increases in summer temperatures of 2.6 to 3.6 °C, and in winter temperatures of 2.5 to 3.2 °C, by mid-century. The Oregon Climate Change Research Institute⁹ summarizes: as winter temperatures warm up, more precipitation falls as rain than as snow. Less snow accumulates in the winter snow pack, and stream flow increases in the winter. Peak flow in rivers occurs earlier in the spring, and the magnitude of peak flow changes. In summer, without storage, there is generally less water in the rivers due to the earlier runoff. However, the North Santiam basin originates in the High Cascades. Runoff in these areas may be sustained through the summer for some time. In addition, it is uncertain how groundwater affects seasonal water flows in these areas, so water flows in high-elevation regions are difficult to forecast (Chang and Jung in OCCRI, 2015).

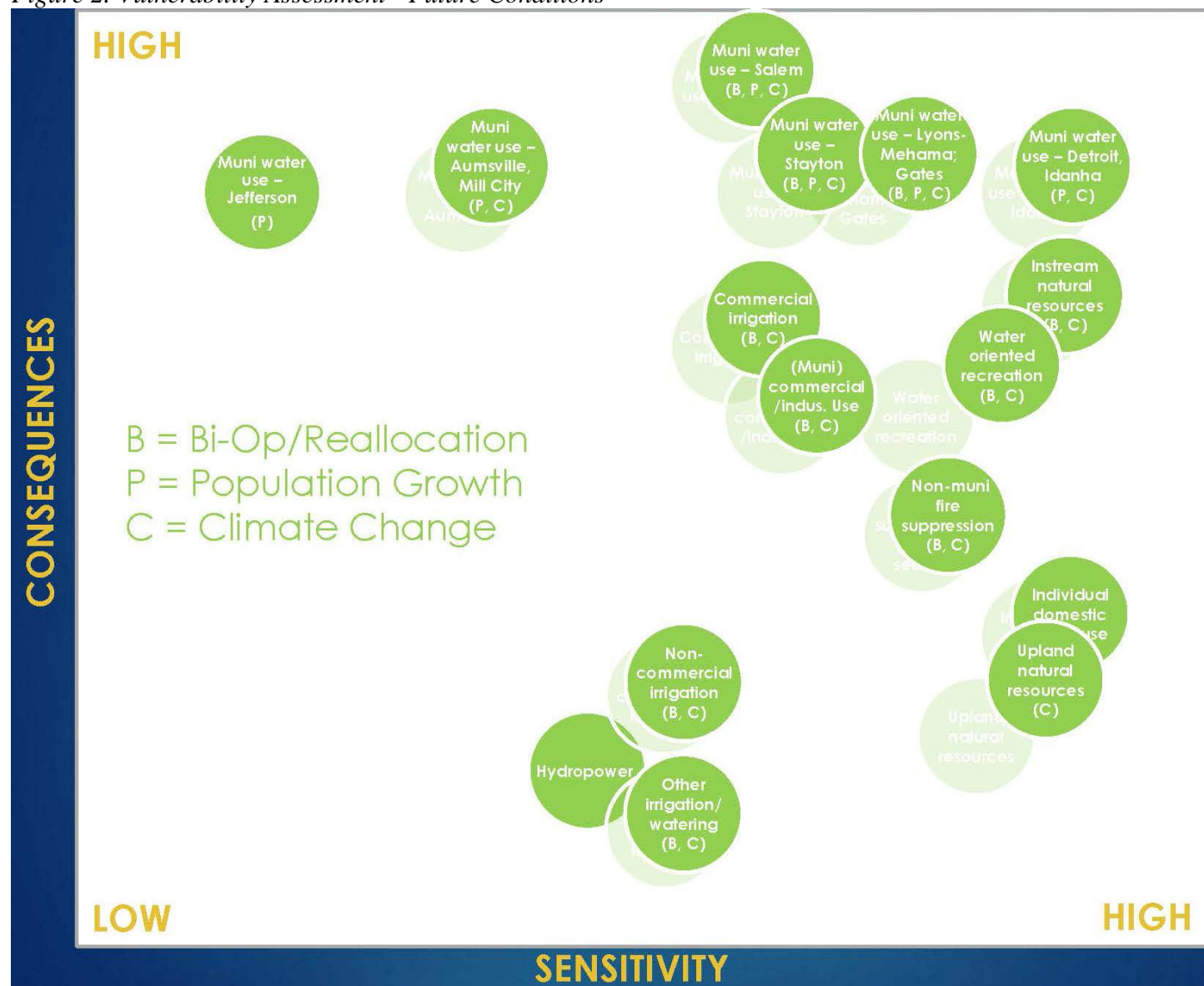
One assumption made in this scenario is that due to many factors (e.g., the large footprint of the Willamette Project, adaptive management efforts to meet competing demands for water, need for Congressional approval to change the rule curve), Detroit Dam and Reservoir operations are unlikely to change. However, as demonstrated by impacts experienced during the 2015 drought, this scenario may result in water levels within the reservoir occurring more frequently below rule curve thresholds.

Future Conditions: Vulnerability Assessment

The Working Group re-evaluated the vulnerability of watershed assets to account for the changes (based on the above discussed trends and assumptions) in the future. The “current condition” locations of the assets on the matrix were shifted to show the change in consequence and sensitivity as future conditions

⁹ <http://occri.net/climate-science/potential-impacts-of-climate-change/water-resources>

Figure 2. Vulnerability Assessment - Future Conditions



arise. For example, under the Bi-Op implementation and stored water reallocation scenario, municipal water rights with priority dates junior to 1964 may be subject to regulation, and therefore, the asset becomes more sensitive. As a consequence, a “less certain” water supply is very likely to have public health, welfare, and economic impacts on a community, therefore the consequences also become higher. Conversely, both the released stored water protected under a water right for instream use, and the natural flow instream water right from the conversion of the MPSF, will provide a previously uncertain “backup” for in-stream natural resources (e.g, endangered species, water quality, and wetlands) that are downstream of the dam. However, climate change may have higher watershed health consequences on upstream flow and other in-stream assets due to warmer water, changes in timing of flow, etc., so this asset also shifts under future conditions.

The future condition scenarios that may potentially affect the assets are noted within the circles on Figure 2. Results indicate that almost all assets become more sensitive and vulnerable, though some shifts have a slightly greater magnitude than others (predominantly due to interactions of multiple variables). The Working Group also placed more emphasis on those assets that are directly reliant on water in the North Santiam River and where the implementation of actions can reduce drought vulnerability. Overall, the most vulnerable assets under future conditions are the same as under current conditions:

- Municipal water users: Detroit, Idanha, Lyons-Mehama, Gates, Stayton, and Salem
- In-stream natural resources (e.g, endangered species, water quality and wetlands)
- Commercial irrigation
- Municipal-supplied commercial/industrial use
- Water oriented recreation

2.2.4 Step 4 - Evaluate underlying causes (to identify actions)

To develop effective mitigation and response actions that build water resiliency, we need to understand the underlying causes of the vulnerability limiting water. Every asset/resource showed some level of current and/or future vulnerability, therefore, each was evaluated. The most vulnerable assets are highlighted in blue (Table 3). For the municipal water users (including municipal fire suppression), underlying causes were generally related to having a single source of water that may be inadequate under future conditions. Municipal water intakes at Salem, Detroit, and Idanha could experience difficulties receiving sufficient water at low flow.

Table 3. Vulnerability Assessment – Underlying Causes

Asset/resource	Underlying causes
Municipal water – Salem	Intake limitations, insufficient backup, reliant on single source to large degree
Municipal water – Lyons-Mehama	Below reservoir, single source, no backup, no interconnection, all water rights junior* to large downstream water users
Municipal water – Gates	Below reservoir, all but .10 cfs junior to potential future instream water right, all water rights junior to large downstream water users, no interconnection
Municipal water – Detroit, Idanha	Above reservoir, supply from small tributaries, single source, no backup, no interconnections

Asset/resource	Underlying causes
Instream natural resources	Below reservoir**, subject to prior out of stream appropriation, no backup, “single source”
Food crop production	Below reservoir, insufficient backup
Muni commercial/industrial use	Below reservoir**, insufficient backup, potentially subject to municipal curtailment
Water oriented recreation - <i>River</i> boating/fishing	Below reservoir**, subject to prior out of stream appropriation, no backup, “single source”
Water oriented recreation - <i>Reservoir</i> recreation	USACE operations (ie., rule curve/Bi-Op implementation), infrastructure limitations (eg., parks, ramps, docks)
Municipal water – Aumsville	No backup, no interconnections, single source (groundwater)
Municipal water – Jefferson	Single source, no interconnections
Upland natural resources	Insufficient precipitation/”single source”
Individual domestic use	Likely no backup, no interconnections, likely single source
Muni fire suppression	(See individual municipal water supplier causes)
Other commercial irrigation; Other irrigation/watering	Below reservoir, insufficient backup
Hydropower	USACE operations (ie., rule curve/Bi-Op implementation), SWCD dams below reservoir

*Junior water rights are prior to 1964 MPSF, and junior to Salem and SWCD water rights.

** These assets may occur above the reservoir, but actions to address water resiliency in these areas are limited.

3 RECOMMENDATIONS AND DATAGAPS

As noted in the discussion above, uncertainties exist that could interact to produce a range of future conditions, such as how regulatory decisions will be implemented to affect each asset (ie., will the stored water reallocation affect individual domestic water users – it is not anticipated to do so), or how multiple future scenarios interact within this watershed to produce a specific change. The following recommendations are made to document and account for these uncertainties and address them within future iterations of this vulnerability assessment.

- Track the Willamette Project Bi-Op implementation and stored water reallocation efforts to understand changes in regulatory structure, water rights and future availability of water to existing water right holders.
- Track USACE decision making regarding altering the rule curve to adjust to future conditions (i.e., to capture water earlier).
- Begin to gather quantitative data to assess the consequences of drought on watershed assets as they specifically relate to the underlying causes, such as gathering information on economic losses, community responses to manage water supply, and impacts on watershed resources such as water quality or salmonid redd survival.
- Examine and agree upon how groundwater interacts with surface water in this watershed, and the effects the interaction may have on low summer flow and individual domestic well users.
- Track the natural resource assessment in GIS being conducted by Partners of the North Santiam Resiliency Action Planning Process to see how it may be used to evaluate future potential drought effects on watershed health (e.g., current cold water refugia, predicted change in mean August temperature).
- Track future population growth forecasts, specifically with respect to future economic development within the Santiam canyon.

- Track adaptive responses and their success.

4 [NOTE TO READER REGARDING NEXT STEPS]

The results of this vulnerability assessment chapter will be incorporated into the DCP chapter for Mitigation Actions (Element #3), and the chapter for Response Actions (Element #4). Working Group meetings for Mitigation and Response Action planning (and future DCP chapter development) will be convened after the June 22 Task Force meeting.

Attachment A: North Santiam DCP Vulnerability Assessment

Updated: May 9, 2016 (Meeting feedback noted in italics)

Step 1: Assess assets at risk in the event of drought				
Sectors/Use	Interested Parties (examples)	Asset/Resource (Specific)	Assets/Resources (General)	Direct and Indirect Impacts
Agricultural	Santiam Water Control District and subdistricts <i>Sydney Irrigation District</i> Animal operations <i>Beaver Creek Drainage District</i>	Food crops (vary based on contracts and conditions) Livestock food crops (pasture, silage corn, hay, alfalfa) Grass seed Nursery/greenhouse crops NORPAC cannery non-contact cooling water (SWCD; temp mit.) Fire suppression ponds (mobile home manuf., high school) Livestock watering (ponds and on-river) Watering for soil moisture (field prep) Department of Corrections irrigation water (SWCD)	Food crop production Other commercial irrigation Other irrigation/watering	Crop quality/yield Increase in ag/range fires Impacted/inoperable infrastructure? Economic loss (production) (note: jobs are in socioeconomic sector) Increased wind erosion/decreased soil quality Decreased land value? Increased demand for groundwater? Increased insects/wildlife damage? Increased disease? Increased non-native plants/weeds? <i>Less predictable timing of products</i> <i>Ability to obtain/contract seasonal help</i>
Municipal Supplied Water	Aumsville Breitenbush Hot Springs (pop 160) Detroit Water System (pop 205) Gates (pop 500) Idanha (pop 140) Jefferson (pop 2620) Linn Co. Lyons/Mehama Water District (pop 1900) Marion Co. Mill City Salem/Turner/Keizer/Sub. East Salem/Orchard Heights (pop 189K) Stayton (pop 7800) (SWCD supplies) Stayton Fire District Department of Corrections Hospitals NORPAC Food, Inc. Freres Lumber Co. Frank Lumber Co.	Aumsville (surface water connection with groundwater) Breitenbush Water/Fire Suppression Detroit Water/Fire Suppression Gates Water/Fire Suppression Idanha Water/Fire Suppression Jefferson Water/Fire Suppression Linn Co. Fire Suppression? Lyons/Mehama Water Marion Co. Fire Suppression? Mill City Water/Fire Suppression Salem/Turner/Keizer/Suburban East Salem/Orchard Heights Water/Fire Suppression Stayton Water/Fire Suppression Stayton Fire District Fire Suppression Department of Corrections Water (Salem for potable) Hospitals Water (water and medical uses) Water for commercial products (NORPAC) <i>Water for commercial products (Freres Lumber)(also gw)</i> <i>Water for commercial products (Frank Lumber)(also gw)</i>	Municipal water use (drinking water/sanitation/water needed for public health, safety and welfare) Commercial/industrial use Fire suppression	Public health (drinking water) Public health (cleaning, sanitary) Public safety (fire suppression) Increased rates to public Less reliable source/supply Impacted/inoperable intakes or other infrastructure Fewer (commercial/industrial) products supplied Increased operating costs Economic loss (processing, revenue) Costs of implementing response plans Increased demand for groundwater? Impacts to Stayton-Sublimity GW Limited Area? <i>Dewatering Mill Creek</i>
Self-supplied Domestic	Opal Ck Ancient Forest Center <i>Residential (County)</i>	Opal Creek Forest Center Water/Fire Suppression Water (surface) Water wells (groundwater)	Individual domestic water supply	Public health (drinking water) Public health (cleaning, sanitary) Less reliable source/supply
Energy	PGE, BPA Roush hydropower plant SWCD Water Street hydropower plant Breitenbush Hot Springs (pop 160)	Grid hydropower (Detroit and Big Cliff) Roush Hydropower (indep water right)- revenue source SWCD Water Street Hydropower (indep and SWCD water right) Breitenbush Hydropower (also thermal)	Hydropower	Municipal rate increases? Less reliable source/supply? Costs of backup power? Irrig. water rate increases (replace revenue from grid)

Attachment A: North Santiam DCP Vulnerability Assessment

Updated: May 9, 2016 (Meeting feedback noted in italics)

Step 1: Assess assets at risk in the event of drought				
Sectors/Use	Interested Parties (examples)	Asset/Resource (Specific)	Assets/Resources (General)	Direct and Indirect Impacts
				(SWCD irrigator power provided by Pacific Power.)
Forestry	ODF BLM USFS Small woodlot	Willamette National Forest Old growth forest in Opal Creek (federally protected) Forest (private <i>and commercial; large and small scale</i>) Santiam State Forest N. Santiam State Park	Upland natural resources	Decrease in tree health (growth/survival) Increase in forest fires (intensity/frequency) Increase in (and decreased capacity for) fire suppression Decreased summer soil moisture Economic loss (timber production) Increase in insect damage Increase in disease Increased erosion/ <i>landslides</i> Increased flooding? Air quality effects of fires/smoke <i>Increased mortality of young trees</i> <i>Landslides can cause road closures</i> Shift in composition of species (long term)
Environmental	USACE ODFW DEQ Tribes DSL DEQ OWRD NMFS	In-stream habitat/flow UWR steelhead UWR Spring Chinook salmon Oregon chub Other ESA wildlife (bald eagle, spotted owl) SOC wildlife (eg., tailed frog, northern torrent salamander) ESA plants (eg., white topped aster, willamette valley daisy) Water quality Wetlands (natural flow) Wetlands (SWCD - direct diversion) <i>Fish collection facilities (support recovery (e.g., Minto facility)</i> LNS wild and scenic waterway Special habitats (Kingston Prairie, old growth forest, Oak savannah) Mad Creek, Rock Creek (high priority for salmonids per WA) USFWS Ankeny National Wildlife Refuge (Natural Heritage Resource Area/Bird Conservation Area)(irrigate wildlife food crops, via Sydney Irrig. Coop) Riparian areas/habitat connectivity Interconnections (natural creek flow modified by irrig. discharge)	Instream natural resources (fish, water quality, wetlands)	Change in quantity /habitat (spawning, rearing, migration corridors) Change in water quality - direct (temp/TMDLs) Water quality - indirect (turbidity, DO, E. coli, pollutants in runoff) Decrease in wetlands, vegetation Decrease in population health (growth/survival/ reproduction due to stress, disease, predation, food source, overpopulation in remaining habitat) Degradation of special habitats In-stream passage barriers/migration issues Reduced biodiversity Reduced functional capacity of wetlands (flood storage, habitat, water quality) Reduced irrigation water for wildlife food crops Algae blooms (affects health, intake function, recreation) <i>Affect/increase in 303(d) listings</i> <i>Pollution abatement flows</i> <i>Fish ladder operation</i> <i>Note: 3 Basin Rule prohibits new wastewater discharge</i>
Recreation	City of Detroit Outdoor Excursions	Detroit Lake recreation Water recreation Private marinas State parks	Water oriented recreation	Drawdown Reduced fishing Reduced boating Economic loss (municipal)

Attachment A: North Santiam DCP Vulnerability Assessment

Updated: May 9, 2016 (Meeting feedback noted in italics)

Step 1: Assess assets at risk in the event of drought				
Sectors/Use	Interested Parties (examples)	Asset/Resource (Specific)	Assets/Resources (General)	Direct and Indirect Impacts
		Mill Ck. (Salem water right for recreation) <i>Marion Forks Hatchery</i> <i>Fishing</i> Duck hunting (SWCD wetlands) <i>Breitenbush recreation</i>	(reservoir and in-river)	Economic loss (business) Reduced tourism Reduced aesthetics (<i>from drawdown, algae</i>) Reduced duck hunting <i>Public safety issues (from forest fires, dead trees, road closures, toxic algae, etc.)</i> <i>Access issues</i>
Socio-economic	All sectors	Economy/Jobs Mill Ck. (Salem water right for aesthetics) <i>Irrigation canals - aesthetics</i>	(Jobs implicit in all sectors)	Increased unemployment Income/business loss Reduced aesthetics (<i>Mill Ck., SWCD canals</i>) Home loss <i>Disproportionate impact on rural, econ. disadvantaged</i>

APPENDIX D

Mitigation

1 INTRODUCTION

The purpose of the NSW DCP mitigation action planning element is to identify, evaluate, and prioritize actions to conserve water and improve resiliency before drought conditions, for the critical resources identified during the vulnerability assessment. The critical resources identified during the vulnerability assessment include: instream natural resources, water dependent recreation, commercial irrigation, municipal water use, and municipal commercial/industrial use.

This DCP is intended to initiate ongoing, collaborative drought planning in the NSW study area. Over time (i.e., during a recurring period to update the DCP), mitigation actions should be reviewed and adjusted based on new information, completed tasks, and how well they serve the needs of decision makers and their constituents.

2 BACKGROUND INFORMATION

The 10-Step Drought Planning Process, published by Dr. Wilhite founding director of the National Drought Mitigation Center, based at the University of Nebraska-Lincoln, has been utilized by states, tribes, and countries around the world since its original publication in the 1990's. Wilhite and others have continued to revise the process over the years. In their 2005 publication (Wilhite et al. 2005) drought mitigation is defined as "...actions taken in advance of or in the early stages of drought that reduce the impacts of the event." Based on an analysis of underlying causes of drought vulnerability, mitigating actions can be identified by a drought plan working group. Wilhite et. al. provide the following sequence of questions that may be asked to support identification of such actions:

- Can the underlying cause be mitigated (can it be modified before a drought)? If yes, then how?
- Can the underlying cause be responded to (can it be modified during or after a drought)? If so, then how?
- Is there some underlying cause, or aspect of the underlying cause, that cannot be modified and must be accepted as a drought-related risk for this activity or area?

The U.S. Bureau of Reclamation (Reclamation) Drought Resiliency Program defines drought resiliency as "...the capacity of a community to cope with and respond to drought (USBR 2015)." The US Bureau of Reclamation program, as evidenced by its funding emphasis, focuses on mitigation actions that will build long-term resiliency to drought and avoid the typically higher cost approach of implementing emergency response actions. Specifically, to be eligible for USBR Drought Resiliency Program funding mitigation actions should build resiliency to drought by achieving the following objectives:

- Increasing the reliability of water supplies and sustainability
- Improving water management and increase operational flexibility
- Implement systems to facilitate the voluntary sale, transfer, or exchange of water
- Providing benefits for fish and wildlife and the environment (e.g. water quality)

3 MITIGATION ACTIONS

3.1 NSW DCP MITIGATION ACTION DEVELOPMENT PROCESS

A Working Group of resource management professionals was convened to review and provide feedback for developing NSW DCP mitigation actions. Workshop meetings were held on August 24 and September 27, 2016 to discuss draft materials and provide feedback. An overview of the process and the results of each step are presented in this section. The final list of Working Group participants is provided in Appendix A of this DCP. Development of mitigation actions followed a three step process, which is described below.

3.1.1 Step 1 – Establish a goal for mitigation actions

Through the combination of workshop input and overall feedback, the following goal was developed to inform the general types of mitigation actions and roles and responsibilities of participants.

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 response 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.*

In addition to the overall goal provided above, goals have been developed for each vulnerable sector. These goals are included in Table D-1.

3.1.2 Step 2 - Develop a menu of mitigation actions for each sector

Table D-1 provides a menu of mitigation actions that entities in the NSW DCP are currently conducting as well as future potential actions that they may undertake. Generally speaking, mitigation actions fell into the following categories:

- Improve understanding of an organizations system risks and inefficiencies (i.e., by understanding the system as a whole, improvements can be made strategically to gain greatest benefit per dollar)
- Improve system efficiencies (i.e., implementing specific projects as opposed to studies)
- Increase natural system resiliency (e.g. habitat improvements)
- Improve resiliency of water dependent recreation providers

- Collective or multi-sector efforts
 - Drought monitoring
 - Public education programs
 - Preparing for response actions (i.e., messaging and mechanisms in place so ready when drought hits)
 - Securing funding for priority collective actions and NSW DCP organizational structure

Note that the above list of actions align well with the Reclamations Drought Resiliency Program funding objectives listed in Section 2 above. However, a closer look at Reclamation funding requirements should be undertaken before assuming that all future potential projects included in this DCP could potentially be funded by the Reclamation Drought Resiliency Program. For example, Reclamation notes that to avoid duplication with the WaterSMART Grants program, projects focused on water conservation, such as canal lining or piping to conserve water, landscape irrigation measures, and others, are not eligible for funding under the Drought Resiliency Program (Reclamation 2015).

3.1.3 Step 3 – Prioritize mitigation actions and a timeline for implementation

From the list of current and future potential actions provided in Table D-1, each group member prioritized key actions to be carried out by their organization in the short term (i.e., one to three years) and long term (greater than four years) as part of their contribution to the NSW DCP efforts. Combined, the individual actions cover the range of vulnerable sectors identified in the watershed. Similarly, collective (i.e., multi-sector) actions were reviewed and prioritized. Priority short and long term mitigation actions are provided in Table D-2.

Prioritization was based on group consensus that the projects should be included on the DCP priorities list. Group discussion about each project focused on factors including costs relative to drought resiliency benefits, technical and regulatory complexity, community support, and potential co-benefits (e.g. developing an alternate municipal water source would also provide resiliency to earthquake hazard). Through these discussions, a draft (qualitative) screening criteria matrix was developed to support future prioritization efforts. The draft matrix is provided in Appendix D-1.

Table D-1 Sector Goals and Current and Future Potential Mitigation Actions

Sector	Goals for Sector	Use/User/Mitigation Action Lead	Current Activities	Future Potential Activities
Instream natural resources (ie., fish, water quality)	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. (from the Willamette Action Plan)	N. Santiam Watershed Council (NSWC)	<ul style="list-style-type: none">Beaver aided restoration and floodplain restoration for groundwater rechargeTree replanting with southern speciesAssisting canyon-area cities with water/wastewater special district formationIntegrate with Willamette Action Plan actions to address limiting factorsPlanting riparian buffers	<ul style="list-style-type: none">Partner with County to develop a N. Santiam specific conservation fund (possibly under Office of Emergency Management)Construct cold water refugiaScreen water diversionsConduct other ecosystem restoration actions (eg., Idanha revetment/floodplain)
		Oregon Department of Forestry	<ul style="list-style-type: none">Monitoring for insects and disease in riparian areas	
		Oregon Water Resources Dept.		<ul style="list-style-type: none">Enforce against illegal water use
River dependent recreation	Provide opportunities for river dependent recreation to meet current levels of socio-economic need during drought	River boating/fishing - as represented by Outdoor Excursions		
		Reservoir recreation - as represented by marinas and Detroit Lake Business Assn.		<ul style="list-style-type: none">Excavate at marinas to allow usage at low waterGet funds for new water parkExtend boat rampsDetroit Lake Recreation Master Plan
Irrigation	Provide opportunities for irrigated agriculture to meet current levels of socio-economic need during drought	Santiam Water Control District (Santiam WCD)	<ul style="list-style-type: none">Looking at "on farm" and delivery system efficiencyImplementing monitoring and controls upgrade project	<ul style="list-style-type: none">Update Water Management and Conservation Plan (WMCP)Develop system improvement plans (SIP) to identify actionsObtain funding and implement actions in SIPsLine or pipe priority sections of canalsConstruct water storage projects for summer use (include tax credits, and make the process easy to do)Provide access to diversions so that moving them does not impact other usersUpper and Lower Bennett Dam projectsPut conserved water back in-streamInstall water metersProvide information to growers on low-water use cropsProvide information on soil moisture saving techniquesEngage Sydney Irrigation Cooperative re: conducting actions

Sector	Goals for Sector	Use/User/Mitigation Action Lead	Current Activities	Future Potential Activities
		NRCS	<ul style="list-style-type: none">• Implement irrigation efficiency projects with last year's drought emergency funds• Provide CREP funding for riparian buffers• Identify and mapping groundwater limited areas with local work groups	
Municipal	Provide opportunities for municipal water providers to meet current levels of socio-economic need for health, safety and welfare, during drought	City of Salem	<ul style="list-style-type: none">• Implements/updates its WMCP• Conducts annual water audit• Conducts annual water quality report• Conducts meter testing and repair program• Structures rates, in-part, on quantity of water used• Conducts leak detection program• Conducts pipe repair and replacement program in conjunction with Capital Improvement Program• Conducts public education and technical assistance as noted in the WMCP• Conducts annual monitoring geomorphology of North Channel• Evaluate dredging N. Santiam water intake• Diversify water sources (high priority)• Update Water System Master Plan• Provide lawn watering gauges and/or toilet leak detection dye tabs to the public• Conducts water quality monitoring in watershed upstream of intake• Conduct annual watershed summit• Participate and provide grant funding to N.Santiam Watershed Council	<ul style="list-style-type: none">• Develop partnerships• Evaluate alternatives to north channel intake system• Improve monitoring water quality and quantity• Align City curtailment plan with DCP plan to implement consistent messaging• Evaluate wastewater/greywater projects• Evaluate City development procedures re: drought tolerant landscaping, and conduct education• Participate in DCP task force
		City of Jefferson		<ul style="list-style-type: none">• Develop individual WMCPs• Obtain funding for projects in WMCPs• Implement projects in WMCPs• Evaluate wastewater/greywater projects (integrate with future canyon-area wastewater/water district as feasible)• Provide outreach to new residents• Idanha revetment/floodplain project• Approve ordinances for future development (e.g., use drought tolerant landscaping)• Install meters• Conduct leak detection surveys• Conduct annual water audits• Evaluate rate structures that conserve water• Explore alternative supply sources
		City of Stayton		
		Lyons-Mehama Water District		
		City of Gates		

Sector	Goals for Sector	Use/User/Mitigation Action Lead	Current Activities	Future Potential Activities
				<ul style="list-style-type: none">• Conduct intake improvement projects• Repair/replace aged pipeline• Develop additional storage• Construct interconnections (Intergovernmental agreement)• Provide lawn watering gauges and/or toilet leak detection dye tabs to the public
		City of Detroit		(See municipal future potential activities on previous page)
		City of Idanha		
		City of Mill City		
		City of Aumsville		
Muni. Commercial/Industrial	Provide opportunities for industrial/commercial users to meet current levels of socio-economic need during drought	NORPAC/ Lumber industries		<ul style="list-style-type: none">• Develop WMCPs• Obtain funding for projects in WMCPs• Implement WMCP projects such as storage• Adopt industry-specific best management practices to conserve water
Multi-sector	Establish partnerships within the watershed to promote public awareness of "it's all one water" Provide opportunities to address drought vulnerability within the watershed	Marion County, in partnership with the following depending on the action item: City of Aumsville, Aurora, Detroit, Gates, Idanha, Mill City, Salem, Silverton, and Stayton, North Santiam Water Control District, Soil and Water Conservation District, GROW EDC, OSU Extension, USDA, USFS, Oregon Department of Agriculture, Army Corp Engineers, Marion County Schools, Media, EarthWise, Oregon Green Schools Program, and Irrigation District.	<u>ONGOING AND SHORT TERM</u> <ul style="list-style-type: none">• Partner with ODA, NRCS, etc. to educate farmers / ranchers about DCP and Marion Soil/Water Conservation District funding opportunities.• Partner with Earthwise and schools to educate students about water conservation• Develop a community education program• Implement County Water Resource Mgt. Plan• Map and develop plan for critical infrastructure• Develop plan for expanding radio capabilities• Assess feasibility for detention basins (ie. Mill Ck. basin)• Complete county Disaster Recovery Plan• Update the Emergency Alert System Plan• Develop pre-scripted hazard messaging• Develop capability to collect/analyze damage assessment data in GIS <u>LONG-TERM</u> <ul style="list-style-type: none">• Monitor economic impacts on recreation, tourism and agriculture• Partner with NSWC to facilitate riparian restoration	<u>EVALUATING FEASIBILITY OF:</u> <ul style="list-style-type: none">• Funding and permitting excavation at marinas• Funding and feasibility for Turner ponds (potential dual purpose project)• Working with Gates to identify underlying cause(s)• Assisting canyon-area cities with water/wastewater special district• Partnering to develop a N. Santiam specific conservation fund (possibly under OEM)

Sector	Goals for Sector	Use/User/Mitigation Action Lead	Current Activities	Future Potential Activities
			<ul style="list-style-type: none">• Develop task force to recover critical water (and other) infrastructure• Align DCP with the Marion County Multi-jurisdictional Hazard Mitigation Plan• Partner with Marion County to support agencies’ determination of locations for additional aquifer studies that might lead to greater water supplies and help determine funding sources for the studies.• Update current water conservation management plans and educate the public on water supply systems.	
		Lead/Partners to be determined	(Not applicable)	<ul style="list-style-type: none">• Establish formal, on-going, DCP group to update and administer the plan• Establish partnership to share, develop and implement outreach and common messaging (ie., templates). Prepare press releases and engage the media. Create common "brand" for watershed-wide dissemination of drought stages and voluntary conservation efforts• Explore development of water supply option-agreements• Evaluate and seek funding to develop a water rights management program (eg., leasing, transfers) for instream flow• Fund a watermaster to understand water use and distribution in the basin, and track use, flow and curb illegal use• Engage in next BiOp (2023) renewal to incorporate DCP information and ideas (e.g., use Green's Bridge gage as flow target location to account for return flow water).• Propose legislation that allows use of OWRD water right emergency drought tools when a DCP has been approved by the state.

4 RECOMMENDATIONS AND DATA GAPS

As discussed in the Vulnerability Assessment chapter, uncertainties exist that could interact to produce a range of future conditions. Likewise, there is currently some uncertainty as to how some mitigation actions intended to benefit one water user could affect other water users. During preparation of this DCP, several entities were in the midst of their organizational planning processes that will prioritize their future actions including those related to water use and drought management. The following are some of the uncertainties or data gaps that should be taken into consideration as mitigation actions are planned for and implemented:

Uncertainties

- How will lining irrigation canals affect groundwater recharge and nearby wells and properties.
- How might stakeholders get recognition for their actions during future Biological Opinion updates and other potential regulatory matters.
- How can we provide support to small communities for involvement in future iterations of this DCP.

Adding future actions

- The City of Salem is conducting its Water Supply Master Plan update, which will be completed in 2018. Priority projects for the City will result from this effort. Several anticipated projects have been included in this DCP.
- The North Santiam River Watershed Council is leading the Partners of the North Santiam Resiliency Action Plan, to be completed within the next few months. Priority actions will result from this plan.

5 REFERENCES

- U.S. Bureau of Reclamation (Reclamation). 2015. Reclamation, Managing Water in the West. Drought Response Program Framework: WaterSMART Program.
- Wilhite, Donald A., Michael J. Hayes, and Cody Knutson. 2005. Drought Preparedness Planning: Building Institutional Capacity. As published as a chapter in *Drought and Water Crises: Science, Technology, and Management Issues*, edited by Wilhite (CRC Press, 2005).

Table D-2 Priority Drought Mitigation Actions by Entity ¹

Mitigation Actions	Reclamation Drought Funding Objectives Directly Addressed ²	Lead Entity and Partners	Brief Description	Short/Long Term Action
Marion Canal Piping Project	<ul style="list-style-type: none"> reliability of water supplies and sustainability increase water management and operational flexibility increase natural system resiliency (e.g. habitat improvements) 	Santiam WCD	Design and construct Marion Canal piping project to reduce system water loss. Design analysis should review potential changes to groundwater recharge that results from the existing unlined canal and potential effects to nearby wells. Also, canal return flow feeds Marion Creek, which is 303d listed for temperature.	Short term = planning and design Long term = construction
Coates Canal Piping Project	<ul style="list-style-type: none"> reliability of water supplies and sustainability increase water management and operational flexibility increase natural system resiliency (e.g. habitat improvements) 	Santiam WCD	Design and construct Coates Canal piping project to reduce system water loss. Design analysis should review potential changes to groundwater recharge that results from the existing unlined canal and potential effects to nearby wells.	Short term = planning and design Long term = construction
Santiam WCD SCADA Phase Two	<ul style="list-style-type: none"> increase water management and operational flexibility 	Santiam WCD	Measure and better manage water withdrawal and delivery through the SWCD system. Phase 1 is underway. Phase 2 would expand the system.	Short term
Santiam WCD WMCP Update	<ul style="list-style-type: none"> reliability of water supplies and sustainability increase water management and operational flexibility 	Santiam WCD	Update SWCD Water Management and Conservation Plan, including incorporation of NSW DCP monitoring and other relevant elements.	Short term = planning and design Long term = construction
Santiam WCD System Improvement Plan	<ul style="list-style-type: none"> reliability of water supplies and sustainability increase water management and operational flexibility benefits for fish and wildlife and the environment 	Santiam WCD	Review SWCD water delivery system as a whole in order to strategically make improvements, including reducing systems losses. The study would also evaluate potential affects to adjacent interests, including the environment.	Short term = planning and design Long term = construction
Upper Bennett Dam Diversion Improvements	<ul style="list-style-type: none"> reliability of water supplies and sustainability increase water management and operational flexibility 	Santiam WCD, Salem, NSWC	Improve diversion facility to allow for low water operation. Improve/modify intakes to provide for low water operation.	Short term = planning and design Long term = construction
Lower Bennett Dam Diversion Improvements	<ul style="list-style-type: none"> reliability of water supplies and sustainability increase water management and operational flexibility 	Santiam WCD, Salem, NSWC, ODFW	Improve diversion facility to allow for low water operation. Improve/modify intakes to provide for low water operation and allow for fish passage.	Short term = planning and design Long term = construction
Salem Water Supply Master Plan Update	<ul style="list-style-type: none"> reliability of water supplies and sustainability increase water management and operational flexibility 	Salem	Complete master plan update in 2018. This will recommend system improvements that may include securing alternate water sources, improving system efficiency, and reducing system losses.	Short term = plan update Long term = projects prioritized in plan
Salem Water Transmission Line Main Evaluation	<ul style="list-style-type: none"> reliability of water supplies and sustainability 	Salem	Evaluate lining a leaking water main that was built in the 1930's.	Short term
Salem Geren Island Intake Evaluation	<ul style="list-style-type: none"> reliability of water supplies and sustainability increase water management and operational flexibility 	Salem	Evaluate alternatives to City's Geren Island intake to facilitate low water withdrawals	Long term
Salem Geren Island Groundwater Enhancement Evaluation	<ul style="list-style-type: none"> reliability of water supplies and sustainability increase water management and operational flexibility 	Salem	Evaluate opportunity to enhance groundwater supply at City's Geren Island facility that could be an alternative to surface water diversion during low flows or inoperable surface water intake.	Long term

Mitigation Actions	Reclamation Drought Funding Objectives Directly Addressed ²	Lead Entity and Partners	Brief Description	Short/Long Term Action
Detroit Lake Low Water Marina Excavation Project	<ul style="list-style-type: none"> increase water management and operational flexibility 	Marinas, Detroit Lakes Federal Lakes Comm., Marion County, USACE, USFS	Excavate the area around existing marinas to allow their use during low water periods. The existing marinas at Detroit Lake become unusable when managed lake levels get too low. This results in loss of recreational opportunities and associated economic activity. The USACE has limited flexibility to manage lake levels for recreation use given other requirements (i.e., flood control and ESA requirements).	Short term = planning and design Long term = implementation
Mongold State Park Floating Boat Ramp	<ul style="list-style-type: none"> increase water management and operational flexibility 	OPRD, Detroit Lakes Federal Lakes Comm., Marion County, USACE, USFS	Improve recreational access to Detroit Lake during low water periods.	Short term
Detroit Lake Recreation Master Plan	<ul style="list-style-type: none"> increase water management and operational flexibility 	OPRD, Detroit Lakes Federal Lakes Comm., Marion County, USACE, USFS, others	Prepare plan to evaluate potential improvements and expansion of recreational facilities associated with Detroit Lake, including providing for opportunities during periods of low lake levels.	Long term
Partners of the North Santiam Resiliency Action Plan	<ul style="list-style-type: none"> benefits for fish and wildlife and the environment (e.g. water quality) 	Partners of the North Santiam	Incorporate restoration projects identified in this plan (upon completion in 2017) that would support drought resiliency, such as floodplain reconnection, and riparian and wetland enhancements.	Short term = plan completion Long term = implement projects prioritized in plan
Establish Drought Contingency Plan Task Force ³	<ul style="list-style-type: none"> All Reclamation Drought Objectives 	NSW DCP Task Force ³	Establish a formal group to oversee implementation of the NSW DCP.	Short term
NSW DCP Education and Outreach Partnership	<ul style="list-style-type: none"> All Reclamation Drought Objectives 	NSW DCP Task Force ³	Establish partnership to develop and implement outreach and common messaging (ie., templates), prepare press 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	<ul style="list-style-type: none"> systems to facilitate the voluntary sale, transfer, or exchange of water 	NSW DCP Task Force ³	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	<ul style="list-style-type: none"> systems to facilitate the voluntary sale, transfer, or exchange of water 	NSW DCP Task Force ³	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
WMCPs for Small Communities and Large Water Users	<ul style="list-style-type: none"> reliability of water supplies and sustainability increase water management and operational flexibility 	NSW DCP Task Force ³	Work with small communities and water users to seek funding and technical assistance to complete WMCP's to improve their understanding of water usage and opportunities to increase efficiencies.	Short term = funding and WMCPs Long term = projects prioritized in WMCPs
Critical Infrastructure Improvements for Small City's	<ul style="list-style-type: none"> reliability of water supplies and sustainability 	NSW DCP Task Force ³	Work with small communities to identify and implement water system infrastructure improvement projects that improve drought resiliency, including reducing system water losses.	Short term = study Long term = implementation

Mitigation Actions	Reclamation Drought Funding Objectives Directly Addressed ²	Lead Entity and Partners	Brief Description	Short/Long Term Action
NSW Water Budget Study	<ul style="list-style-type: none">All Reclamation Drought Objectives	NSW DCP Task Force ³	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.	Short term = funding and scoping Long term = conduct study
Incorporate NSW DCP into Willamette Basin Project Review	<ul style="list-style-type: none">All Reclamation Drought Objectives	NSW DCP Task Force ³	Engage the Willamette Basin Project and associated regulatory agencies. Goal is to get NSW DCP Partners’ mitigation actions recognized in the Project Review (reallocation study) and future BiOp updates.	Short term = early engagement Long term = recognition in updated BiOp
Expand Emergency Drought Tool Usage	<ul style="list-style-type: none">All Reclamation Drought Objectives	NSW DCP Task Force ³	Support legislation and administrative rules that allow the use of OWRD Emergency Drought Tools when a DCP has been approved by the state	Short term
<div><div>1.</div><div>Note that several of the mitigation actions listed in this table, particularly those with NSF DCP Task Force noted as lead, are intended to lay the ground work for response actions. The link between mitigation and response actions is detailed in the response action chapter of this report.</div></div> <div><div>2.</div><div>Although all projects listed meet at least one of Reclamation’s drought funding objectives, not all projects listed would necessarily qualify for funding under Reclamation’s drought program.</div></div> <div><div>3.</div><div>The NSW DCP Task Force listed in this table refers to a permanent task force to be developed as an outcome of this project. It does not refer to the current NSW DCP task force that is supporting development of this plan; however, it is anticipated that many of the same entities will be part of the permanent task force.</div></div>				

Appendix D-1

Draft Drought Mitigation Actions Prioritization Criteria Matrix (6 = highest priority)

Criteria	Criteria Ranking/Score				
	1	2	3	4	5
Estimated Cost	\$ (<25,000)	\$\$ (25k -100k)	\$\$\$ (100k – 500k)	\$\$\$\$ (500k – 1 mill)	\$\$\$\$\$ (>1 million)
Estimated Drought Resiliency Benefits (e.g. economic, public health and safety, environmental)	Very High		Moderate		Minimal, generally provides non-drought benefits
Technical Complexity	Straightforward		Somewhat complex		Very complex
Community/Political Support	High degree of support within and outside of organization		Overall support, but potential limited opposition that can likely be addressed		General support within the organization, but known opposition outside the organization
Regulatory Issues	Minimal		Intermediate		Very complex
Co-benefits (e.g. local employment, reduces non-drought risks, etc.)	High		Intermediate		Low

Calculating Results for Each Potential Project

This appendix provides a suggested method for prioritizing future mitigation projects as they are identified. Simply add up scores for each criterion. Lower scores are higher priority. Projects scoring 24 points or higher (e.g. all criteria score as 4 or higher) will not be included as priority projects. This means that expensive complex projects that may have a high degree of regulatory scrutiny should be offset by having high drought resiliency benefits (e.g. back up water supply for large population) and overall community support. Likewise, low cost straightforward projects, such as small community riparian tree planting projects, need only have a moderate or so level of drought resiliency benefits to be included as priority projects.

APPENDIX E

Response

1 INTRODUCTION

The objective of the NSW DCP response actions element is to reduce risks to critical assets and resources that were identified during the vulnerability assessment (Element #2) by identifying, evaluating, and prioritizing actions to improve resiliency during drought conditions. Response actions are planned actions that are implemented in a step-wise manner, based on the specific stages of drought identified in the monitoring framework (Element #1). They are not intended to be crisis driven (i.e., in response to unanticipated circumstances); such actions are implemented by emergency response programs. In the pre-drought stage (Stage 1 – “Heads up”), response actions are interrelated with mitigation actions (Element #3), which conserve water and improve resiliency before drought conditions. This relationship between mitigation and response, the process used to identify the NSW DCP response actions, and the final response actions matrix, are described in more detail in this chapter.

This DCP is intended to initiate ongoing, collaborative drought planning in the NSW study area. Over time (i.e., during a recurring period to update the DCP), the response actions matrix should be reviewed and adjusted based on new information, and how well it serves the needs of decision makers and their constituents. Some of this new information is discussed in Section 3 of this chapter.

2 RESPONSE ACTIONS

2.1 RESEARCH

Response actions are one of the most common elements of drought contingency, management, and emergency management planning. A review of state, local and watershed level drought plans compiled on the National Drought Mitigation Center’s website¹ indicates that plans are based upon locally defined stages of drought that increase in intensity; though the number of stages, specific triggers used to define the stages, and individual response actions themselves all differ. For example, the City of Santa Fe, NM² uses the three stages and triggers (Figure 1), though the City of Las Vegas, NV³ uses ten stages.

Figure 1: City of Santa Fe, NM, stages and triggers.

	Non-Emergency	Emergency	
Stages	Normal	Warning	Crisis
	Green	Orange	Red
Triggers	Supply >=Unrestricted Demand	Supply is 80-100% Unrestricted Demand	Supply is 0-10% Unrestricted Demand

¹ <http://drought.unl.edu/Planning/DroughtPlans/StateDroughtPlans/CurrentStatePlans.aspx>

² City of Santa Fe Water Conservation and Drought Management Plan (2015)
http://drought.unl.edu/archive/plans/drought/city/SantaFeNM_2014.pdf

³ City of Las Vegas Drought Contingency and Emergency Response Plan (2011)
http://www.lasvegasnm.gov/Water_Shortage_Action_Plan.pdf

Three to four stages are the most common in planning, though a greater number may be useful in some cases, depending upon the likelihood of drought and the results of the vulnerability assessment.

Stages are often based upon local water supply conditions. As the intensity of drought conditions increase, the stages increase. For example, the City of Arlington, TX⁴ water is supplied by reservoirs, therefore its drought stages are based upon when the total raw water supply in its reservoirs drops to 25%, 40% and then 55% of conservation storage depleted. Stages for the City of Columbia, TN⁵, are more varied. Stages 1 through 3 are based upon declining reservoir levels; however, Stage 4 (Emergency Shortage) is based upon when river flow is inadequate to meet water demands.

Of interest, drought response plans prepared at the local level for reservations and watersheds with multiple jurisdictions often emphasize the voluntary nature of coordination and action implementation. The Klamath Basin⁶ Drought Plan indicates that a menu of response actions (such as reducing surface water for irrigation, water leasing, forbearance, short-term transfers, groundwater substitution, etc.) are voluntary. The Susquehanna River Basin⁷ entities issue public notices of a drought watch/warning/declaration and call for voluntary water conservation, though the plan indicates that restrictions could be adopted (such as for nonessential water uses applying to individual water users). The Blackfoot Plan⁸ explains the need for “shared sacrifice”, and calls for voluntary reduction of water use to maintain in-stream flows. This concept of shared sacrifice to protect critical in-stream and out-of-stream needs and competing demands for water was raised with the Working Group during response action development, and is discussed in the following sections.

2.2 NSW DCP RESPONSE ACTION PLANNING PROCESS

A Working Group of resource management professionals was convened to review and provide feedback on the NSW DCP response action planning process and matrix. Meetings were held on August 17 and September 20, 2016 to establish a vision/goal for the process, discuss response actions and a draft matrix, and approve the final draft response actions for submittal to the Task Force. Additional input and participants were solicited via email to ensure adequate sector representation. The final list of Working Group participants is provided in Appendix A of this DCP. An overview of this planning process and the results of each step are presented in this section.

⁴ Arlington TX Drought Contingency and Emergency Water Management Plan (2014) <http://www.arlington-tx.gov/water/wp-content/uploads/sites/3/2014/05/City-of-Arlington-2014-Drought-Contingency-and-Emergency-Water-Management-Plan-May2014.pdf>

⁵ City of Columbia TN Drought Management Plan (2011) http://www.cpws.com/Files/Drought%20Management%20Plan_Dec2011.pdf

⁶ Klamath Basin Restoration Agreement Drought Plan (2011) http://216.119.96.156/Klamath/library/DroughtPlan2011_0711.pdf

⁷ Susquehanna River Basin Drought Coordination Plan (2000) <http://www.srbrc.net/hydrologic/docs/dm212.pdf>

⁸ Blackfoot Drought Response Plan (2010) <http://www.blackfootchallenge.org/Clone/wp-content/uploads/2012/06/Blackfoot-Drought-Response-Plan.pdf>

2.2.1 Step 1 – Establish a goal for response actions

During the first meeting, the consultants presented an overview of the amount of water currently used by municipal water providers and irrigation districts in the NSW, and what potential levels of water conservation could look like (in acre-feet) now and in the future. Currently, the possibility of regulatory action is small because a sufficient amount of “public water” is available to all water users. (Stored water released from Detroit Reservoir without an associated water right is considered public water and available for appropriation by downstream water right holders). However, junior water right holders could be at risk for regulation in favor of senior water right holders in the event of multiple years of drought, and water dependent businesses above the reservoir experience drought conditions sooner than lower areas in the watershed. In the future, the amount of “public water” is likely to be reduced after the issuance of water rights to protect stored water releases from Detroit Dam and the conversion of minimum perennial streamflows to instream water rights. This would reduce the amount of water available to all water users/sectors, particularly junior water rights holders (including municipalities), and water-dependent businesses. In the longer-term future, climate change and population growth in the basin are expected to exacerbate these conditions and impacts on all sectors to varying degrees.

This introduction to local water-use provided background for the Working Group to discuss how water use and water users affect one another within the watershed, now and in the future. One group member suggested that if all water rights holders reduce water use, it could benefit in-stream natural resources (e.g., vulnerable listed fish) as well as provide “insurance” for the reservoir (e.g., vulnerable recreational assets). Another member suggested that a watershed-wide plan could help inform the next Willamette Project Biological Opinion, which will likely be developed prior to 2023. And another indicated that, while regulatory action has not yet occurred in this watershed, it is occurring in other areas so there is precedent. However, a collaborative effort, where watershed residents direct their own response to drought conditions could replace the need for future regulation. It is all “one water”, and residents must protect one another and the critical natural resources within the watershed during drought.

The outcome of this discussion was the following goal for implementing response actions:

As participants of the NSW DCP, drought response actions in the N. 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 Chapter 5 of the DCP (yet to be developed). 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 the critical natural resources within the watershed.

2.2.2 Step 2 – Develop a prioritized draft response action matrix framework

Using information compiled from the research (Section 2.1) and the stages and indicators identified during development of the monitoring framework (Element #1), the consultants prepared a draft response actions framework. The framework identifies five categories of response actions that are prioritized based upon progressive stages of drought (i.e., public education begins in Stage 1, whereas emergency response begins in Stages 3 and 4):

- Public education and relations
- Monitoring and evaluation
- Water rights management
- Water conservation
- Emergency response

Additional detail about these categories is provided in Section 2.2.4.

Each category includes several more-specific response actions, and identifies the relevant sectors, lead entities for implementation⁹, and relevant stage of implementation for each action. (Implementation of each response action may correspond to one or more stages of drought.) The four drought stages for implementation correspond to the following stages in the drought monitoring framework:

- Stage 1 – Heads up
- Stage 2 – Moderate drought
- Stage 3 – Severe drought
- Stage 4 – Extreme drought

2.2.3 Step 3 – Populate response action matrix (develop actions for each drought stage)

With the framework drafted, the Working Group provided preliminary input at the first meeting for response actions that they would like to see included in the matrix. In addition, the consulting team reviewed existing response actions for those Working Group members that currently operate under their own response programs. For example, the City of Salem implements a 4-stage curtailment plan with its own triggers that are identified in their Water Conservation and Management Plan (WMCP) (Figure 2).

Figure 2: Salem Curtailment Plan Stages

Exhibit 4-1. Curtailment Levels 1 through 4.

Curtailment Stages	Initiating Conditions: If minimum available storage is below 85 million gallons and there is a:
Level 1: Alert	• Rolling five day average when supply is 90% to 95% of demand
Level 2: Voluntary Curtailment	• Rolling five day average when supply is 80% to 89% of demand
Level 3: Mandatory Curtailment	• Rolling five day average when supply is 70% to 79% of demand
Level 4: Severe Curtailment	• Rolling five day average when supply is below 69% of demand

⁹ Additional detail will be provided in an overarching operational and administrative framework outlined in Element 5 of the DCP (yet to be developed).

The SWCD also lists curtailment options in its WMCP (although this document is under revision) that can be triggered based upon state declaration of drought¹⁰. Using this information and local knowledge, the consultants populated the draft NSW DCP response actions matrix (Figure 3).

The NSW response actions matrix is intended to primarily focus on those actions that can be conducted on a watershed-wide basis, and provide flexibility for water users to continue to use their existing plans. For example, one (draft) NSW DCP response action is to “Practice ‘wise water use’”. For the SWCD, this may mean “Decrease operation and management spills to near zero”, whereas for the City of Salem, this may mean “Discontinue operating City decorative fountains that do not recirculate water”. For those entities that do not have existing response plans, their final local response actions should be determined by their planning and governing bodies with the specific intent to conserve water and protect vulnerable assets and resources within the watershed.

2.2.3.1 Objectives

After discussion with the Working Group, it was agreed that all actions will be implemented on an as needed, collaborative, voluntary, and watershed-wide basis. For example, if additional streamflow is needed in Stages 3 or 4, a water rights holder may voluntarily forebear (ie., stop) use, or switch to an alternate source. The amount of water is not specified. There were several reasons for not including numeric objectives (e.g., 10 percent reduction at a specific flow measurement location) for water conservation, including: political, budgetary, lack of enforcement capacity (even if objectives are voluntary), inability to quantify the benefits, and insufficient infrastructure to currently measure baseline withdrawal accurately. On-going collaboration with state and federal natural resource managers is needed to provide guidance on the appropriate numeric objectives for meaningful conservation. As an alternative, voluntary reduction objectives will be included in outreach messaging (see Step 4, Stages 2, 3 and 4). Overall, the Working Group preferred a voluntary approach for this first iteration of the DCP. If voluntary measures do not increase resiliency, numeric objectives may be considered in future plan iterations.

2.2.3.2 Relationship between Mitigation and Response Actions

In Stage 1, response actions are interrelated with mitigation actions (Element #3), which are the actions to conserve water and improve resiliency before drought conditions. The distinction is drawn between preparing for drought and implementing preparations. This is most clear with public education. One mitigation action that Marion County is working on is to prepare a pre-scripted response messaging program. Implementation of this program, that is, issuing the messages on websites and in newspapers, even in Stage 1, is a response action that will let watershed residents know how monitoring indicators are changing and inform of worsening conditions.

¹⁰ Oregon Drought Council makes recommendations to the state Emergency Management Group, which then provides a recommendation to the Governor on which areas in the state should be declared as a Drought Area. If the Governor officially declares the specific county or region as a Drought Area, the SWCD is then allowed to use any of the applicable tools under OAR 690-15-300 and ORS 540.523 for temporary water right transfer, water supplementation, qualify for federal relief funds, etc.

2.2.4 Step 4 – Finalize and approve response actions matrix

At the second Working Group meeting, members reviewed each response action for its inclusion in the final draft matrix, as well as the drought stage identified as the implementing guideline. The Working Group agreed that the following response actions should be included:

Stage 1: Heads Up

Conservation Messaging, Public Education and Outreach

- **Carry out response action messaging for each drought stage.**

Watershed-wide response action messaging (developed during the mitigation action element) should be communicated in a stylized, branded manner (also developed as a mitigation action), using partner websites, newspapers and press releases. The need to communicate: (1) how upstream areas of the watershed will be in drought before downstream areas, (2) how all residents within the watershed are conserving water (e.g., “shared sacrifice”), and (3) why conservation is important, are key ideas for messaging. Both instream flow and supply should be discussed. A map could be added with details. Example messages could include:

- The watershed is in Stage 1/Heads up drought. Many sectors depend upon the N. Santiam River. Here’s how others in the watershed are affected by drought. Practice using water wisely. Here’s how (provide examples of wise water use such as in WMCPs, and information about future response action opportunities such as water rights leasing – explained below).

Municipal, agricultural, natural resource managers, and recreation owners would be expected to collaborate on and benefit from this response action. Marion County emergency public information officers and City emergency response managers already engage multiple sectors in natural hazard mitigation preparedness, response and recovery and should participate in this effort. Resulting messages should then be shared with other agencies and sectors within the watershed. Establishing a partnership to develop and implement outreach and common messaging (ie., templates), and a common "brand" for watershed-wide dissemination of drought stages and voluntary conservation efforts is a short term mitigation action in this plan.

Monitoring and evaluation

- **Continue to track and report drought monitoring framework indicators.**
- **Coordinate among N. Santiam Watershed water providers, managers, and users.**

Both of these response actions are critical for preparing for and responding to drought by using the appropriate response actions for each drought stage. Using the NSW DCP monitoring framework to track drought stage is critical to triggering coordinated implementation of actions. Coordination is necessary to prepare for and implement response actions watershed wide, and promote voluntary withdrawal reductions to reduce vulnerability to key assets and resources. Municipal, agricultural,

natural resource managers, recreation and commercial/industrial users would be expected to collaborate on these response actions to benefit all water users in the watershed.

Water rights management

- **Forebear use**

Water rights owners currently have the ability to forbear use of any portion of their water at any time. That is, they can voluntarily stop or reduce their water use during the season to leave more water instream during critical periods to protect vulnerable instream natural resources.

- **Switch to an alternate water source**

A separate, or complimentary, option that is currently available is to leave water instream and switch to an alternate water source, such as groundwater or impounded water. This response action provides the same benefits as forbearing use, though in certain areas, groundwater withdrawals could also impact water levels in neighboring wells or reduce groundwater contributions to instream flow. It may be best to implement this response action only after consulting local natural resources managers (ie., NRCS, watershed councils)

- **Lease water rights (full or split-season leases)**

An option that is currently available but not used very often in the N. Santiam is leasing instream of certificated water rights. Water rights leasing provides water right holders with a voluntary opportunity to leave water instream to protect natural resources when needed, but still protect rights for future beneficial out-of-stream use. (Leasing a water right instream is considered a beneficial use and protects the water right from forfeiture due to non-use). There are two different types of water rights leases: full and split-season. As part of the full lease, a water rights owner would indicate a specific number of acres that they voluntarily elect not to irrigate for the full season. A split-season lease requires an owner to measure the amount of water used so that the amount of water remaining for instream use can be quantified.

Municipal, agricultural, natural resource managers, and commercial/industrial users would be expected to collaborate on and benefit from this response action. Developing and seeking funding to incentivize a water rights leasing program is a high priority mitigation action in this plan.

Water conservation

- **Implement strategies identified in Water Management and Conservation Plans (WMCPs)**

As discussed in Section 2.2.3, entity-specific WMCPs (e.g., cities, SWCD) include curtailment plans that identify their own response actions for implementation at each curtailment stage. Actions may be for the entity itself and/or its customers. Though individually-defined curtailment stages may not exactly align with watershed-wide defined DCP drought stages, some parallels can be drawn. One suggested mitigation action is to align stages in curtailment plans with the DCP monitoring framework stages. Examples of local response actions from a city-specific curtailment plan include:

City actions

- Reduce watering at City facilities and/or parks as determined by the City Manager.
- Discontinue operating City decorative fountains that do not recirculate water.
- Limit City hydrant and water line flushing to essential needs for safety and human health.
- Prohibit City-staff from washing sidewalks, walkways, streets, driveways, parking lots, or other hard surfaces except where necessary for public health or safety.
- Discontinue washing City vehicles.

Customer actions

- Request that City water customers voluntarily reduce outdoor water uses such as lawn watering, car washing, patio cleaning, etc.

Stage 2: Moderate Drought

All Stage 1 response actions should be implemented in Stage 2. The following additional actions also can be implemented:

Conservation Messaging, Public Education and Outreach

- **Carry out response messaging (as developed during mitigation action development), using partner websites, newspapers and press releases.** Messaging should convey how upstream areas of the watershed may be in drought before downstream areas, how all residents within the watershed are conserving water, and why conservation is important. More information is provided in Stage 1 above. Example messages in Stage 2 could include:
 - The watershed is in Stage 2/Moderate drought. Some areas in the watershed are experiencing drought and drought impacts (eg., recreation is slow because reservoir levels are low; green bean yield is low because growers are water less). Here's how everyone is saving water (provide examples). Please voluntarily reduce water by 5 percent. Here's how you can do it (provide examples).

Monitoring and evaluation

- **Compile socioeconomic and environmental impacts of drought (ie. local data) for use in funding applications, messaging, and refinement of the vulnerability assessment**

As noted in the Vulnerability Assessment, local data quantifying impacts of drought on each of the sectors is a datagap. This information would be useful for refining the assessment, as well as for messaging, identifying future effective actions to build resiliency, and “making the case” in grant applications to obtain funding to implement these actions. Municipal, agricultural, natural resource managers, and the recreation sector (the most vulnerable sectors) would be expected to collaborate on and benefit from this response action.

Stage 3: Severe Drought

All Stage 1 and Stage 2 response actions can be implemented in Stage 3. The following additional actions also can be implemented:

Conservation Messaging, Public Education and Outreach

- **Carry out response messaging (as developed during mitigation action development), using partner websites, newspapers and press releases.** More information is provided in Stages 1 and 2 above. Example messages in Stage 3 could include:
 - The watershed is in Stage 3/Severe drought. All areas in the watershed are experiencing drought and drought impacts. Conservation is important to help prevent Stage 4. Here's how everyone is saving water (provide examples). Please voluntarily reduce water by 10 percent. Here's how you can do it (provide examples).

Water rights management

- **Implement drought emergency water rights tools (ie., temporary transfers of water rights, emergency water use permits, and use of existing right option/agreement) available during governor declared drought**

A Governor's drought declaration enables counties to benefit from emergency streamlined water rights programs, ground water usage, and other programs¹¹. These program include the ability to obtain: an emergency water use permit to replace water not available under an existing water right; temporary drought transfers to temporarily change water rights type of use, place of use and point of diversion; temporary drought instream leases; and temporary substitution of a supplemental groundwater right for a primary surface water right. In addition, under a Governor's drought declaration, it is possible to exercise a pre-approved agreement or option for moving water use from one location to another or for use by another entity. Municipal and agricultural sectors would be expected to collaborate on and benefit from this response action. The ability to use these tools prior to a Governor's drought declaration (and based on having an approved DCP) is a mitigation action.

Emergency response

- **Seek state and federal assistance for emergency response actions**

Federal. Drought declaration may be granted at the federal level if the U.S. Drought Monitor (<http://droughtmonitor.unl.edu/>), indicates that a county is under intensity value D2 (Severe Drought) for eight consecutive weeks. The following federal drought benefits may be granted:

- NRCS – Technical and financial assistance
- Farm Services – Loan program to establish wells and overcome financial difficulties
- Rural Development – Loan programs to alleviate water shortages in rural areas
- American Red Cross – Technical assistance to distribute water and first aid from central sites to the municipal sector
- Department of Defense – Transport water for 30 days, drill wells for human consumption (after all other assistance is exhausted)
- Department of Health and Human Services – Technical, medical, and financial assistance

¹¹ https://www.oregon.gov/OMD/OEM/fin_rec/docs/drought/drought_procedures.pdf (2014)

- Small Business Administration – Loans to homeowners and businesses to restore damaged property

State. Drought declaration may be granted at the state level¹¹ when:

- County commissioners request by letter that the Governor declare a “drought emergency” “due to severe and continuing drought conditions.
- Copies of county requests are then forwarded to the Office of Emergency Management who forwards to the State Drought Council to provide recommendations and action.
- A State Drought Council meeting is then held to discuss climate and water conditions and to make a recommendation on the county request. Recommendations are then submitted to the Governor to approve or deny, or continue monitoring.

Assistance requests at the state level should be directed to the Oregon Emergency Management office in Salem (503-378-6377), or OWRD (503-378-8455). The Department of Administrative Services may authorize agencies to purchase without competitive bidding, and may purchase emergency supplies or equipment on behalf of agencies.

Additional details about federal and state agencies, and the assistance they can provide, is found at: https://www.oregon.gov/OMD/OEM/fin_rec/docs/drought/drought_info_sheet_OEM.pdf

Local. Ultimate responsibility for providing water service to citizens lies with the local water districts. Each jurisdiction is responsible for its own water supplies and maintenance of facilities. Assistance from the County and State will be in the form of personnel and equipment as requested by the affected area. Examples of emergency response assistance at the county level include:

- Submitting a request for emergency/disaster declaration
- Identifying and securing alternative drinking water supplies
- Providing emergency response messaging for radio and television
- Identifying contractor and vendors
- Coordinating with state and local supporting agencies

Assistance requests at the local level should be directed to Marion County Emergency Management Services (503-588-5108) or Linn County Sheriff’s Office, which is responsible for its Emergency Management Program (541-967-3950).

- **Implement Marion County Disaster Recovery Plan**

Marion County is working on completing a Disaster Recovery Plan that comprises the short and long term steps the County will take after an emergency to restore government function and community services to levels existing prior to the emergency. Short-term operations seek to restore vital services to the community and provide for the basic needs of the public (e.g., power, communication, water and sewage) to an acceptable standard while providing for basic human needs (e.g., life safety, food, clothing, and shelter). Once stability is achieved, long-term recovery efforts focus on restoring the community to a normal or improved state of affairs. Currently, the County’s Emergency Action Plan

Annex ESF-18, Community Recovery and Economic Stabilization summarizes specific procedures and plans to support recovery, mitigation, and economic stabilization following a disaster.

Stage 4: Extreme Drought

All Stage 1 through 3 response actions can be implemented in Stage 4. The following additional actions also can be implemented

Conservation Messaging, Public Education and Outreach

- **Carry out response messaging (as developed during mitigation), using partner websites, newspapers and press releases.** More information is provided in Stages 1 and 2 above. Example messages in Stage 4 could include:
 - The watershed is in Stage 4/Extreme drought. The watershed is in extreme drought. Here's how everyone is saving water (provide examples). Only use water for essential purposes (provide examples).

Emergency response

- **Carry out water hauling programs**

Assistance requests at the local level should be directed to Marion County Emergency Management Services. Local governments may request emergency water transportation from the following state departments: Department of Forestry (non-potable), when not being used for firefighting, Department of Transportation, Department of Fish and Wildlife, Military Department (National Guard). The municipal sector would be expected to benefit from this response action.

- **Dredge intakes, alter diversions**

Municipal water supplies are sourced from the North Santiam by intakes; agricultural water supplies are sourced by intakes and diversions. Poor water quality (ie., algae) due to low water may foul intakes; low water itself may disable both intakes and diversions. Dredging intakes and altering diversions may allow them to access water at lower flow. Because these activities are in-water actions, permits and consultations with state agencies are required, and should only be considered as emergency actions, such as to protect health, safety and welfare.

Municipal and agricultural sectors would be expected to collaborate on and benefit from this response action. Two related projects are long-term mitigation actions in this plan: Seeking funding for the design and implementation of upgrades to the Upper and Lower Bennett Dams (for irrigation), and evaluating alternatives to the Geren Island intake to access water at low flow (City of Salem).

3 *RECOMMENDATIONS AND DATAGAPS*

Marion County is working with the University of Oregon to inventory the drought (and other hazard mitigation) concerns of the smaller cities within the watershed. The Marion County Multijurisdictional Hazard Mitigation Plan will identify action items for future implementation, including infrastructure upgrades. The Plan should be complete and adopted in December 2016. Actions and projects in the Plan should be evaluated for inclusion as mitigation or response actions in this DCP.

4 *[NOTE TO READER REGARDING NEXT STEPS]*

The results of the mitigation and response action chapters will be incorporated into the next DCP chapters for Operational and Administrative Framework (Element #5), and the chapter for DCP Update Process (Element #6). Working Group meetings for these elements will be convened after the November Task Force meeting.

Figure 3: Actions and Triggers for Watershed-wide Coordinated Drought Response

Revised 10/20

				Triggers			
Actions	Related Multi-Sector Mitigation Action	Sectors	Lead	Stage 1: Heads up	Stage 2: Moderate Drought	Stage 3: Severe Drought	Stage 4: Extreme Drought
Conservation Messaging, Public Education and Outreach							
Carry out response messaging (as developed during mitigation) (e.g., newspapers, websites). Example messages:	NSW DCP Education and Outreach Partnership	Municipal, Agriculture, Natural Resource Mgrs., Recreation		x	x	x	x
Stage 1: Many sectors depend on the N. Santiam R. Practice using water wisely. Here's how and why (provide examples).							
Stage 2: Some sectors are experiencing drought. Here's how everyone is saving water (provide examples). Please reduce water use by 5%. Here's how you can do it.							
Stage 3: All sectors are experiencing drought. Here's how everyone is saving water (provide examples). Please reduce water use by 10%. Here's how you can do it.							
Stage 4: Only use water for essential purposes.							
Monitoring and Evaluation							
Continue to track and report drought monitoring framework indicators	Establish DCP Group	Municipal, Agriculture, Natural Resource Mgrs.		x	x	x	x
Coordinate among N. Santiam Watershed water providers, managers, and users to promote voluntary withdrawal reductions		Municipal, Agriculture, Recreation, Natural Resource Mgrs., Commercial/Industrial		x	x	x	x
Compile socioeconomic and environmental impacts of drought (ie. local data) for use in funding applications, messaging, and refinement of the vulnerability assessment		Municipal, Agriculture, Recreation, Natural Resource Mgrs.			x	x	x
Water Rights Management							
Forebear use (e.g., stop using during the season)	Water Rights Management Program	Municipal, Agriculture, Natural Resource Mgrs.		x (Planning step for this response)	x	x	x
Switch to an alternate water source (eg., wells)		Municipal, Agriculture, Commercial/Industrial		x (Planning step for this response)	x	x	x
Lease water rights for instream use	Expand Emergency Drought Tool Usage	Municipal, Agriculture, Natural Resource Mgrs.		x (Full or split-season)	x (Full or split-season)	x (Split-season)	x (Split-season)
Full lease (1 year)							
Split-season lease (less than one year, need to measure)							
Implement drought emergency water rights tools (eg., transfers, permits) available during governor declared drought		Municipal, Agriculture				x	x
Water Conservation							
Implement strategies identified in Water Management and Conservation Plans (WMCPs) for voluntary conservation and to implement curtailment when water supply is inadequate.	WMCPs for Small Communities and Large Water Users	Public water providers		x	x	x	x
Emergency Response							
Seek local, state and federal assistance		Municipal, Agriculture, Natural Resource Mgrs., Recreation				x	x
Implement Marion County Disaster Recovery Plan		Municipal	Marion County			x	x
Carry out water hauling programs		Municipal					x
Dredge intakes, move diversions		Municipal, Agriculture					x

APPENDIX F

Operational Framework

1 INTRODUCTION

The objectives of the NSW DCP Operational and Administrative Framework are to “clarify the ongoing roles and responsibilities for the DCP, and to facilitate a quick and efficient response to drought conditions”. Sections 2 and 3 of this chapter provide background research and the process used to prepare this chapter, respectively. Section 4 explains the roles and responsibilities for the DCP Management Team, Task Force, a lead coordinator, and four planning element groups, as well as how these groups will work together to carry out the DCP. Section 5 explains the on-going process to efficiently monitor, evaluate, and respond to drought conditions in order to ensure resiliency within the watershed.

This DCP is intended to initiate ongoing, collaborative drought planning in the NSW study area. Over time (i.e., during a recurring period to update the DCP), the operational and administrative framework should be reviewed and adjusted based on new information, and how well it serves the needs of decision makers and their constituents.

2 RESEARCH

Watershed level and state drought mitigation and response plans were reviewed to help develop the NSW DCP operational and administrative framework and integrate it with the Oregon state response. These plans indicated that, typically, one main committee fulfills all drought-related responsibilities, and communicates with other agencies and organizations. The Massachusetts Drought Management Plan (2013) states, “The role of the [main committee] is to facilitate communication and situational awareness, provide a comprehensive assessment of the situation, and develop recommendations on potential responses to drought situations.” In the case of Massachusetts, the main committee is supported by “coordinating agencies” for administrative tasks, such as to convene the committee, set agendas, collect monitoring data, etc. The exception tends to be that monitoring information is provided by outside information sources such as state agencies; however, the main committee compiles the information and makes recommendations. In Oregon, the Water Supply Availability Committee, chaired by OWRD, evaluates and communicates the status of drought conditions to local, state and tribal agencies and their emergency points of contact (2016).

With regard to facilitating a quick and efficient response to drought, agencies may also support the main committee in implementing mitigation and response actions. In Oregon, the Drought Readiness Council, co-chaired by OWRD and the Office of Emergency Management (OEM), helps assess and communicate potential drought-related impacts. The Drought Readiness Council is generally responsible for ensuring coordination among state agencies and helps water users access drought-related information and assistance programs.

In Oregon, under ORS 536.640 and 536.750, the Governor may declare “severe, continuing drought” in any basin, which can trigger conservation, curtailment plans, and access to water management tools. Under ORS 401, the Governor may declare an emergency; however, this requires local governments to “first conduct response operations to the full extent of their capability” (Oregon Drought Annex 2016). Of interest, in the Montana-based Blackfoot Drought Response Plan (2010), the decision to implement response is by the Blackfoot Drought Committee at the watershed level, rather than based on the Governor’s drought declaration.

3 PROCESS

A Working Group of resource management professionals was convened to review and provide feedback on the NSW DCP Operational and Administrative Framework and drought monitoring and declaration process. Meetings were held on December 13, 2016 and January 19, 2017, to discuss the framework and draft chapter prior to submittal to the Task Force for concurrence. The final list of Working Group participants is provided in Appendix A of this DCP.

4 NSW DCP FRAMEWORK, ONGOING ROLES AND RESPONSIBILITIES

The on-going NSW DCP Operational and Administrative Framework consists of a Management Team, technical advisory Task Force, and four planning element groups. In the short term, the Framework will include a Lead Coordinator to facilitate efficient operation and updates to the DCP (Figure 1). Each group will include one or two liason(s) to/from the Management Team, to ensure thorough communications and on-going development of the DCP. More information about each group is provided in the following sections.

4.1 MANAGEMENT TEAM

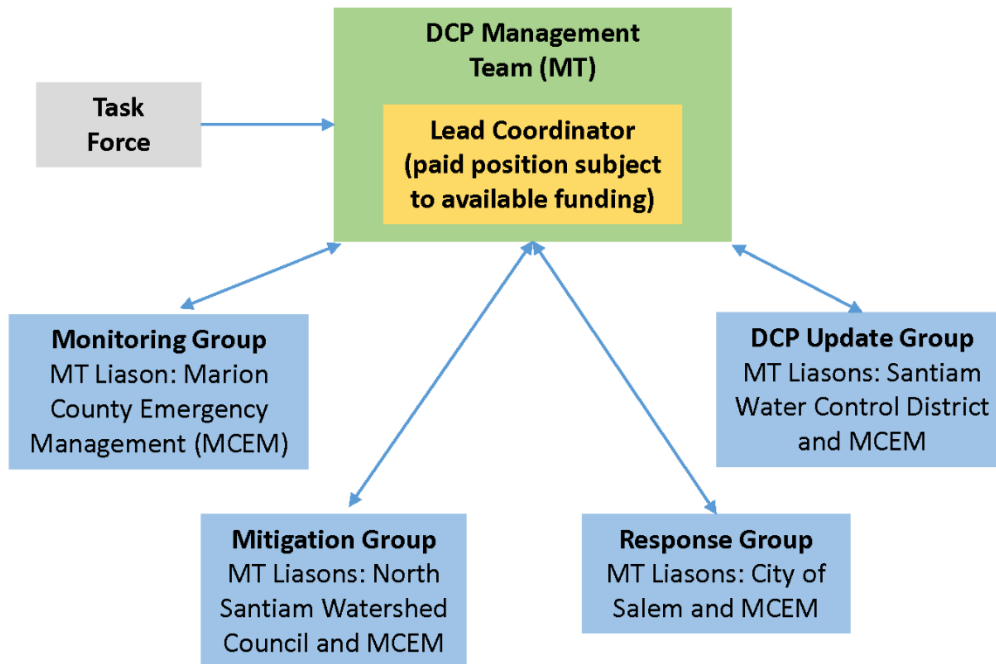
The Management Team is responsible for the overall management of the DCP, and is anticipated to be convened monthly at least for the first year of the DCP, and have the following roles and responsibilities:

- Evaluate monthly monitoring reports. Depending upon drought stage, submit to Response Group or County/Public official recommendations regarding drought declaration. Additional detail is provided in Section 5.
- Ensure that progress is being made on the Joint Actions Implementation Plan¹.
- Review proposed changes to monitoring, vulnerability assessment, mitigation and response actions and approve periodic updates to the DCP.
- Coordinate with the Governor's Water Supply Availability Committee.
- Provide annual updates to the Task Force.
- Provide fiscal oversight of Lead Coordinator and joint actions.

Initially, the Management Team is proposed to consist of representatives from North Santiam Watershed Council, City of Salem, Santiam Water Control District, and Marion County Emergency Management.

¹ A *Joint Actions for Water Supply Resiliency Implementation Plan* will be developed to describe the scope, schedule and proposed budget to develop the joint mitigation and response actions described in the DCP.

Figure 1: DCP Operational and Administrative Framework



4.2 LEAD COORDINATOR

The Lead Coordinator is a paid position (based on available funding) to support the Management Team with coordination of the Framework groups and processes. The roles and responsibilities of the Lead Coordinator are to:

- Collect monitoring data and complete the monthly monitoring report. Submit to Monitoring Group. Train Monitoring Group members to continue monthly monitoring reporting function in the event the Lead Coordinator position is not funded. (Additional detail provided in Figure 2.)
- Coordinate monitoring and drought declaration recommendation process (discussed in Section 5).
- Collect environmental and socioeconomic data for use in periodic updates to the vulnerability assessment.
- Track and report on effectiveness of individual and joint mitigation actions to Mitigation Group.
- Track and report on effectiveness of response actions to Response Group.
- Make recommendations to the Management Team for how to incorporate new information into the DCP. Lead the Update process.
- Implement the Joint Action Implementation Plan and report progress to the Management Team.
- Track funding sources for implementing actions and pursue grants, as feasible. Track grants being pursued for all Mitigation Action projects, and report to the Management Team (and Task Force as needed).
- Provide administrative assistance to the Management Team.

4.3 TASK FORCE

The Task Force will provide technical input to the Management Team or groups as requested. It is anticipated that this group will be convened at least annually to receive updates from the Management Team, and will be comprised of the same local, state and federal agencies; municipalities; and stakeholders that comprised the Task Force during development of the DCP.

4.4 MONITORING GROUP

The Monitoring Group will support the Management Team and fulfill the following roles and responsibilities:

- Compile monthly monitoring report (Lead Coordinator to conduct initially, with responsibility eventually transitioned to the Monitoring Group).
- Review monthly monitoring report and make drought stage recommendations for Management Team review.
- Revise report based upon Management Team evaluation.
- Provide review of monitoring efficacy at the end of each water year and makes recommendations for DCP Update.

The liason to the Management Team will be: Marion County Emergency Management.

4.5 MITIGATION GROUP

The Mitigation Group will support the Management Team and fulfill the following roles and responsibilities:

- Coordinate on the Joint Action Implementation Plan and provide support as needed for implementation of mitigation actions.
- Provide periodic review of other DCP mitigation actions.
- Provide periodic review of the status and effectiveness of joint mitigation actions and other mitigation actions and make recommendations for DCP Update.

The liasons to the Management Team will be: North Santiam Watershed Council and Marion County Emergency Management.

4.6 RESPONSE GROUP

The Response Group will support the Management Team and fulfill the following roles and responsibilities:

- Distribute monitoring stage information and messaging to the public.
- Coordinate on the Joint Action Implementation Plan and provides support as needed, such as to update NSW DCP Education and Outreach communication tools.
- Provide periodic review of the status and effectiveness of response actions and makes recommendations for DCP Update.

The liasons to the Management Team will be: City of Salem and Marion County Emergency Management.

4.7 DCP UPDATE GROUP

The DCP Update Group will support the Management Team and fulfill the following roles and responsibilities:

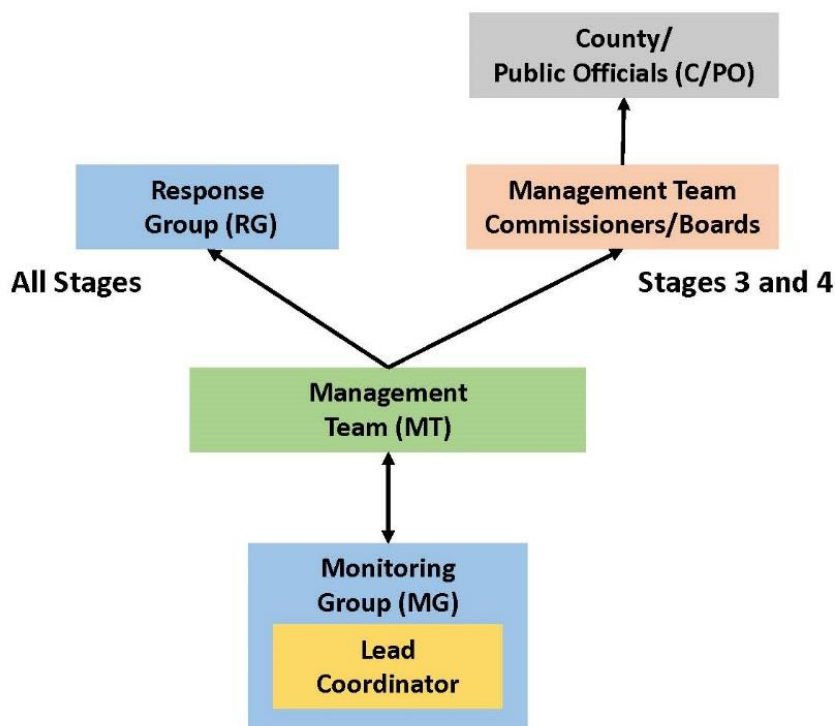
- Track new technology, research, and legal requirements for periodic updates to the DCP and its actions.
- Track environmental, social and economic consequences of local drought to identify strengths and weaknesses in response for potential changes to the DCP.

The liasons to the Management Team will be: Santiam Water Control District and Marion County Emergency Management.

5 EFFICIENT RESPONSE TO DROUGHT CONDITIONS

The second objective of the NSW DCP Operational and Administrative Framework is to facilitate a quick and efficient response to drought conditions. Therefore, the Management Team, Monitoring Group and Response Groups will be part of an on-going process to evaluate and respond to drought conditions in order to ensure preparedness within the watershed. In advanced stages of drought, county and public officials will be involved to request a drought declaration of the Governor (Figure 2). More information about the monitoring process and recommendation for a drought declaration is provided in the following sections.

Figure 2: Communications and Drought Declaration Recommendation Process



5.1 MONITORING AND REPORTING

The Lead Coordinator, Monitoring Group, Management Team, and Response Group will perform the following actions (coordinated by the Lead Coordinator) on at least a monthly basis:

- Using the monitoring framework developed in Chapter 2 of this DCP, the Lead Coordinator (as a Monitoring Group member) will prepare a monitoring report during the 1st week of each month and submit to the Management Team.
- The Management Team will review the report and make changes or comments if needed. The Management Team may consult one or more members of the Task Force for technical input.
- The Management Team will then submit the monthly monitoring report to the Response Group by the 15th of each month.
- The Response Group will issue the monthly monitoring report for broader communications to the public in accordance with the DCP Education and Outreach Partnership (See Joint Action Implementation Plan).

5.2 RESPONSE AND DROUGHT DECLARATION RECOMMENDATIONS

The findings of the monthly monitoring report will trigger one of the following two processes, depending upon the recommended drought stage in the report:

- At all Drought Stages, the Monitoring Group will forward the monthly monitoring report to the Response Group for action, as appropriate (Figure 2) (See Chapter 6, Response Actions).
- If the Drought Stage = 3 or 4, then Management Team members will submit the monthly monitoring report to, and seek a input from, its council/commissioners/boards, etc. within 72 hours, as to whether to recommend an ORS 536 drought declaration.
- If Management Team council/commissioners/boards recommend an ORS 536 drought declaration, they will request that County/Public Officials review the monthly monitoring report and pursue a drought declaration from the Governor (Figure 2). County/Public Officials and state agencies² may also provide messaging guidance to the Management Team for outreach to stakeholders. The Management Team will also submit the resulting County/Public Officials decisions and guidance, to the Response Group for action. (See Chapter 6).

² OWRD is the lead state agency for coordinating and communicating information regarding water supply shortages. Other state agencies can also contribute information or guidance, such as ODFW, ODF, Oregon Parks and Recreation Department, and the Oregon State Marine Board. These agencies, for example, will inform the public of any fishing restrictions, parks-related closures or operational changes, boater and recreational access to waterbodies, and any fire-related restrictions, closures, or general information. State agencies will develop or routinely update their communications plan to help alleviate drought-related risks. (Oregon Drought Annex 2016)

If the County does not elect to request a drought declaration from the Governor, cities are able to declare drought within their communities. Local declarations enable cities to obtain hazard mitigation funding from their county emergency management programs.

APPENDIX G

DCP Update Process

1 DCP UPDATE PROCESS: INTRODUCTION

The objective of the NSW DCP Update Process is to “evaluate and update the DCP on an ongoing basis to ensure its effectiveness.” Updates are necessary to incorporate new science, regulations, legislation, and stakeholder information; reassess vulnerability of critical resources; and incorporate improvements in monitoring, mitigation and response actions. Post-drought evaluation ensures that pre-drought planning was effective, and identifies and corrects issues to improve future implementation and response. Sections 2 and 3 of this chapter respectively provide background research and the process used to prepare this chapter. Section 4 presents an annual evaluation process to identify new information, assess post-drought response, and suggest ways to improve effectiveness. This DCP Update process is conducted **annually between November and January**. Every five years or as determined necessary by the Management Team, annual results will be reviewed and the DCP document will be revised.

2 RESEARCH

Watershed level and state drought mitigation and response plans were reviewed to help develop the NSW DCP Update process. Details in these plans are lacking, though generally, evaluations are conducted on an annual schedule, and as needed to capture post-drought response effectiveness. The watershed-level Blackfoot Drought Response Plan (2010) Committee hosts an annual year end meeting to summarize hydrology, drought plan participation, water conserved, outreach activities, drought plan related issues, and possible changes in approaches. The state-level Colorado Drought Mitigation and Response Planning Committee is convened at least once yearly, to discuss the progress made on mitigation actions, lessons learned from response to drought conditions, drought outlook and preparation needs, and to review the response procedures in the plan (to help to ensure that staffs remain up to date on the activities related to the Mitigation plan and the response procedures) (Colorado Drought Mitigation and Response Plan, 2013). It is anticipated that, at first, evaluations will require more time, but the level of effort will decrease over time.

3 PROCESS

A Working Group of resource management professionals was convened to review and provide feedback on the NSW DCP Update Process. A draft process was circulated to the Working Group, and discussed at a meeting held on January 19, 2017. Feedback was incorporated prior to submitting the draft chapter to the Task Force for review and concurrence. The final list of Working Group participants is provided in Appendix A of the DCP.

4 NSW DCP UPDATE OVERVIEW AND PROCESS

To begin the Update Process, in November of each year, the DCP Update Group will request information from Task Force members that will be used to help review the effectiveness of the DCP and make future adjustments. The Task Force members represent all sectors, and are knowledgeable about changes in their respective fields that may affect future drought planning and response. Members will submit environmental and socio-economic drought impact information from the preceding year, as well as new regulatory and technical information, to the DCP Update Group. The DCP Update Group will use this information to review the Vulnerability Assessment, and recommend any changes in vulnerability to the Management Team and the Monitoring, Mitigation and Response Groups. (After the first year, the DCP

Update group will also review this process.) The groups will then consider this information in their annual evaluations of their respective drought planning elements, and send recommended changes to the Management Team. The Management Team will review, evaluate and compile update recommendations from the groups and may seek feedback from the Task Force. Every five years, the DCP Update Group will review the annual evaluations, and recommend updates to the DCP document for Management Team comment and formal revision.

An overview of this process is provided in Figure 1. Greater detail is presented in Table 1, which includes the timeline, responsible parties (as identified in the Operational and Administrative Framework), and more responsibilities needed to complete annual/post-drought evaluation and 5-year plan revision. The schedule for the process may be adjusted to align with the Marion County Hazard Mitigation Planning process. A suggested process kick-off email from the DCP Update Group to the Task Force is provided in Appendix G-1.

Figure 1: Overview of DCP Update Process

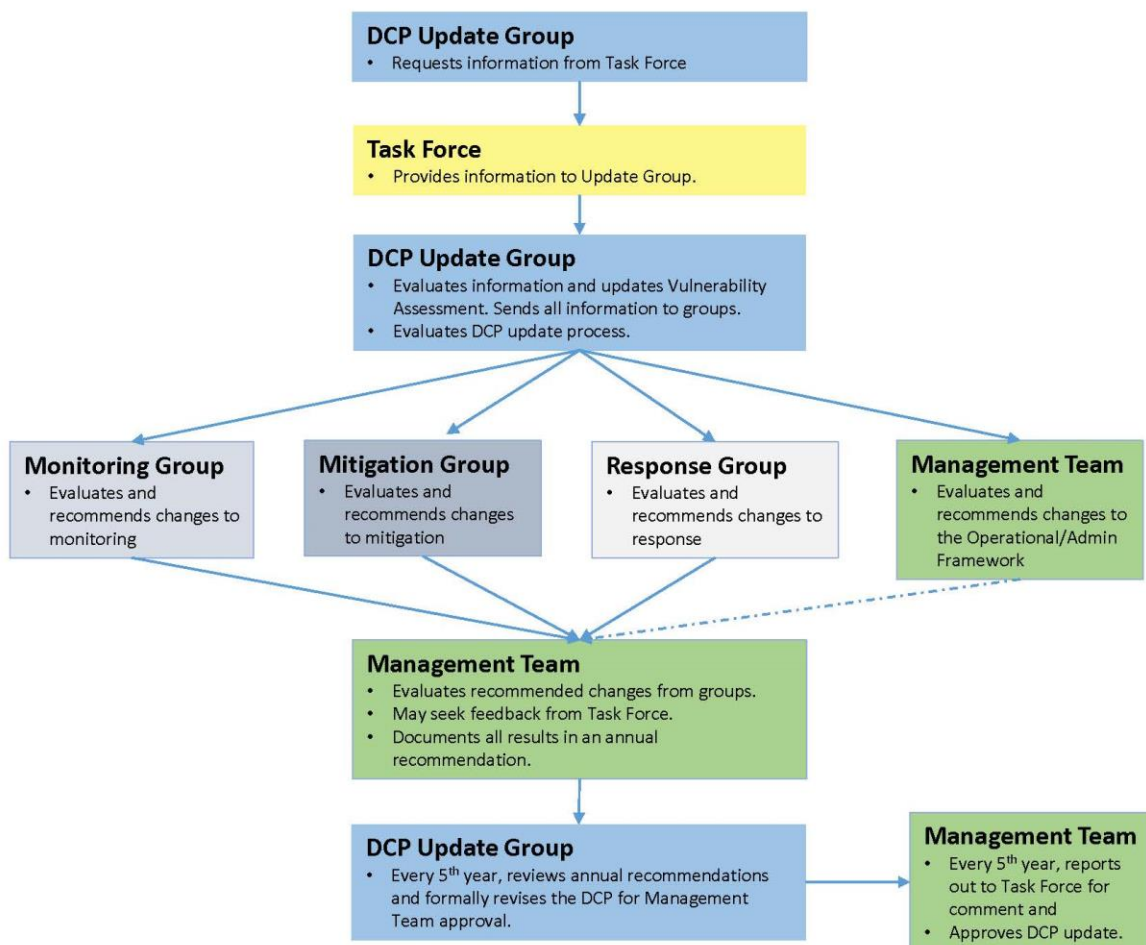


Table 1: DCP Update Process (revised draft)

NSW DCP Update Process: Conduct the following tasks annually/post-drought:			
Timeline	Responsible Group	Responsibilities	Provide information annually to
By Nov. 1	DCP Update Group will	<ul style="list-style-type: none"> Send an email request to the Task Force requesting annual review information for their areas of expertise. 	N/a
By Nov. 15	Task Force members will (by email or meeting)	<ul style="list-style-type: none"> Communicate the following watershed-specific annual review information: <ul style="list-style-type: none"> Environmental, economic and social impacts of drought within the NSW. Address each sector to the extent information is available. New regulations and legislation (e.g., Bi-Op/Reallocation), climate change data and population growth data that may affect water supply resiliency for each sector. New technology or research that may be useful. 	Management team and DCP Update Group
By Nov. 22	DCP Update Group will	<ul style="list-style-type: none"> Update the Vulnerability Assessment <ul style="list-style-type: none"> * Gather and review watershed-specific annual review information from the Task Force. * Update the Vulnerability Assessment as needed, document findings, and communicate to the Monitoring, Mitigation and Response Groups for use in their evaluations. Evaluate how the DCP Update Process is functioning <p><i>Note additional DCP Update Group responsibilities on following page.</i></p>	Management Team and groups
By Dec. 1	Monitoring Group will	<ul style="list-style-type: none"> Evaluate existing indicators and triggers at each stage, and add new or replace if needed. Incorporate new science or watershed information as necessary. Evaluate process for data collection and monthly reporting to the Management Team 	DCP Update Group
By Dec. 1	Mitigation Group will	<ul style="list-style-type: none"> Evaluate information from the DCP Update Group regarding new regulations and legislation, and changes in vulnerability that may affect mitigation needs in the watershed Track status and update each DCP Table 2 Priority Mitigation Action 	DCP Update Group

NSW DCP Update Process: Conduct the following tasks annually/post-drought:			
Timeline	Responsible Group	Responsibilities	Provide information annually to
		<ul style="list-style-type: none"> As Priority Mitigation Actions are completed, evaluate Table 1 Potential Mitigation Actions to elevate to priority status. Identify lead entity, funding sources, etc. Gather information from all sectors to identify new Table 1 Potential Mitigation Actions 	
By Dec. 1	Response Group will	<ul style="list-style-type: none"> Evaluate information from the DCP Update Group regarding new regulations and legislation, and changes in vulnerability that may affect response needs in the watershed Review each DCP Figure 3 Response Action and evaluate effectiveness at improving resiliency in the watershed. Gather information from all sectors. Propose new, changes, or removal of actions as needed. Identify lead entity, funding sources, etc. 	DCP Update Group
By Dec. 15	Management Team will	<ul style="list-style-type: none"> Evaluate how the Operational and Administrative Framework is functioning Review and evaluate all group recommendations for the vulnerability assessment, monitoring, mitigation, response and the DCP update process. Consult Task Force if needed. Document results in annual evaluation. <p><i>Note additional Management Team responsibilities below.</i></p>	DCP Update Group
By Dec. 15	DCP Update Group will	<ul style="list-style-type: none"> Every 5 years, evaluate annual documentation for the last 5 years and prepare updated DCP document. Identify funding needs for the next update cycle so that the necessary resources are in place in advance of the update year. Coordinate with Lead Coordinator to pursue and track funding. 	Management Team
By Jan. 15	Management Team will	<ul style="list-style-type: none"> Every 5 years or as determined necessary, present updated DCP to the Task Force for comment, receive comments, and revise/approve DCP. 	DCP Update Group and Task Force

APPENDIX G-1: UPDATE PROCESS KICK OFF EMAIL TO TASK FORCE

DATE: November 1, 2017

SUBJECT: Annual drought resiliency evaluation and projections

North Santiam Watershed Drought Contingency Plan Task Force members,

Your expertise is requested in improving drought resiliency in the NSW. In 2017, we implemented the first year of the *North Santiam Watershed Drought Contingency Plan*. The DCP includes monthly monitoring, an on-going vulnerability assessment, and projects to mitigate for, and actions to respond to, drought conditions.

As we prepare for the second year of implementation, we are completing an annual evaluation, and would greatly appreciate feedback in your area of expertise for the following:

- To evaluate the year in review: Any environmental, economic and social impacts of drought that you have observed within the NSW. The following supporting information would also be helpful:
 - Research or newspaper articles
 - Photographs
 - Quantified data (e.g., economic loss, field data)
- To adjust future need/vulnerability: Any information that may affect water supply resiliency for each sector (e.g., municipal, commercial irrigation, instream natural resource, water-dependent recreation, individual domestic use):
 - New or updated regulations and legislation
 - Updated information regarding infrastructure and/or water supply
 - Population growth data for your municipality
 - Supporting new technology or research would also be helpful.

This review process will be conducted annually, and Task Force members may be contacted again to help recommend changes to the DCP. After five years, all annual reviews will be evaluated, and a revised NSW DCP will be presented to the Task Force for comment.

Your feedback for this year's evaluation is requested by November 15, 2017.

Thank you in advance for your continued support.

APPENDIX H

Joint Mitigation Actions for Water Supply Resiliency - Implementation Plan

Implementation Plan

Joint Actions for Water Supply Resiliency

Prepared for
**North Santiam Watershed
Drought Contingency Plan Task Force**

March 2018

Prepared by
GSI Water Solutions and David Evans and Associates

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Appendixes

- A Messaging Information
- B Press Release Templates

1. Introduction and Purpose

In May 2017, the North Santiam Watershed (NSW) Drought Contingency Plan (DCP) Task Force approved a DCP to “build long-term resiliency to drought in order to minimize impacts to the communities, local economies, and the critical natural resources within the watershed”. The DCP identified a drought monitoring framework, as well as mitigation and response actions to promote water supply resiliency before and during drought. Most of these actions will be implemented by individual DCP Task Force members; however, eight “new” joint actions will be implemented by the collective DCP Task Force. The purpose of this implementation plan is to provide steps to carry out these joint actions.

The eight new joint actions were identified by DCP stakeholders as important tools for managing water in the NSW that do not currently exist in a programmatic form specific to this basin. They are intended to be developed prior to drought, so that they can be implemented in response to specific, increasing stages of drought (as identified in the monitoring framework). For each joint action, this implementation plan identifies the purpose, process, steps needed to complete the action, potential funding sources, and a schedule to develop these new water supply management tools for the NSW.

2. Joint Actions

Joint Action 1: NSW DCP Education and Outreach

Purpose

The purpose of this joint action is to establish consistent NSW DCP education and outreach communication tools to provide to stakeholders before and during drought. Tools include messaging, press release templates for stages of drought, and a common “brand”. This joint action identifies to whom, what, how, and when drought status information will be disseminated. An established group and communications tools will ensure that relevant information is provided in a timely manner to officials, emergency managers, and the general public.

The desired outcomes of this joint action are:

- Awareness and understanding of the water supply challenges in the NSW
- Credibility and accountability for the DCP monitoring and actions
- Support for implementation of the DCP actions.

Process

NSW DCP education and outreach will be conducted under the Response Group, which is described in the DCP Operational and Administrative Framework. The DCP Administrative Team liaison, assisted by the DCP paid lead, will convene and facilitate a subcommittee and be responsible for its progress. The subcommittee will be composed of municipal, agricultural, natural resource managers, and recreation owners, as these sectors would be expected to benefit from this action. Marion County and City of Salem public information officers and emergency managers already engage multiple sectors in hazard mitigation preparedness, response, and recovery and should participate in this effort to encourage information sharing and message consistency. Cities and counties with separate public health agencies should also involve representatives from these agencies.

The subcommittee will present draft tools to the DCP Administrative Team, which may consult with the DCP Task Force. Comments from the DCP Administrative Team will be incorporated into final tools. Once final, the DCP Response Group will be responsible for overseeing the dissemination of drought communications to the public by working with the regional Public Information Officer (PIO) group (WRAPPIO) and its existing Joint Information Center (JIC) network.

Actions

The subcommittee will:

- (1) **Develop and use a common “brand” for consistency on all communications.** The brand should be recognizable and specific to the DCP and should be used on all materials. The brand could be accompanied by a watershed map indicating where drought conditions are present.
- (2) **Identify the audience, key messages, outlets/contacts, and a schedule for outreach implementation.** An example is provided in Table 1 for Drought Stages 1 and 2. Review the example in Table 1, and use the following information to modify Table 1 (below) as needed and develop additional information for Drought Stages 3 and 4:
 - a. **Communication Audience.** DCP stakeholders include anyone potentially affected by or interested in the DCP, including those actively engaged and those who have interest but may not wish to be actively engaged (e.g., the public, residents in the basin, and other interest groups). Stakeholders include municipalities, irrigation districts, Federal and state agencies, Tribes, business, industry, interest groups (including but not limited to the fishing community, kayakers, flatwater recreationists, and environmental groups), communities, and individuals. Individuals may include groups such as private well owners. At various stages, primary audiences (those that must be reached) may be distinguished from secondary audiences (those that are helpful to reach).
 - b. **Key messages.** Communicate the collaborative, voluntary, and watershed-wide basis for sharing water that is needed to reduce impacts to the health, safety, and welfare of communities, economies, and critical natural resources in the watershed, as identified in the DCP response actions vision (e.g. “it’s all one water,” and “shared pain”). Provide information about the human health and environmental health implications of drought and recommend clear actions to minimize risk/ impacts. Impacts should be characterized by both instream flow and drinking water supply. Messaging guidelines are provided in Appendix A. Develop targeted messages as necessary.
 - c. **Communication outlets and contacts.** Identify as many outlets as possible, including websites (example: <http://www.njdrought.org/>), newspapers, radio, television (e.g., public service announcements), social media, bulletin boards (offices, libraries), presentations to local businesses or group meetings (watershed council), educational programs/schools, cable access channels, and water bill inserts. Identify partners that are willing to include information in their publications and mailings. Document contact information for each.
 - d. **Schedule for disseminating drought communications.** At the request of the DCP Administrative Team, drought communications should be disseminated by the Response Group at each drought stage, and possibly when certain indicators reach identified thresholds. (Certain indicators are more relevant to target audiences.) Consider that certain groups need longer lead time or earlier warning, and incorporate more frequent and detailed updates for those groups if possible (e.g., farmers). Increase the frequency and scope of communication as drought develops.

Table 1: Audience, key messages, outlets/contacts, and outreach schedule, by drought stage

Stage 1/Heads Up	
Primary audience:	Irrigation districts, water-dependent recreation businesses
Key messages:	<ul style="list-style-type: none"> • We are not in a drought yet, but one may be coming. • Many people – residents, businesses, farmers and recreationists – depend on the N. Santiam River. • Here’s how others in the watershed are affected by drought.... • Practice using water wisely. Here’s how (provide examples of wise water use such as in WMCPs, and information about future response action opportunities such as water rights leasing).
Primary outlets:	Local newspaper, partner websites (e.g., NRCS), agriculture newsletters. Use common brand.
Frequency of communications:	Monthly
<i>Initiate Stage 2 communications when boat ramp elevation in Detroit Lake drops below 1,555 feet.</i>	
Stage 2/Moderate drought	
Primary audience:	Irrigation districts, water-dependent recreation businesses, municipalities above Detroit dam (officials, emergency response, and the general public).
Secondary audience:	Municipalities below Detroit dam (officials, emergency response, and the general public), state agencies, all business, industry, interest groups, and individuals, including private groundwater well owners, new residents, and non-English speakers.
Key messages:	<ul style="list-style-type: none"> • Some areas in the watershed are experiencing drought and drought impacts (provide examples). • Here’s how everyone is saving water (provide examples). • Please voluntarily reduce water by 5 percent. Here’s how you can do it (provide examples).
Primary outlets:	Local newspaper, partner websites (e.g., NRCS), agriculture newsletters, radio, bulletin boards (offices, libraries), presentations to local businesses or group meetings (watershed council), educational programs/ schools. Use common brand.
Frequency of communications:	Bi-weekly to primary audience; monthly to secondary audience.

- (3) **Use stage-specific press release templates** for each stage of drought, to keep the public informed and to request or encourage behavior changes, such as voluntary conservation. Templates are provided in Appendix B.

Joint Action 2: Develop A Water Supply Option Agreement Pilot Project

Purpose

The purpose of this joint action is to evaluate the feasibility of including water supply Option Agreements in the NSW Water Rights Management Program toolbox (see Joint Action 3). The Oregon Water Resources Department (OWRD) has not processed an Option Agreement to date; however, the potential exists for this to be a water supply management tool during drought. If deemed feasible, a program will be developed as part of Joint Action 3. If drought has been declared in the county, an Option Agreement enables a water-right holder to enter into an agreement that authorizes the use of water at locations, from points of diversion, and for uses other than those described in the water right (established under ORS 536.077). The Agreement remains in place until terminated by the parties, and provides additional water-supply options in times of drought. This joint action identifies the steps to complete a pilot Options Agreement.

The desired outcome of a water supply Option Agreements Pilot Project are:

- To introduce a state water supply resiliency tool to help mitigate the effects of drought in the NSW.
- To leave water in-stream to provide ecological benefits and to temporarily reallocate water to local governments with vulnerable water rights during drought.

https://www.oregon.gov/owrd/pages/wr/drought_overview.aspx

Option Agreements are intended to have an expedited review process, reduced fee schedule, and to be short-term emergency authorizations, not permanent solutions to deal with water supply challenges. Option agreements must be approved by, and are subject to, the OWRD Director or Commission. The Director must find that the use of water under the proposed option agreement will not cause injury to existing water rights and will not impair or be detrimental to the public interest. Affected parties may file a protest and a hearing may be held.

Though OWRD has not processed any Option Agreement applications, it has identified a review timeline. The Director will provide notice of an application for at least three successive weeks in a newspaper and shall not take action on an application until at least 20 days after the last date the notice appeared in the newspaper. Therefore, processing of Option Agreements begins 6 weeks after OWRD receives an application. Once the Agreement is approved, use of water under the Option Agreement terms may begin only after the declaration of severe, continuing drought has been made by the Governor and lasts until the drought declaration has ended.

Table 2: Option Agreement Basics and Examples

Basics of Option Agreements
<ul style="list-style-type: none"> • Private water agreements formally authorize potential change in use (i.e., locations, points of diversion, or for other beneficial uses) during drought • May not exceed use authorized under the rights involved • Remains in place until terminated by parties • Must provide notice to OWRD • Must be approved by Director or Commission • Cannot cause injury to existing users • Cannot harm public interest
Examples of Potential Option Agreements
<ul style="list-style-type: none"> • One irrigator curtails water use and sells excess to another irrigator to avoid forbearance¹ and crop damage • One municipality allows another to use an established portion of its water right during the drought period when certain needs conditions are triggered • A water right holder temporarily switches points of diversion from a tributary to main stem to improve instream flow • A water right holder temporarily changes the place of use of his/her water right to “instream” to promote instream flows during drought

Since Option Agreements have not yet been implemented, this action focuses on investigating the feasibility of potential Option Agreements and identifying opportunities to improve the application and review process.

Process

Review of this joint action will be under the Mitigation Group, which is described in the DCP Operational and Administrative Framework. A subcommittee will evaluate the feasibility of using this water rights management tool in the NSW.

The DCP Administrative Team liaison, assisted by the DCP paid lead, will convene and facilitate the subcommittee and be responsible for its progress. The subcommittee will be composed of municipal, agricultural, and natural resource managers, as these sectors would be expected to benefit from this action.

The subcommittee will present its findings to the DCP Administrative Team, which may consult with the DCP Task Force. The DCP Administrative Team will make the final determination regarding development of a program for the NSW as part of Joint Action 3.

Actions

The DCP Mitigation Group will:

¹ A forbearance agreement is a contract between private parties where one water user agrees not to exercise his/her right to use water.

- (1) **Conduct a feasibility study.** Determine a viable pilot project for implementing one Option Agreement in the NSW.
- (2) **Conduct research to determine opportunities and constraints** within the rules (690-019-0080). This may involve coordination with OWRD Staff and legal experts.
- (3) **Identify parties.** Determine municipalities and/or irrigators who may be well-suited for and interested in developing an Option Agreement. When approaching potential parties, communication should focus on how an agreement could benefit them individually, rather than benefits to the other party and/or fish and wildlife.
- (4) **Develop and submit the pilot Agreement,** acting as an agent (rather than as a party to the Agreement).
- (5) **Monitor and assess** the efficacy and efficiency of the pilot Agreement, including water right holder satisfaction, clarity of OWRD review process, and analyzing goals and outcomes of the Agreement. (Monitoring should be completed before Agreement is triggered by drought conditions, when the Agreement goes into effect, and after the Agreement period has concluded).
- (6) **Present summary report** of pilot Option Agreement and program evaluation to the DCP Administrative Team.
- (7) **Facilitate integration of Option Agreements** information into education materials and outreach events for water rights management tools (see Joint Action 3).

Joint Action 3: Water Rights Management Program

Purpose

The purpose of this joint action is to establish a framework for managing water rights to promote resiliency to drought and to “share the pain” among use sectors and instream needs. These water rights management tools can be used before and during drought. The key is to have a framework in place and water right holders educated about the options. Moreover, having a fund to facilitate the transactions and potentially compensate water users for foregoing the use of water will likely be a key to successful implementation. Establishing a water rights management program in the NSW will take time, thus these implementation tasks are focused on establishing the groundwork for building trust, educating water users, and identifying the best framework for a program.

The desired outcomes of this joint action are:

- Education of water users about water management tools
- Complete a Pilot “pooled instream lease.”
- Establish a framework and “clearing house” for facilitating certain water management actions that provide water supply (instream and out-of-stream) before or during a drought.
- Establish a fund to compensate water right holders that forego use of water and protect that water instream for ecological purposes.

A suite of water management tools was described in the DCP Response Chapter and are summarized in Table 3. To date, water right holders on the N. Santiam have little

experience with these tools and there is no framework/organization in the basin that promotes activities such as leasing of water rights instream.

Table 3: Water Rights Management Tools

Forebear use	Water rights owners currently have the ability to forbear use of any portion of their water at any time. That is, they can voluntarily stop or reduce their water use during the season to leave more water instream during critical periods to protect vulnerable instream natural resources. Forbearance agreements can outline specific times of year when the water user voluntarily agrees to forego using water and identify any compensation. These agreements do not provide legal instream protection of water from junior users (unlike an instream lease or instream transfer).
Diversion reduction	Water rights owners can sign an agreement to reduce their water use at the point of diversion by a certain amount (cfs) or percentage. Diversion reduction agreements can outline specific time of year or conditions that trigger the diversion reduction agreement, including any compensation. These agreements also do not provide legal instream protection of water from junior users.
Switch to an alternate water source	A separate, or complimentary, option that is currently available is to leave water instream and switch to an alternate water source, such as groundwater or stored water. This response action provides the same benefits as forbearing use, though in certain areas groundwater withdrawals could also impact water levels in neighboring wells or reduce groundwater contributions to instream flow.
Lease water rights (full or split-season leases)	An option that is currently available but rarely used in the N. Santiam is leasing certificated water rights instream. Instream leasing provides water right holders with a voluntary opportunity to leave water instream to protect natural resources when needed, but still protect rights for future beneficial out-of-stream use. (Leasing a water right instream is considered a beneficial use and protects the water right from forfeiture due to non-use). The water is protected instream with the same priority date as the certificate being leased. There are two different types of water rights leases: full and split-season. As part of the <u>full lease</u> , a water rights owner would indicate a specific number of acres that they voluntarily elect not to irrigate for the full season. A <u>split-season lease</u> requires an owner to measure the amount of water used so that the amount of water remaining for instream use can be quantified.
Allocation of Conserved Water	When a water right holder improves their irrigation system efficiency, he/she can apply for an Allocation of Conserved Water. The amount of water “conserved” as a result of upgrades is calculated and divided. A minimum of 25% of the “conserved water” is dedicated instream, while the remaining portion of “conserved water” can be protected instream or used with less restrictions than a standard water right (e.g. no rate limitation, can be “layered” on top of existing water rights, can be moved

	more easily). The original water right is given a reduced duty and rate to reflect new system efficiencies.
Option Agreements	For instream and out of stream. (See Joint Action 2).

Process

The water rights management program will be developed under the Mitigation Group, which is described in the DCP Operational and Administrative Framework.

The DCP Administrative Team liaison, assisted by the DCP paid lead, will convene and facilitate the subcommittee and be responsible for its progress. A subcommittee will be composed of municipal, agricultural, natural resource managers, and recreation owners, as these sectors would be expected to benefit from this action.

The subcommittee will present draft materials to the DCP Administrative Team, which may consult with the DCP Task Force. Comments from the DCP Administrative Team will be incorporated into the materials. Once final, the DCP Mitigation Group will be responsible for overseeing the implementation of the water rights management program.

Actions

The subcommittee will:

- (1) Work in cooperation with OWRD to provide information about water rights management tools to N. Santiam basin water users. Forbearing use and switching to an alternate source are tools that involve individual water users. Water leasing and option agreements may involve multiple water users, therefore, program development is needed to coordinate among users. The “Water Leasing Program” subsection that follows outlines a suggested plan for coordinating use of these water rights management tools.
- (2) Identify any water rights holders in the NSW who have leased their water right instream and contact them to discuss successes and challenges. Incorporate success stories in education materials.
- (3) Conduct targeted outreach meetings with NSW water users and partners (ODA, NRCS) to gather information and promote voluntary use of instream flow restoration tools. Refer to Joint Action 1 for messaging and NSW DCP branding in communications.
 - a. Make efforts to include all use sectors (especially the fishing community, recreation community, and ODFW).
 - b. Include any seasoned instream lessors in outreach meetings to build trust and share successes and challenges.
 - c. When available, include relevant findings of pilot Option Agreement (Joint Action 2) in education materials and fact sheets.

Water Leasing Program:

- (1) Identify a water bank-type framework appropriate for the N. Santiam basin that would facilitate instream leasing and seek funding to establish and (if necessary) incentivize the action by compensating water rights holders. (A water bank is an institution or organization used to facilitate the legal temporary transfer of existing water rights between different water users, typically within the same watershed. A form of water banking already exists in the Deschutes and Klamath Basins. In 2002, irrigation “sellers” in the Upper Klamath Basin were paid \$175 per acre to cease diverting water plus \$125 per acre for the estimated reduction in crop consumptive use, for a total of \$300 per acre. Currently, in the Deschutes Basin, the Deschutes River Conservancy pays approximately \$7 to \$15 per acre-foot of water leased instream, depending on the location). The development of a water bank-type framework may include the following tasks:
 - a. Coordinate with experts (e.g. with the Monitoring Group, the WC, ODFW, and NMFS) to identify specific stream reaches where water aquatic species needs are not being met during periods of drought in the NSW.
 - b. Identify potential implementation of water rights management tools in vulnerable reaches of stream and determine existing relationships and potential gains to water right holders in those areas.
 - c. Assist interested water rights holders in identifying the most beneficial water management tools for benefitting their needs as well as instream needs.
- (2) Work with Santiam Water Control District to implement a pilot-project “pooled instream lease.”
- (3) Develop a contact list of likely/potential instream leasing participants and ensure they are receiving information from the Response Group about water conditions and impending drought.
- (4) Develop a fact sheet to convey details of the water rights management program (e.g. who to contact, pricing, timing) and send to list of likely leasing participants. Messaging should focus on benefits to water right holders, while promoting the message “share the pain.” Include in partner newsletters.

Joint Action 4: WMCPs for Small Communities and Large Water Users

Purpose

Individual water users (such as the city of Salem and the Santiam Water Control District) have water planning documents (such as Water Management and Conservation Plans; WMCP) that contain “curtailment plans” that identify their own response actions for curtailment of water use based on supply shortages. Actions may be for the entity itself and/or its customers. However, individual water user curtailment stages may not align with the watershed-wide defined DCP drought stages. One suggested mitigation action is to align stages in existing curtailment plans with the DCP monitoring framework stages. A related action is to help small communities develop WMCPs that align with the NSW DCP.

The purpose of this joint action is to align all North Santiam water planning documents, to the extent possible, with the actions in the NSW DCP. The desired outcome is improved coordinated response among water users at each drought stage.

Process

This action will be conducted by individual water users in the basin, with assistance and coordination provided by the DCP paid lead. To align existing North Santiam water planning documents, each water user will identify and review its own documents and align response actions with those in the NSW DCP at each drought stage. This may involve developing a schedule and plan for aligning actions over time. For new water planning documents, the DCP paid lead will provide coordination to small communities in terms of identifying funding sources and alignment of curtailment actions. The paid lead will update the NSW DCP Administrative Team as needed.

Actions

For all North Santiam Water users:

- (1) Identify all planning and regulatory documents (e.g., water conservation and management plans, water system master plans, ordinances, curtailment plans, etc.) within their own jurisdiction.

For North Santiam water users with existing planning documents, each water user will:

- (2) Review and compare drought stages in existing planning documents to NSW DCP drought stages. Be sure to understand the monitoring indicators and triggers of each drought stage, rather than the drought stage number, to ensure the appropriate drought conditions are compared.
- (3) Outline triggers for response actions under existing plans and compare these to NSW DCP response action triggers.
- (4) Outline curtailment actions under existing plans and compare these to NSW DCP curtailment actions. Identify curtailment actions that are unique to each plan.
- (5) Evaluate drought stage triggers in existing plans that can be streamlined to match NSW DCP triggers.
- (6) Evaluate whether response actions in existing plans can be “moved” to another drought stage to align with the NSW DCP, and create a schedule for doing so (e.g., with next WMCP update, at July city council meeting, etc.).
- (7) Add new actions from the NSW DCP to existing planning documents. Inform the DCP paid lead of successful actions in existing plans that should be added during the DCP update process.

For North Santiam water users that do not have WMCPs, paid lead will:

- (2) Convene small communities in the basin to discuss existing drought response actions and curtailment plans.
- (3) Develop a curtailment plan template that aligns with the NSW DCP.
- (4) Work with small communities to identify funding to develop a comprehensive WMCP.

Joint Action 5: Critical Infrastructure for Small Cities

Purpose

The purpose of this joint action is to work with small communities to identify and implement water system infrastructure improvement projects that improve drought resiliency. Small cities in the watershed may not have the staff capacity to identify opportunities, seek funding, and design projects. Critical infrastructure may include projects that: reduce the need for water, reuse water, reduce system water losses, provide redundant water sources (e.g., through interconnections), and store water during periods of abundance for use during drought. Marion County is already working with some of the small communities in the canyon area to assist them with this action during Natural Hazard Mitigation Planning process. Other communities outside of Marion County should be included in this action.

The desired outcomes of this joint action are:

- Awareness of funding opportunities for technical assistance and implementation of resilient water supply infrastructure.
- Successful completion of water system infrastructure improvements that create more drought resilient communities.

Process

The critical infrastructure action will be conducted under the Mitigation Group, which is described in the DCP Operational and Administrative Framework.

Marion County, assisted by the DCP paid lead and the Mitigation Group, will be responsible for the progress of this action. County staff may communicate with Linn County staff about leading progress for cities in that county (e.g., Lyons-Mehama).

Actions

- (1) **Educate communities about drought risk, potential water supply resiliency projects, and funding opportunities.** Identify local city contacts, or when available, provide information to the steering committees identified for the region-specific Santiam Canyon Regional Hazard Mitigation Plan (RHMP)².
- (2) **Assist with funding.** For high priority system improvements, assist small communities with identifying enough information (e.g., pre-designs, work scopes and budgets) to seek funding. Assist with identifying potential funding sources (grants, loans, etc.) and completing applications if necessary. The Governor's Drought Task Force has recommended that the Legislature develop a drought emergency fund that may be a source, as well as identify existing infrastructure funding programs and barriers to accessing them. Funding sources may be specific to conducting feasibility studies, project implementation, or both.

² These steering committees include city staff, county representatives, members of the public, and emergency service management. City recorders are the designated conveners of the NHMP and lead in implementing, maintaining, and updating the addendum to the Marion NHMP in collaboration with Marion County Emergency Management.

(3) **Assist with feasibility studies, design, and implementation.** Assist communities with completing the technical analyses, engineering specifications, permits, refined budgets and schedules needed for project construction. Communicate with local and state agencies to obtain permits, approvals, etc. If needed, assist small communities with additional funding requests for implementation, developing requests for proposals for contractors, and with overseeing project construction.

Joint Action 6: NSW Water Budget Study

Purpose

Water budget studies help understand where, when, and how much water is flowing into and out of a watershed, and are useful tools to understand how much is available at any given time. The U.S. Geological Survey³ explains that “Water budgets account for the inputs, outputs, and changes in the amount of water by breaking the water cycle down into components. They provide scientific measurements and estimates of the amount of water in each component and calculate the movement of water among the different components – the flux or flow of water. The result is a budget that is a hydrologic record comparable to deposits, withdrawals, and changes in the balance of a checking account.”

The desired outcomes of this joint action are to:

- Understand how much water is available to meet needs in the NSW.
- Understand stresses to the water system to identify opportunities for resiliency projects.

Process

As noted above, the water budget is a useful tool for understanding the amount of water available at any given time. The Mitigation Group DCP Administrative Team liaison, assisted by the DCP paid lead, will identify volunteers or potential funding opportunities to develop a NSW water budget. Municipal, agricultural, natural resource managers, and recreation owners, as these sectors would be expected to benefit from this action. Results would be presented to the DCP Administrative Team, which may consult with the DCP Task Force. Comments from the DCP Administrative Team would be incorporated into the final water budget.

Actions

- (1) **Review existing studies** for references to water budget.
- (2) **Identify the conceptual water model for the NSW and the water budget equation.** An accounting of the inflow, outflow, and changes in storage is called a water budget. Typically, the equation is:

$$\text{Inflow} = \text{Outflow} \pm \text{change in Storage}$$

³ <https://water.usgs.gov/watercensus/water-budgets.html>

The complexity of a water budget increases with increasing watershed urbanization and interbasin transfer of water.

- (3) **Identify the time frame for data.** Water budgets are typically calculated for cover a period of time and a range of conditions to represent wet and dry years.
- (4) **Identify data sources.** Data can be obtained from long-term meteorological and hydrological data collection stations and from water-use data collected by regulatory agencies. Potential sources include:

- a. Precipitation, evapotranspiration, and streamflow. The USGS Water Budget Program provides annual, monthly and daily data at the N. Santiam basin level (8-HUC). <https://cida.usgs.gov/nwc/#!waterbudget/huc/17090005>

Precipitation data are also available from National Oceanic and Atmospheric Administration (NOAA) precipitation stations in or near each watershed. If multiple stations are available, using GIS, Thiessen polygons may be used to extrapolate the data over the entire watershed (Sloto & Buxton, USGS 2005).

It may be useful to look specifically at the May-Sep rainfall to determine what years to analyze.

- b. Evaporation. If evaporation is a significant issue, weather stations collect evaporation pan data, which should be multiplied by a coefficient to obtain an estimated value. Evaporation data are tabulated for each month, or the growing season of May-October, then the higher value is used in the water budget.
- c. Groundwater flow (ft³/day) can be estimated using Darcy's Law. Data needed for this calculation includes hydraulic conductivity of the soil, the width and saturated thickness of the aquifer, and the slope of the groundwater head contours. Net groundwater loss from unconfined to confined aquifers may be determined by using groundwater flow-model simulations.
- d. Change in surface water and groundwater storage. Annual change in groundwater storage may be estimated from water-level records from USGS observation wells. If monthly groundwater levels are available, the annual change in water level can be calculated by subtracting the December water level from the previous year's December water level, converting the difference to inches, and multiplying by the result by the specific yield of the aquifer (Sloto & Buxton, USGS 2005).
- e. Change in snow and ice storage may be available from NRCS.
<https://www.nrcs.usda.gov/wps/portal/nrcs/main/or/snow/>
- f. Compile water rights information to determine withdrawals and interbasin transfers. If relevant, and not accounted for elsewhere, these data should be quantified and added to the water budget equation.

- (5) **Compile all data and links to source information in a spreadsheet.** An example is provided in the inset Table 2 from Sloto & Buxton (USGS 2005).

Table 2. Basin water budget for the East Branch Brandywine Creek watershed, Chester County, Pennsylvania, 1977-2001.

[All units are given in inches]

Year	Precipitation (P)	Imported water (IMP)	Streamflow (SF)	Change in ground-water storage (Δ GWS)	Change in surface-water storage (Δ SWS)	Ground-water exports (GWEXP)	Consumptive use (CON)	Evapotranspiration (ET) and errors
1977	49.86	0.31	20.50	1.76	0.08	0.00	0.16	27.67
1978	51.61	.44	29.64	-.55	-.36	.00	.16	23.16
1979	59.50	.50	34.26	.13	-.06	.00	.19	25.48
¹ 1980	35.41	.39	15.52	-3.31	.18	.00	.17	23.24
1981	39.03	.43	9.74	-.18	.00	.00	.17	29.73
1982	45.27	.51	20.56	1.80	-.35	.00	.17	23.60
1983	57.01	.68	30.95	3.30	.56	.00	.19	22.69
1984	53.66	.82	33.31	-2.83	-.42	.00	.18	24.24
1985	44.11	.58	15.10	.98	.09	.00	.21	28.31

- (6) **Identify data gaps and uncertainties.** Errors in water budget terms can be caused by missing data, poor or incomplete measurements, overestimated or underestimated quantities, measurement or reporting errors, and the use of point measurements, such as precipitation and water levels, to estimate an areal quantity, particularly if the watershed is hydrologically or geologically complex or the data-collection station is outside the watershed (Sloto & Buxton, USGS 2005).
- (7) **Summarize in a technical memo.**

Joint Action 7: Incorporate NSW DCP into Willamette Basin Project Review

Purpose

The USACE owns and operates thirteen reservoirs in the Willamette Basin, 42 miles of revetments, and five fish hatcheries, collectively called the “Willamette Project.” Also involved in the Willamette Project are Bonneville Power Administration (BPA) and the U.S. Bureau of Reclamation (BOR), which issues contracts for stored water for the purpose of irrigation. Together, the USACE, BPA, and BOR are the “Action Agencies.” In 2008, National Marine Fisheries Service (NMFS) issued a Biological Opinion (Bi-Op), which outlines actions (referred to as “reasonable and prudent alternatives” or RPAs) that these three “Action Agencies” must take to avoid harm to thirteen aquatic species listed under the Endangered Species Act, including the two most affected species, the Upper Willamette River Chinook salmon and the Upper Willamette River steelhead and their critical habitat.

One of the steps the Action Agencies must take includes conducting research on the effects of the project, monitoring those effects, and evaluating options. Research will be conducted by two main teams: the WATER committee (federal and state agencies, Tribes, and local interests), which will review research and make recommendations to the USACE, and the

Willamette System Review Study, which will synthesize information regarding the feasibility and benefits of various mitigation measures. Concerns on the North Santiam include dams that block fish migration, habitat and water quality, floodplain connectivity, and “the irrigation water contract program [that] would reduce streamflow,” (Willamette Project Bi-Op, 2008). Actions required by the Bi-Op include implementing improved water temperature control downstream of Detroit/Big Cliff Dam through operational changes and possible structural modifications by 2018, possible amendments to flow requirements, protection of water released for fish conservation purposes, irrigation diversion screens, and reduction of new water contracts.

The success of these actions and the health of the listed species and critical habitat will be reassessed in 2023. The goal of this action is to communicate NSW DCP mitigation success and monitoring efforts to the Action Agencies so that mitigation efforts are incorporated into ongoing research and reassessment of the Willamette Project’s impact on the listed species.

Process

Joint Action 7 includes incorporating the NSW DCP into ongoing research that informs the Action Agencies and NMFS and will be conducted by the DCP paid lead. The DCP paid lead will communicate with the Action Agencies to remain updated on Bi-Op studies and revision of RPAs. The DCP lead will also communicate NSW DCP’s mission, framework, and accomplishments to the Action Agencies and update the DCP Administrative Team on Bi-Op developments that impact NSW DCP stakeholders.

Actions

- (1) **Establish communication with Action Agencies** to introduce NSW DCP planning and mitigation efforts. Identify an effective Action Agency liaison between Action Agencies and DCP paid lead, which may include a member(s) of the WATER study team or Willamette System Review Study Team.
- (2) Identify and **subscribe to list serves** that communicate Bi-Op updates and public meeting details.
- (3) **Communicate with Action Agencies** or identified point of contact monthly to track development of Bi-Op studies and developments. When possible, utilize update materials created by the DCP Update Group.
- (4) **Report relevant updates to DCP Administrative Team** during monthly meetings. If applicable, MT liaisons communicate to the Mitigation Group mitigation actions that may be preferred by NMFS.
- (5) **Share NSW DCP successes** to the Action Agency liaison.
 - a. Monthly- share monitoring reports.
 - b. Annually-share NSW DCP Update Group Report and summary of successful implementation of Mitigation Group efforts and Response Group efforts.
 - c. If needed, coordinate with Monitoring Group and Mitigation Group to ensure reports are compatible with Bi-Op study team data collection.
- (6) In the event of a drought declaration, establish a reasonable frequency of communication with Action Agency liaison to **understand how drought declaration impacts implementation of the Bi-Op**.
 - a. Report updates to Response Group.

- (7) If necessary, **attend meetings to follow Bi-Op** development.

Joint Action 8: Expand Emergency Drought Tool Usage

Purpose

The purpose of this joint action is to expand the implementation of drought emergency water rights tools (i.e., temporary transfers of water rights, emergency water use permits, and use of existing right option/agreement) and to expand the flexibility of drought tools available during a governor declared drought.

A Governor's drought declaration enables counties to benefit from emergency streamlined water rights programs, groundwater usage, and other programs⁴. These programs include the ability to obtain: an emergency water use permit to replace water not available under an existing water right; temporary drought transfers to temporarily change water rights type of use, place of use and point of diversion; temporary drought instream leases; and temporary substitution of a supplemental groundwater right for a primary surface water right.

Process

Expanding emergency drought tool usage will be accomplished by the DCP paid lead and includes broad communication efforts with the Mitigation Group and the DCP Administrative Team. This also includes sharing successes of the DCP to federal agencies, state agencies, and water managers located outside of the North Santiam.

Actions

- (1) Work with OWRD and Governor's Office to identify whether the Option Agreement Pilot could be implemented in the absence of a governor declared drought.
- (2) During drought declaration, coordinate with the Mitigation Group to maintain a record of drought tools that were implemented. Assist Mitigation Group with periodic review of the status and effectiveness of joint mitigation actions.
- (3) Report to OWRD and Governor's Office a summary of periodic review of status and effectiveness of joint mitigation actions. At a minimum, during drought declaration and after declaration has ended, report to OWRD and Governor's Office the results of drought tool implementation.
- (4) Annually: Analyze DCP Update Group report to determine the effectiveness of Mitigation Team actions, Response Team actions, and Joint Action Implementation Plan progress report.
 - a. Identify common barriers to using drought tools.
 - b. Identify success and challenges of using drought tools.
- (5) May-October: Determine when drought tool usage could expand. Analyze monthly monitoring reports and Mitigation Group updates to maintain a record of days or extended periods of time when drought tools would improve water management, but tools could not be implemented due to lack of a governor's drought declaration).
 - a. Identify which tools that would have been useful and in what capacity.
 - b. Report to OWRD and Governor's Office a summary of analysis.

⁴ https://www.oregon.gov/OMD/OEM/fin_rec/docs/drought/drought_procedures.pdf (2014)

- (6) Ongoing: Identify available funds that prioritize communities with established drought mitigation plans.
- (7) Showcase drought plan successes with OWRD, Governor, and other stakeholders in the region (appropriate venues include regional conferences and public meetings).

3. Potential Funding Sources

This chapter includes grant or loan programs from federal agencies, state agencies, and private entities, including EPA's State Revolving Fund, Federal Emergency Management Agency's (FEMA's) Hazard Mitigation or Public Assistance Programs, and the U.S. Department of Agriculture's Rural Development Loan & Grant Program. Check agency websites or with local officials for eligibility requirements and applications.

Funding Source	Funding Entity	Eligible projects
Acres for America	National Fish and Wildlife Foundation	Primarily intended to conserve acreage, but projects that "Provide a Range of Ecological Services: are a priority: Projects that can demonstrate or even quantify the ecological services provided or protected through land protection (i.e., protecting drinking water, increasing stream flow for aquatic resources, reducing carbon) are preferred.
Bring Back the Natives/More Fish	National Fish and Wildlife Foundation	Provides funding to projects that identify measureable conservation outcomes for native fish species of special concern, including those that address habitat alteration, lack of adequate in-stream flows, and invasive and/or non-native species.
Clean Water State Revolving Fund Program	OR Department of Environmental Quality (funded through US Environmental Protection Agency)	Loans and bond purchase agreements are available for planning, design, and construction projects. Eligible projects include: Wastewater facility plans and studies; Wastewater treatment facilities; Facilities related to solids treatment, disposal, resource recovery or management; Irrigation improvements; Infiltration and inflow correction; Replacement or repair of interceptor or collector sewers; Stormwater facilities, systems or projects; Onsite wastewater system repairs; Estuary management activities; Various nonpoint source projects (stream restorations, animal waste management, conservation easements); Wastewater reuse projects; Qualified brownfields projects.

Funding Source	Funding Entity	Eligible projects
Climate Resilient Mitigation Activities	FEMA	<p>Activities are: Aquifer Storage and Recovery, Floodplain and Stream Restoration, Flood Diversion and Storage, and Green Infrastructure Methods. These activities can mitigate any natural hazard; however, are focused on mitigating the impacts of flood and drought conditions:</p> <p>https://www.fema.gov/media-library/assets/documents/110202</p>
Columbia Basin Water Transactions Program	National Fish and Wildlife Foundation	To enhance stream flow, the Columbia Basin Water Transactions Program (CBWTP) works through locally based entities to acquire water rights voluntarily from willing landowners. Using temporary and permanent water rights acquisitions and other incentive-based approaches, the CBWTP supports program partners in Oregon, Washington, Idaho, and Montana to assist landowners who wish to voluntarily restore flows to key fish habitat.
Community Development Block Grant	Oregon Infrastructure Finance Authority	For "non-metropolitan cities and counties in rural Oregon". Funds preliminary engineering and planning - water master plans, wastewater facilities plans, water conservation and management plans, inflow and infiltration studies. Final engineering - preliminary engineering reports, studies.
Community Facilities Direct Loan & Grant Program in Oregon	US Department of Agriculture - Rural Development	Provides affordable funding to develop essential community facilities in rural areas. Funds can be used to purchase, construct, and / or improve essential community facilities, purchase equipment and pay related project expenses.
Conservation Innovation Grants	US Department of Agriculture - National Resources Conservation Service	Projects support the development and adoption of innovative conservation approaches and technologies, while also aiding agricultural production. Proposed projects must occur within Oregon and may be county-based or statewide in scope. Must involve farmers who are Environmental Quality Incentives Program eligible.

Funding Source	Funding Entity	Eligible projects
Conservation Partners Program	National Fish and Wildlife Foundation	Eligible projects should improve the efficiency of on-farm irrigation practices and provide quantifiable benefits to instream flows through a state approved transfer or some other form of enforceable agreement. Projects should be located in priority anadromous salmonid streams in California, Oregon, Washington and Idaho and should benefit stream reaches where insufficient instream flows are identified as a key limiting factor for fish survival by a state or federal agency, Conservation practices that promote instream flows and water quality in freshwater systems, Conservation planning on agricultural lands that restore stream flows while maintaining or balancing crop yields, Conservation planning on agricultural lands that promote and facilitate conservation best practices including irrigation efficiencies and other conservation agricultural practices that benefit freshwater systems and promotes water conservation, Integrate Farm Bill funding into whole farm planning efforts aimed at producing better water quality.
Developing the Next Generation of Conservationists	National Fish and Wildlife Foundation	Funds paid internships and mentorship of underserved youth to perform hands-on implementation of habitat restoration, stewardship, monitoring, and other conservation-related activities.
Drinking Water Providers Partnership - Source Water Initiative	GEOS Institute - Working Waters Program	Restore and protect the health of watersheds which communities depend upon for drinking water while also benefiting aquatic and riparian ecosystems, including the native fish that inhabit them. Support local partnerships between drinking water providers, landowners, and restoration practitioners.
Emergency Community Water Assistance Grants	US Department of Agriculture - Rural Development	This program helps eligible communities prepare for, or recover from, an emergency that threatens the availability of safe, reliable drinking water for households and businesses.

Funding Source	Funding Entity	Eligible projects
Emergency Conservation Program	US Department of Agriculture	Helps farmers and ranchers to repair damage to farmlands caused by natural disasters and to help put in place methods for water conservation during severe drought by giving ranchers and farmers funding and assistance to repair the damaged farmland or to install methods for water conservation.
Emergency Watershed Protection Program	US Department of Agriculture - National Resources Conservation Service	Address debris-clogged streams, restore streambanks, flood storage and flow, erosion control. Private landowners participate through a sponsoring municipality.
Environmental Infrastructure Loans - Construction	Rural Community Assistance Corporation	Water, wastewater, solid waste and storm facilities that primarily serve low income rural communities. Includes predevelopment costs.
Environmental Infrastructure Loans - Feasibility and Predevelopment	Rural Community Assistance Corporation	Water and/or wastewater planning; environmental work; and other work to assist in developing an application for infrastructure improvements.
Environmental Infrastructure Loans - Intermediate Loans	Rural Community Assistance Corporation	Water, wastewater, solid waste and storm facilities that primarily serve low income rural communities. Includes predevelopment costs.
Environmental Quality Incentives Program	US Department of Agriculture - National Resources Conservation Service	Provides financial and technical assistance to agricultural producers to plan and implement conservation practices that improve soil, water, plant, animal, air and related natural resources on agricultural land and non-industrial private forestland. May also help producers meet Federal, State, Tribal, and local environmental regulations.

Funding Source	Funding Entity	Eligible projects
Environmental Sustainability Grants	National Science Foundation	The goal of the Environmental Sustainability program is to promote sustainable engineered systems that support human well-being and that are also compatible with sustaining natural (environmental) systems. These systems provide ecological services vital for human survival. Research efforts supported by the program typically consider long time horizons and may incorporate contributions from the social sciences and ethics. The program supports engineering research that seeks to balance society's need to provide ecological protection and maintain stable economic conditions (includes innovations in management of storm water, recycling and reuse of drinking water).
Feasibility Study Grants	Oregon Water Resources Department	Fund qualifying costs of studies that evaluate the feasibility of a proposed conservation, reuse, or storage project: water needs analyses, hydrologic analyses, engineering and financial feasibility studies, geologic analyses, water exchange studies, analyses of by-pass, optimum peak, flushing and other ecological flows of the affected stream and impact on flows, environmental impacts and public benefits.
Five Star and Urban Waters Restoration Grant Program	National Fish and Wildlife Foundation	Funding priorities for this program include: On-the-ground wetland, riparian, in-stream and/or coastal habitat restoration (and others).
Focused Investment Partnerships	Oregon Watershed Enhancement Board	Capacity building funds to develop a strategic action plan for a partnership or implementation funds to address restoration; must be in a specific geography and address one of the ecological priorities (includes several wetlands habitats, aquatic habitat).
Land and Water Acquisitions	Oregon Watershed Enhancement Board	Grants for land and water acquisitions to protect and restore watersheds.

Funding Source	Funding Entity	Eligible projects
National Rural Water Association Revolving Loan Fund	National Rural Water Association - Oregon Association of Water Utilities	The Rural Water Revolving Loan Fund (RWRLF) is a funding program specifically designed to meet the unique needs of small water and wastewater utilities. The RWRLF provides low-cost loans for short-term repair costs, small capital projects, or pre-development costs associated with larger projects. Eligible Projects: Pre-development (planning) costs for infrastructure projects, Replacement equipment, system upgrades, maintenance and small capital projects; Energy efficiency projects to lower costs and improve system sustainability; Disaster recovery or other emergency loans are available.
Nonpoint Source Pollution 319 Grants	Oregon Department of Environmental Quality	Projects that will lead to the restoration of beneficial uses in impacted water bodies. Funds projects that address nonpoint source water quality and watershed enhancement. Address the short and long term NPS priorities. Long term priorities are included in the Oregon Water Quality Nonpoint Source Management Plan. Short term priorities are included in the annual request for proposals (RFP) document.
Open Solicitation Grants	Oregon Watershed Enhancement Board	Grants for watershed restoration, technical assistance (design, action planning, landowner recruitment), monitoring, and outreach associated with restoration.
Oregon Tribal Grant	Spirit Mountain Community Fund	Project areas include: environmental preservation (see announcement for further details), <\$150K, one grant per tribe per year.
Pollution Control Bonds	OR Department of Environmental Quality	Funds very large pollution control projects, including wastewater and solid waste facilities (see Clean Water State Revolving Fund Program, above).
Pre-disaster Mitigation Grants	US Federal Emergency Management Agency	Awards planning and project grants to address climate resilient mitigation activities, aquifer storage and recovery, floodplain and stream restoration, flood diversion and storage and stormwater management and flood control measures.

Funding Source	Funding Entity	Eligible projects
Public Works and Economic Adjustment Assistance Program	US Economic Development Administration	The Economic Development Administration's mission is to help economically distressed communities in ways that help them build long-term economic development capacity. Projects must foster the creation or retention of higher-skilled, higher-wage employment opportunities for local displaced workers and attract private-sector capital investment.
Rural Energy for America Program	US Department of Agriculture - Rural Development	Provides guaranteed loan financing and grant funding to agricultural producers and rural small businesses to purchase or install renewable energy systems or make energy efficiency improvements (includes irrigation motors).
Safe Drinking Water Revolving Loan Fund (aka Drinking Water State Revolving Fund)	Oregon Health Authority/Infrastructure Finance Authority (funded through US Environmental Protection Agency)	Drinking water system projects must resolve existing or future non-compliance with current or future state and federal drinking water standards, that addresses the most serious human health risks, or that is essential to create a new drinking water system improvement that will substantially benefit public health. <i>Eligible Activities:</i> Planning, engineering, design, water source construction, land or easement acquisition, treatment, storage, transmission/distribution, system purchase, system consolidation, system creation, system security, restructuring. <i>Ineligible Activities:</i> Dams or rehabilitation of dams, water rights, raw water reservoirs or rehab of raw water reservoirs, projects primarily needed to address fire protection, and projects primarily needed to serve future population growth.
Safe Drinking Water Revolving Loan Fund (aka Drinking Water State Revolving Fund)	Oregon Health Authority (OHA) / Infrastructure Finance Authority (funded through US Environmental Protection Agency)	Projects that lead to risk reduction within a delineated source water area or that would contribute to a reduction in contaminant concentration within the drinking water source.

Funding Source	Funding Entity	Eligible projects
Safe Drinking Water Revolving Loan Fund (aka Drinking Water State Revolving Fund)	Oregon Health Authority (OHA) / Infrastructure Finance Authority (funded through US Environmental Protection Agency)	Projects that include planning activities that promote sustainable water infrastructure. Priority will be given to those systems serving fewer than 300 service connections and/or are considered disadvantaged communities. Eligible Activities: feasibility studies, asset management plans, system partnership studies, resilience plans, water rate analysis, leak detection studies, and water system master plans for systems with fewer than 300 connections.
Secure Rural Schools and Community Self-Determination Act, 2015-2017 Projects, Oregon (SRS)	US Department of the Interior	The project must benefit Federal lands or resources. A resource advisory committee, made up of local citizens and responsible for a specific geographic area, reviews the project applications and recommends to the Secretary, or designee, which should be funded. Such projects shall enjoy broad-based support with objectives that may include, but are not limited to: Road, trail, and infrastructure maintenance or obliteration; Soil productivity improvement; Improvements in forest ecosystem health; Watershed restoration and maintenance; Restoration, maintenance and improvement of wildlife and fish habitat.
Special Evaluation Assistance for Rural Communities and Households Program	US Department of Agriculture - Rural Development	Water and/or wastewater planning; preliminary engineering reports, environmental reports, and other work to assist in developing a project that is expected to be funded by Rural Development in the next 12-18 months.
Special Public Works Fund	Oregon Infrastructure Finance Authority	The Special Public Works Fund provides funds (loans and grants) for publically owned facilities that support economic and community development in Oregon. Includes storm drainage, wastewater and water systems.
Technical Assistance Grants	Oregon Department of Land Conservation and Development	Has funded planning for water and/or wastewater public facilities planning in the past.

Funding Source	Funding Entity	Eligible projects
Water and Waste Disposal Predevelopment Planning Grant	US Department of Agriculture - Rural Development	Water and/or wastewater planning; preliminary engineering reports, environmental reports, and other work to assist in developing a project that is expected to be funded by Rural Development in the next 12-18 months.
Water Environmental Programs Direct Loan & Grant Program	US Department of Agriculture - Rural Development	Pre-construction & construction associated with constructing, repairing, or improving water, sewer, solid waste or storm wastewater disposal facilities.
Water Infrastructure Finance and Innovation Act	US Environmental Protection Agency	Eligible projects: Wastewater conveyance and treatment projects that are eligible for the Clean Water State Revolving Fund (see below); Drinking water treatment and distribution projects that are eligible for the Drinking Water State Revolving Fund; Enhanced energy efficiency at drinking water and wastewater facilities; Brackish or seawater desalination, aquifer recharge, and water recycling projects; Acquisition of property if it is integral to the project or will mitigate the environmental impact of a project; Bundled State Revolving Fund projects submitted under one application by an State Revolving Fund program; A combination of projects secured by a common security pledge.
Water Project Grants and Loans	Oregon Water Resources Department	This account provides grants and loans to evaluate, plan, and implement instream and out-of-stream water projects that have economic, environmental and social/cultural benefits. Eligible projects include, but are not limited to conservation, reuse, above-ground storage, below-ground storage, streamflow protection or restoration, water distribution, conveyance or delivery systems, and other water resource development projects that result in economic, environmental, and social/cultural public benefits.

Funding Source	Funding Entity	Eligible projects
Water/Wastewater Agency Response Network (WARN)		<p>A mutual aid program. Can provide in-kind services to help with repairs and resource loans for personnel or equipment.</p> <p>https://www.epa.gov/sites/production/files/2016-03/documents/epa_drought_response_and_recovery_guide.pdf</p>
Water/Wastewater Financing Program	Oregon Infrastructure Finance Authority	The proposed project must be owned and operated by a public entity as listed above. Allowable funded project activities may include: reasonable costs for construction improvement or expansion of drinking water system, wastewater system or stormwater system; water source, treatment, storage and distribution; wastewater collection, treatment and disposal facilities; stormwater system; purchase of rights of way and easements necessary for construction; design and construction engineering; or planning/technical assistance for small communities.
Watershed and Flood Prevention Operations	US Department of Agriculture - National Resources Conservation Service	Funds planning and implementation of watershed projects for watershed protection; flood mitigation; water quality improvements; soil erosion reduction; rural, municipal, industrial water supply; irrigation; water management; sediment control; fish and wildlife enhancement; hydropower. Can also request funding for upgrades and operations.
WaterSMART Grants: Small-Scale Water Efficiency Projects	US Bureau of Reclamation	This Funding Opportunity Announcement supports specific small-scale water efficiency projects that have been prioritized through planning efforts led by the applicant.
WaterSMART Grants: Water and Energy Efficiency Grants	US Bureau of Reclamation	The objective of this Funding Opportunity Announcement is to invite eligible applicants to leverage their money and resources by cost sharing with Reclamation on projects that seek to conserve and use water more efficiently, increase the use of renewable energy and improve energy efficiency, benefit endangered and threatened species, otherwise support water sustainability benefits, or carry out other activities to address climate-related impacts on water or prevent any water-related crisis or conflict.

Funding Source	Funding Entity	Eligible projects
WaterSMART Grants: Water Marketing	US Bureau of Reclamation	Through this funding opportunity, Reclamation will provide grants to conduct planning activities in developing a water marketing strategy to establish or expand water markets or water marketing transactions.
Willamette River Initiative	Meyer Memorial Trust	Grants to watershed councils, land trusts and other groups to develop restoration plans, cultivate partnerships with public and private landowners, and implement on-the-ground projects.

4. Schedule

An example schedule framework to complete the joint actions identified in this plan can be divided into two tiers: improving response tools, and improving integration and efficiency.

Tier 1 actions immediately expand drought response options and build resiliency, and include:

Action 1: NSW DCP Education and Outreach Partnership

By 12/17	Develop NSW DCP Brand, communication audience and key messages
By 3/18	Identify communication outlets and contacts; Determine schedule for disseminating drought communications
By 5/18	Begin disseminating education materials
Ongoing	Disseminate education materials and coordinate with monitoring team for drought stage updates

Action 2: Water Supply Option Pilot Agreement

By 12/17	Conduct feasibility study to determine a viable project
By 3/18	Identify parties to be involved in Pilot Agreement
By 6/18	Develop plan for Pilot Agreement
By 9/18	Submit Pilot Agreement to OWRD
Ongoing	Monitor and assess efficacy of Pilot Agreement.
By 9/19	Report results of Pilot Agreement to DCP Administrative Team

Action 3: Water Rights Management Program

By 12/17	Develop fact sheet about water right management tools and establish contact list for pilot leasing project
By 3/18	Establish framework for pilot pooled instream lease with SWCD
By 9/18	Implement and monitor success of pilot pooled instream lease
By 9/18	Conduct targeted outreach meetings with NSW water users and partners
By 12/19	Develop contact list of potential instream leasing participants

Action 4: WMCPs for Small Communities and Large Water Users

By 12/17	Request that all North Santiam Water managers identify planning and regulatory documents within their jurisdiction
By 2/18	Review and compare drought stages in existing planning documents
By 4/18	Convene water managers to coordinate response actions
By 6/18	Develop template curtailment plan for communities without existing plans
9/18-9/19	Provide assistance to small communities to develop curtailment plans

Action 5: Critical Infrastructure for Small Cities

By 12/17	Identify deadlines for funding opportunities
By 1/18	Educate communities about drought risk, potential water supply resiliency projects, and funding opportunities
By 3/18	Assist with identifying funding for high priority system improvements
9/18-9/19	Marion County to assist with feasibility studies, design, and implementation

Action 8: Expand Emergency Drought Tool Usage

By 12/18	Work with OWRD on Option Agreement
By 2/19	Share with OWRD and Governor's Office a summary of successful drought tool implementation and lessons learned
By 5/19	Determine when drought tool usage could expand
By 6/19	Showcase drought plan successes

Tier 2 actions improve integration and efficiency, and include:**Action 6: Water Budget Study**

By 6/18	Identify a volunteer or funding opportunity that will complete the following water budget tasks:
By 9/18	Identify conceptual water model for NSW and water budget equation.
By 12/18	Identify the time frame for data, identify data sources, and compile into spreadsheet.
By 3/19	Identify data gaps and uncertainties.
By 6/19	Summarize in technical memo.

Action 7: Incorporate DCP into the 2023 Bi-Op Update

By 9/18	Establish communication with Action Agencies to introduce NSW DCP
Ongoing	Communicate with Action Agencies and report relevant updates to DCP Administrative Team. Subscribe to list serves and, if necessary, attend meetings to follow Bi-Op development.
By 6/19	Share NSW DCP successes with Action Agency communication partners.

Appendix A: Messaging Guidelines

Messages should:

- Be consistent, accurate/credible, straightforward, and timely
- Be easy to remember
- Convey updates and recommendations throughout all stages of drought
- Take into consideration culture, literacy and educational levels
https://www.cdc.gov/nceh/ehs/docs/when_every_drop_counts.pdf
- Use terms that people can relate to easily. For example, instead of using “millions of gallons per day”, use relative terms such as the equivalent in number of showers, or compare water use with that of previous years.
http://drought.unl.edu/portals/0/docs/DRC_Guide.pdf

Messages should help stakeholders understand:

- Who experiences drought first in the watershed
- What are the risks/impacts to each sector during drought conditions
- How their water use affects the watershed and other users
- What they can do and the resources available to help share water
- Where to get more information about whether drought is worsening
- How all residents within the watershed are conserving water (e.g., “shared sacrifice”)
- Why conservation is important

Appendix B: Press Release Templates

[Insert DCP Brand here]

****Press Release Template****

Drought Conditions in North Santiam Watershed Elevated to Stage 2.

[Date] – Based on local water conditions, the North Santiam Watershed Drought Contingency Planning Group advised today that drought conditions in the watershed have been elevated to Drought Stage 2. Information evaluated for this advisory looks at water supply for municipal water, irrigation, recreation, industry, and natural resources such as forests and fisheries. In Drought Stage 2, U.S. Geological Survey river flow measurements indicate moderate hydrologic drought at both the Mehama and Boulder Creek gages. Detroit Reservoir is at ## feet at the Mongold Boat Ramp. This information also indicates a worsening trend this year. [note: edit to reflect monitoring results.]

Watershed map

There are four drought stages. Drought Stage 2 means that some areas in the watershed are experiencing drought and drought impacts. *[Add 1 to 2 sentences to provide specific examples of current impacts here, e.g., recreation is slow because reservoir levels are low. Add quotes if possible to illustrate.]*

Residents, businesses, farmers, recreationists and fish depend on the same source of water – the N. Santiam River. Some are already conserving water to help fish and support their neighbors in the watershed. *[Add 1 to 2 sentences to provide specific examples here. Add quotes if possible to illustrate.]*

You can help those that are already experiencing early drought conditions and help prevent future impacts if water levels continue to drop. Please voluntarily reduce your water use by 5 percent.

Here's some ways you can help:

- Install low-flow showerheads or take shorter showers
- Turn off the faucet while shaving and brushing teeth
- Only run washing machines and dishwashers when full
- Check for toilet and faucet leaks
- When replacing appliances, look for water efficient models
- Reduce the amount of water applied to crops and landscaping
- Consider enrolling in a water rights leasing program (for irrigators)
- *[Adjust examples depending upon timing of advisory. Try to have examples for each sector.]*

For more details on water conservation, visit:

- The North Santiam Watershed Council: <http://northsantiam.org/>
- Natural Resource Conservation District: <https://www.nrcs.usda.gov/wps/portal/nrcs/main/national/water/manage/>

- EPA: <https://www3.epa.gov/watersense/products/index.html>
- Water bank contact: ...

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The North Santiam Watershed Drought Contingency Planning (DCP) Group is building long-term resiliency to drought in order to minimize impacts to the communities, local economies, and critical natural resources within the watershed. The DCP planning process enables local stakeholders to collaboratively develop a coordinated response to drought in the NSW by identifying drought conditions, critical water supply needs (i.e., vulnerabilities), and mitigation and response actions for implementation before and during drought conditions.

[Insert DCP Brand or all DCP Task Force Logos here]

****Press Release Template****

Drought Conditions in North Santiam Watershed Elevated to Stage 3.

[Date] – Based on local water conditions, County officials have elevated drought conditions in the watershed to Drought Stage 3. Officials were advised by the North Santiam Watershed Drought Contingency Planning Group, which has been following water supply data all year. Information evaluated for this advisory includes water supply for municipal water, irrigation, recreation, industry, and natural resources such as forests and fisheries. In Drought Stage 3, U.S. Geological Survey river flow measurements indicate severe hydrologic drought at both the Mehama and Boulder Creek gages. Stream water temperature is warmer than the maximum set by Oregon Department of Environmental Quality. Water intakes are at risk. Water level in Detroit Reservoir is below the Mongold East Boat Ramp. Wildfire danger is high. Information also indicates a worsening trend this year. **[note:** edit to reflect monitoring results.]

Watershed map

There are four drought stages. Drought Stage 3 means that all areas in the watershed are experiencing drought and drought impacts. *[Add 1 to 2 sentences to provide specific examples of current impacts here, e.g., recreation is slow because reservoir levels are low. Add quotes if possible to illustrate.]*

Residents, businesses, farmers, recreationists and fish depend on the same source of water – the N. Santiam River. Conservation is important to help prevent emergency measures in Stage 4. Here is how everyone is conserving water to help fish and support their neighbors in the watershed. *[Add 1 to 2 sentences to provide specific examples here. Add quotes if possible to illustrate.]*

You can help prevent future impacts if water levels continue to drop. Please voluntarily reduce your water use by 10 percent. Here are some ways to do this:

- Allow lawns to go dormant.
- Don't wash vehicles.

- Only run washing machines and dishwashers when full.
- Reduce the amount of water applied to crops.
- Enroll in a water leasing program temporarily to leave part of your water rights in-stream.
- Enroll in a water options agreement temporarily to share your water with others that need it.
- Change your water source temporarily from surface water to groundwater.
- [Adjust examples depending upon timing of advisory. Try to have examples for each sector.]

For more details on water conservation, visit:

- The North Santiam Watershed Council: <http://northsantiam.org/>
- Natural Resource Conservation District: <https://www.nrcs.usda.gov/wps/portal/nrcs/main/national/water/manage/>
- EPA: <https://www3.epa.gov/watersense/products/index.html>
- Water bank contact:

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[Insert DCP Brand or all DCP Task Force Logos here]

****Press Release Template****

Drought Conditions in North Santiam Watershed Elevated to Stage 4: Extreme Drought

[Date] – Local water conditions continue to deteriorate. As a result, County officials have elevated drought conditions in the watershed to the highest of four drought stages, Extreme Drought. Officials were advised by the North Santiam Watershed Drought Contingency Planning Group, which has been following water supply data all year. Information evaluated for this advisory includes water supply for municipal water, irrigation, recreation, industry, and natural resources such as forests and fisheries. In Drought Stage 4, U.S. Geological Survey river flow measurements indicate extreme hydrologic drought at both the Mehama and Boulder Creek gages. Stream water temperature is at least 4 degrees warmer than the maximum set by Oregon Department of Environmental Quality. Water intakes are dry in the upper watershed [note: edit to reflect water supply conditions for all cities] and may not function properly for Salem; emergency measures are being considered to maintain municipal water supply to protect

Watershed map

public health and safety. Wildfire danger is extreme. Information also indicates a worsening trend this year [note: edit to reflect monitoring results].

All areas in the watershed are experiencing drought and drought impacts. *[Add 1 to 2 sentences to provide specific examples of current impacts here. Add quotes if possible to illustrate.]*

Residents, businesses, farmers, recreationists and fish depend on the same source of water – the N. Santiam River. Conservation is critical to help minimize the need for emergency measures. Here is how everyone is conserving water to help fish and support their neighbors in the watershed. *[Add 1 to 2 sentences to provide specific examples here. Add quotes if possible to illustrate.]*

The City of Salem has initiated Level 3: Severe Curtailment measures, indicating a critical water supply shortage. You may notice:

- Restricted watering at city parks and golf courses.
- Decorative water fountains and swimming pools are dry.

You can help prevent future impacts if water levels continue to drop. Water may only be used for essential purposes. These include:

- Drinking water.
- Personal hygiene. Please shorten showers and turn off water when brushing teeth.
- Emergency firefighting.
- Essential crop watering. Please water in the evening to prevent evaporative loss.
- Essential business needs.

If you have additional water that you can spare:

- Enroll in a water leasing program temporarily to leave part of your water rights in-stream.
- Enroll in a water options agreement temporarily to share your water with others that need it.
- Change your water source temporarily from surface water to groundwater.

For more details on water conservation, visit:

- The North Santiam Watershed Council: <http://northsantiam.org/>
- Natural Resource Conservation District: <https://www.nrcs.usda.gov/wps/portal/nrcs/main/national/water/manage/>
- EPA: <https://www3.epa.gov/watersense/products/index.html>
- Water bank contact:

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