CENTRAL PLATTE NRD DROUGHT MITIGATION PLAN

2020

Funding for Central Platte NRD's Drought Mitigation Plan was provided through the Water Sustainability Fund from the Nebraska Natural Resources Commission.

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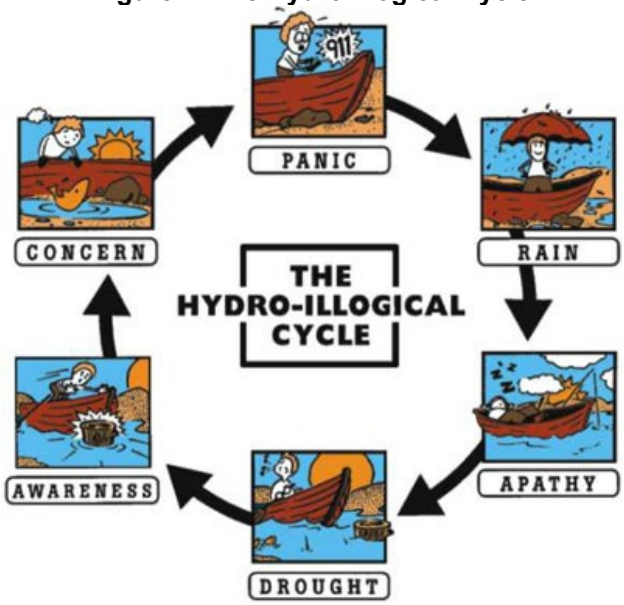
SECTION 1: INTRODUCTION

Hydro-Illogical Cycle

Traditionally, many water users have reacted to droughts in the manner shown in Figure 1. During normal or wet years, people are often apathetic to the possibility of drought. When a drought does occur, people are not sufficiently prepared and often respond too late. As a result, drought impacts are much more severe than if people had planned ahead. Once the drought is over, people are glad to forget about it and resume business as usual. The Central Platte Natural Resources District (CPNRD) is attempting to break the hydro-illogical cycle by taking a proactive approach to planning for drought.

Figure 1: The Hydro-Illogical Cycle



Source: National Drought Mitigation Center

Plan Purpose

The intent of the CPNRD Drought Management Plan is to define drought locally and identify processes in order to respond to and manage the impacts of future drought events. The Drought Management Plan is a tool that will assist the CPNRD in long term resource management and policy development.

Drought

Drought is generally defined as a natural hazard resulting from a substantial period with a lack of precipitation. Although many incorrectly consider it a rare and random event, drought is actually a normal, recurrent feature of climate. It occurs in virtually all climatic zones, but its characteristics vary significantly from one region to another. A drought often coexists with periods of extreme heat, which together can cause significant social stress, economic losses, and environmental degradation.

Drought is a slow-onset, creeping phenomenon, and its impacts are largely non-structural. Drought normally affects more people than other natural hazards do, and its effects are spread over a larger geographical area. As a result, the detection and early warning signs of drought conditions and the subsequent assessment of impacts are more difficult to identify than quick-onset natural hazards (e.g., flood and storm) that results in more immediate, visible impacts. In

addition, drought has more than 150 definitions and this lack of a universal definition makes it even harder to indicate the onset and ending. According to the National Drought Mitigation Center (NDMC), droughts are classified into four major types:

Meteorological Drought – is defined based on the degree of dryness and the duration of the dry period. Meteorological drought is often the first type of drought to be identified and should be defined regionally as precipitation rates and frequencies ("norms") vary.

Agricultural Drought – occurs when there is deficient moisture that hinders plant germination, leading to low plant population per hectare and a reduction of final yield. Agricultural drought is closely linked with meteorological and hydrological drought as agricultural water supplies are contingent upon the two sectors.

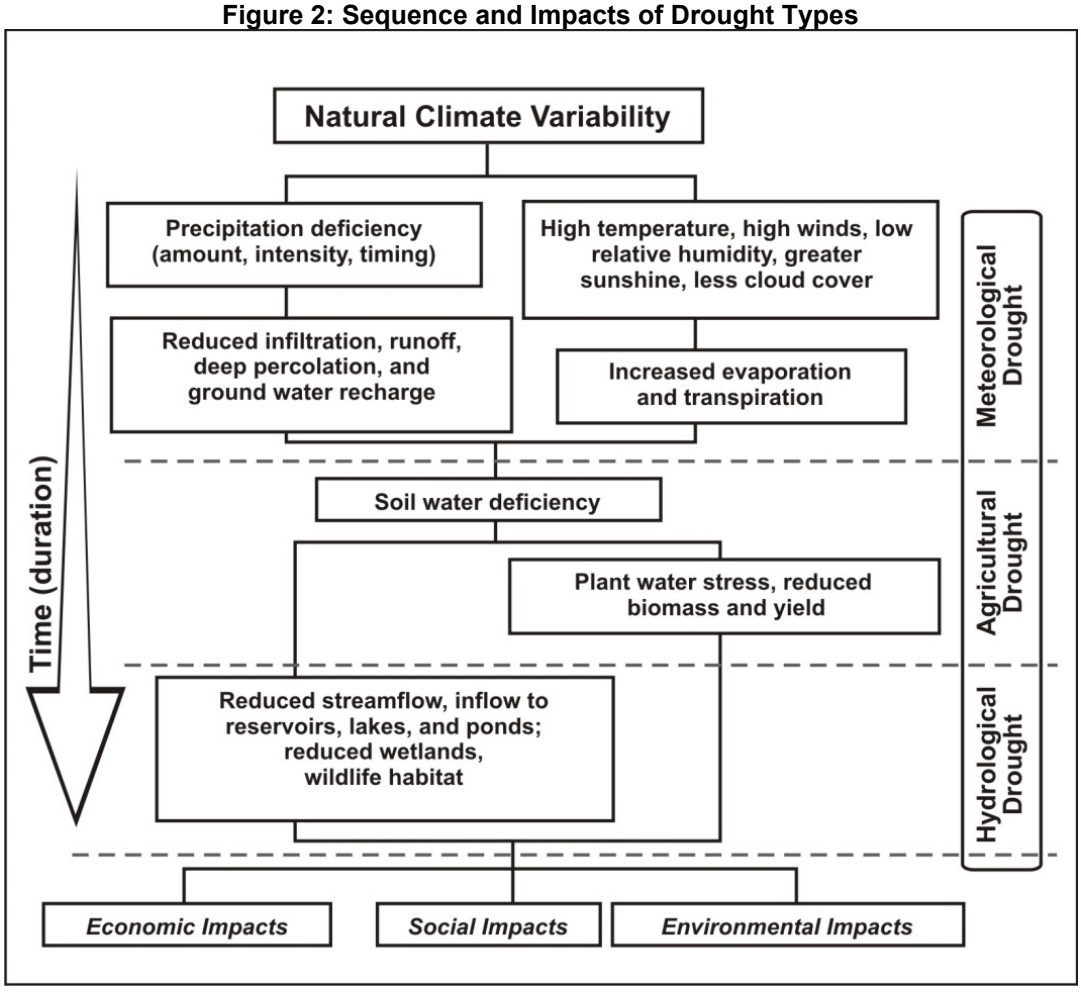
Hydrological Drought – occurs when water available in aquifers, lakes, and reservoirs falls below the statistical average. This situation can arise even when the area of interest receives averages precipitation. This is due to the reserves diminishing from increased water usage, usually from agricultural use or high levels of evapotranspiration, resulting from prolonged high temperatures. Hydrological drought often is identified later than meteorological and agricultural drought. Impacts from hydrological drought may manifest themselves in decreased hydropower production and loss of water-based recreation.

Socioeconomic Drought – occurs when the demand for economic goods exceeds supply due to a weather-related shortfall in water supply. The supply of many economic goods includes, but is not limited to, water, forage, food grains, fish, and hydroelectric power.

The occurrence of a drought can also create conditions which exacerbate the impacts of other hazards or increase the probability of their occurrences. The damage done by these other hazards is understood as cascading impacts from the drought. Drought, for example, might increase the risk of wildfires due to the resulting dry conditions. Drought conditions can also lead to flooding, since overly dry soil is not able to absorb moisture quickly, increasing the amount of runoff, and leading to flash flooding. Droughts can also weaken trees and result in greater damages during severe weather or high wind events.

Figure 2 indicates the different types of droughts, their temporal sequence, and the various types of effects they can have on a community.

Figure 2: Sequence and Impacts of Drought Types



SECTION 2: PLANNING PROCESS

The CPNRD began the process of securing funding for their Drought Management Plan in July 2017. The CPNRD was awarded a grant from the Nebraska Natural Resources Commission's Water Sustainability Fund to assist the development of the plan. The grant funded 60% of the project, with a 40% local match. JEO Consulting Group (JEO) was contracted in February 2018 to guide and facilitate the planning process and assemble the Drought Management Plan. Jesse Mintken (Assistant Manager with CPNRD) served as the project manager.

The CPNRD Drought Management Plan planning team included the individuals listed below. The planning team provided regular updates at the public CPNRD Board of Directors meetings.

Lyndon Vogt – General Manager
Jesse Mintken – CPNRD, Assistant Manager
Courtney Widup – Water Resources Technician
*Jeff Henson – JEO, Project Manager
*Phil Luebbert – JEO, Planner
*Karl Dietrich – JEO, Junior Planner
*Served as an advisory role

Drought Tournament

A drought workshop was developed as a component of the Drought Management Plan in order to encourage stakeholder involvement. The goals of the workshop were to gain an understanding of how stakeholders across the NRD respond to drought conditions, and to identify potential gaps in planning, mitigation, preparedness, and response. The workshop consisted of a drought game followed by several discussion questions. The jurisdictions invited to the drought tournament are shown in Table 1.

Table 1: Invited Stakeholders

Ag Valley Cooperative	Aurora Cooperative	Buffalo-Sherman County Farm Service Agency
Central Nebraska Public Power and Irrigation District	Central Platte NRD	Central Valley Ag
Chief Ethanol Fuels	City of Central City	City of Cozad
City of Gibbon	City of Gothenburg	City of Grand Island
City of Kearney	City of Lexington	City of Osceola
City of Ravenna	City of Stromsburg	City of Wood River
Clearview Utilities Corporation	Country Partners Cooperative	Custer County Farm Service Agency
Dawson County Emergency Management	Dawson County Farm Service Agency	Ducks Unlimited, Inc.
Frontier Cooperative	Glenwood Estates Mobile Home Park	Green Plains
Hall County Emergency Management	Hall County Farm Service Agency	Hi-Line Cooperative
Hitch N Rail Mobile Home Court	Iain Nicholson Audubon Center	Lakeview Acres
Little Blue NRD	Lower Loup NRD	Lower Platte North NRD
Merrick County Emergency Management	Merrick County Farm Service Agency	Middle Republican NRD
Monsanto Water Utilization Learning Center	National Audubon Society	National Drought Mitigation Center
Nebraska Department of Health and Human Services (DHHS)	Nebraska Department of Natural Resources (NDNR)	Nebraska Emergency Management Agency

Nebraska Game and Parks Commission (NGPC)	Nebraska Public Power District (NPPD)	North Point Johnson Lake
Platte County Farm Service Agency	Polk County Emergency Management	Polk County Farm Service Agency
Regional Golf Courses	Rich Mobile Home Court	Southside Irrigation District
The Nature Conservancy	Tri Basin NRD	Twin Platte NRD
University of Nebraska Public Policy Center	Upper Big blue NRD	US Fish and Wildlife Service
Village of Alda	Village of Amherst	Village of Cairo
Village of Chapman	Village of Clarks	Village of Doniphan
Village of Duncan	Village of Elm Creek	Village of Eustis
Village of Franam	Village of Miller	Village of Oconto
Village of Overton	Village of Palmer	Village of Pleasanton
Village of Polk	Village of Riverdale	Village of Shelby
Village of Shelton	Village of Silver Creek	Village of Sumner

The 21 stakeholders that attended the workshop are shown below.

John Collins (City of Grand Island)
Norm Manstedt (Village of Clarks)
Carol Flaute (NDNR)
Margeaux Carter (NDNR)
Marketa Pdebradska (National Drought Mitigation Center)
Shelley Rekte (DHHS)
Mike Drain (Central Nebraska Public Power and Irrigation District)
Cory Steinke (Central Nebraska Public Power and Irrigation District)
Jeff Shafer (NPPD)
Ann Smith (Southside Irrigation District)
Kyle Hauschild (Little Blue NRD)
Jacob Fritton (The Nature Conservancy)
Michelle Koch (NGPC)
Tony Barada (NGPC)
Andrew Pierson (National Audubon Society)
Jack Wergin (Upper Big Blue NRD)
John Thorburn (Tri-Basin NRD)
Randy Zach (NPPD)
Courtney Widup (Central Platte NRD)
Mindy Osterman (Hall County Emergency Management Agency)
Keith Koupal (NGPC)

Information gathered at the Drought Workshop is incorporated throughout this Drought Management Plan and greatly influenced the risk assessment and drought management recommendations sections of the plan. The Drought Workshop Summary Report is located in *Appendix A*.

SECTION 3: CENTRAL PLATTE NRD PROFILE

Central Platte NRD

The CPNRD is one of Nebraska's 23 Natural Resource Districts (NRDs). Unlike the county-wide districts found in most states, Nebraska's NRDs are based on river basin boundaries, enabling them to approach natural resources management on a watershed basis. The CPNRD is autonomous, governed by a locally-elected Board of Directors. While NRDs share a common set of responsibilities, each district sets its own priorities and develops its own programs to serve local needs. The CPNRD has nine areas of responsibility:

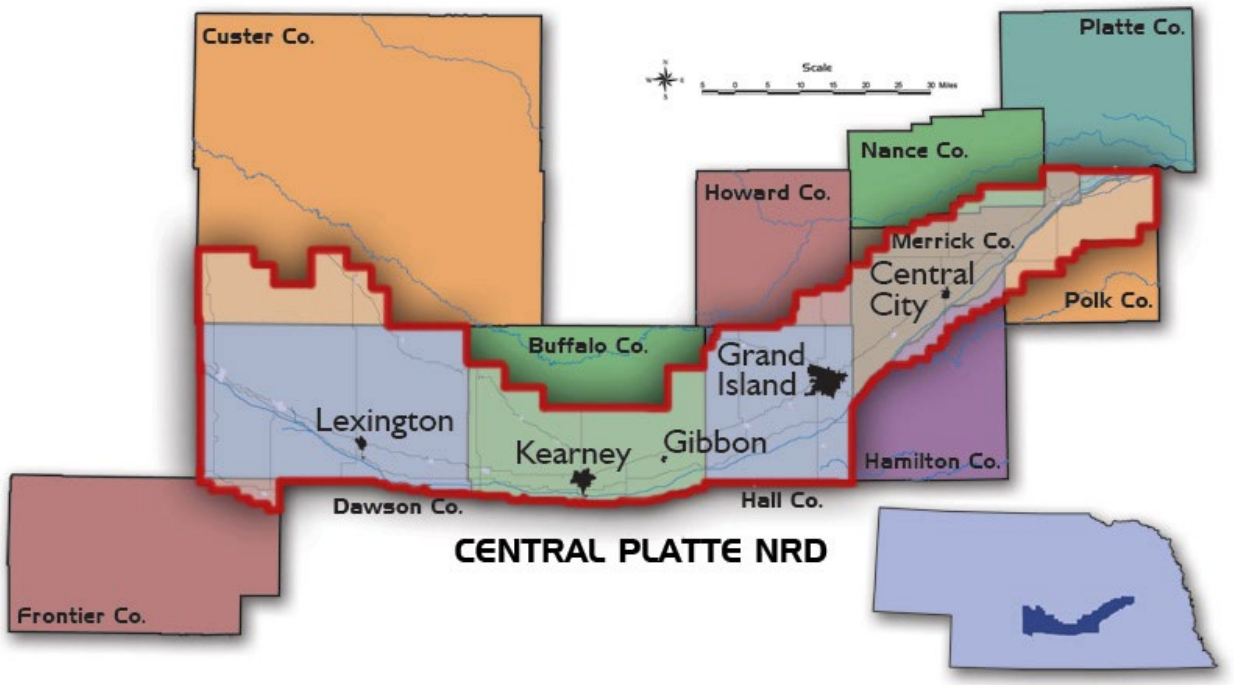
- Soil conservation and erosion control
- Flood prevention, control and channel rectification
- Drainage
- Groundwater, surface water, and water supply
- Water quality, pollution control, solid waste disposal, and sanitary drainage
- Fish and wildlife habitat
- Forestry management
- Recreation and parks
- Range management

Nebraska Statute, Chapter 2, Article 32 establishes Nebraska's NRDs and grants them the powers and authorities that assist in the function of the districts. The CPRND has the authority to levy property taxes to fund the function of the district, which include a variety of programs and incentives to facilitate the implementation of resource management activities.
The CPNRD has a wide range of statutory responsibilities and authorities, including, but not limited to, Nebraska Revised Statutes §2-3,201 through 2-3,243 and the Ground Water Management and Protection Act (Nebraska Rev. Statutes §46-701 through46-756). Specifically, Nebraska Rev. Statutes §46-707(f) confer to the NRDs the power to "conduct investigations and cooperate or contract with ...public or private corporations, or any association or individual on any matter relevant to the administration of the [Ground Water Management and Protection] act."

The CPNRD is located in central Nebraska and is made up of approximately 2,130,000 acres; encompassing all or parts of 11 counties including: Dawson, Custer, Buffalo, Hall, Howard, Nance, Merrick, Hamilton, Platte, Polk, and Frontier counties.

The Platte River is the predominant surface water feature in the CPNRD. The major tributary of the Platte River is Wood River on the northwest side of the District. There are a number of other streams that enter the Platte River, however, none of these streams can be considered major sources of water since their flows are largely intermittent and flows are not considered adequate for any use. The largest water impoundment in the District is Johnson Lake, which is located on the southern boundary of Dawson County and lies mainly in Gosper County (Tri-Basin NRD).

Figure 3: Location of CPNRD



Source: www.cpnrd.org

Population

Table 2 provides a summary of population trends within the planning area from 2000 to 2010. The percent change was used to project the population for 2020. This is a relatively simple method to predict population change, and it does not account for predominant age cohorts in the community, birth and death rates, or in and out migration which will likely impact the rate of growth or decline. In Table 2, the entire population of counties within the CPNRD were provided despite the fact that the CPNRD boundary only includes portion of many of these counties. This was done because the US Census Bureau does not organize data by the NRD level. The total population living within the CPNRD boundaries is approximately 137,966.

It is important to address population trends because water use and population are positively correlated; meaning that as population increases there also is likely to be an increase in water use. Most of the planning area is experiencing population increase; therefore, there will likely be an increase in non-agricultural water use in these areas.

Table 2: Population Trends 2000-2010

Jurisdiction	2000 Population	2010 Population	Change	2020 Projected Population	2030 Projected Population
Buffalo County	42,259	46,102	9.09%	50,294	54,868
Village of Amherst	277	248	-10.47%	222	199
Village of Elm Creek	894	901	0.78%	908	915
City of Gibbon	1,759	1,833	4.21%	1910	1990
City of Kearney	27,431	30,787	12.23%	34,554	38,781
Village of Miller	156	136	-12.82%	119	103
Village of Riverdale	213	182	-14.55%	156	133
Village of Shelton	1,140	1,059	-7.11%	984	914
Custer County	11,793	10,939	-7.24%	10,147	9,412
Village of Oconto	141	151	-7.09%	162	173

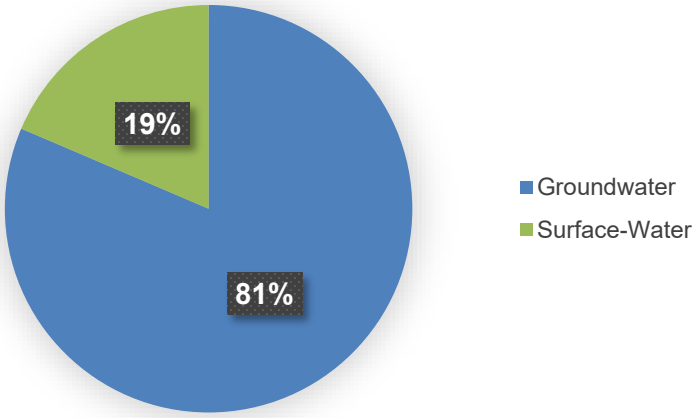
Jurisdiction	2000 Population	2010 Population	Change	2020 Projected Population	2030 Projected Population
Dawson County	24,365	24,326	-0.16%	24,287	24,248
City of Cozad	4,163	3,977	-4.47%	3,799	3,630
Village of Eddyville	96	97	1.04%	98	99
Village of Farnam	223	171	-23.32%	131	101
City of Gothenburg	3,619	3,574	-1.24%	3,530	3,486
City of Lexington	10,011	10,230	2.19%	10,454	10,682
Village of Overton	646	594	-8.05%	546	502
Village of Sumner	237	236	-0.42%	235	234
Frontier County	3,099	2,756	-11.07%	2,451	2,180
Village of Eustis	464	401	-13.58%	347	300
Hall County	53,534	58,607	9.48%	64,161	70,241
Village of Alda	652	642	-1.53%	632	622
Village of Cairo	790	785	-0.63%	780	775
Village of Doniphan	763	829	8.65%	901	979
City of Grand Island	42,940	48,520	12.99%	54,825	61,950
City of Wood River	1,204	1,325	10.05%	1,458	1,605
Merrick County	8,204	7,845	-4.38%	7,502	7,173
City of Central City	2,998	2,934	-2.13%	2,871	2,810
Village of Chapman	341	287	-15.84%	242	203
Village of Clarks	361	369	2.22%	377	386
Village of Silver Creek	441	362	-17.91%	297	244
Platte County	31,662	32,237	1.82%	32,822	33,419
Village of Duncan	359	351	-2.23%	343	336
Polk County	5,639	5,406	-4.13%	5,183	4,968
City of Osceola	921	880	-4.45%	841	803
Village of Polk	322	322	0.00%	322	322
Village of Shelby	690	714	3.48%	739	765
City of Stromsburg	1,232	1,171	-4.95%	1,113	1,058

Source: United States Census Bureau – 2000, 2010

Water Sources and Uses

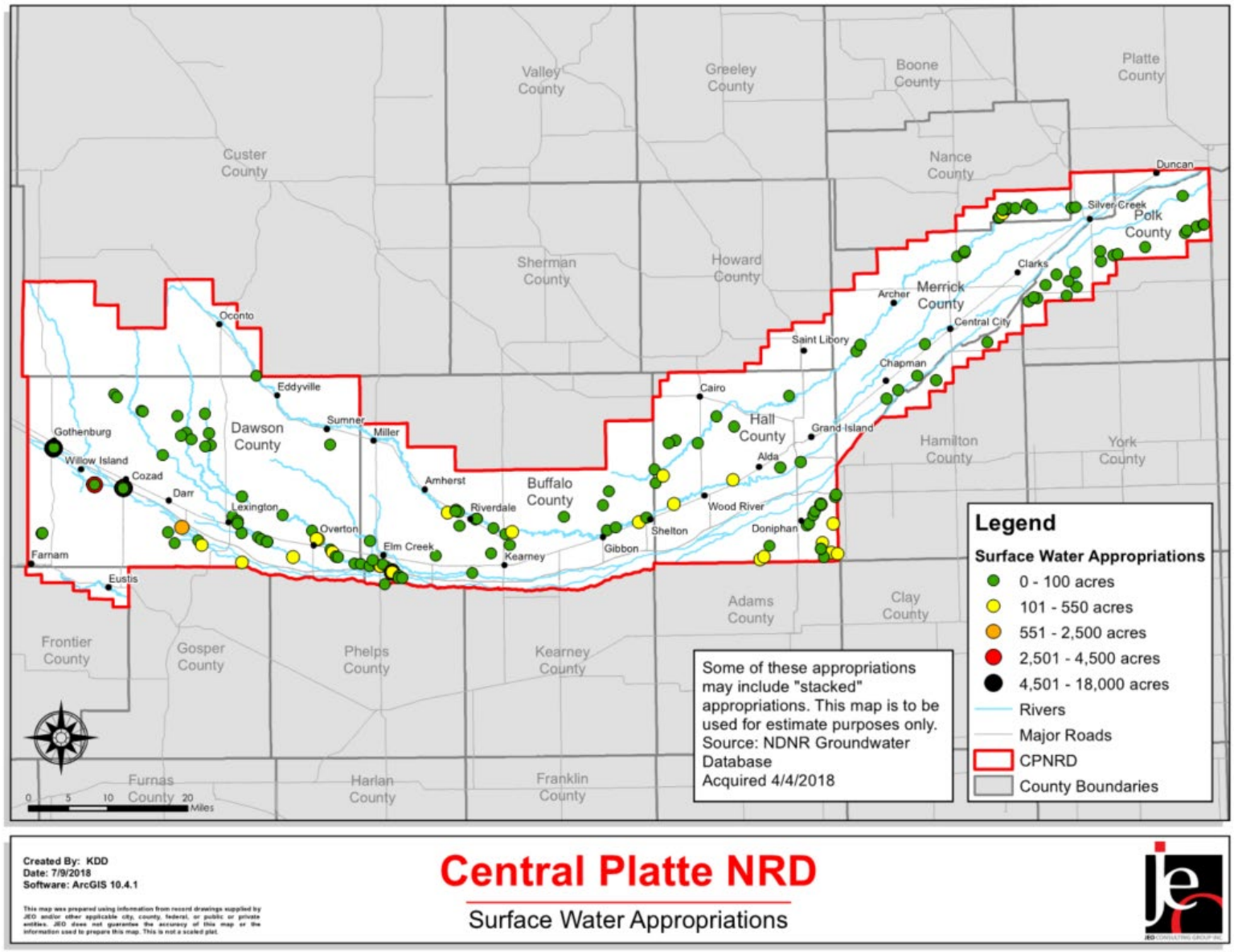
Figure 4 shows that most the water consumed within the CPNRD is sourced from groundwater. Surface-water does account for approximately 20% of the consumption within the CPNRD. There are a number of surface water users within the district; mainly along the Platte River and Wood River (Figure 5).

Figure 4: Water Sources in CPNRD



Source: USGS, 2010 Water Use by County

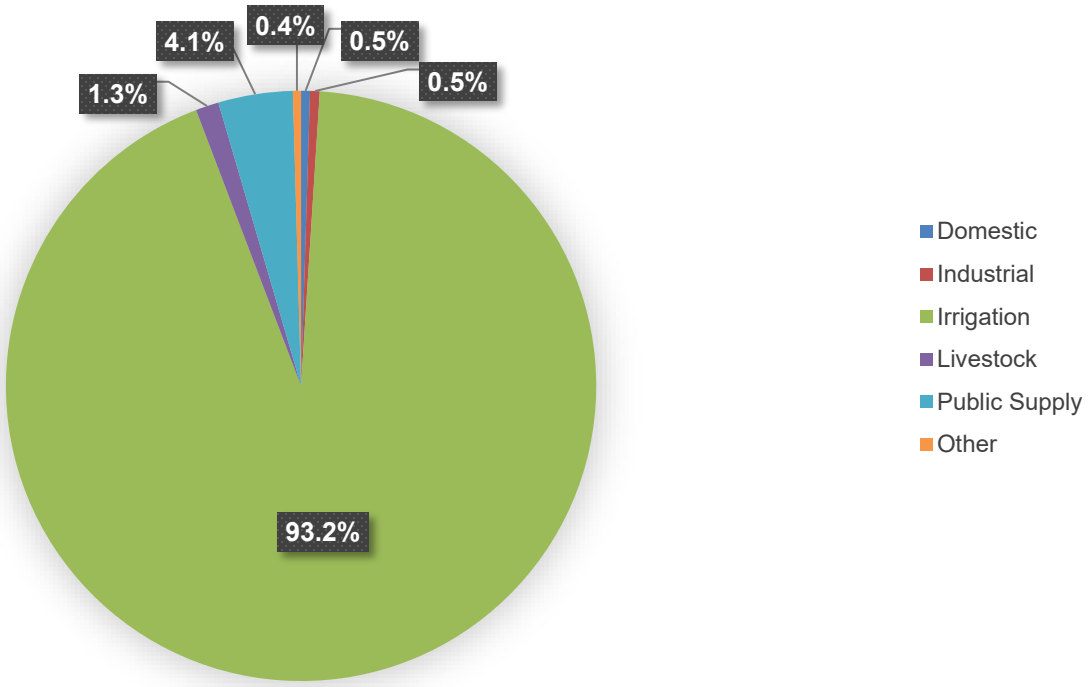
Figure 5: Surface Water Appropriations



As shown in Figure 6, irrigation use accounts for the overwhelming majority of water use within the planning area. Irrigation use is seasonal in nature, with peak demands occurring (depending upon the year) during the timeframe of late June through mid-September.

The CPNRD had 25,529 active registered wells (all uses) as of February 2018 (Figure 7). The registration of newly constructed domestic wells was not required until 1993; therefore, the actual number of wells within the district is likely much higher, as many of the older constructed wells have never been registered but are still in service. The majority of wells are used for irrigation (69%), domestic use (15%), and monitoring (7%). Wells indicated as "other" include wells that support uses like injection, recovery, lake supply, geothermal, aquaculture, etc.

Figure 6: Water Use in CPNRD



Source: USGS, 2010 Water Use by County

Figure 7: Registered Wells in CPNRD

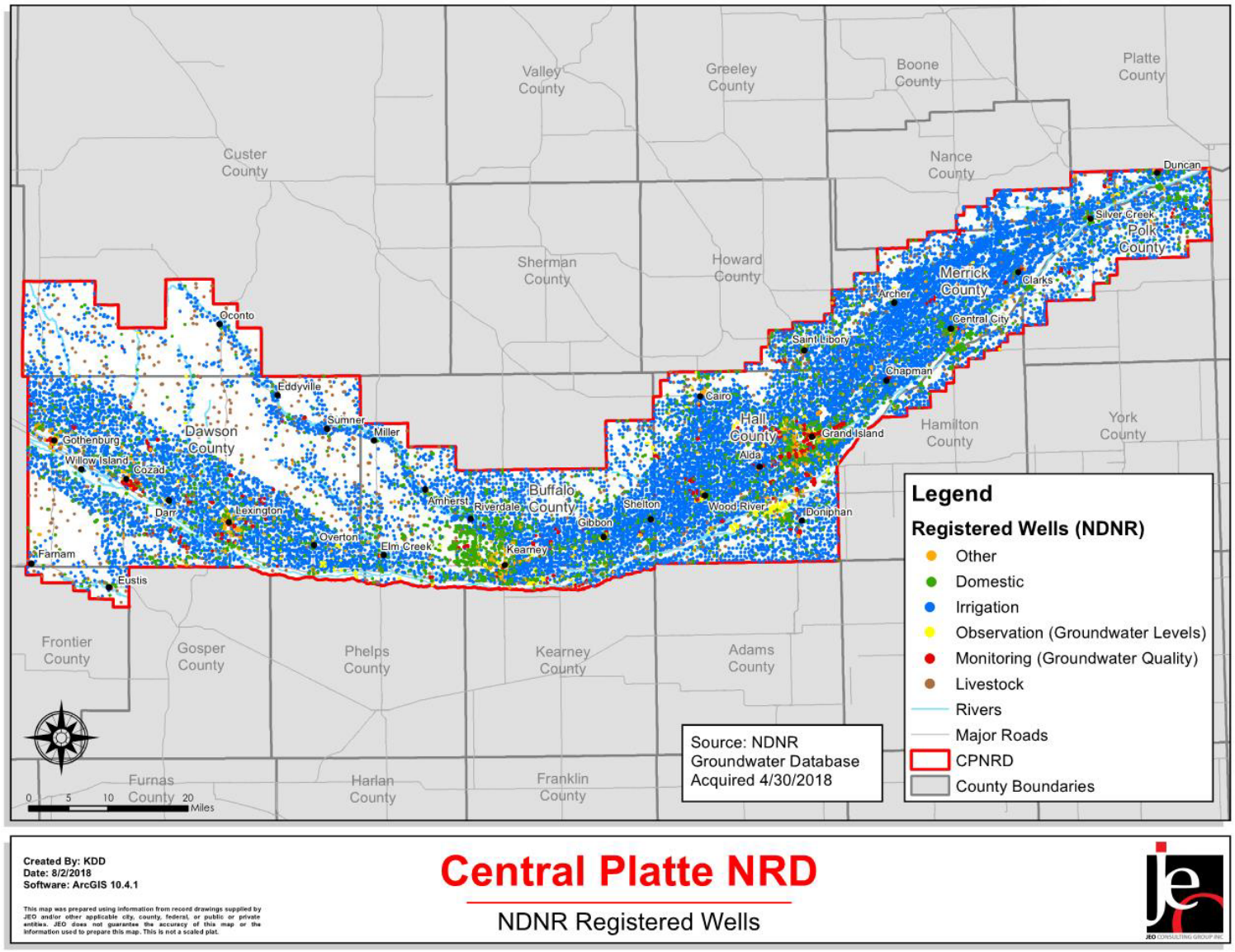
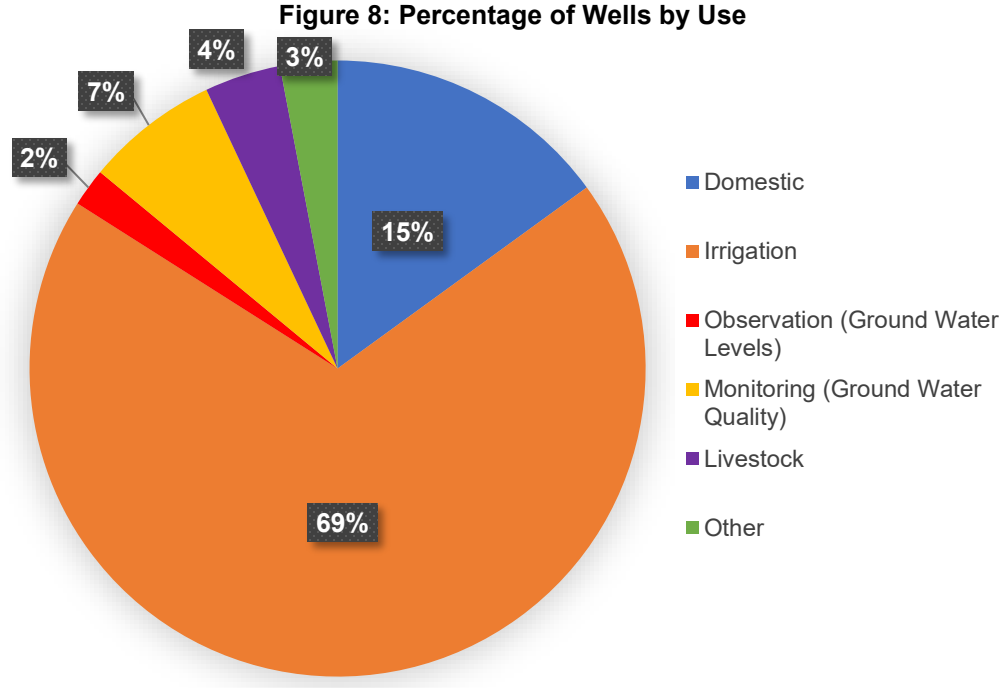


Figure 8: Percentage of Wells by Use



Source: NDNR, 2018

Current Drought Related Planning Efforts

The planning process identified current planning efforts within the CPNRD that either directly or indirectly relate to drought. As the CPNRD is tasked with managing the groundwater resources in the area, there are a number of current relevant planning efforts. The identified planning mechanisms are described below.

Central Platte NRD Multi-Jurisdictional Hazard Mitigation Plan 2017

The Hazard Mitigation Plan specifically addresses hazards such as drought, and subsequently proposes mitigation actions to reduce the risk from drought at the regional and local level. The following participants identified drought as a high priority hazard during the hazard mitigation planning process:

- City of Kearney
- Dawson County
- City of Cozad
- Merrick County
- Village of Clarks
- Village of Silver Creek
- City of Osceola
- Village of Shelby
- Village of Oconto

Central Platte NRD Master Plan 2011

The CPNRD Master Plan includes the overall goals and objectives for the NRD. One goal identified in the plan is to assure an adequate supply of water for feasible and beneficial uses, through the proper management, conservation, development, and utilization of the District's water resources. The plan includes a number of objectives to achieve that goal including establishing irrigation management practices and techniques in order to properly conserve water. The plan also includes a goal to protect and enhance the quality of groundwater and surface water within the District. The plan includes a number of objectives to achieve that goal including reducing or maintaining groundwater nitrate levels at 10 ppm or lower. Projects identified within the Master

Plan will be consistent with the projects identified within the Drought Management Plan. The Master Plan is updated by the CPNRD every ten years. Further information about the plan can be found on the CPNRD website.

Long Range Implementation Plan 2018

The Long-Range Implementation Plan summarizes planned district activities and includes projects of financial, manpower, and land right needs of the district for the next five years. The plan includes a summary of the programs and actions the CPNRD has undertaken for water quantity and water quality. The Long-Range Implementation Plan is updated on an annual basis. Further information about the plan can be found on the CPNRD website.

Groundwater Management Plan

The Groundwater Management Plan serves as a foundation for decision-making while managing groundwater resources within the district. The plan creates rules and regulations for the enforcement of the Nebraska Groundwater management and Protection Act. Sections within the rules and regulations include groundwater use in fully and over appropriated areas, groundwater quality management controls, groundwater supply management controls, and the chemigation program. The plan also breaks the district down into 24 groundwater management areas to better identify groundwater issues and implement controls. Further information about the plan can be found on the CPNRD website.

Fully and Over Appropriated Areas – This section provides regulations for groundwater use in fully and over appropriated areas. Regulations include a ban on new well permits increasing groundwater use, requiring irrigated acres to be certified, outlining transfer requirements, and eligibility requirements for the Groundwater Exchange Program.

Groundwater Quality Management Controls – This section outlines the groundwater management controls related to nitrate levels across the district. Each groundwater management area is given a phase based on the average nitrate levels. Each phase contains controls to manage the nitrate levels. As phases increase, the controls become more restrictive.

Groundwater Supply Management Controls – Similar to the groundwater supply controls the groundwater supply management controls are broken down by which phase the groundwater management area is in. For groundwater supply, phases are determined by the percentage of water table falls from the maximum decline level. As phases increase, additional controls and cutbacks are required.

Chemigation Program – The CPNRD has adopted the Nebraska Department of Environment and Energy's (NDEE) Title 195 – Rules and Regulations Pertaining to Chemigation.

Basin-Wide Integrated Management Plan 2019

This is the second increment of the Basin-Wide Integrated Management Plan. The plan was developed by the North Platte NRD, South Platte NRD, Central Platte NRD, Twin Platte NRD, and Tri-Basin NRD to manage the over appropriated portions of the Platte River Basin. Goals of the plan include:

- Incrementally achieve and sustain a fully appropriated condition while maintaining economic viability, social and environmental health, safety, and welfare of the Basin.

- Prevent or mitigation human-induced reductions in the flow of a river or stream that would cause non-compliance with an interstate compact or decree or other formal state contract or agreement.
- Partner with municipalities and industries to maximize conservation and water use efficiency.
- Work cooperatively to identify and investigate disputes between groundwater users and surface water appropriators and, if determined appropriate, implement management solutions to address such issues.
- Keep the Upper Platte River Basin-Wide Plan current and keep stakeholders informed.

Each goal has several objects which will need to be done to meet the goals. This plan does not include any controls which the NRD's have to follow. Further information about the plan can be found on the CPNRD website.

Integrated Management Plan 2019

The Integrated Management Plan provides a framework for how the CPNRD and NDNR will work collaboratively to management groundwater and surface water within the District, so that the economic viability, social and environmental health, safety, and welfare can be achieved and maintained for both the near and long term. Goals include securing future water supply projects, provide for water consumption that does not exceed full appropriation, maintain CPNRD's water resources while allowing for economic growth, provide an adequate water supply for beneficial uses, resolve conflicts between users, and ensure the NRD complies with all agreements and laws. Lastly, the plan outlines action items which need to be taken in order to meet the goals. Further information about the plan can be found on the CPNRD website.

Emergency Response Plans for Community Water Systems within the NRD

An Emergency Response Plan is a documented strategy describing actions that a community water system would take in response to various major events, including drought. Emergency Response Plans from the following community water systems were reviewed:

- 1733 Estates Associates
- Alda
- Amherst
- Cairo
- Central City
- Chapman
- Clarks
- Clearview Utilities
- Cozad
- Doniphan
- Duncan
- Elm Creek
- Eustis
- Farnam
- Gibbon
- Glenwood Estates
- Gothenburg
- Grand Island
- Groves by Riverside
- Hitch N Rail
- Kearney
- Lakeview Acres Lot Owners
- Lexington
- Miller
- North Point – Johnson Lake
- Oconto
- Osceola
- Overton
- Palmer
- Pleasanton
- Polk
- Prairie West Mobile Home Park
- Ravenna
- Rich mobile Home Court
- Riverdale
- Shelby
- Shelton
- Silver Creek
- Stromsburg
- Sunset View Mobile Home Park
- West Side Mobile Home Park
- Wood River Valley Mobile Home Park
- Wood River

Information gathered during the Drought Tournament and within the Emergency Response Plans indicated that for water users across the district, there is an inconsistent and largely undocumented drought response. Most community water systems within the CPNRD do not have a local drought definition or response triggers and for the community water systems that do list drought response triggers, the triggers vary widely between different communities. The Emergency Response Plans also fail to define the end of drought.

Not having defined triggers does allow the community flexibility in determining the appropriate time to enforce water restrictions. However, the lack of specific triggers may make the decisions to declare drought and enforce water restrictions more difficult for the community. Drought declarations are typically politically difficult decisions as the declaration may impact some in the community economically. Pre-established triggers can help ease the political pressure and enable decision makes to formulate an informed decision regarding a drought declaration.

Wellhead Protection Plans

Wellhead protection plans attempt to proactively protect and manage the source of community drinking water from potential contaminates. Wellhead protection plans often recommend specific actions that can be taken to protect water quality.

The following table shows communities within the CPNRD that have an established wellhead protection plan as of 2013.

Table 3: Wellhead Protection Plans in CPNRD

Community	Date Approved
Village of Doniphan	12/31/2003
Village of Marquette	3/26/2007
Village of Palmer	5/1/2006
Village of Prosser	5/17/2004

Source: NDEQ, State Approved Wellhead Protection

Community Comprehensive Plans

Community and county comprehensive plans determine community goals and aspirations for future development. These plans often contain goals and strategies to protect ground and surface water quality and quantity. Comprehensive Plans from the following areas were reviewed:

- Buffalo County
- Central City
- City of Kearney
- City of Lexington
- Merrick County
- Village of Duncan

SECTION 4: RISK AND VULNERABILITY ASSESSMENT

This section describes the unique characteristics of the planning area that affect its risk and vulnerability to future drought events. The risk assessment provides the factual basis for developing specific strategies to mitigate the impacts of drought. This section contains a description of historical drought occurrence and extent, previous drought impacts and damages, probability of future occurrences, and a vulnerability assessment.

Historical Drought Occurrence and Extent

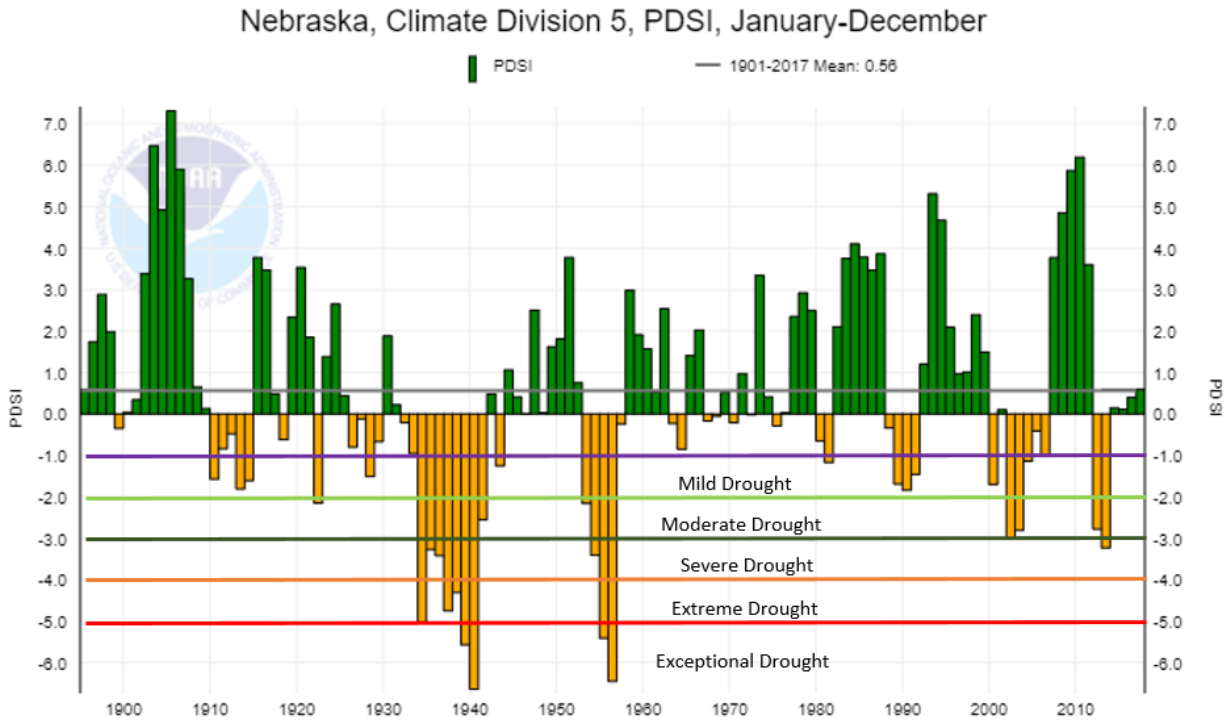
The Palmer Drought Severity Index (PDSI) was used to document historical occurrence and extent of drought within the planning area beginning in 1895. Among the various indices, the PDSI has been widely used by state and local governments in the United States. The PDSI is further discussed in *Section 5: Drought Monitoring*. The following tables depicts the percentage of months the CPNRD experienced drought and the extent associated with this index.

Table 4: Historical Drought Occurrence in CPNRD

Drought Classification	PDSI Range	Total Occurrences in Month	Percent of Months
Drought	-1.0 or Less	444/1476	30.1%
Mild Drought	-1.0 to -1.99	188/1476	12.7%
Moderate Drought	-2.0 to -2.99	100/1476	6.8%
Severe Drought	-3.0 to -3.99	49/1476	3.3%
Extreme Drought	-4.0 to -4.99	41/1476	2.8%
Exceptional Drought	-5.0 or Less	66/1476	4.5%

Source: NCEI, PDSI 1895 to 2017

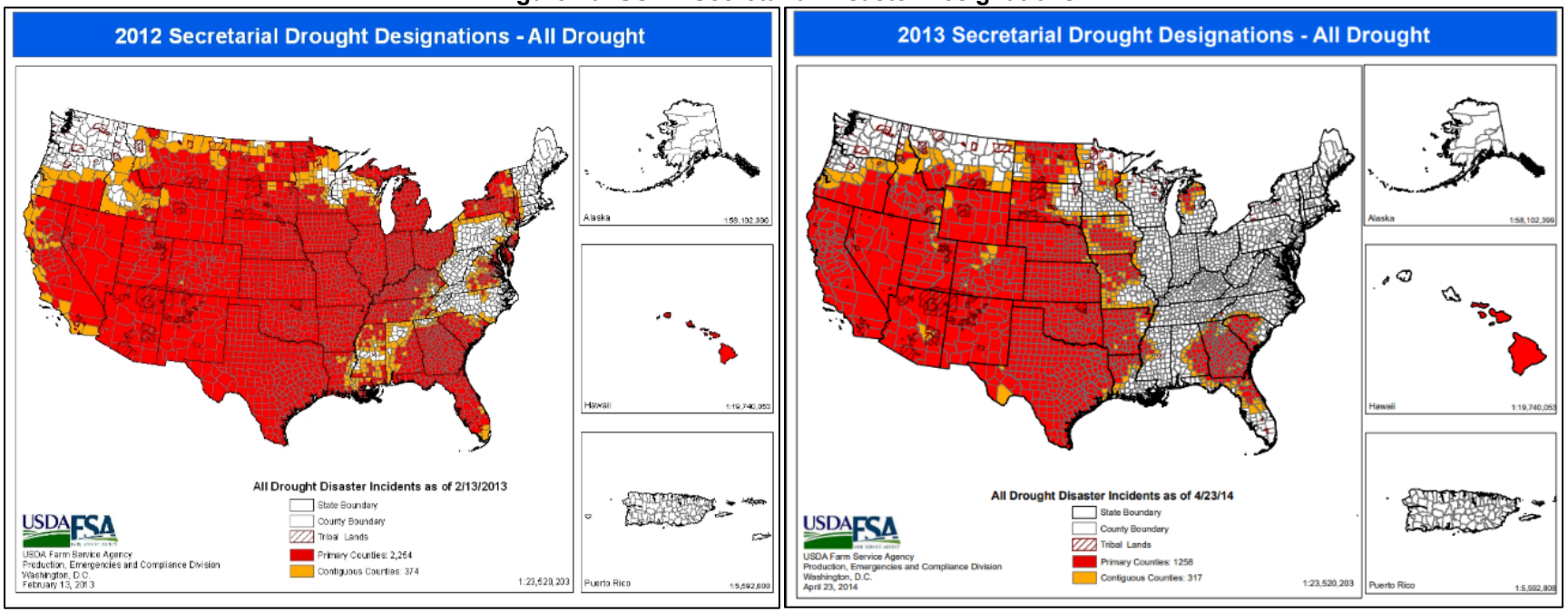
Figure 9: Palmer Drought Severity Index



Source: NCEI

Past drought events in the planning area have resulted in United States Department of Agriculture (USDA) Secretarial Disaster Designations, most recently in 2012, 2013, 2014, and 2016. Figure 10 shows that the entirety of the planning area was associated with a drought disaster designation for 2012 and 2013. In 2014, Dawson County was designated as a primary county while Buffalo and Howard counties were designated as contiguous counties. In 2016 the only county affected in the planning area was Buffalo County and it was designated as a contiguous county

Figure 10: USDA Secretarial Disaster Designations



Source: U.S. Department of Agriculture

Past Drought Impacts

Drought causes significant economic, environmental, and social impacts. Drought impacts several sectors including: agriculture, rural and municipal water supplies, fish and wildlife, tourism, recreation, water quality, soil erosion, the incidence of wildfires, electricity demand, and other sectors. Drought can also indirectly impact personal and business incomes, tax revenues, unemployment, and other areas as well.

The NMC's Drought Impact Reporter documents the impacts of drought throughout the United States. The following table summarizes, by category, the impacts within the CPNRD from 2000 – 2017. Many of these reported impacts have been in the agricultural sector.

Table 5: Reported Drought Impacts (2000 to 2017)

Area	Agricultural	Business & Industry	Energy	Fire	Plant & Wildlife	Relief, Response, & Restrictions	Society & Public Health	Tourism & Recreation	Water Supply & Quality
CPNRD	17	0	1	3	8	21	2	1	14

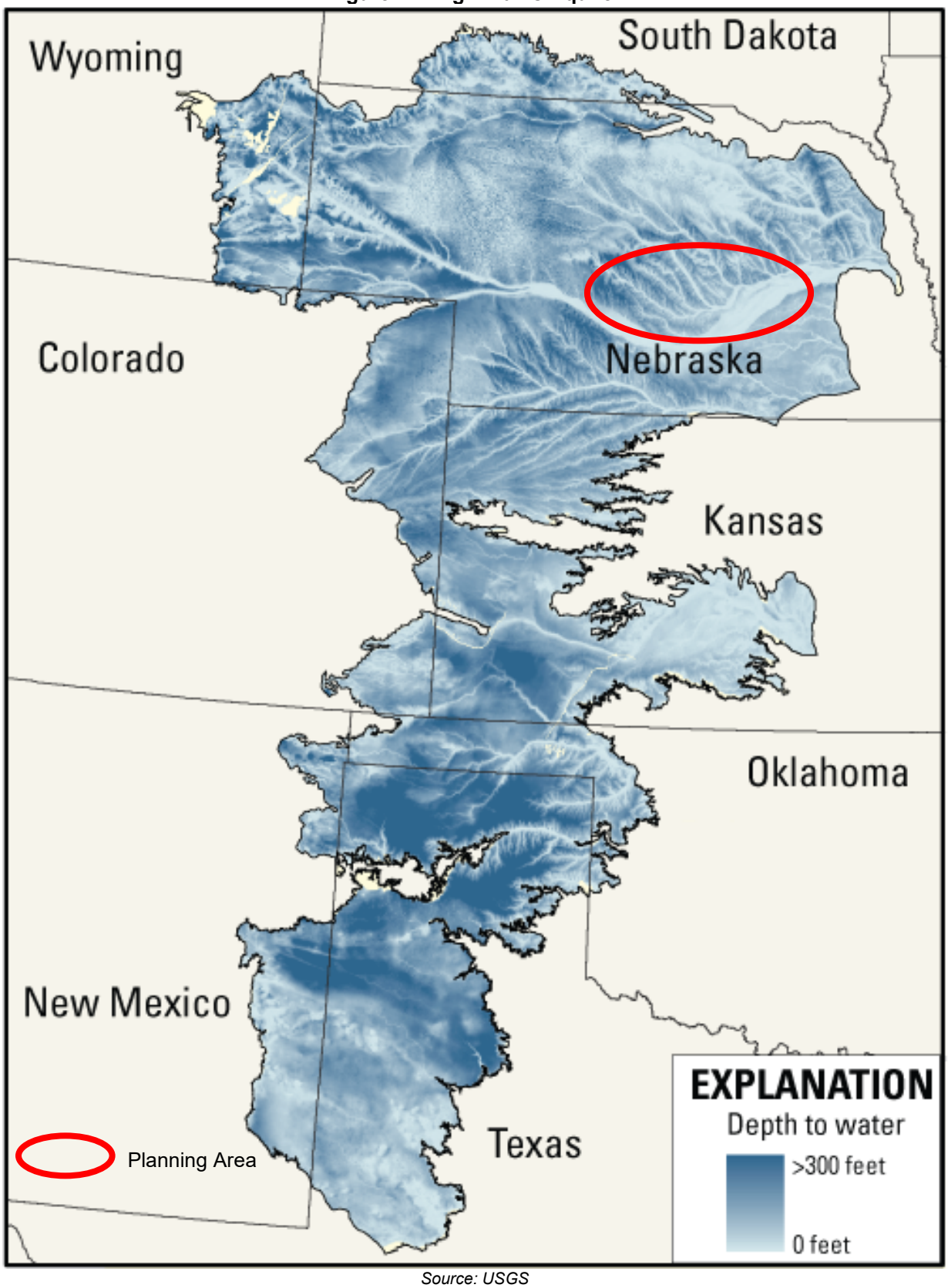
Source: NDMC – Drought Impact Reporter

According to the Drought Impact Reporter, there have been more than 10 impacts reported related to water supply and quality in the planning area. During the 2012 drought more than 1,100 surface irrigators across the state received a notice to stop pumping from the Nebraska Department of Natural Resources.[i] The CPNRD reported that during the 2012 drought, they received several complaints from acreage owners due to well issues. The likely issue was the wells were not drilled deep enough to handle the groundwater draw down during prolonged periods of drought.

Historically, the CPNRD has not experienced as many negative impacts from previous drought events as other areas in the state. There are several reasons that the district has been protected from the impacts of drought. First is Platte River which runs east-west through the entire region. The Platte River provides a relatively stable surface water resource for both municipalities and irrigators. The second reason is that the NRD is located downriver of Lake McConaughy. Lake McConaughy is a reservoir located on the North Platte River and in times of drought, additional water can be released to increase stream flows along the Platte River. The final reason for lack of previous drought impacts is High Plains (Ogallala) Aquifer. The aquifer provides a reliable source of groundwater even during drought conditions. Figure 11 shows the location NRD location relative to the aquifer.

[i] Lincoln Journal Star: https://journalstar.com/news/state-and-regional/govt-and-politics/state-orders-irrigators-to-stop-pumping-water/article_98391404-9487-50b1-9820-323a19f94f42.html

Figure 11: High Plains Aquifer



Source: USGS

There is a local concern that a lack of historic drought impacts, and plentiful water resources has helped create a false sense of security for many in the region. Much of the water resources are reliant on snowmelt from the Rocky Mountains. Both the Platte River and Lake McConaughy are fed from snowmelt from the Ricky Mountains in Colorado and Wyoming. If an extended period of drought were to occur in either of those states, the Central Platte NRD region would be impacted and might also experience an extended drought. The CPNRD estimated that major concerns would occur for Lake McConaughy by year six or seven of a drought. During a multi-year drought, power utilities would begin to scale back production which would place significant financial hardship on the utilities.

Drought is one of the costliest hazard events. According to NOAA National Centers for Environmental Information (NCEI), there have been 23 billion-dollar disasters in the U.S. attributed to drought since 1980. Table 6 shows the damage that drought causes in the planning area each year. This table does not include losses from displacement, functional downtime, economic loss, injury, or loss of life.

Table 6: Average Annual Damages

Total Property Loss[1]	Average Annual Property Loss[1]	Total Crop Loss[2]	Average Annual Crop Loss[2]
$0	$0	$76,542,179	$4,252,343

Source: 1 Indicates the data is from NCEI (January 1996 to December 2017); 2 Indicates data is from USDA RMA (2000 to 2017)

Future Probability of Occurrence

The probability for future drought events was calculated by the previous number of months in drought divided by the total months on record. The planning area experienced drought 444 out of 1,476 months on record; resulting in a 30.1% chance of drought occurring each month within the CPNRD. However, according to the University of Nebraska-Lincoln report *Understanding and Assessing Climate Change: Implications for Nebraska*, the State of Nebraska can expect an increase in drought frequency and severity in the future.

Vulnerability Assessment

As drought is a normal, recurrent feature of climate, the entirety of the planning area is susceptible to its impacts. However, there are some areas, industries, and populations that may experience greater impacts due to the vulnerabilities described below.

Water Quantity Concerns

Drought conditions have a major impact on water quantity conditions for both surface water and groundwater. The effects of drought can be especially difficult on areas where there are already water quantity concerns. The CPNRD has created 24 groundwater management areas (GWMA) the district has created to monitor and management the groundwater in the area. The CPNRD measures approximately 500 wells throughout all 11 counties twice a year in order to monitor the district's groundwater levels. Groundwater levels in 1982 have been used by NRD as the benchmark year to compare groundwater level changes.

Figure 12 shows accumulated change in groundwater levels from 1982 to 2018. Most areas around the Platte River are above 1982 levels while the areas located farthest from the Platte River are below 1982 levels. A possible reason for this is the groundwater recharge that the Platte River provides those areas.

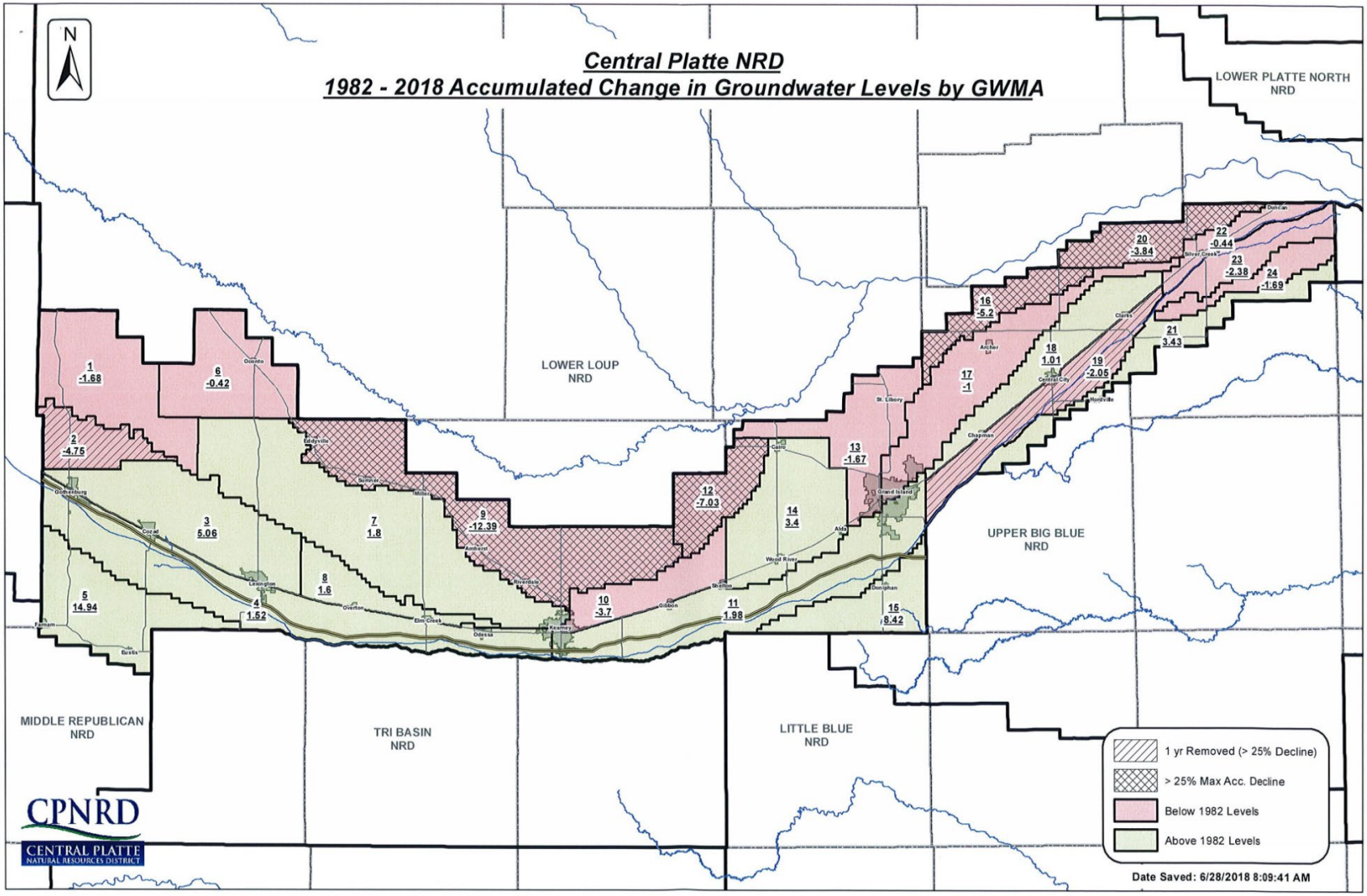
Figure 13 shows the maximum acceptable decline of groundwater for each GWMA. Each management area is given a phase depending on the percentage decline in that areas water table as it relates to the maximum acceptable decline level. Table 7 shows the phases and corresponding percentage decline. As the phases increase additional controls, mandatory cutbacks in irrigated acreage, and increased spacing limits for new wells are added. Specifics on the controls can be found in the NRD's Groundwater Management Plan.

Table 7: Groundwater Supply Phasing

Phase	Percentage Water Table Decline as Related to the Maximum Acceptable Decline Level
Phase I	<50%
Phase II	50% - 69%
Phase III	70% - 89%
Phase IV	90% - 99%
Phase V	100%

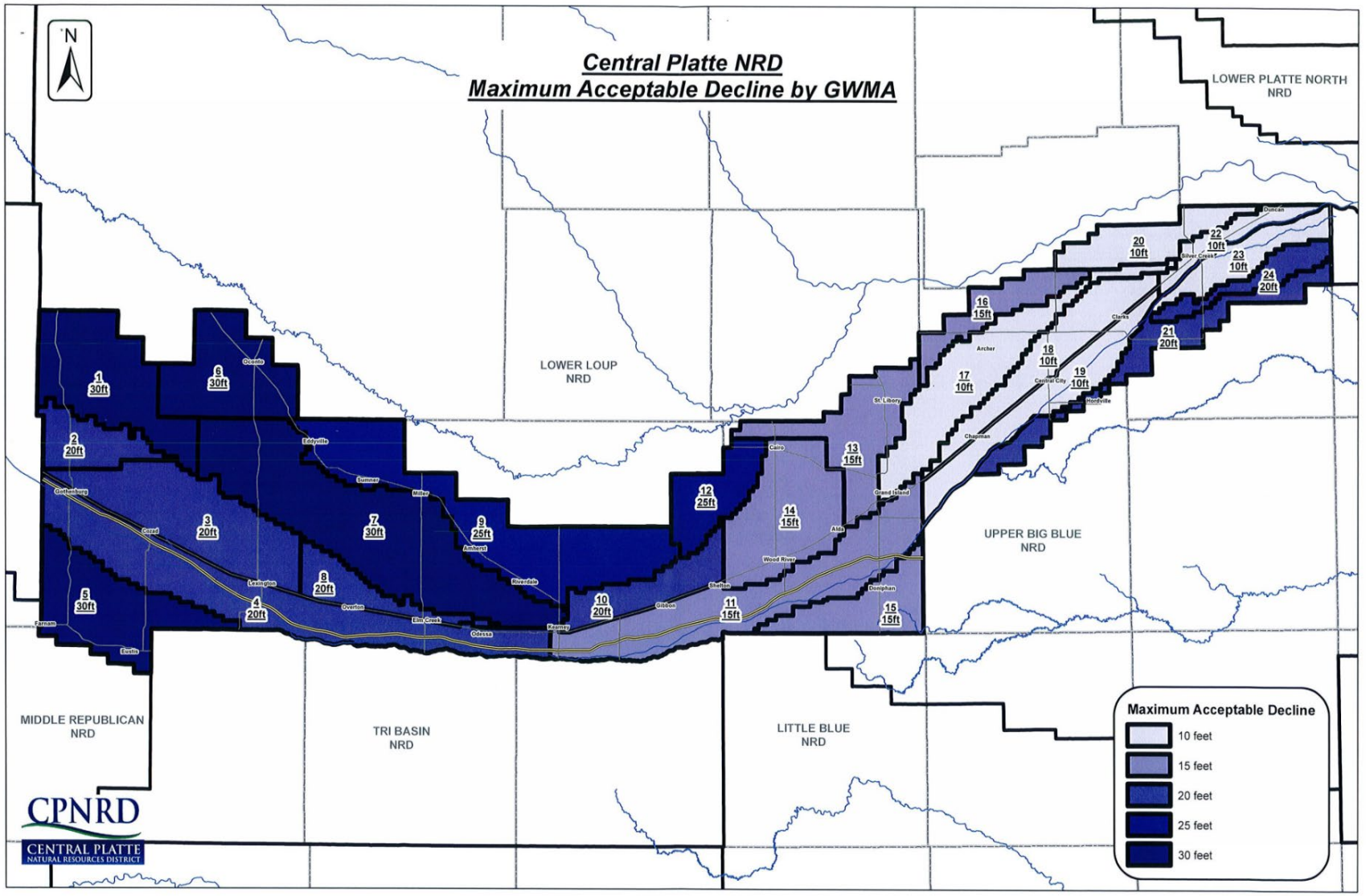
Source: CPNRD

Figure 12: 1982-2018 Accumulated Change in Groundwater Levels



Source: Central Platte NRD

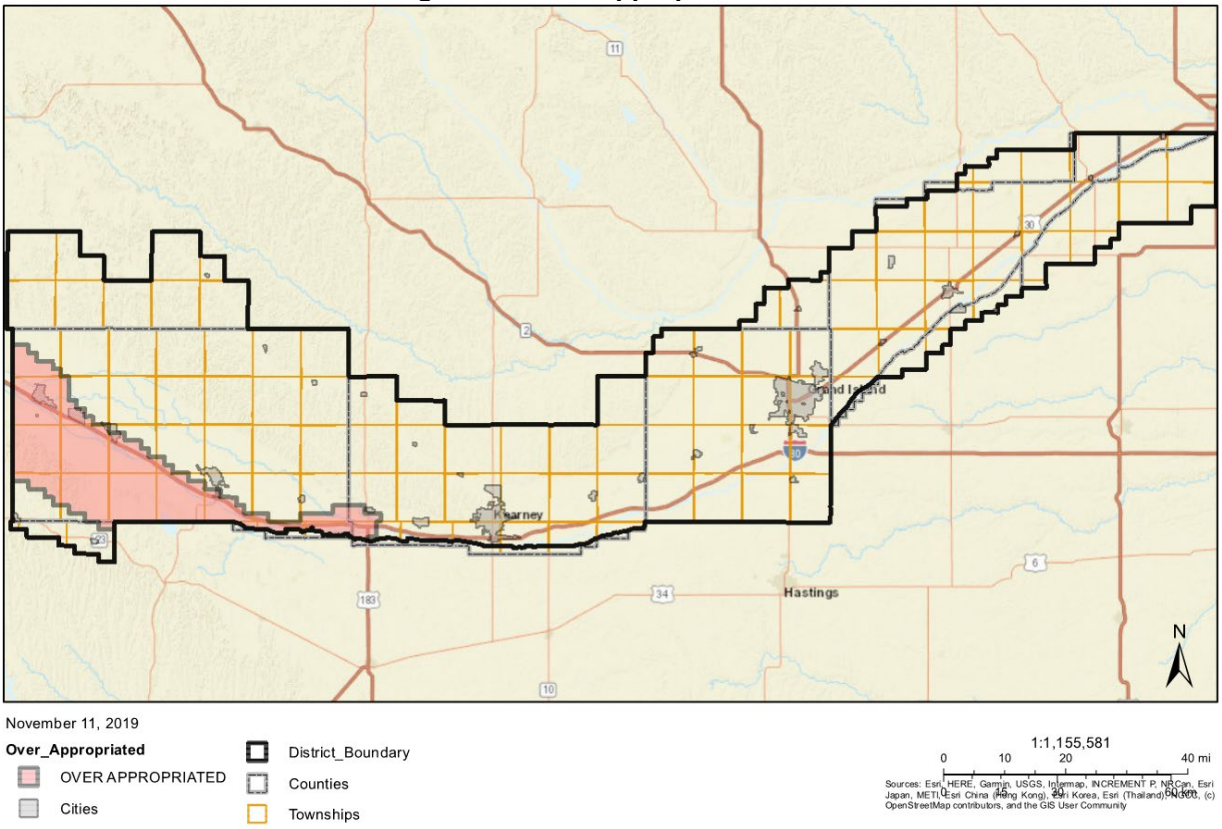
Figure 13: Maximum Acceptable Decline by GWMA



Source: Central Platte NRD

Figure 14 shows the Nebraska Department of Natural Resources (NeDNR) over appropriated areas within the CPNRD. Once an area is designated as over appropriated additional controls are implemented. Controls include closure to issuance of new well preventing expansion of irrigated acres, and preventing the increase in, or expansion of consumptive use of groundwater for other uses. The southwestern portion of the NRD surrounding the Platte River has been designated as over appropriated. Additional rules and regulations can be found in the Groundwater Management Plan.

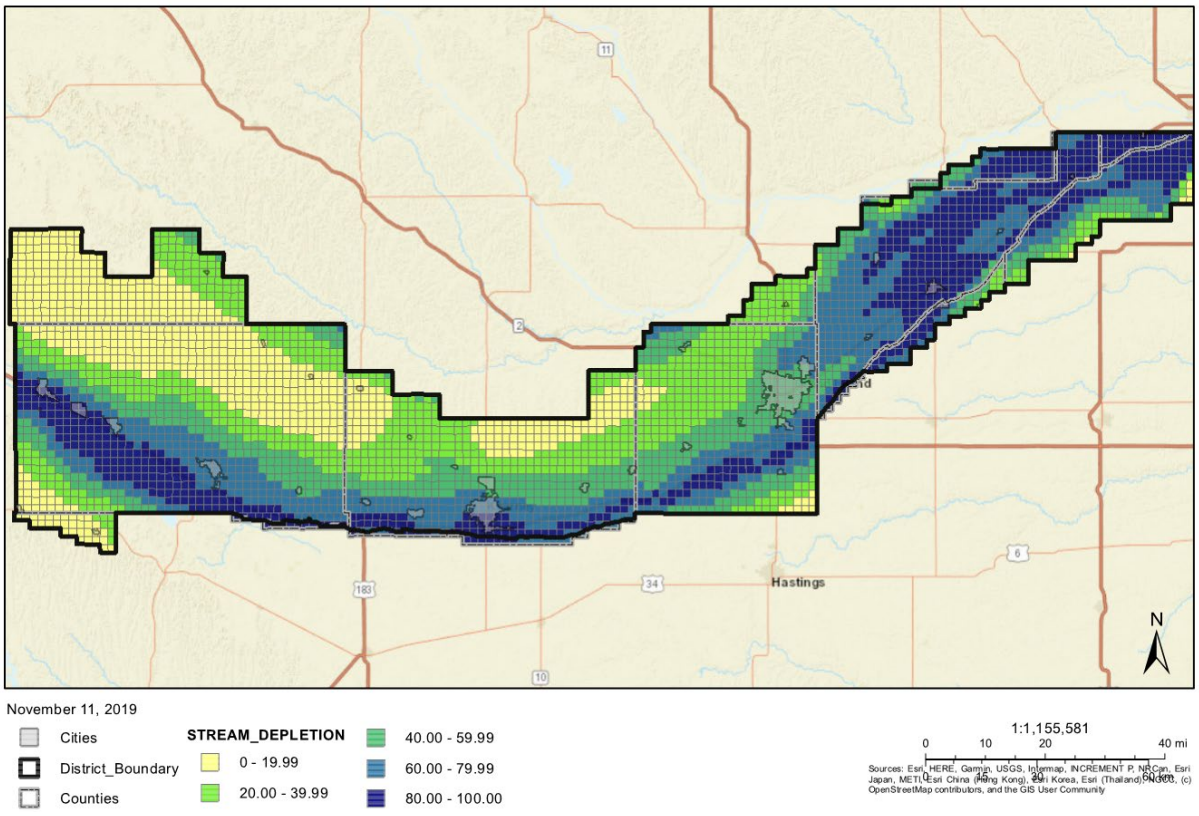
Figure 14: Over Appropriated Area



Source: GIS Workshop

The figure below shows stream depletion across the entire NRD. Stream depletion is the reduction in the flow rate as a result of pumping in an aquifer that is hydraulically connected to a river. The northeast portion of the NRD and along the Platte River have the stream depletion. The northwester portion of the NRD have shown the least stream depletion. This is likely due to the number of registered wells in the district. When compared with Figure 7 above, areas of high well density have higher levels of stream depletion.

Figure 15: Stream Depletion



Source: GIS Workshop

Water Quality Concerns

Water quality concerns are often exacerbated under drought conditions because contaminants can become more concentrated in light of a diminished water supply. Figure 16 shows the known nitrate levels within wells (tested for nitrate concentrations) throughout the district. The EPA has set a Maximum Contaminant Level of nitrate as nitrogen at 10 mg/L (or 10 parts per million) for safety of drinking water. Only wells with nitrate levels over 10 mg/L are shown in Figure 16.

Figure 17 shows the groundwater quality phases throughout the district. There are four potential phases which can be used in order to manage those activities having an effect on groundwater quality. Phase I areas have average nitrate levels between 0 and 7.5 ppm and no municipal supply potentially adversely impacted. Phase II areas have an average nitrate level between 7.6 and 15.0 ppm or areas with a municipal supply within a sub-region that is potentially impacted. Phase III areas have an average nitrate level of 15.1 or greater ppm or areas with a municipal supply within a sub-region that is potentially impacted. Currently the district does not have any Phase IV areas where nitrate levels are not declining at an acceptable rate as determined by the Board of Directors. As phases increase, additional management activities are added and become more restrictive.

Figure 18 shows the identified wellhead protection areas within the district. A wellhead protection area is defined by the geographic area (and flow direction) contributing water to the well or well field of a municipal water system. These areas also include information that estimate the time-of-travel of the groundwater as it flows towards the wellhead. Identifying the wellhead protection area allows a community to proactively protect and manage the source of community drinking water.

Figure 16: Known Nitrate Levels

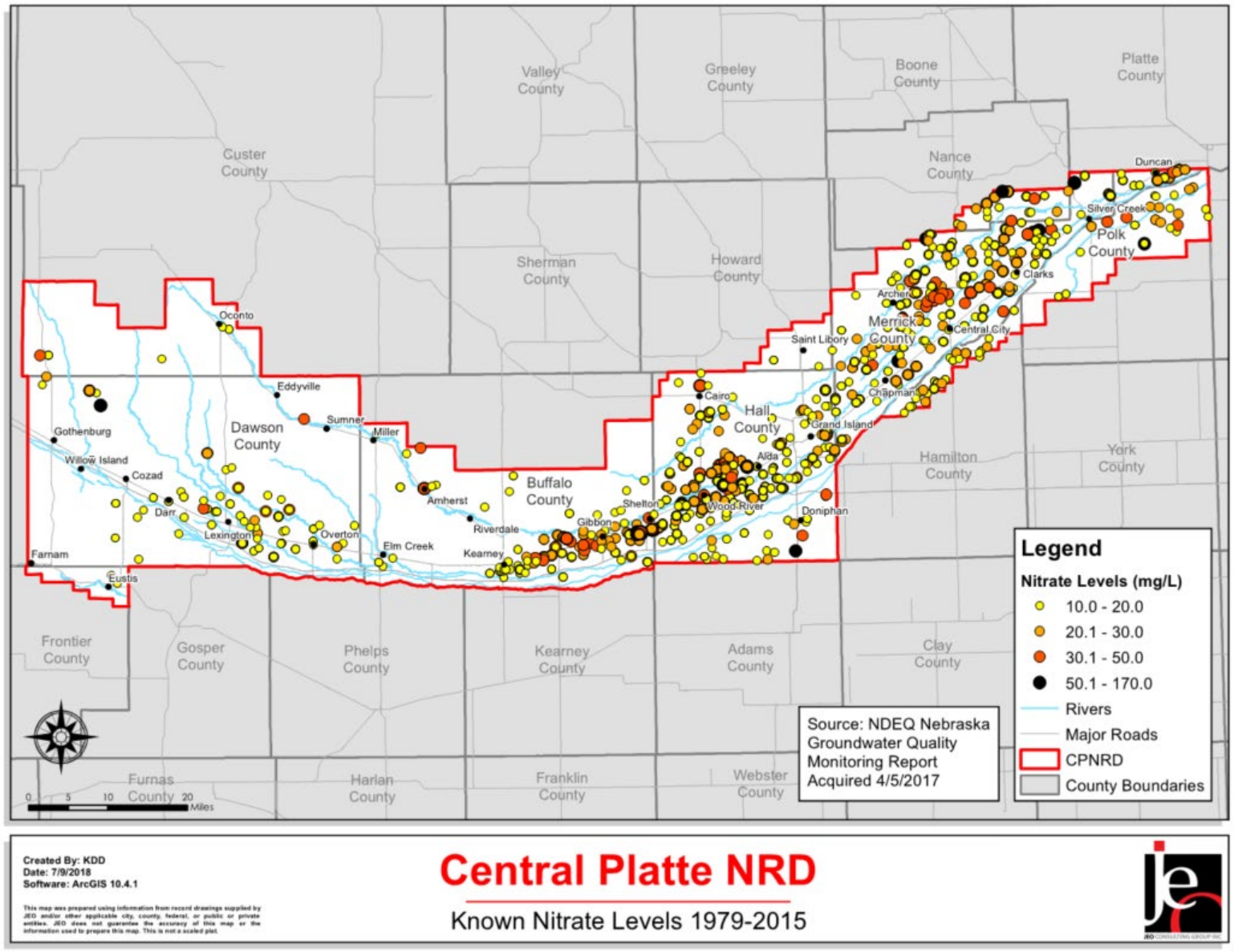
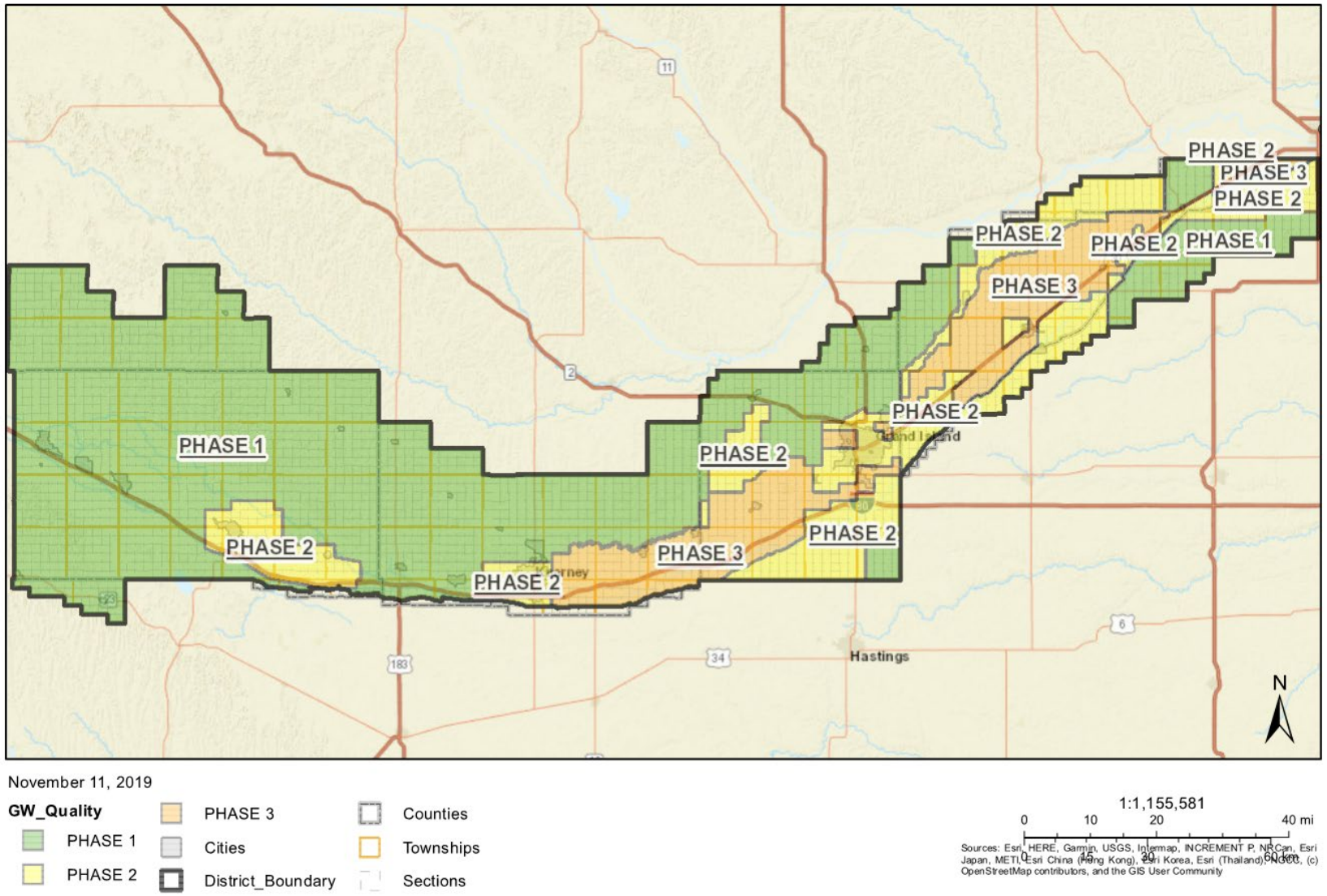
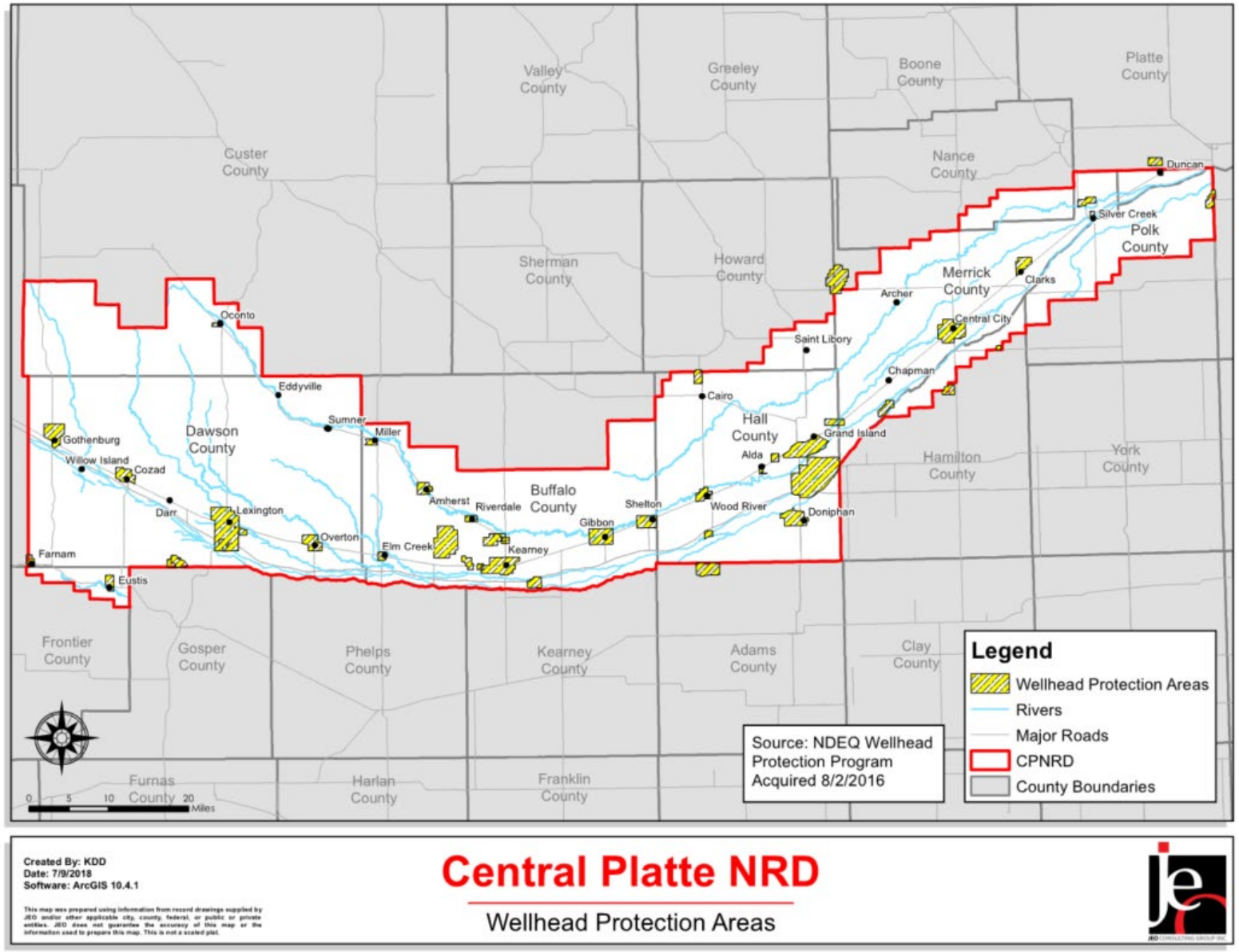


Figure 17: Groundwater Quality Phases by GWMA



Source: GIS Workshop

Figure 18: Wellhead Protection Areas



Economics

Agriculture is a major industry and economic driver of the economy within the CPNRD. The following tables display the importance of the agricultural sector within the CPNRD. Drought can cause significant economic impacts in agriculturally based economies. According to the USDA Risk Management Agency (RMA), drought accounted for $76,542,179 of crop losses within the planning area from 2000-2017. Reduced income for farmers has a ripple effect into other sectors, as their ability to purchase goods and services is reduced.

Table 8: Farm Employment Structure by County, 2016

County	Jobs	% of Jobs	Location Quotient
Buffalo	1,149	3.1	2.3
Dawson	1,044	6.8	4.9
Hall	706	1.6	1.2
Merrick	565	14.0	10.3
Polk	525	19.1	13.9
Total	3,989	-	-

Source: Nebraska Regional Economic Analysis Project (NE-REAP) with data provided by the U.S. Department of Commerce, Bureau of Economic Analysis

Table 9: Agricultural Land Sales by County

County	Number of Farms	Land in Farms, Acres	Market Value of Agricultural Sales
Buffalo	1,046	580,579	$395,127,000
Dawson	806	630,466	$826,281,000
Hall	593	329,668	$353,237,000
Merrick	492	235,072	$275,222,000
Polk	466	245,268	$326,239,000

Source: USDA, 2012 Census of Agriculture

There are also a number of water intensive industries that may be vulnerable during a drought event. These industries include ethanol plants, power plants, automotive manufacturing, meat production, dairy production, breweries, paper industries, and textile mills.

Every year from late February to early April, an estimated 500,000+ sandhill cranes stop along the Platte River in the planning area to rest and feed on waste grain before finishing the rest of their migration. The University of Nebraska-Kearney estimated the economic impact of the 2017 crane migration on Central Nebraska was $14.3 million and supported 182 year-round jobs.[ii] Drought can impact how much food and water is available, which impacts how long the birds will stay in the area.

The other major event in the planning area is the Nebraska State Fair. In 2012 the Grand Island Independent reported that drought impacted the number of livestock brought to the fair because of poor pastures and high feed costs.[iii]

[ii] University of Nebraska-Kearney. 2017. "The Economic Impact of the Annual Crane Migration on Central Nebraska". Accessed May 2018". http://unknews.unk.edu/wp-content/uploads/2017/07/Crane-Economic-Impact-Study.pdf

[iii] The Grand Island Independent. August 2012. "Drought has impact on State Fair cattle entries". Accessed May 2018. http://www.theindependent.com/news/local/drought-has-impact-on-state-fair-cattle-entries/article_c0d0081a-554a-5a2e-908c-2aed2f1194f9.html

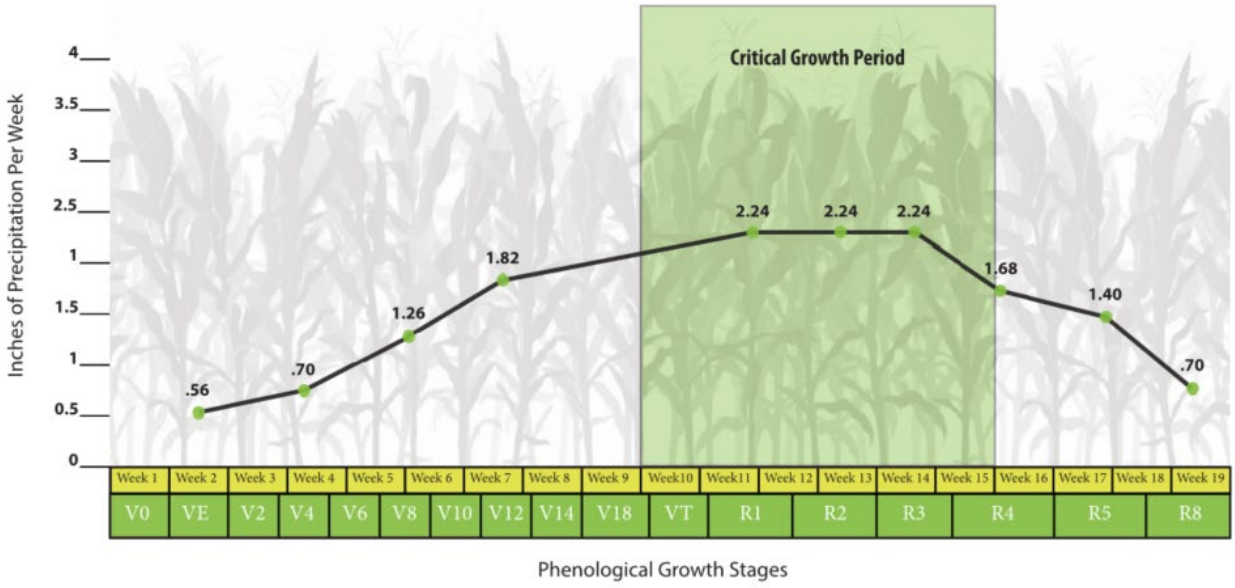
Seasonal Vulnerabilities

Seasonal vulnerabilities related to water availability and high-water demand exist within the NRD and across the state. The planning area will be more vulnerable to drought during these periods. These seasonal vulnerabilities may impact when a drought stage is declared.

Agricultural irrigation is one key consideration directly related to monitoring and managing water use and water need for the CPNRD. The phenology for crop development provides insight regarding times of high water demand. The development cycle for corn crops was reviewed (corn is more intensive than the other primary crops for the region) and can be viewed in Figure 19. The ideal time to sow crops in the region ranges from April 25th to May 10th. Clearly there is need for moisture throughout the growth cycle, but the most critical times for adequate soil moisture are during the pre-tasseling and tasseling phases. Critical moisture management times for 113-day maturing corn occur between weeks 10 and 15. If the assumed sowing date is May 1st, critical periods with adequate soil moisture for this particular crop would be during the months of July and August.

While monitoring water supplies throughout the year is helpful, it is most important for agricultural, municipal, commercial, and industrial water users to manage and develop contingency plans in case of shortage, during the periods of peak demand.

Figure 19: Example of Crop Water Use by Growth Stage for 113-Day Maturity Corn



**Ideal sowing range: April 25-May 10*

Threatened or Endangered Species

There are seven species with ranges in the planning area that are on either the state or federal threatened and endangered species list, they are: Small White Lady's Slipper, Western Prairie Fringed Orchid, American Burying Beetle, River Otter, Piping Plover, Interior Least Tern, and Whooping Crane. Although drought will impact each species differently, in general species will become more vulnerable during drought conditions. When a drought occurs critical habitat and food supplies may become damaged. Certain species may also find it difficult to find adequately supplies of drinking water. Piping Plovers, the River Otter, the American Burying Beetle, and Whooping Cranes are all especially vulnerable to drought conditions affecting their habitat.

Health Implications

In periods of limited rainfall, water bodies may become reduced in size, causing them to become stagnant. Inadequate water supplies can also cause people to collect rainwater which can lead to additional bodies of water. These stagnant water bodies provide an excellent breeding ground for certain types of types of mosquitoes (for example, Culex tarsalis) which carry West Nile Virus. Outbreaks of West Nile Virus, which is transmitted to humans via mosquitoes, have an increased likelihood of occurring during drought conditions.[iv]

Drought conditions may impact air quality causing acute issues as well as negatively impacting individuals who have certain chronic health conditions such as asthma. Fire and dry soil can increase the number of particulates in the air such as dust, pollen and smoke. These substances can increase the risk for acute respiratory infections like bronchitis and bacterial pneumonia.[v]

[iv] Centers for Disease Control and Prevention. August 2017. "Drought and Health". Accessed May 2018. https://www.cdc.gov/nceh/drought/default.htm

[v] Centers for Disease Control and Prevention. August 2017. "Drought and Health". Accessed May 2018. https://www.cdc.gov/nceh/drought/default.htm

Section Five: Drought Monitoring

The goal of this section is two-fold. The first goal is to use historical drought information to define drought locally. The second goal works to identify the best available resource to the CPNRD to monitor and detect the potential for drought occurrence as early as possible. This section includes a brief overview of various drought monitoring tools, limitations, and the recommended tool to be used by the CPNRD.

Defining Drought Locally

Currently the CPNRD does not have a local drought definition. However, there are many practices already in place to monitor water levels. The NRD monitors static water levels in approximately 500 wells across the district. South Platte River and Platter River flows are also monitored on a regular basis. There are also groundwater and surface water controls already in place. For groundwater they include: groundwater moratorium, certification of groundwater uses, groundwater variances, groundwater transfers, and municipal and industrial accounting. Surface water control are: maintaining the moratorium on new surface water appropriation and on expanded surface water uses, transfers of appropriations are subject to department rules, continuation of surface water administration and monitoring, and no additional requirements to use additional conservation measures.

Drought Monitoring Resources

The CPNRD and planning team considered a number of indicators that could be used to monitor drought. Examples include the Palmer Drought Severity Index (PDSI), the Standardized Precipitation Index (SPI), stream flows, groundwater levels, and creating its own drought monitoring tool using data from multiple sources. Through discussion, it was decided that those indicators did not provide consistent or thorough data, were too costly, or were too time intensive. Ultimately the CPNRD determined that it will use the U.S. Drought Monitor (USDM) in order to monitor drought for the region.

U.S. Drought Monitor

The USDM is a map released weekly, showing which parts of the U.S. are in drought. The map uses five classifications which are shown in Figure 20. Figure 21 shows the map released on November 7, 2019. In addition, maps are available on a regional and statewide (showing counties) scale. The USDM is not a statistical model but relies on experts to synthesize the best available data and local observers to interpret the information. Data inputs include PDSI, SPI, the Keech-Byram Drought Index for fire, Surface Water Supply Index, snowpack, hydrologic data, assessments of vegetation health, and various indicators of soil moisture.

Figure 20: U.S Drought Monitor Classification

			Ranges				
Category	Description	Possible Impacts	Palmer Drought Severity Index (PDSI)	CPC Soil Moisture Model (Percentiles)	USGS Weekly Streamflow (Percentiles)	Standardized Precipitation Index (SPI)	Objective Drought Indicator Blends (Percentiles)
D0	Abnormally Dry	Going into drought: ▪ short-term dryness slowing planting, growth of crops or pastures Coming out of drought: ▪ some lingering water deficits ▪ pastures or crops not fully recovered	-1.0 to -1.9	21 to 30	21 to 30	-0.5 to -0.7	21 to 30
D1	Moderate Drought	▪ Some damage to crops, pastures ▪ Streams, reservoirs, or wells low, some water shortages developing or imminent ▪ Voluntary water-use restrictions requested	-2.0 to -2.9	11 to 20	11 to 20	-0.8 to -1.2	11 to 20
D2	Severe Drought	▪ Crop or pasture losses likely ▪ Water shortages common ▪ Water restrictions imposed	-3.0 to -3.9	6 to 10	6 to 10	-1.3 to -1.5	6 to 10
D3	Extreme Drought	▪ Major crop/pasture losses ▪ Widespread water shortages or restrictions	-4.0 to -4.9	3 to 5	3 to 5	-1.6 to -1.9	3 to 5
D4	Exceptional Drought	▪ Exceptional and widespread crop/pasture losses ▪ Shortages of water in reservoirs, streams, and wells creating water emergencies	-5.0 or less	0 to 2	0 to 2	-2.0 or less	0 to 2

Source: U.S Drought Monitor

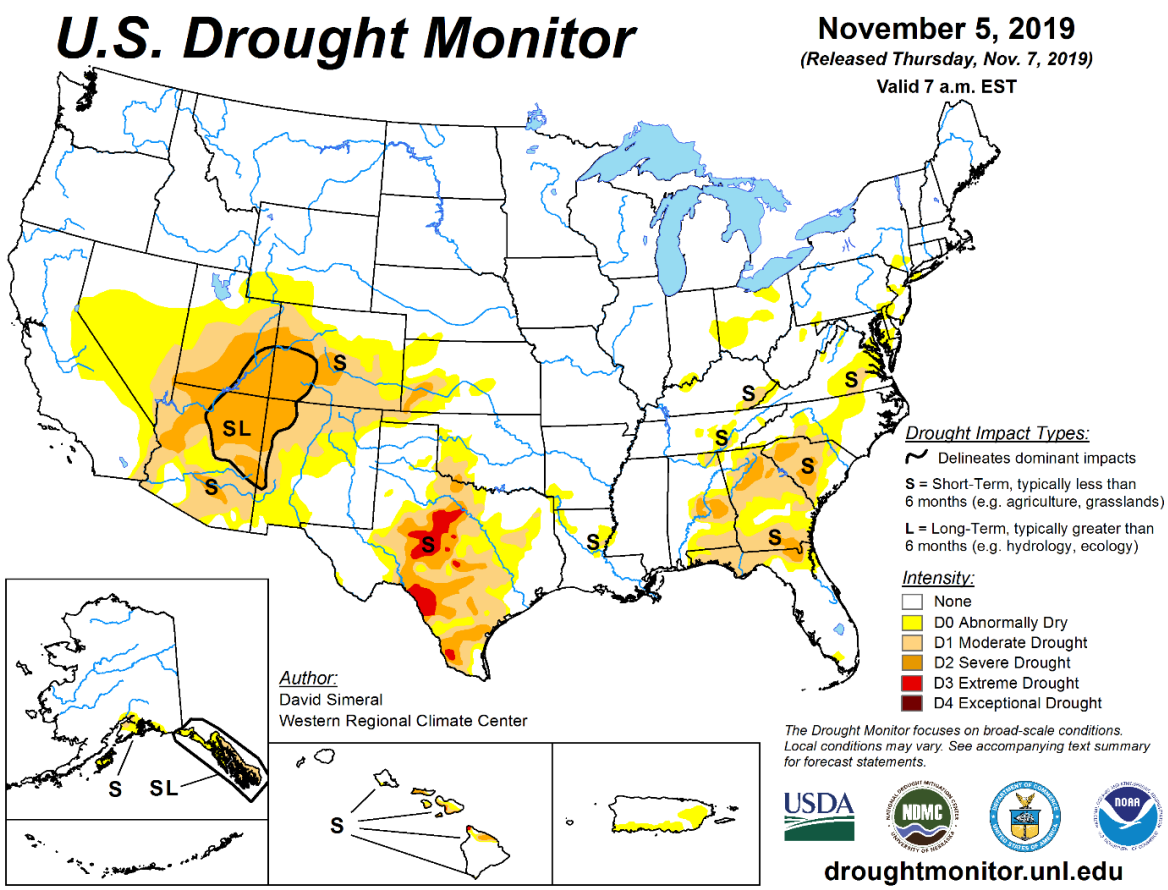
Recommended Drought Monitoring and Declaration Protocol

During meetings with the CPNRD, drought monitoring, and declaration protocol were discussed. The NRD does want to pursue any triggers or additional controls related to drought at this time. Several controls are in place for both surface and groundwater and the NRD did not feel that additional trigger controls were necessary. The primary function of the NRD related to drought will be monitoring and educating the public and communities.

As stated earlier the CPNRD will use the USDM to regularly monitor drought for the region. In addition, the NRD will also continue to monitor ground and surface water levels through the district. For the long more long-term drought outlook, the National Oceanic and Atmospheric Administration's (NOAA) U.S Seasonal Drought Outlook can be used: https://www.cpc.ncep.noaa.gov/products/expert_assessment/sdo_summary.php.

For a more long-range look at drought the NRD could utilize a committee to perform a yearly drought outlook. Within the CPNRD there is currently a committee that meets on an annual basis to discuss potential ice jam issues. The role of this committee could be expanded to examine all potential hazard events including drought. This committee could be renamed to the Extreme Events Committee (EEC). At the beginning of each year the committee could meet and look at the NOAA U.S. Seasonal Drought Outlook. The committee could also look at more localized data including steam gauges, groundwater levels, and the snowpack in the Rocky Mountains to determine if drought is likely to be an issue during the year and what can be done do reduce its impacts.

Figure 21: U.S Drought Monitor (November 5, 2019)



Source: U.S Drought Monitor

The USDM can be used for monitoring throughout the year. Special attention should be given to the NRD and surrounding area, as well as the Rocky Mountain areas in Colorado and Wyoming. Below are recommendations of actions which the CPNRD could take depending on the district's drought designation given by the USDM.

No Drought (white on the USDM map): No additional monitoring of local indicators needs to be done. The NRD can continue to monitor the USDM map.

D0 Abnormally Dry (yellow on the USDM map): No additional monitoring of local indicators needs to be done. The NRD can continue to monitor the USDM map.

D1 Moderate Drought (light orange on the USDM map): Once the district, surrounding area, or Rocky Mountains is designated as D1, the NRD should begin to monitor other drought indicators such as snowpack, groundwater levels, and surface water flows on at least a monthly basis.

D2 Severe Drought (dark orange on the USDM map): Once the district is designated as D2, the NRD should put out a press release and contact communities and stakeholders

to notify them of drought conditions. Additional monitoring of drought indicators should be ongoing and done on at least a weekly basis. The NRD should be coordinating with the National Drought Mitigation Center for messaging and appropriate responses.

D3 Extreme Drought (red on the USDM map): Once the district is designated as D3, the NRD should put out an additional press release and contact communities letting them know the district is in an extreme drought. A meeting of the EEC should be called to discuss the data given by local indicators and the USDM. If needed, the EEC should also identify potential actions which can be taken by the NRD and communities within the district to reduce the impacts of the drought event.

D4 Exceptional Drought (dark brown on the USDM map): Once the district is designated as D4, the NRD should put out an additional press release and contact communities letting them know the district is in an exceptional drought. All local indicators should continue to be monitored on an increased basis. The CPNRD may also want to hold a meeting with communities, counties, other NRD's, and major stakeholders to discuss current drought impacts and ways to mitigate them. If needed, additional long-term controls should also be discussed. This meeting can help the district identify areas of need and help create a unified message to the public.

Every drought event is different and has varying impacts. These monitoring and response recommendations are not meant to be implemented as written for every drought event. Rather, they should serve as a framework for the CPNRD to follow and edit as the situation dictates. After each drought event, the NRD should update the framework based on lessons learned in order for it to better suit the needs of the district the populations they serve.

Section Six: Mitigation and Management Actions

Ongoing/Completed Projects

Below are actions, projects, and programs that the CPNRD is already taking in the district to reduce the negative impacts from drought. Many of these projects serve multiple purpose objectives on top of reducing drought impacts and show how actions can have wide ranging benefits.

Canal Rehabilitation Projects and Water Back to the Platte River

CPNRD has been proactive in creating new ways to increase irrigation efficiency, protect water supplies, and increase flows to the river in Dawson County by working with the canal companies in the area. The Canal Rehab Project is the first conjunctive water management project in the CPNRD. In 2010 CPNRD purchased the Six-Mile Canal in order to close it. The NRD worked with farmers to convert their land to groundwater use and were able to fill in the canal. By closing the canal, the NRD reduced the amount of water being withdrawn from the Platte by an average of 2,377 acre-feet annually. 2015 marked the first year that all three of CPNRD's irrigation canal rehabilitations in Dawson County have been in full operation. The Cozad Ditch, Thirty Mile Irrigation District, and Southside Irrigation District produced needed returns back to the Platte River from both excess flows and natural flow diversions, as they were designed to do. The flowing table shows the total returns achieved in 2015.

Table 10: Water Back to the Platte River for 2015

Type of Return	Cozad	Thirty Mile	Southside	Totals (ac-ft)
Return of Surface Water to Platte	9,159.3	5,543.4	1,623.7	16,326.4
Return in 2015	204	796	221	1,221
Recharge Over Time	9,363.3	6,339	1,844.7	17,547

Source: 2017 Central Platte NRD Multi-Jurisdiction Hazard Mitigation Plan

In March 2018, the CPNRD purchased 157.4 acres of groundwater irrigated land located southeast of Cozad, NE. The purchase allows for a variety of options to return water back to the Platte River. Options include retirement of irrigated acres, transferring water from the South Side Irrigation District canal, and directly discharging flows back to the river from an adjacent property.

Water Banking Program

The canal rehabilitations were developed as a result of the NRD's Water Banking Program, which began in January 2007 to try to reduce the need to regulate irrigators within the district. As part of the program, the NRD purchases water rights as a solution to balance water that is being used with water that is available. Two major programs required the NRD to find a solution: the Platte River Recovery Implementation Program and Legislative Bill 962. CPNRD's water bank is the first to be implemented in Nebraska. Through the water bank program, the NRD acquires water rights from landowners. Every acre-foot of water that the NRD acquires impacts the river, thus reducing regulation and imposed cutbacks. The NRD has spent $4.6 million to purchase water rights to return the over-appropriated area back to a fully appropriated status, resulting in 3,000 ac-ft of water returned to the Platte River.

Groundwater Exchange Program

In 2016 the CPNRD held a groundwater exchange program. The program is where a producer with a certified groundwater use may temporarily transfer its right to use groundwater for the upcoming growing season to another participant in order to increase their own groundwater use for the same growing season. Buyers may also remove groundwater from use for the purpose of increasing streamflow. In order to participate in the program both the producer and buyer had to

obtain pre-approval from the CPNRD. Participation eligibility and rules for the program can be found in the Groundwater Management Plan.

Cost Share Programs

The CPNRD and Nebraska Soil and Water Conservation Program (NSWCP) offer cost sharing on a variety of projects. This program helps individuals reduce the costs of various projects and improvements which the NRD deems as helpful to the district and the environment. During the past fiscal year, water conservation funds for this program totaled $1,080,287.53 over 4,383.6 acres. The list below shows the drought related program available through the CPNRD and NSWCP.

Central Platte NRD Programs

- Well Abandonment (60%)
- Windbreaks and Weed Barrier (50%)
- Streambank Stabilization (50%)
- Flow Meter (50%)
- Phragmites Control (75%)
- High Intensity Soil Moisture Sensors ($2,000)

Nebraska Soil and Water Conservation Program (50%)

- Terrace Systems
- Water Impoundment Dams
- Grade Stabilization & Sediment Control
- Diversions
- Irrigation Tailwater Recovery Pits
- Underground Water Return Pipe from Reuse Pits
- Irrigation Water Management (surge valves, flow meters, goose necks, rainfall auto-shutoff, drip irrigation, soil moisture sensors, conversion nozzles)

Chemigation Program

The chemigation rules and regulations from NDEE helps ensure that the ground and surface waters of the state would not be contaminated by backflow of chemicals from irrigation water application systems used to apply crop nutrients and pesticides. The law requires a person directly involved in calibrating and monitoring a chemigation system to be certified by NDEE.

Platte River Recovery Implementation Program

The Platte River Recovery Implementation Program (PRRIP) was developed by the federal government, Colorado, Wyoming, and Nebraska in order to meet the Endangered Species Act requirements for the basin. The first part of the PRRIP includes the completion of water projects in order to improve flows in the central Platte by an average of 130,000-150,000 acre-feet annually. The second part of the program is the protection and maintenance of 10,000 acres of habitat for whooping cranes, pallid sturgeon, least terns, and piping plovers.

Water Management Studies

The CPRND commissions and participates in varies water management studies. The goal of which is understand ground and surface water better and to use these resources as efficiently as possible. These studies not only help individual land owners but also help to keep water in the rivers, creeks, and aquifer. A list of studies involving the CPNRD is given below.

- Water Conservation Study

- Inventory of Sandpits and Small Reservoirs
- Cooperative Hydrology Study
- Platte River Conjunctive Management Study
- CPNRD Vadose Zone Nitrate Study

Flood Control Projects

The CPNRD works with landowners and other agencies to minimize damages that cause flooding. With 27 communities across the CPNRD with varying degrees of flood control issues and challenges, the NRD has worked with many of them on flood control projects ranging from dams to levees to clearing of creeks and streams. Many of these projects provide benefits for groundwater recharge in addition to flood protection. For example, the recently completed Upper Prairie Silver Moores Flood Control Project included dry detention cells for flood waters, which can also help increase recharge after a large rain event.

Drought Education Outreach

One way to mitigate the impacts of drought is through outreach and education. Outreach can focus on identifying and sharing resources for agricultural producers, homeowners, renters, and other organization. The CPNRD currently provides a number of education opportunities. The following are some of the opportunities currently available from the CPNRD.

- Outdoor Classroom Program
- Natural Resources Newsletter
- Nebraska Envirothon
- Nebraska Children's Groundwater Festival
- Grand Island Groundwater Guardian Team
- Outdoor Learning Area at the Nebraska State Fairgrounds

Operational and Administrative Framework

In order to manage ground and surface water, the CPNRD must operate within the framework provided by the State of Nebraska. Below is a brief explanation of some of the frameworks for surface water administration and ground water allocation.

Surface Water Administration

The NeDNR governs the use of surface water in the State of Nebraska. This means that NeDNR has the authority to restrict the use of surface water. The state governs surface water through the prior appropriation doctrine which states that the oldest water rights holders get their full allocation of water before any junior rights holders can get their water.

As drought conditions develop a senior water rights holder can place a call to the local NeDNR field office and can request a hold to be placed on junior rights holders because the senior water right holders are not receiving their full allocation. The field office will then analyze the situation and determine how they can adjust water consumption to ensure that the senior rights holder will be able to get the water they need. If the senior appropriator is in fact not receiving the allocated amount, other surface water users whose priority date is junior will be required to cut back, or cease usage, in order to satisfy the senior appropriator.

Ground Water Allocation

The CPNRD is authorized by the state to manage and govern groundwater within the district. This authority provides the NRD with the means to restrict the use of groundwater, if conditions

warrant. As drought conditions develop, the NRD will ensure that groundwater is not being over pumped, thereby causing potential long-term harm to the aquifer.

The CPNRD will consider the climatic information from the pervious year, current year, and any future forecasted drought conditions when determining any changes to the groundwater allocation (as applicable) for the upcoming year.

Mitigation Actions

The following actions are mitigation actions identified throughout the planning process as well as the 2017 Central Platte NRD Multi-Jurisdictional Hazard Mitigation Plan. These actions are meant to help increase the NRD's resiliency to drought.

Action	Collaboration and Stakeholder Identification
Description	Work with various agencies, stakeholders, and communities to meet and discuss contacts, roles, tools, resources, etc. related to drought.
Estimated Cost	Staff Time
Potential Funding	General Fund
Timeline	2-5 Years
Priority	Low
Status	Not Started

Action	Coordinate with National Drought Mitigation Center
Description	Coordinate with the National Drought Mitigation Center for educational information, drought updates, and mitigation alternatives.
Estimated Cost	Staff Time
Potential Funding	General Fund
Timeline	1 Year
Priority	Low
Status	Not Started

Action	Development Regulations
Description	Work with communities and the county to encourage development away from high risk areas and areas vital to aquifer recharge (wetlands/riparian areas). Encourage zoning and real estate transactions to include water availability information.
Estimated Cost	Staff Time
Potential Funding	General Fund
Timeline	5+ Years
Priority	Medium
Status	Not Started

Action	Dredge Dams
Description	Dredge Dams to restore the structures to their previous capacity, increase water retention abilities, improving water availability during periods of drought: this would also enable structures to better store water during periods with high precipitation.
Estimated Cost	$25,000-$50,000
Potential Funding	General Fund, Grants
Timeline	2-5 Years
Priority	Medium
Status	Not Started

Action	Eliminate Invasive Weeds
Description	Elimination of invasive weeds from waterways in the district; work within the NRD and with neighboring NRDs to eliminate phragmites from the Platte River and other waterways in the region.
Estimated Cost	$7 million
Potential Funding	General Fund, Riparian Vegetation Management Grants
Timeline	Ongoing
Priority	High
Status	Ongoing. The NRD has had limited success in eliminating phragmites, but the grasses are perennial and need constant management.

Action	Extreme Event Committee
Description	Expand the hazards the ice jam committee looks at to include all hazards. The EEC will meet regularly to discuss future drought conditions, vulnerabilities, and future actions.
Estimated Cost	Staff Time
Potential Funding	General Fund
Timeline	1 Year
Priority	High
Status	A committee currently meets to discuss ice jams. The scope of this committee could be easily expanded to include other hazards.

Action	Improve Drought Education
Description	Develop or obtain drought education materials to conduct a multi-faceted public education and awareness program. Emphasize water conservation even during non-drought periods.
Estimated Cost	$0-$500+
Potential Funding	General Fund
Timeline	Ongoing
Priority	Medium
Status	Ongoing

Action	Improve Flood and Stormwater Detention/Retention Capacity
Description	Evaluate current stormwater and flood water capacity; implement measures to improve flood water and stormwater capacity. Additional storage capacity will help to increase groundwater recharge. Create additional wetland/riparian areas that can protect areas from floods as well as mitigate drought.
Estimated Cost	$25,000-$100,000+
Potential Funding	General Fund, Grants
Timeline	2-5 Years
Priority	Medium
Status	Ongoing

Action	Irrigated Land Acquisition
Description	Purchase surface or groundwater irrigated land in order to provide recharge back to the Platte River.
Estimated Cost	$100,000+
Potential Funding	General Fund, Grants
Timeline	5+ Years
Priority	Medium
Status	Ongoing. In 2018 the CPRND was able to acquire irrigated land near Cozad in order to reduce water taken out of the Platte.

Action	Reduce Water Demand
Description	Conduct a water use study to evaluate/implement methods to conserve water/reduce consumption; evaluate/implement water use restriction ordinance; identify/evaluate current/additional potable water sources.
Estimated Cost	Staff Time
Potential Funding	General Fund
Timeline	Ongoing
Priority	Medium
Status	Not Started

Action	Remove Non-Native Species
Description	Support property owners in removing non-native species that intensify wildfire vulnerability, specifically remove red cedar trees. During times of drought red cedar trees can be especially dangerous as a wildfire risk.
Estimated Cost	$200,000
Potential Funding	General Funds, Nebraska Forest Service Funds
Timeline	2-5 Years
Priority	Medium
Status	Not Started

Action	Upgrade Irrigation Channels
Description	Upgrade irrigation channels to reduce damages during flood events: this may include lining canals and/or increase storage reservoirs to ensure water availability during drought periods.
Estimated Cost	$25,000+
Potential Funding	General Fund, Grants
Timeline	2-5 Years
Priority	Medium
Status	Not Started

Action	Well Construction Education
Description	Educate municipalities and well drillers on the importance of appropriate well depths in future developments. Deeper wells for acreages will reduce the impacts during a drought event.
Estimated Cost	Staff Time
Potential Funding	General Fund
Timeline	Ongoing
Priority	Medium
Status	Not Started

Section Seven: Plan Maintenance and Updates

The CPNRD will be responsible for monitoring, evaluating, and updating the plan. Support and suggestions from stakeholders and the public will influence and enhance this process. Review of this plan should be done on an annual basis with an update occurring at least every five years. The plan may be updated more frequently at the discretion of the CPNRD Board, especially in the event of a major drought. If new, innovative mitigation strategies arise that could impact the planning area or elements of this plan, a plan amendment may be proposed and considered separate from the annual review.

Continued Public Involvement

To ensure plan support and input from the public as well as other stakeholders, public involvement should remain a top priority from the CPNRD. Notices for public meetings involving the discussion of or action on plan updates should be published and posted at least two weeks in advance.