CACHE COUNTY
WATER MASTER PLAN

Prepared

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GATEWAY MAPPING INC.

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Master Plan Informational Pamphlet (Located in report binder pocket)

CACHE COUNTY WATER MASTER PLAN

Executive Summary

Cache County's population is growing and consequently increasing stress on its most valuable resource, water. The County population has grown nearly 30 percent since 2000, and is projected to double by approximately 2050, placing progressively more stress on water resources. Any plan to address this reality should have the following purposes:

1. **Evaluate existing water resources and demands;**
2. **Determine future water demands;**
3. **Educate and build consensus;**
4. **Create a plan for the future; and**
5. **Establish a plan and system to manage water resources in the County.**

The recommendations in this master plan are founded on extensive analysis and evaluation of technical data and feedback from county, municipal, irrigation and environment stakeholders. This collaborative process informed the creation of an objective criterion which was used to assess and evaluate dozens of options and resulted in the proposed solutions.

Problem Statement

Cache County will not be able to protect and use its water resources efficiently without a water master plan and management system that empowers it to maximize the benefit of its existing resources and secure the Bear River water allocation.

Opportunity

Create a plan and management system that protects and conserves Cache County's long-term agricultural, environmental, and municipal water interests with an emphasis on securing its allocation entitlements pursuant to the Bear River Water Development Act.

Recommendations

Recommended Projects and Studies

Dozens of projects were evaluated using the objective criteria. The following projects are recommended based on how well they meet the objectives.

- Implement a water conservation program to conserve 25% by year 2025
- Evaluate environmental water demands and prioritize critical areas
- Bank water rights made available through agricultural to municipal conversion or through Bear River development

- Develop Bear River water through:
  1. Aquifer Storage and Recovery to develop 5,000 to 20,000 acre feet
  2. Above ground storage reservoirs to develop up to 60,000 acre feet
- Start a canal rehabilitation program
- Construct secondary water systems

These projects:

- Develop the Bear River water allocation
- Preserve agriculture
- Extend supply for future municipal growth
- Improve understanding of environmental water needs
- Improve water efficiencies

Management System

Create a Water Conservancy District

A water conservancy district is the most viable management system to realize the stated goals and objectives, and implement the recommended projects. It also incorporates the key purposes of the water master plan. More specifically, a conservancy district:

- Protects the Bear River water allocation through planning and development
- Provides a stronger voice for Cache County on water legislation issues
- Promotes water conservation
- Provides representation for both irrigators and drinking water users
- Functions as a water bank
- Facilitates cooperation between communities and irrigation companies to complete regional projects
- Provides a funding source to plan for and help complete needed regional water projects
- Allows individual communities and irrigation companies to manage their own water systems
- Provides a local governing water board that is 100% focused on water issues.

More details of how the analysis was completed and how the recommendations were determined are given in the master plan report.

1 INTRODUCTION

1.1 Project Background

Cache County, like many other counties in Utah, is growing and with that growth it is essential to have a plan to manage efficiently one of its most important resources, water. In comparison to many of the other counties in Utah, Cache County is relatively rich in water. Many of the water resources have been developed and used in the past for a number of different purposes, with the primary use of the water being agricultural production irrigation. The water has also been used to beautify the valley with trees and green scape. As the population increased in the valley, more water was utilized to meet municipal and industrial needs. It is projected that the population in the County will double by the 2050 reaching a population of more than 230,000. Cache County residents need a plan to protect, manage, utilize and conserve their water resources as efficiently as possible to meet current and future needs. These future needs fall into three main categories:

- Municipal and Industrial (M&I)
- Agricultural
- Environmental

It has been said "the demise of several civilizations has been traced directly to failed regional water management" (Peru, Mesopotamia) (Artzy and Hillel 1988: Ortloff et al. 1985). As the population increases, a regional plan for Cache County residents to maintain this resource is vital to meet the needs of the three categories.

1.2 Bear River Development

An important component of the water master plan is the Bear River water resource which includes many rivers that are tributary (rivers that drain) to the Bear River. All of the area within Cache County drains to the Bear River.

In 1991, The Utah Division of Water Resources (DWRe) was tasked with developing the Bear River waters based on legislation that was defined as part of the Bear River Development Act (BRDA). The BRDA identified the volume of water that could be stored in the Bear River drainage basin during winter months without negatively impacting the existing water right holders along the river and at the Bear River Bird Refuge. In the BRDA, 220,000 acre-feet of water can be developed in Utah. Storage facilities are needed in order to capture this water. The 220,000 acre feet of water is to be split as listed in Table 1.1. **Bear River water can only be developed though water storage projects.**

Table 1.1: Bear River Development Act Allocations

Bear River Development Act Allocations (acre-feet)	
Bear River Water Conservancy District	60,000
Jordan Valley Water Conservancy District	50,000
Weber Basin Water Conservancy District	50,000
Cache County or a Conservancy District in Cache County	60,000

The Jordan Valley Water Conservancy District and the Weber Basin Water Conservancy District have begun plans to develop their Bear River allocation.

1.3 Groundwater Management Plan

In 1999, the Utah Division of Water Rights (DWRi) completed a ground water study and determined that the surface water and ground water resources in Cache County are physically connected. A groundwater management plan was implemented that limited total future ground water withdrawals to a preliminary volume of 25,000 acre feet per year, and requires (typically) that replacement water be provided for any withdrawals. Once the initial 25,000 acre feet of water has been withdrawn from the ground, the State Engineer will re-evaluate the situation to determine if additional withdrawals will be allowed.

1.4 Representation on State Water Issues

Utah water laws and legislation are frequently changed and updated. In the water community, there are organizations experienced in water management and water issues that provide guidance to legislators as they vote to modify or establish new water law. Three major organizations that have a strong influence on the formation of Utah water law are:

- The Executive Water Task Force
- The Water Development Commission
- The Utah Water Coalition

Cache County needs a plan to have a stronger voice amongst these organization and others on water legislation issues such as the Bear River Development Act.

1.5 Purpose of Master Plan

Cache County will not be able to protect and use its water resources efficiently without a water master plan and management system that empowers it to maximize the benefits of its existing resources and secure the County's Bear River water allocation.

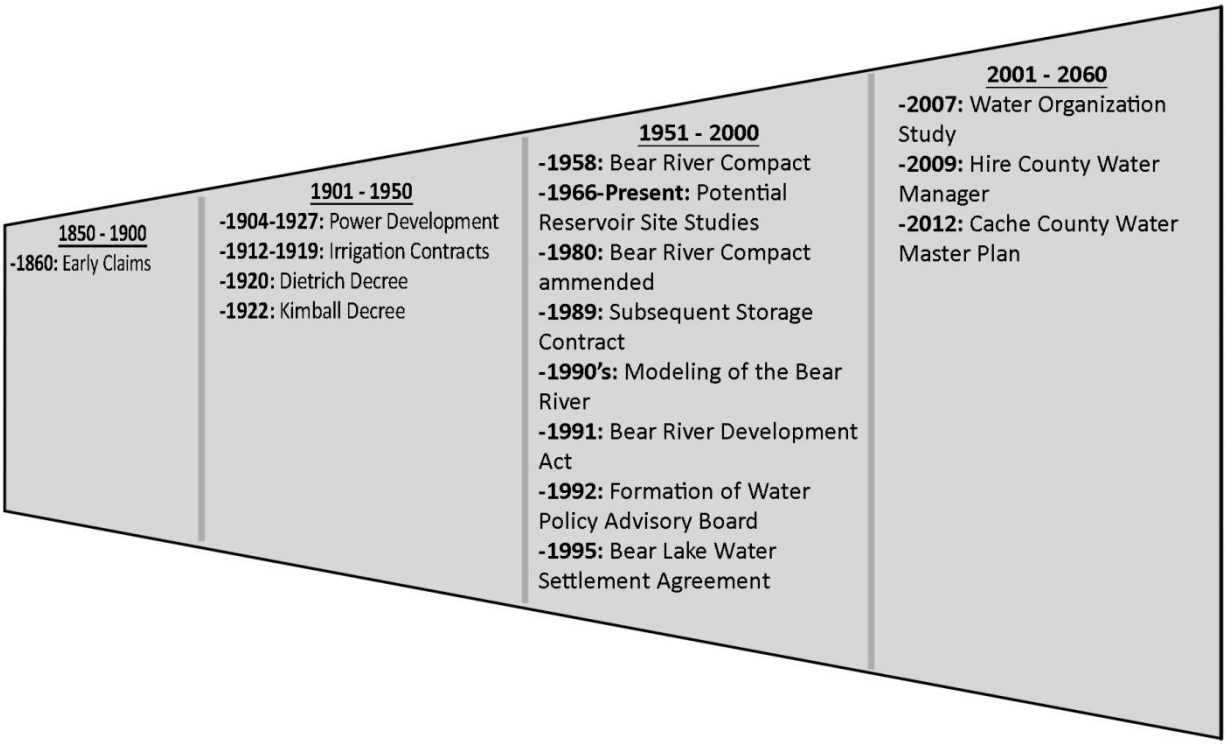
The following goals were set for the master plan:

- Evaluate existing water resources and their regional use
- Determine existing and future water demands across the County and make recommendations on future projects
- Educate and build consensus with stakeholders
- Set goals and have a plan for the future based on stakeholder input
- Recommend and create a prioritized schedule to complete future reports, actions and projects. Prepare conceptual opinions of probable costs to complete the evaluated water improvement projects
- Provide a plan to fund water improvement projects
- Demonstrate how fiscal resources can meet the funding needed to complete the planned projects
- Develop a recommendation for the organizational structure needed to manage water resources in the County
- Develop a plan that will help the County gain a greater voice with the state legislature on water issues

1.6 Cache County Water History

Cache County is more diverse because of the efforts that have been made in the past to develop water. Figure 1.1 gives an overview of some of the major past water milestones in the County. An increase in water policy and development activities has occurred during each of the last three 50-year periods. This trend will continue moving into the future as the population continues to increase in the County and along the Wasatch Front. With the increase in water policy and development, Cache County needs to dedicate more resources toward water management and development.

Figure1. 1: Major Water Milestones



1.7 Master Plan Process

The process used to develop this master plan involved the following components:

- **Public Process** – A public process was followed that involved interviews with key stakeholders, formation of a steering committee and periodic meetings with the Steering Committee during the development of the plan. This process is explained in greater detail in Section 2.
- **Supply and Demand Projections Coordination** – The Division of Water Resources participated in this project by evaluating the municipal and industrial supply and demands. The process and results are given in greater detail in Sections 3 and 4.
- **Technical Analysis of Alternatives** – An evaluation of potential projects and management structures was completed based on objective criteria developed through the public process and is explained in Section 5
- **Conclusions and Recommendations** – The overall conclusions and recommendations of the master plan are given in Chapter 6.

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2 PUBLIC PROCESS

2.1 Introduction

Water is a very important resource and plays an important role in social and physical needs. The water interests of stakeholders in the County play a major role in the design of a comprehensive water strategy. Water stakeholders include those representing agricultural, environmental and municipal interests. The team implemented a strategic stakeholder involvement campaign with key stakeholders in the planning process.

This strategy has helped regional water leaders feel ownership in the process of evaluating existing water resources and demands, determining future water demands, educating and building consensus, deciphering which management structure best meets the county's needs, and ultimately creating a plan for the future. The strategy involved executing a situational assessment, developing and consulting with a steering committee, updates to the County Council and holding additional meetings with other entities for a comprehensive understanding of issues at hand.

A comprehensive list of stakeholders that have participated in the public process through interviews or attendance at planning meetings is given in Appendix 2-A.

2.2 Situational Assessment

One of the first steps of the master plan was to conduct interviews with key stakeholders in order to gain an understanding of their water concerns and positions on Cache County water issues.

2.2.1 Goals of Interviews

The goals of the interviews were to:

- Gather information about each of the water systems in the County
- Identify water concerns
- Understand the water development priorities
- Understand views about various water strategies for the future
- Identify water goals
- Understand positions with regards to development of the Bear River
- Hear stakeholder views of potential water management options

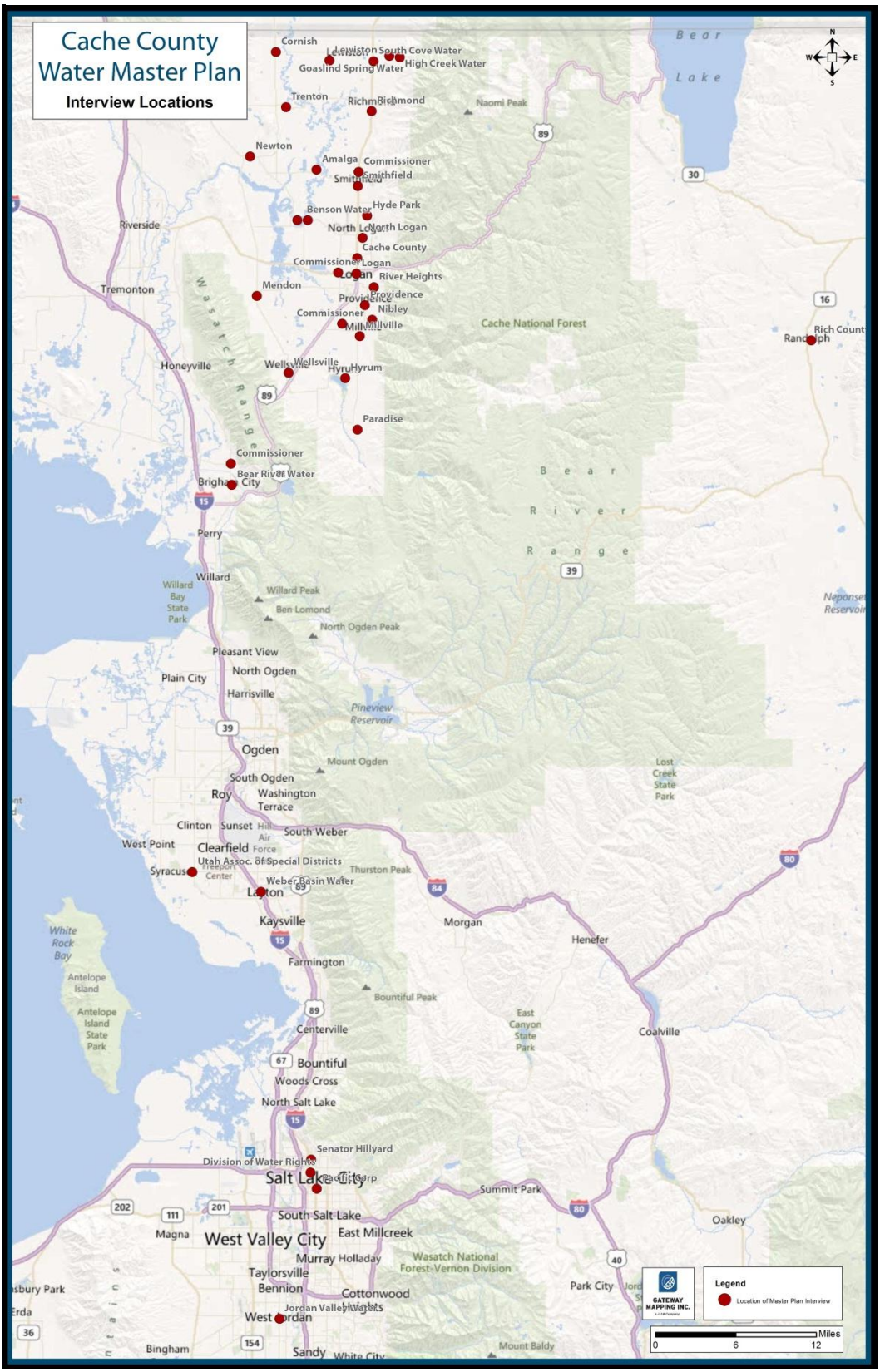
2.2.2 Stakeholders Interviews

Representatives from a variety of water backgrounds and positions were interviewed including the following:

- Cache County
- Public community culinary water systems in Cache County
- Representatives from the Logan River, Bear River, Little Bear River and Summit Creek water commissions and other irrigators
- Division of Water Rights (North Logan Office)
- PacifiCorp
- Utah Association of Special Districts
- Bear River, Weber Basin and Jordan Valley Water Conservancy Districts
- State representatives
- Rich County

A complete list of interviews conducted can be found in Appendix 2-B-i. Figure 2.1 shows the locations of the interviews.

Figure 2.1 Location of Interviews



2.2.3 Irrigation Stakeholder Meeting

There are many irrigation companies in Cache County, many of which are very small. Because of time limitations, not all of these irrigation companies were interviewed individually as part of the situational assessment. An open house meeting was held on May 24, 2012 with representatives from the irrigation companies. At the open house, the irrigators were asked about the same water issues that other stakeholders were asked during the interviews. Representatives of 55 irrigation companies were invited. The complete list of irrigators that were invited and a list of those that attended are given in Appendix 2-B-ii. Representatives of the irrigation companies listed in the appendix were invited to come to the steering committee meetings or to have the river commissioners represent them at the meetings.

2.2.4 Summary of Information Gathered From Interviews

The interviews and the meeting with the irrigation stakeholders provided valuable information about the key water issues, needs and concerns. A summary of the key points is given in Appendix 2-B-iii.

2.3 Steering Committee Meetings

The stakeholders that were interviewed were asked to participate on a steering committee that met four times over the course of a year. They were also asked if there were other people that should be interviewed or involved in the meetings. The purpose of the Committee was to provide input and guidance during the creation of the master plan and recommendations. The purposes of the Committee meetings were to educate and build consensus. The Committee is made up of people with agricultural, environmental, and municipal water backgrounds. Many of the Steering Committee members attended all of the meetings, but some could not attend some of the meetings. A list of who attended each meeting is given at the beginning of all the meeting minutes included in Appendix 2-C. Meetings were held on the following dates:

- July 18, 2012
- October 25, 2012
- January 16, 2013
- April 24, 2013

2.3.1 July 18, 2012 Meeting

The purpose of this meeting was to review synthesized data collected through the key interviews and meetings with water stakeholders. Ground rules were established for future committee meetings, the key themes that came from the situational assessment were presented, and input was received from the committee on topics that should be covered in future meetings. A full copy of the meeting minutes is found in Appendix 2-C-i.

2.3.2 October 25, 2012 Meeting

At the second meeting, the following items were included:

- A review of preliminary forecasted water supplies and demands based on the evaluation completed by Division of Water Resources (DWRe)
- Overview of Bear River Development Act and current development plans and activities

- A panel discussion to gain better understanding of conservancy and special service districts. The panel was made up of representatives from Weber Basin Water Conservancy District, Bear River Water Conservancy District, the attorney for the Utah Association of Special Districts (UASD) and the executive director of UASD

A complete copy of the meeting minutes is included in Appendix 2-C-ii.

2.3.3 January 16, 2013 Meeting

The focus of the third meeting was on education of Bear River operations and future supply and demand projections. The following items were included:

- Presentation about Bear River water management by PacifiCorp
- Split of the committee into two groups with about half attending a presentation given by Neil Allen (USU Irrigation Extension) about water Banking. The other half of the committee listened to a presentation about Aquifer Storage and Recovery that was given by Paul Inkenbrandt (Utah Geological Survey)
- Updated supply and demand projections from DWRe
- An instant poll conducted using electronic polling equipment

The results of the poll and the rest of the meeting minutes are included in Appendix 2-C-iii.

2.3.4 April 24, 2013 Meeting

The fourth steering committee meeting was used to present the preliminary results of the master plan and receive feedback from the Steering Committee. The minutes are included in Appendix 2-C-iv.

2.4 County Council Meetings

Periodic updates on the master plan progress were given to the County council at County Council meetings. Updates were given on:

- July 10, 2012
- December 11, 2012
- February 12, 2013

Summaries of the updates are given in Appendices 2-D-i, 2-D-ii, 2-D-iii.

2.5 Additional Meetings

Other meetings were held during the master plan to increase understanding of key water issues among a larger group of people and to receive more input. Valuable input was received by meeting with the following groups of people:

2.5.1 Bear River Small Pumpers Meetings

- March 1, 2012 – Introduced master plan
- March 6, 2013 – Master plan progress update, received input on value of having additional water for irrigation in the late summer.

2.5.2 City Managers Meeting

The City Managers in the county met with the project team on May 11, 2013. A master plan update was provided and valuable feedback was received.

2.5.3 Northern Utah Mini Water Users Conferences

The master plan team gave a presentation at the Cache County Mini Water Users Conference on March 28, 2012. The goal of presentation was to provide an introduction to the master plan process and encourage interaction and buy-in from the audience, many of whom would be involved in the process. Copies of the presentation slides from the meeting are given in Appendix 2-E-i.

A master plan update was given at the Northern Utah Mini Water Conference on April 4, 2013. The presentation slides can be found in Appendix 2-E-ii.

2.5.4 North Cache Conservation District Meetings

Water master plan updates were given to the North Cache Conservation District on April 4, 2012 and, again, on July 11, 2012.

2.5.5 Meetings with USU Staff Members

USU staff members have provided valuable input for the master plan. On November 7, 2012, the project team met with USU faculty members to present what had been completed on the master plan up until that time. The meeting was used to receive feedback on the master plan evaluation process. Notes from the meeting are given in Appendix 2-E-iii. A follow-up meeting with a smaller group of faculty members was held on November 30, 2012. Notes from the meeting are given in Appendix 2-E-iv.

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3 WATER SUPPLY AND DEMAND INVENTORY

3.1 Introduction

In order to plan to meet future water needs, a clear picture of the current water supply and demands is required. In Cache County, the water needs can be split into three main categories.

- Municipal and Industrial (M&I)
- Agricultural
- Environmental

It is important to understand each of these water categories to manage water supplies efficiently. Each of the three categories is explained more in depth below.

3.2 Municipal & Industrial (M&I)

Currently there are 23 M&I water systems in the County of varying size. Many of these systems are experiencing growth. DWRe is continually evaluating M&I water supply and demands for different areas of the state and has developed a process to complete the evaluations. As part of this master plan effort, the Utah Division of Water Resources (DWRe) has evaluated Cache County's existing and future M&I water supplies and demands.

3.2.1 Evaluation

The M&I evaluation includes supply and demand estimates for the following water uses:

- Residential
- Culinary indoor
- Culinary outdoor
- Secondary outdoor
- Commercial
- Institutional
- Industrial

The evaluations are based on yearly reports that each water system submits to the Division of Water Rights and from information gathered during interviews conducted by DWRe. These interviews are referred to as data collection and analysis meetings. A full description of the methodology and assumptions used in the evaluation is given in Appendix 3-A-i. The description given in the appendix comes from a portion of a DWRe report prepared in November 2007 entitled "Municipal and Industrial Water Supply and Uses in the Bear River Basin."

3.2.2 Existing Populations

The existing supply and demand estimates are based on countywide populations given for the 2010 census. This population was 112,656. Of this population, DWRe estimates that 107,326 people were connected to public water systems. The difference of 5,330 people is assumed to be served by private wells.

Water system boundaries do not match exactly with municipal boundaries. Because of this fact, the populations used in the evaluation of the individual systems are often times different from the populations of the municipalities.

3.2.3 Evaluation Results

A countywide summary of the existing demand versus the supply is given in Table 3.1. A table showing the results of the evaluation for each of the individual water systems is given in Appendix 3-A-ii.

Table 3.1: Countywide Summary of Existing Demand versus Supply

Countywide Summary of Existing Demand vs. Supply									
		DEMANDS				SUPPLY			
BASE YEAR 2010	Population Served by Public Water Systems	Potable Total (Ac-ft/yr)	Secondary Total (Ac-ft/yr)	M&I Total (Ac-ft/yr)	Total (GPCD)	Reliable Potable Supply (Ac-ft/yr)	Secondary Supply (Ac-ft/yr)	Total Supply (Ac-ft/yr)	Total Supply Surplus (Ac-ft/yr)
COUNTY TOTALS	107,326	25,677	7,037	32,713	272	54,586	7,037	61,623	28,909

The potable supply estimates are based on the reliable potable supply. The reliable potable supply is an estimate of the total annual supply available for use assuming that wells typically operate for half of the year and that spring flows vary during a given year. An in-depth definition of reliable supply is given on page 18 of Appendix 3-A-i.

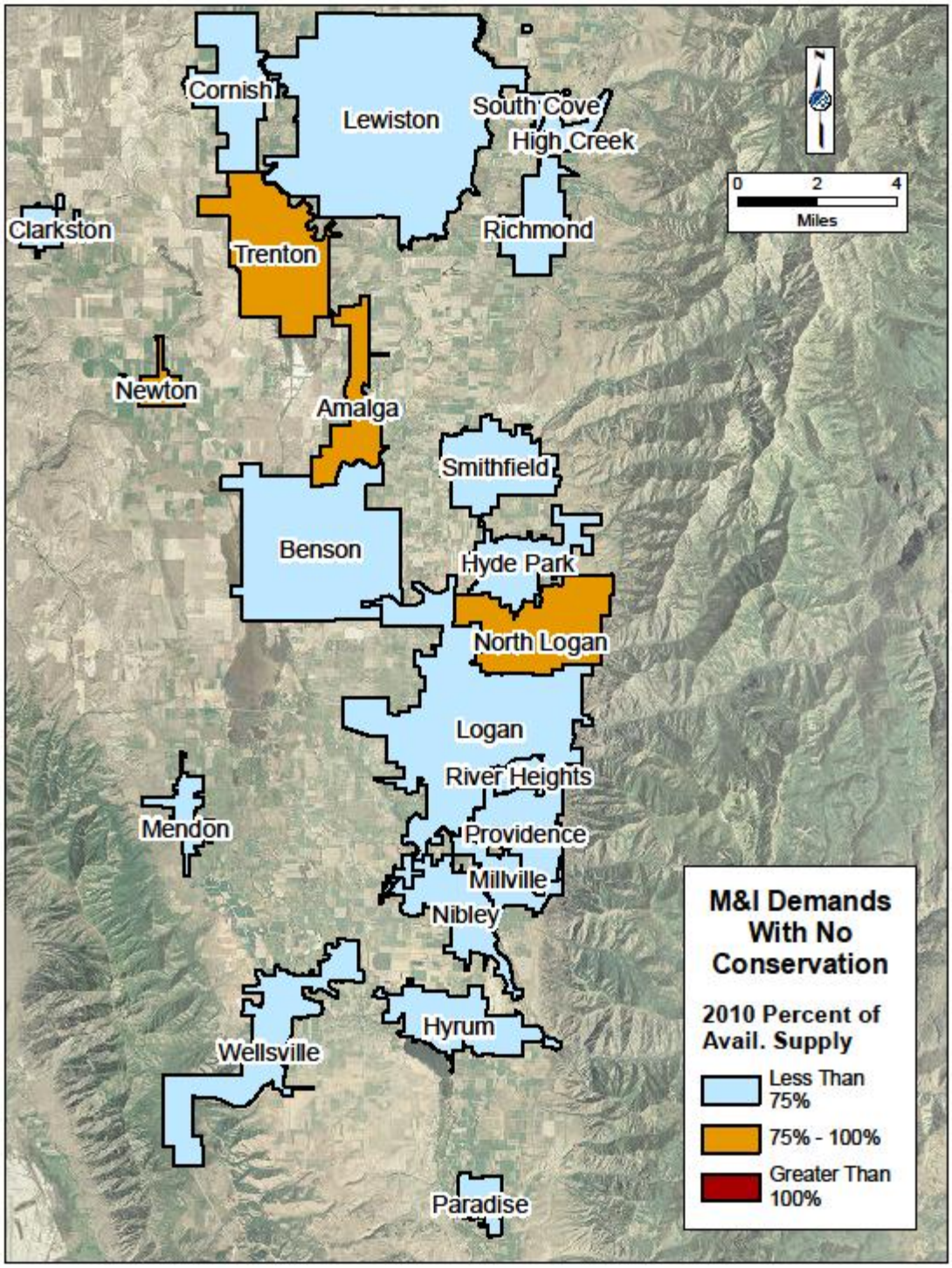
Currently, the developed water supply is adequate on a County-wide annual basis with approximately 29,000 acre feet of surplus water. However, there are a few individual systems that may be experiencing peak water demand days during the late summer when their demands are very close to, or that exceed the available supply. An evaluation to estimate the peak day supply of each individual system has not been completed as part of this plan. Each individual water system should continually monitor its supply to ensure that the peak day demands can be met. Figure 3.1 shows the status of each of the M&I water systems at year 2010. The following categories are represented on Figure 3.1:

- Systems that have annual demands that are less than 75% of their annual reliable supply are shown in light blue.
- Systems that have annual demands that are between 75% and 100% of the annual reliable supply are shown in orange.
- Systems that have annual demands that exceed their annual reliable supply are shown in red.

Currently there are no systems that have annual demands that exceed the annual supply. There are four systems that are shown in orange indicating that the annual demands are greater than 75% of the annual reliable supply. These systems are approaching, or may already have experienced days when the peak demand exceeds the available water supply. These systems have enough supply year to year, but may not have enough supply to meet peak day demands at certain times of the year. There may

even be some systems that are shown in blue that occasionally get close to having shortages on peak demand days, but on a year-round basis have adequate supplies. Again, all of the systems are different with different use patterns and should continually monitor their own capacity to meet peak demands.

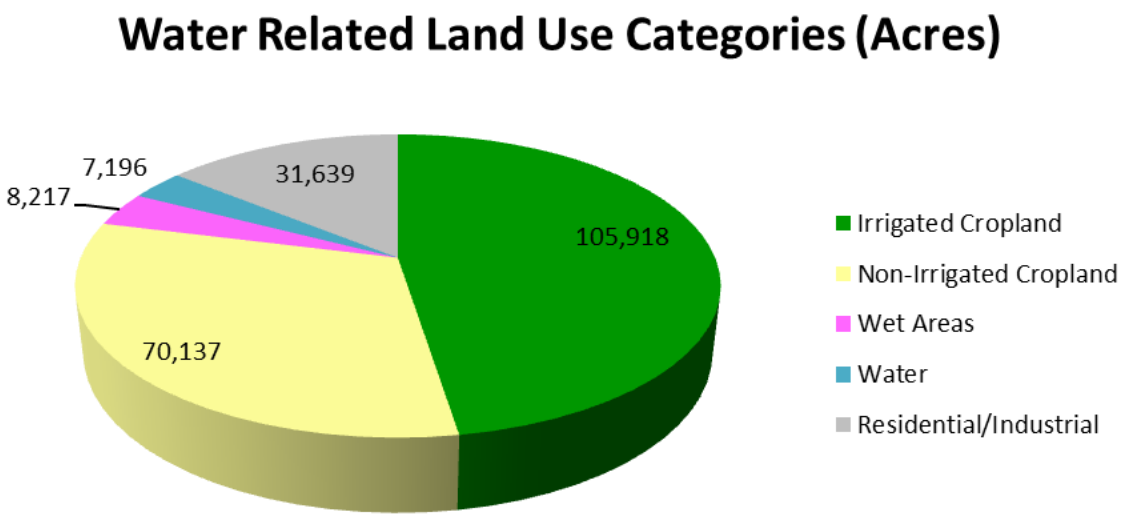
Figure 3. 1: M&I Demand Map in 2010



3.3 Agricultural

Agriculture makes up a very large part of the water use in Cache County. The County includes more than 100,000 acres of cropland and more than 90 individual irrigation companies. Many of the irrigation companies are quite small, but they are all needed to distribute water throughout a large portion of the County. This water is critical to support a large share of the economy in the County. Figure 3.2 gives the approximate acreages for the different water related land use categories in Cache County. The figure illustrates how large the agriculture areas are compared with the other land use areas. The data for the pie chart is based on information given in the Bear River Basin Land Use Inventory (Utah Division of Water Resources, 2009).

Figure 3.2: Water Related Land Use Categories



3.3.1 Irrigation Demands

With so much irrigated land, the agricultural water demands are much greater than the M&I water demands. A breakdown of the flood irrigated acres and sprinkler irrigated acres along with the estimated annual volumes of water needed for those acreages is given in Appendix 3-B.

Ideally,more than 300,000 acre feet per year are needed for irrigation of the areas that are currently being irrigated in the County.

3.3.2 Irrigation Supply

The amount of irrigation water supply available for agriculture purposes varies year to year depending on many things including snow pack, rainfall, summer temperatures and other factors. In order to quantify how much irrigation water it available, the average amount of water diverted off of each of the major rivers over the last 10 years has been evaluated. Table 3.2 provides a summary of the average diversions based on annual volumes recorded over the last 10 years on the Utah Division of Water Rights web page or based on phone calls to river commissioners or irrigation company representatives.

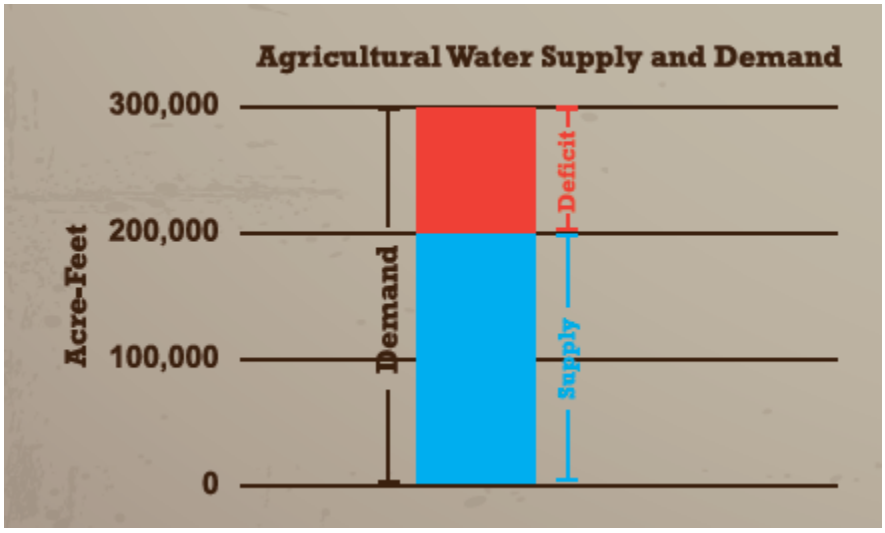
Table 3. 2: Historic Irrigation Average Annual Water Diversion Volumes

*Historic Irrigation Average Annual Water Diversion Volumes		
Blacksmith Fork River		River Total (Acre Feet/Year)
Nibley Blacksmith Fork Canal	9,850	
		9,850
High Creek		
Coveville	510	
Hill Ditch	10	
Lewiston	10	
Mountain Home	40	
Richmond Lower	50	
Richmond Upper	190	
		810
Little Bear River		
Big Spring	1,400	
East Fork	11,240	
Pole Creek	590	
Porcupine Creek	350	
Davenport	1,610	
Hyrum Canal	7,230	
LB Below Paradise	30,580	
		53,000
Logan River		
8th Ward Canal	19,000	
Hyde Park and Smithfield Irr Co.	13,490	
Logan Northern (Lower)	10,660	
Providence Pioneer Canal	512	
Providence Logan Irr Co.	1,280	
		44,940
Lower Bear River		
Cub River Irrigation Co.	19,820	
Total Pumps	9,950	
West Cache	38,510	
		68,280
Summit Creek		
	7,110	
		7,110
	Annual Average Total	**183,990**

*Volumes are based on annual volumes recorded over the last 10 years on the Utah Division of Water Rights web page or based on phone calls to river commissioners or irrigation company representatives.

The average diversion volumes are indicative of the amount of water that is available for irrigation use on an average water year. There are some irrigation water sources such as wells that may not be included in the annual average total. Figure 3.3 provides a representation of the volume of irrigation water that is needed for efficient agricultural production versus the volume of irrigation water is typically available for use on a given year in the County.

Figure 3. 3: Agricultural Water Supply and Demand

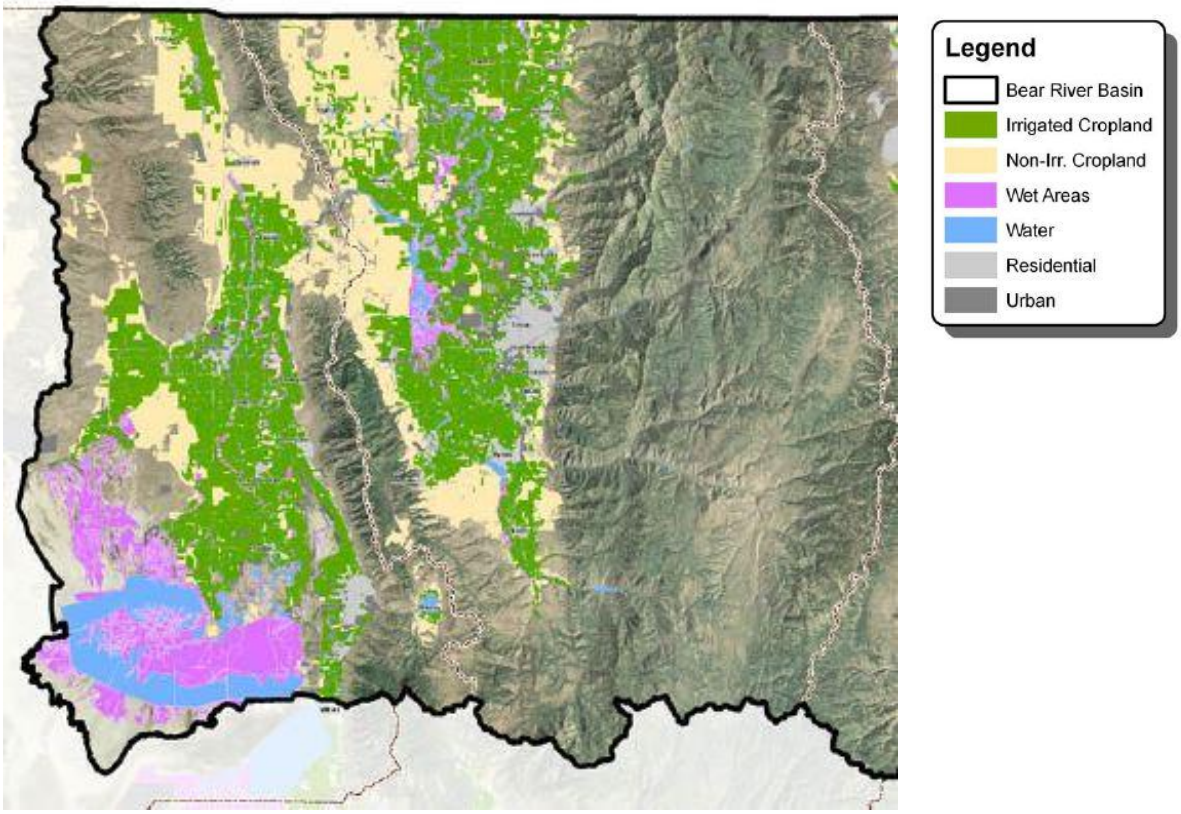


Irrigators in Cache County typically do not have adequate water supply in the later months of the irrigation season. They have expressed that on many years their production is limited due to water shortages at the end of the irrigation season. They typically, depending on their location, could use another half foot to one foot of water per year to improve production. There are roughly 35,000 acres of land that are irrigated off of the Logan River and approximately 26,000 acres irrigated in Cache County off of the Bear River. To provide an additional half foot of water over these two areas would require an annual volume of approximately 30,000 acre feet. There are other areas served off of different rivers that often experience shortages and could use additional water as well. For example, there are many irrigation water users on the Blacksmith Fork River, which experiences periods of no flow.

3.3.3 Non Irrigated Acres

There are approximately 70,000 acres of cropland around the edges of the valley, mostly along the foothills that are currently not being irrigated. These areas are not irrigated mostly because they are located above existing water delivery channels. If they were to be irrigated, they would require approximately 245,000 acre feet of water. These areas correspond closely with many undeveloped areas on the benches that are buildable and are shown in yellow on the land use inventory map shown in Figure 3.3. The figure shows a large part of Cache County and some of Box Elder County. Most of the valley floor is irrigated cropland.

Figure 3. 4 Land Use Inventory Map



Division of Water Resources, Bear River Basin 2009 Water Related Land Use Inventory

3.3.4 Irrigation Delivery Systems

Many of the irrigation canals in the County were constructed over a century ago. These canals are old and often times not adequately maintained. In areas that have had more development, maintenance has been made very difficult due to encroachment of homes and business along the canals. Because of inadequate maintenance, many of the canal banks are over grown and falling apart. Safety is a concern in many areas that need to be repaired or improved.

The irrigation canals in the valley are important and provide many benefits. The canals need to be maintained as they provide the water that is needed to sustain agriculture. They also can provide a water source for existing and potential future secondary water systems, which extend the culinary water supply for new growth.

3.4 Environmental

Water plays a major role in shaping the environment for the residents that live in Cache County. The environment is very dependent upon adequate water supplies and proper management of the water. During this master plan process, it has become very evident that there are a lot of unknowns about the environmental water needs in Cache County.

Some key questions are:

- Where are environmental and ecosystem water uses located?
- How are the locations connected physically and hydrologically?
- If an upstream location is disturbed, what are the effects on downstream resources?
- How do uses intersect with nearby landowners/stakeholders?
- What volume and timing of water are needed to maintain environmental benefits?

More information needs to be gathered to quantify and prioritize environmental water needs in the County. A preliminary environmental and ecological water uses fact sheet is given in Appendix 3-C (Utah State University, 2013). The fact sheet includes the key questions listed above and gives an overview for a potential pilot study to determine where rivers and riparian areas provide environmental benefits, how they are connected, and quantify the volume and timing of water needed to maintain these benefits.

3.5 Endangered Species

Currently there are no endangered species on the federal list in Cache County, but there are some species that are listed as threatened or as candidates. Table 3.2 gives a current summary of the threatened species and the species that are listed as candidates in Cache County. (Department of the Interior, 2013)

Table 3.3: Threatened and Endangered Species in Cache County

Threatened and Endangered Species in Cache County		
COMMON NAME	SCIENTIFIC NAME	FEDERAL STATUS
Canada lynx	Lynx Canadensis	Threatened
Greater Sage-grouse	Centro cercus Urophasiamus	Candidate
Least chub	Iotichthys Phlegethontis	Candidate
Maguire primrose	Primula Maguirei	Threatened
Ute ladies'-tresses	Spiranthes Diluvialis	Threatened
Western yellow-billed cuckoo	Coccyzus Americannus Occidentalis	Candidate

Additional information for the species listed in the table along with lists for other counties in Utah are given in Appendix 3-D. The list is always changing and should be checked whenever a project is being planned. It is the responsibility of the sponsors of the projects to take actions to protect these species.

4 WATER SUPPLY AND DEMAND FORECASTING

4.1 Introduction

In the future, the water demands in Cache County will change as the population increases, as changes in agricultural areas are made, and, potentially, as variations in the climate occur. It is important that the County has a plan that allows for a secure future water supply to meet the M&I, agricultural, and environmental needs.

4.2 Future M&I Demands

The Division of Water Resources (DWRe) completed an evaluation of the future water demands for each of the 23 M&I systems in the County. The projections estimate the annual demands from 2010 to 2060. The evaluation is based on the process and assumptions that are defined in Appendix 3-A-i. For the future projections, it is assumed that the total water supply for each system will remain the same until 2060. The demands are projected to increase based on the population growth for each water system.

4.2.1 M&I Evaluation

From the existing evaluation, an estimated average water use per-capita per-day is calculated for each water system. This is calculated by dividing the total M&I water use for each system by the number of people projected to be served by the system in a given year. The average use per capita per day is based on total water use in the systems, which include the following categories.

- Residential
  - Culinary indoor
  - Culinary outdoor
  - Secondary outdoor
- Commercial
- Institutional
- Industrial

As growth projections are made, the projected population is multiplied by the contribution per-capita to estimate the future annual demands. The estimated future demands are compared with the existing reliable supply and used as a tool to estimate when additional water supply and/or water conservation will be needed.

4.2.2 Population Projections

The population projections for the master plan are based on the projections for each community prepared by the Governor's Office of Planning and Budget (GOPB). GOPB utilized 2010 census data and assigned a growth rate to each County for each of the next five decades (to 2060). Bear River Association of Governments (BRAG) worked with GOPB to make adjustment to the projections for each community to follow past growth trends. To identify the growth trends, BRAG used population records from the last three decades to identify what percent of total County population each community has included over time. These population trends were projected forward for each of the next five decades. A table that lists the population projections for each of the communities and for the County as a whole is given in Appendix 4-A-i.

DWRe utilized the population projections to evaluate the future demands for each of the water systems. The boundaries for the water systems do not correspond exactly with the boundaries of communities. For this reason, many of the projected populations for the water systems are different from the projections for the communities. The populations that are projected for each of the water systems can be seen in the supply and demand projection tables in Appendix 4-A-ii.

The Countywide population in 2010 was 112,656. Of this population, DWRe estimates that 107,326 people were connected to public water systems. The difference of 5,330 people is assumed to be served by private wells. For the future growth and water demand projections, DWRe assumes that all of the growth will be connected to a public water system. DWRe assigned a large portion of the projected growth in unincorporated areas to be added to the Benson Culinary Water System. It is likely that some of this growth will be spread out over other areas of the County. However, it is difficult to estimate where the growth will actually occur.

4.2.3 Supply and Demands Assuming No Additional Water Conservation

With the population projections from BRAG, DWRe was able to complete an evaluation to compare the existing reliable water supplies to the projected demands for each water system. A countywide summary of the supplies versus the estimated future demands based on current per-capita water use is given in Appendix 4-A-ii. The appendix includes summary tables for each community on the following years: 2010, 2020, 2025, 2030, 2040, 2050, and 2060.

Maps that show the status of each of the M&I water systems at the above listed time frames are included in Appendix 4-A-iii. The following categories are represented on the Maps:

- Systems that have annual demands that are less than 75% of their current annual reliable supply are shown in light blue.
- Systems that have annual demands that are between 75% and 100% of the current reliable supply are shown in orange.
- Systems that have annual demands that exceed their current annual reliable supply are shown in red.

Systems that are shown in orange at any given time frame indicate that the annual demands will be greater than 75% of the current annual reliable supply. These systems may experience days when the peak demand exceeds the available water supply. These systems probably have enough supply year to year but may not have enough supply to meet peak day demands at certain times of the year. All of the systems are different with different use patterns and should continually monitor their own capacity to meet peak demands.

Table 4.1 gives a summary of the number of communities that are projected to have shortages at the indicated future time frames.

Table 4.1: Summary of M&I System Shortages without Conservation

Summary of M&I System Shortages without Conservation							
Year	2010	2020	2025	2030	2040	2050	2060
Number of Systems with Projected Annual Shortages	0	4	6	8	11	16	17
Number of Systems with Projected Demands Greater than 75% of Annual Supply	4	10	12	15	17	18	18

4.2.4 State Conservation Goal

In 2000, the state of Utah set a goal to reduce the amount of water used per-capita throughout the state 25% by 2050. In the third Steering Committee meeting held during this water master plan, DWRe indicated that statewide water use per-capita has been reduced by approximately 18% since 2000. Cache County has not done as well with an estimated water use reduction of approximately 6%. Recently the Governor shortened the time frame to achieve the 25% conservation goal by 2025 instead of 2050.

4.2.5 Supply and Demands Assuming 25% Conservation

DWRe created a set of water projections assuming that Cache County will reach the state goal of 25% conservation by 2025. A Countywide summary of the supplies versus the estimated future demands based on the assumption that the 25% conservation goal will be achieved is given in Appendix 4-A-iv.

Maps that show the status of each of the M&I water systems at each of the future time frames assuming that the 25% conservation goal is met are included in Appendix 4-A-v.

Table 4.2 gives a summary of the number of communities that are projected to have shortages at the indicated future time frames if the state goal to conserve 25% by 2025 is reached.

Table 4.2: Summary of M&I System Shortages with 25% Conservation by 2025

Summary of M&I System Shortages With 25% Conservation by 2025							
Year	2010	2020	2025	2030	2040	2050	2060
Number of Systems with Projected Annual Shortages	0	2	3	4	5	8	12
Number of Systems with Projected Demands Greater than 75% of Annual Supply	4	8	7	11	14	16	16

4.2.6 Overall summary of Future M&I Supply and Demands

Table 4.3 provides a comparison of the projected number of communities that will have annual water shortages at years 2030 and 2060 and an estimate of how much additional water supply will be needed on a Countywide basis at those times. The table compares the projections based on using water at the current per-capita usage rates to the projections assuming that Cache County conserves 25% by year 2025.

Table 4.3: Water Projections Summary Table

Water Projections Summary Table		
	No Conservation	25% Conservation
Number of Communities with Annual Water Shortages by Year 2030	8	4
Number of Communities with Annual Water Shortages by Year 2060	17	12
Additional Annual Water Supply Needed on a County Wide Basis by Year 2060 (Acre-Feet)	20,000	0
Number of Communities with Projected Demands Greater than 75% of Annual Supply by Year 2030	15	11
Number of Communities with Projected Demands Greater than 75% of Annual Supply by Year 2060	18	16

Many agreements and a great deal of pipe infrastructure would be needed to share resources very efficiently to meet demands.

If no additional conservation is achieved, on a countywide basis, more water supply will be needed near 2040. There are very few communities in the County that are currently interconnected to help utilize the County water supply efficiently across the County. By 2030, more than one-third of the municipal water systems will have annual water shortages and more than half will be approaching potential peak day shortages.

4.3 Future Agricultural Water Needs

Additional water for irrigation is needed now during the late parts of the summer in many areas (See Figure 3.3). This is due to a lack of water storage on many of the rivers that supply irrigation water and to needed maintenance of water delivery systems. There are approximately 50,000 acres of land in Cache County that are currently irrigated off of the Bear River and the Logan River alone that often times could use another half-foot of water to one foot of water per year to improve crop production (Pumpers, 2013). During multiple meetings throughout this master plan, the project team has received feedback indicating that many irrigators would be willing to pay $100 to $200 per acre foot per year to supplement water supplies for existing irrigated lands.

Growth will continue in Cache County and good water planning is needed in order to preserve the agricultural lands.

4.4 Future Environmental Water Needs

The environmental water demands need to be quantified and prioritized by region in order to understand the current and future water needs. The environment needs to be maintained or improved in the future (see section 3.4).

4.5 Changes in the Climate

The climate is obviously a very important factor when evaluating the amount of water supply that is available in Cache County. There are many uncertainties with regard to what weather patterns Cache County will experience in the future. Some climate studies have been conducted on a very large regional level, but very little work has been done with a focus on potential changes specifically within Cache County. Some potential effects of climate change may be:

- Decreased annual runoff
- Earlier runoff
- More rain and less snow
- Higher potential for flooding
- More potential for drought

In the future, more evaluation is needed to understand how water demands will change with potential changes in the climate. It is possible that the environmental water demands will increase because of the need to provide a reliable stream of water in the natural water channels for fish and wildlife.

As mentioned above, there are uncertainties associated with climate change projections. Cache County needs a plan that considers contingencies with regards to the water supplies that will be needed in the future in order to account for some of the uncertainties associated with climate change.

4.6 Sources of Water to Meet Future Needs

There are three main future water sources in the County:

- Improved conservation of water
- Conversion of agricultural water to M&I water
- Development of Bear River water allocation

A combination of all of these sources is needed to provide a secure of supply of water to meet the future needs.

4.6.1 Water Conservation

Water conservation is a tool to extend the service of the available and future water supplies. Based on the evaluation completed by DWRe, reducing the amount of M&I water that is used per capita in Cache County by 25%, will save approximately 21,000 acre feet of water by 2060. If the conservation goal is reached, the reliable water supply can be extended close to 2060 on a countywide basis.

More than half of the individual M&I systems will still have annual water shortages by 2060 even if the conservation goal is met. However, in the near future conservation could be of great benefit to many communities that are currently close to having demands that exceed the available supply.

4.6.2 Conversion from Agricultural Water to M&I Water (Groundwater Management Plan)

To meet future increased water demands, water could be converted from agricultural uses to municipal uses. In order to accomplish this, typically, surface water rights are converted to groundwater rights.

Cache County has significant volumes of groundwater. However, the limiting factor regarding ground-water development in Cache Valley is not the amount of water, which is physically available within the aquifers, but rather the amount of ground water, which can be withdrawn without impairing prior downstream surface water rights. It has been determined that the ground water and surface water in Cache County are hydrologically connected.

Surface water users generally have higher priority water rights over users that pump water from the underground aquifers. Over time, depletion of the underground aquifers reduces surface flow so that senior surface users could get deprived of water by junior pumpers.

The ground water management plan was created to help protect the rights of Bear River water users downstream and others that have rights to the ground water here in Cache County. The plan explains that based on a USGS study that measured data and created model simulations, the surface and ground water within Cache Valley are connected. Because of this fact, the plan outlines some guidelines to be followed by the Division of Water Rights in managing the groundwater resources in Cache Valley. These guidelines are given in the 1999 Interim Cache Valley Ground-Water Management Plan. A copy of the plan is included in Appendix 4-B.

Total future ground water withdrawals are limited to a preliminary volume of 25,000 acre feet per year, and typically require that replacement water be provided. Once the initial 25,000 acre feet of water has been withdrawn from the ground, the state engineer will re-evaluate the situation to determine if additional withdrawals will be allowed.

It is estimated that since year 2000, approximately 4,000 to 5,000 acre feet of water have been withdrawn from the ground. This source of water does have impacts on agriculture as it requires that existing irrigated agricultural lands be taken out of production to allow for additional M&I water to supply new development.

There are approximately 70,000 acres of developable land around the edges of the County on the benches that are currently not being irrigated. These are in areas that are very suitable and desirable for homes, but do not have any associated water rights. If these areas are to be developed, the water rights will have to come from taking irrigated agricultural lands out of production or from water made available through Bear River development.

4.6.3 Development of Bear River Water Allocation

In 1991, DWRe was tasked with developing the Bear River waters based on legislation that was defined as part of the Bear River Development Act (BRDA). The BRDA identified the volume of water that could be stored in the Bear River drainage basin during winter months without negatively impacting the existing water right holders along the river. Table 4.4 gives the volumes of water that were allocated and who received an allocation.

Table 4.4: Bear River Development Act Allocations

Bear River Development Act Allocations (acre-feet)	
Bear River Water Conservancy District	60,000
Jordan Valley Water Conservancy District	50,000
Weber Basin Water Conservancy District	50,000
Cache County or a Conservancy District in Cache County	60,000

This water is available for use through development of storage facilities. Currently, during peak demand periods of most years, principal water sources are fully appropriated and there is not sufficient flow in surface sources to meet the demand of all existing surface water rights.

The BRDA is defined in Utah Code Annotated 73-26-201. In the code it states that water developed by projects, except water reserved for wildlife or public recreation, shall be made available by contract exclusively to the entities listed in Table 4.4. In addition, a county or conservancy district that purchases or leases developed water may lease the water to any person. Construction cannot start on a project until contracts have been made for the sale of 70% of the developed water and all environmental permits are in place.

4.6.4 Needs for Bear River Water Allocation

The Bear River allocation is important because it can meet many existing and future water needs including the following:

- Agricultural
  - Supplement annual water supplies for the 105,000 acres that are currently being irrigated.
  - Preserve prime agricultural areas by providing another source of water for future M&I demands.
  - Irrigate approximately 15,000 acres of dry crop land.
- Environmental
  - Increase late summer flows in streams and maintain riparian areas.
- Municipal
  - Provide a source to meet the M&I needs that are projected within the next 30 to 50 years depending on the amount of water that is conserved between now and then.
  - Provide for water exchange agreements to be executed, which allow stored water to go down the rivers to keep downstream water users whole and allow for more M&I groundwater withdrawals.

One of the main priorities from the Steering Committee is to protect the Cache County Bear River allocation. Development of the Bear River will allow the County to keep more current agriculture lands in production and develop some of the areas around the edges of the valley that are not being irrigated.

4.6.5 Current Bear River Development Plans

Conceptual planning is being done now to evaluate alternatives to develop Bear River Water for use along the Wasatch Front. Many storage facilities are being evaluated along with potential pipe alignments to convey water from Box Elder County to Salt Lake County. It is projected that the Bear River water will be needed along the Wasatch Front by 2035. DWRe came to the Steering Committee meeting in October and gave an update on the Bear River Development Project. Notes from the presentation are given in Appendix 2-C-ii.

5 ANALYSIS OF ALTERNATIVES

5.1 Introduction

Water planning is very important in order to help preserve and develop the water that is needed now and for the future. In order to make recommendations for future actions, an evaluation of alternatives was completed. This section of the report explains the process that was used to evaluate the alternatives.

When dealing with water issues, there are a variety of interest groups with different water priorities. A rational planning procedure was followed based on a multi-objective approach to evaluate alternatives. The evaluation is based on conceptual data and is a living document that may be updated over time as more detailed information is made available.

The planning evaluation of alternatives has been completed following two main steps:

1- **Project Evaluation:** What water projects need to be completed in Cache County to meet current and future water needs?
2- **Management Evaluation:** What type of water management system should be organized to complete the identified water improvement projects and meet other management needs?

Objectives were identified for use in the evaluation of potential projects and management systems based on information gathered in the key stakeholder interviews, stakeholder meetings and based on the projected water supply needs.

5.2 Project Objectives

Many objectives were identified for use in the evaluation of projects. The objectives are divided into the following three categories:

- Supply
- Implementation
- Environment

5.3 Metrics

Metrics define how well a given alternative meets each objective. Initially, many metrics were evaluated to measure how well the objectives are met by the proposed projects. During the evaluation, process some metrics were changed or removed based on information that dictated that such a change be made. For example, the following environmental metric was included preliminarily:

Project complies with the environmental process (yes/no)

This metric was removed during the evaluation process because any project that is constructed will be required to comply with the environmental process. Table 5.1 shows the objectives used in the analysis and the corresponding metrics. Some objectives have more than one metric.

Table 5.1: Objectives and Metrics For Evaluation of Projects

Objective Type	Objective	Metric (method of measurement)
Water Supply	Protect Bear River water allocated to County	Water put to beneficial use or in approved non-use status (acre-feet)
		Bear River water developed (acre-feet)
	Provide adequate reliable future culinary supply	Additional communities with adequate culinary supply to year 2060 (number)
	Provide adequate reliable irrigation supply now and in the future	Reliable late season irrigation supply added (acre feet)
	Maintain existing irrigation delivery systems	Canals dredged, lined, or reconstructed (linear feet)
	Keep rights to water that is converted from Ag to M&I uses in Cache County	Amount of converted water that is banked (Acre-Feet)
	Match use of water to the water quality	Residential units with secondary water (number)
	Conserve water	Volume of water conserved (acre feet/year)
Implementation	Promote collaboration and focus on regional projects	Entities that benefit (number)
	Minimize costs	Capital Costs ($)
		Debt service and operation and maintenance costs for 50 year life cycle ($ per acre feet per year)
		Potential grant money available (yes/no)
	Educate public about Bear River development	Additional County residents that understand Act (number)
	Educate public about current water situation and future anticipated problems	Residents that understand how long water supplies will last (number)
Environment	Maintain or improve environmental quality	Water developed to maintain or improve wildlife habitat (acre-feet)
		Water developed to maintain or improve fish flows in natural streams (acre-feet)
		Water related recreational opportunities added (yes/no)
	Protect water quality and drinking water sources	Enhances water source protection (yes/no)
	Minimize Power consumption to operate water systems	Change in power consumption (Increase or Decrease)

5.4 Key Objectives

The objectives used to evaluate the alternatives were not weighted because of the diversity of the stakeholders. What is very important to one stakeholder may not be as important to another stakeholder. However, during the stakeholder input process it became evident that there are a few key objectives that were important to a large group of the stakeholders. These are:

- Protect the Bear River development water that is allocated to Cache County
- Focus on regional projects that benefit multiple water entities and let individual water systems continue to manage their own systems
- Educate the public
- Maintain or improve the quality of our environment

5.4.1 Protect Bear River Allocation

Developed Bear River water is needed currently to improve habitat for wildlife and to provide late season irrigation water to many areas. It will be needed in the future for municipal water or for exchanges for municipal water. Developed Bear River water could potentially be leased to others.

5.4.2 Focus on Regional Projects

Individual communities can focus on local water issues. The County should focus on projects that involve multiple water entities.

5.4.3 Educate the Public

A constant message from the Steering Committee was that more public education needs to be done. More specifically, people need to be educated about:

- How much water supply is available
- What Bear River development plans are being made in other locations
- How to use water resources more efficiently (conservation)

5.4.4 Maintain the Environment

Water is essential to the environment that is currently enjoyed by the residents of Cache County. Efforts to maintain water supplies for environmental needs such as fish and wildlife habitat must be made. Currently there is a limited amount of data available that quantifies or prioritizes environmental water demands in Cache County.

5.5 Types of Projects Evaluated

Specific examples of potential projects were evaluated at a conceptual level to see how well they met the objectives. The following types of projects were chosen to be evaluated based on input from the Steering Committee.

- Bear River Development
  - Aquifer Storage and Recovery (ASR)
  - Reservoirs
- Water Banking
- Secondary Water
- Irrigation Delivery
- Culinary Water Distribution
- Public Education
- Water Conservation
- Water Quality
- Water Studies
- Other
  - Beaver Dams
  - Riparian Meadows

Multiple specific projects were evaluated for each of the types of projects in the list.

5.6 Explanation of Evaluation of Project Alternatives Table

A large table called the Evaluation of Project Table Alternatives (Table 5.2) was created to evaluate specific example projects to determine what types of projects should be done.

The table contains the information that was used for the evaluation and is located in the next four pages. An explanation of the table components is given immediately following the table. This table is also included in Appendix 5-A.

Table 5.2: Evaluation of Project Alternatives

PROJECT ALTERNATIVES	OBJECTIVES																		
	Water Supply								Implementation						Environment				
	Protect Bear River water allocated to County		Provide adequate reliable future culinary supply	Provide adequate reliable irrigation supply now and in the future	Maintain existing irrigation delivery systems	Keep rights to water that are converted from Ag to M&I uses in Cache County	Match use of water to the water quality	Conserve water	Promote collaboration and focus on regional projects	Minimize costs			Educate public about Bear River development	Educate public about current water situation and future anticipated problems	Maintain or improve environmental quality			Protect water quality and drinking water sources	Minimize power consumption to operate water systems
	METRICS (methods of measurement)																		
	Water put to beneficial use or in approved non-use status (acre-feet)	Bear River water developed (acre-feet)	Additional communities with adequate culinary supply to year 2060 (number)	Reliable late season irrigation supply added (acre-feet)	Canals dredged, lined, or reconstructed (linear feet)	Amount of converted water that is banked (acre-feet)	Residential units with secondary water (number)	Volume of water conserved (acre-feet / year	Entities that benefit (number)	*Capital Costs ($)	*Debt service and operation and maintenance costs for 50 year life cycle ($ per acre-feet per year)	Potential grant money available (yes/no)	Additional County residents that understand act (number)	Residents that understand how long water supplies will last (number)	Water developed to maintain or improve wildlife habitat (acre-feet)	Water developed to maintain or improve fish flows in natural streams (acre-feet)	Water related recreational opportunities added (yes/no)	Enhances water source protection (yes/no)	Change in power consumption (increase or decrease)
	COLOR KEY																		
	Less than 1000	Less than 1000	0	Less than 1000	0	Less than 500	Less than 500	Less than 50	less than 3	more than $150,000,000	More than $500	None	None	None	None	None	None	No	Large increase
	1000 to 10,000	1000 to 10,000	1 to 5	1000 to 10,000	1 to 5000	1 to 5,000	501 to 1,000	50 to 3000	3 to 7	$75,000,000 to $150,000,000	276 to 450	Grants in past	Low	Low	Low	Low	Low		Some increase
	10,001 to 20,000	10,001 to 20,000	6 to 10	10,001 to 20,000	5001 to 20,000	5,000 to 10,000	1,001 to 1,500	3001 to 6,000	8 to 15	$4,000,001 to $75,000,000	101 to 275	50%	Medium	Medium	Medium	Medium	Medium		No change
	More than 20,000	More than 20,000	11 to 15	More than 20,000	More than 20,000	More than 10,000	More than 1,500	More than 6,000	More than 15	Less than $4,000,000	Less than 100	75%	High	High	High	High	High	Yes	Some decrease
Aquifer Storage and Recovery Projects																			
Aquifer Storage and Recovery (ASR)at mouth of Green Canyon	2,000	2,000	3	Low	0	0	0	0	More than 15	$600,000	$20	50% Grant	None	None	None	Low	None	No	Some Decrease
ASR using River Park Well	5,000	5,000	3	Low	0	0	0	0	More than 15	$3,000,000	$30	50% Grant	None	None	None	Low	None	No	Some Decrease
Reservoir Projects																			
Logan Canyon Reservoir - add 0.5 feet of irrigation water each year to irrigators (approx. 35,000 acres served)	30,000	30,000	15**	30,000	0	0	Low	0	More than 15	$138,000,000	$240	75% funding for irrigation reservoir	None	None	Low	Low	High	No	No Change
Reservoir in Logan Canyon - Irrigate 8000 new acres in Petersboro area (Pump from Cutler)	30,000	30,000	15**	30,000	0	0	Low	0	More than 15	$173,000,000	$330	75% funding for irrigation reservoir	None	None	Med	Low	High	No	Large Increase
Reservoir on Cub River, adds one foot more summer water for small pumpers and West Cache Irrigation	15,000	15,000	15**	15,000	0	0	Low	0	More than 15	$95,000,000	$340	75% funding for irrigation reservoir	None	None	Low	Low	High	No	Some Increase
Construct Multiple Small (less than 10,000 acre feet) Reservoirs to provide more secure irrigation water supply	60,000	60,000	15**	60,000	0	0	Low	0	More than 15	$315,000,000	$370	75% funding for irrigation reservoir	None	None	None	None	Low	No	No Change
Enlarge Hyrum reservoir to provide more irrigation to South Cache Irrigators	16,000	16,000	15**	16,000	0	0	Low	0	More than 15	$84,000,000	$280	75% funding for irrigation reservoir	None	None	Low	Low	Low	No	Some Decrease

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**Would require surface water treatment plant or exchange for ground water along with drilling a well or making spring improvements

PROJECT ALTERNATIVES	OBJECTIVES																		
	Water Supply								Implementation						Environment				
	Protect Bear River water allocated to County		Provide adequate reliable future culinary supply	Provide adequate reliable irrigation supply now and in the future	Maintain existing irrigation delivery systems	Keep rights to water that are converted from Ag to M&I uses in Cache County	Match use of water to the water quality	Conserve water	Promote collaboration and focus on regional projects	Minimize costs			Educate public about Bear River development	Educate public about current water situation and future anticipated problems	Maintain or improve environmental quality			Protect water quality and drinking water sources	Minimize power consumption to operate water systems
	METRICS (methods of measurement)																		
	Water put to beneficial use or in approved non-use status (acre-feet)	Bear River water developed (acre-feet)	Additional communities with adequate culinary supply to year 2060 (number)	Reliable late season irrigation supply added (acre-feet)	Canals dredged, lined, or reconstructed (linear feet)	Amount of converted water that is banked (acre-feet)	Residential units with secondary water (number)	Volume of water conserved (acre-feet / year	Entities that benefit (number)	*Capital Costs ($)	*Debt service and operation and maintenance costs for 50 year life cycle ($ per acre-feet per year)	Potential grant money available (yes/no)	Additional County residents that understand act (number)	Residents that understand how long water supplies will last (number)	Water developed to maintain or improve wildlife habitat (acre-feet)	Water developed to maintain or improve fish flows in natural streams (acre-feet)	Water related recreational opportunities added (yes/no)	Enhances water source protection (yes/no)	Change in power consumption (increase or decrease)
	COLOR KEY																		
	Less than 1000	Less than 1000	0	Less than 1000	0	Less than 500	Less than 500	Less than 50	less than 3	more than $150,000,000	More than $500	None	None	None	None	None	None	No	Large increase
	1000 to 10,000	1000 to 10,000	1 to 5	1000 to 10,000	1 to 5000	1 to 5,000	501 to 1,000	50 to 3000	3 to 7	$75,000,000 to $150,000,000	276 to 450	Grants in past	Low	Low	Low	Low	Low		Some increase
	10,001 to 20,000	10,001 to 20,000	6 to 10	10,001 to 20,000	5001 to 20,000	5,000 to 10,000	1,001 to 1,500	3001 to 6,000	8 to 15	$4,000,001 to $75,000,000	101 to 275	50%	Medium	Medium	Medium	Medium	Medium		No change
	More than 20,000	More than 20,000	11 to 15	More than 20,000	More than 20,000	More than 10,000	More than 1,500	More than 6,000	More than 15	Less than $4,000,000	Less than 100	75%	High	High	High	High	High	Yes	Some decrease
Reservoir near Avon - Irrigate Mt. Sterling Area (pump from Hyrum reservoir)	12,000	12,000	15**	12,000	0	0	Low	0	More than 15	$118,000,000	$550	75% funding for irrigation reservoir	None	None	Low	Low	Med	No	Large Increase
Logan Canyon Reservoir- Irrigate Petersboro area (Pipe from Logan Canyon)	30,000	30,000	15**	30,000	0	0	Low	0	More than 15	$286,000,000	$480	75% funding for irrigation reservoir	None	None	None	None	Med	No	No Change
Reservoir near Avon - Irrigate Mt. Sterling Area (Pipe from Avon)	12,000	12,000	15**	12,000	0	0	Low	0	More than 15	$199,000,000	$830	75% funding for irrigation reservoir	None	None	None	None	Med	No	No Change
Participate in a Box Elder Reservoir, pump back to cutler, pump to west bench areas	30,000	30,000	15**	30,000	0	0	0	0	1 to 5	$170,000,000	$470	75% funding for irrigation reservoir	None	None	None	None	None	No	Large Increase
Construct Millcreek Reservoir	10,000	10,000	15**	10,000	0	0	Low	0	More than 15	$79,000,000	$420	75% funding for irrigation reservoir	None	None	Med	Med	Med	No	No Change
Water Banking Projects																			
Bank water that is made available during conversion from Ag to Municipal & Through Bear River Development	60,000	0	13	0	0	12,000	0	0	More than 15	Depends on organizational structure used (less than $4Million)	Depends on organizational structure used	50% Grant	None	None	Low	Low	Low	No	No Change
Secondary Water Projects																			
Construct secondary water system in North Logan below L&N canal	0	0	1	0	0	0	1,800	50	3 or 4	$6,800,000	$230	50% Grant	None	None	None	None	None	No	Some Decrease
Construct secondary water system in Logan	0	0	1	0	0	0	3,000	100	3 or 4	$6,500,000	$230	50% Grant	None	None	None	None	None	No	Some Decrease

*Low values are preferred and are shown in a darker color than higher values.

**Would require surface water treatment plant or exchange for ground water along with drilling a well or making spring improvements

PROJECT ALTERNATIVES	OBJECTIVES																		
	Water Supply								Implementation						Environment				
	Protect Bear River water allocated to County		Provide adequate reliable future culinary supply	Provide adequate reliable irrigation supply now and in the future	Maintain existing irrigation delivery systems	Keep rights to water that are converted from Ag to M&I uses in Cache County	Match use of water to the water quality	Conserve water	Promote collaboration and focus on regional projects	Minimize costs			Educate public about Bear River development	Educate public about current water situation and future anticipated problems	Maintain or improve environmental quality			Protect water quality and drinking water sources	Minimize power consumption to operate water systems
	METRICS (methods of measurement)																		
	Water put to beneficial use or in approved non-use status (acre-feet)	Bear River water developed (acre-feet)	Additional communities with adequate culinary supply to year 2060 (number)	Reliable late season irrigation supply added (acre-feet)	Canals dredged, lined, or reconstructed (linear feet)	Amount of converted water that is banked (acre-feet)	Residential units with secondary water (number)	Volume of water conserved (acre-feet / year	Entities that benefit (number)	*Capital Costs ($)	*Debt service and operation and maintenance costs for 50 year life cycle ($ per acre-feet per year)	Potential grant money available (yes/no)	Additional County residents that understand act (number)	Residents that understand how long water supplies will last (number)	Water developed to maintain or improve wildlife habitat (acre-feet)	Water developed to maintain or improve fish flows in natural streams (acre-feet)	Water related recreational opportunities added (yes/no)	Enhances water source protection (yes/no)	Change in power consumption (increase or decrease)
	COLOR KEY																		
	Less than 1000	Less than 1000	0	Less than 1000	0	Less than 500	Less than 500	Less than 50	less than 3	more than $150,000,000	More than $500	None	None	None	None	None	None	No	Large increase
	1000 to 10,000	1000 to 10,000	1 to 5	1000 to 10,000	1 to 5000	1 to 5,000	501 to 1,000	50 to 3000	3 to 7	$75,000,000 to $150,000,000	276 to 450	Grants in past	Low	Low	Low	Low	Low		Some increase
	10,001 to 20,000	10,001 to 20,000	6 to 10	10,001 to 20,000	5001 to 20,000	5,000 to 10,000	1,001 to 1,500	3001 to 6,000	8 to 15	$4,000,001 to $75,000,000	101 to 275	50%	Medium	Medium	Medium	Medium	Medium		No change
	More than 20,000	More than 20,000	11 to 15	More than 20,000	More than 20,000	More than 10,000	More than 1,500	More than 6,000	More than 15	Less than $4,000,000	Less than 100	75%	High	High	High	High	High	Yes	Some decrease
Irrigation Delivery Projects																			
Reduce seepage from canals and use saved water to create more habitat for wildlife (1200 feet per year)	0	0	0	0	60,000	0	0	5,000	More than 15	$30,000,000	$270	50% Grant	None	None	Med	Med	Low	No	No Change
Program to rebuild or improve major canals in Cache County (1200 ft per year)	0	0	0	5,000	60000	0	Low	5,000	More Than 15	$30,000,000	$270	50% Grant	None	None	None	None	None	No	No Change
Enclose Crockett Canal east of Logan Center Street	0	0	0	Low	2450	0	0	440	12	$2,600,000	$17,000	50% Grant	None	None	None	None	Low	No	No Change
Create access along major canals in Logan, North Logan Hyde Park, Providence, River Heights	0	0	0	0	0	0	0	0	12	$400/lineal foot. Does not develop water	N/A	Low	None	None	None	None	Low	No	No Change
Culinary Water Distribution Projects																			
Culinary water pipe between Mendon and Wellsville	1,300	0	2	0	0	0	0	0	2	$2,200,000	$80	Low	None	None	None	None	None	No	No Change
Culinary water pipe Between Lewiston and Cornish	1,300	0	1	0	0	0	0	0	2	$600,000	$20	Low	None	None	None	None	None	No	No Change
Culinary water pipe between Trenton and Lewiston	1,300	0	1	0	0	0	0	0	2	$2,100,000	$80	Low	None	None	None	None	None	No	No Change
Culinary water pipe between Trenton and Cornish	1,300	0	1	0	0	0	0	0	2	$2,100,000	$70	Low	None	None	None	None	None	No	No Change
12" Culinary water pipe between Logan and Cache Junction, 8" lines to Mendon and Newton	2600	0	2	0	0	0	0	0	4	$14,000,000	$260	Low	None	None	None	None	None	No	No Change

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**Would require surface water treatment plant or exchange for ground water along with drilling a well or making spring improvements

PROJECT ALTERNATIVES	OBJECTIVES																		
	Water Supply								Implementation						Environment				
	Protect Bear River water allocated to County		Provide adequate reliable future culinary supply	Provide adequate reliable irrigation supply now and in the future	Maintain existing irrigation delivery systems	Keep rights to water that are converted from Ag to M&I uses in Cache County	Match use of water to the water quality	Conserve water	Promote collaboration and focus on regional projects	Minimize costs			Educate public about Bear River development	Educate public about current water situation and future anticipated problems	Maintain or improve environmental quality			Protect water quality and drinking water sources	Minimize power consumption to operate water systems
	METRICS (methods of measurement)																		
	Water put to beneficial use or in approved non-use status (acre-feet)	Bear River water developed (acre-feet)	Additional communities with adequate culinary supply to year 2060 (number)	Reliable late season irrigation supply added (acre-feet)	Canals dredged, lined, or reconstructed (linear feet)	Amount of converted water that is banked (acre-feet)	Residential units with secondary water (number)	Volume of water conserved (acre-feet / year	Entities that benefit (number)	*Capital Costs ($)	*Debt service and operation and maintenance costs for 50 year life cycle ($ per acre-feet per year)	Potential grant money available (yes/no)	Additional County residents that understand act (number)	Residents that understand how long water supplies will last (number)	Water developed to maintain or improve wildlife habitat (acre-feet)	Water developed to maintain or improve fish flows in natural streams (acre-feet)	Water related recreational opportunities added (yes/no)	Enhances water source protection (yes/no)	Change in power consumption (increase or decrease)
	COLOR KEY																		
	Less than 1000	Less than 1000	0	Less than 1000	0	Less than 500	Less than 500	Less than 50	less than 3	more than $150,000,000	More than $500	None	None	None	None	None	None	No	Large increase
	1000 to 10,000	1000 to 10,000	1 to 5	1000 to 10,000	1 to 5000	1 to 5,000	501 to 1,000	50 to 3000	3 to 7	$75,000,000 to $150,000,000	276 to 450	Grants in past	Low	Low	Low	Low	Low		Some increase
	10,001 to 20,000	10,001 to 20,000	6 to 10	10,001 to 20,000	5001 to 20,000	5,000 to 10,000	1,001 to 1,500	3001 to 6,000	8 to 15	$4,000,001 to $75,000,000	101 to 275	50%	Medium	Medium	Medium	Medium	Medium		No change
	More than 20,000	More than 20,000	11 to 15	More than 20,000	More than 20,000	More than 10,000	More than 1,500	More than 6,000	More than 15	Less than $4,000,000	Less than 100	75%	High	High	High	High	High	Yes	Some decrease
Public Education Projects																			
Visit each city council/ culinary water board to discuss results of master plan	0	0	Low	Low	0	0	0	0	More than 15	$40,000	0	Low	350	350	None	None	None	Yes	No Change
Water Conservation Projects																			
Water Conservation Campaign to reduce water usage by 25% by year 2050	0	0	8	0	0	0	0	21,000	More than 15	$28,000,000	$60	50% Grant	None	10,000	None	None	None	No	Some Decrease
Water Wise landscaping classes	0	0	Low	0	0	0	0	5,000	More than 15	?	?	50% Grant	None	2,000	None	None	None	Low	Some Decrease
Large water user workshops to help promote conservation	0	0	Low	0	0	0	0	5,000	More than 15	?	?	50% Grant	None	2,000	None	None	None	No	Some Decrease
Water conservation demonstration garden	0	0	Low	0	0	0	0	2,000	More than 15	?	?	50% Grant	None	2,000	None	None	None	No	Some Decrease
Water Quality Projects																			
Public Education campaign in Cache County to help public understand how to protect our aquifers	0	0	0	0	0	0	0	0	More than 15	$100,000	N/A	Low	None	None	None	None	None	Yes	No Change
Water Study Projects																			
Study to quantify environmental water needs in Cache County (min stream flows etc.)	0	0	0	0	0	0	0	0	More than 15	$250,000	N/A	Low	None	None	High	High	Med	Yes	No Change
Climate change study	0	0	0	0	0	0	0	0	More than 15		N/A	Low	None	None	None	None	None	No	No Change
Other Projects																			
Construct riparian Meadows	less than 1000	0	0	0	0	0	0	0	10 to 12	?	?	50% Grant	None	None	Med	Med	No	Yes	No Change
500 Beaver Dams	500	500	0	500	0	0	0	0	2 or 3	Small	small	50% Grant	None	None	500	500	No	No	No Change

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**Would require surface water treatment plant or exchange for ground water along with drilling a well or making spring improvements

5.6.1 Project Alternatives

The alternatives that were evaluated are listed down the left hand side of the table and are sorted by the type of project.

5.6.2 Objectives

The goals or objectives that have been identified as important by the steering committee and project team are listed across the top of the table. These objectives are split into the following three categories:

- Water Supply (shown in blue)
- Implementation (shown in purple)
- Environment (shown in green)

5.6.3 Metrics

The metrics for each objective are listed across the top of the table just below the objectives. The metrics provide the units and the method used to measure how well a given alternative meets the corresponding objective. In the future, as more specifics are gathered for a given alternative, more solid data can be added to the analysis.

5.6.4 Color Key

A color key is shown just below the metrics and gives four ranges of values for each metric. The alternatives were evaluated at a conceptual level. Therefore, there is a level of uncertainty in the values calculated for the evaluation. The four color levels indicate how well the objectives or goals are attained by a given alternative, with the darker colors indicating a higher level of attainment than the lighter colors.

5.6.5 Evaluation

In the columns to the right of each listed alternative, numbers are given in cells to indicate the estimated value that each alternative has for each of the metrics. For metrics that could not be exactly quantified, without further evaluation, an assignment of “None”, “Low”, “Medium”, or “High” was given. Any cell that is labeled with “N/A” indicates that the metric in that column does not apply to the alternative listed on that row.

The strength of a given alternative can be determined by looking across a row for the given alternative and comparing how dark the cells are for that alternative with the cells for other alternatives. Alternatives that have darker cells are stronger than alternatives with lighter cells.

5.7 Conceptual Project Costs

Cost estimates were created as part of the evaluation of most of the projects. All of the costs are conceptual and were created solely as a tool to help evaluate and compare different types of projects. Two columns in the evaluation matrix include costs. One column gives the estimated capital cost to complete a project. A separate column gives an estimated annual payment to finance a project over a 50 year life cycle. All of the estimates include a 50% contingency based on the uncertainty of the estimates and to account for environmental permitting and engineering. A summary of the major assumptions that were used to create the conceptual cost estimates for the projects is found in Appendix 5-B.

5.8 Evaluation of Projects Uncertainty

There is a level of uncertainty in the analysis done for the evaluation of the conceptual projects such as:

- Unknown exact project locations
- Number of communities that will choose to participate in a project
- Amount of water that can be developed through ASR
- Environmental water demands in the County

5.9 Recommended Projects

The project team, made up of water engineers, irrigation engineers, planners, and environmental engineers evaluated the projects listed in the table. The projects were not ranked but were rated. Through this evaluation, the following types of projects rose to the top based on how well they meet the objectives and are recommended moving forward:

- Water banking
- Aquifer storage and recovery projects
- Reservoirs (more specifically, reservoirs that add additional irrigation water to areas that are currently being irrigated and do not require new pumps or distribution networks).
- Secondary water systems
- Water conservation programs
- Irrigation canal rehabilitation
- Studies to evaluate and prioritize environmental water demand areas

A brief description of each of these projects and some key points about the projects are given below. Many of the listed projects will need to be studied further to identify specific projects and to evaluate them based on the criteria that has been established.

5.9.1 Aquifer Storage and Recovery (ASR) Projects

ASR is a method to use groundwater and surface water resources conjunctively. For example, high surface flows from streams can be infiltrated or injected into the ground during spring months to supplement ground water storage supplies. The water that is stored through this process can be withdrawn from the aquifer at a later time in the year or during a dry year to meet demands. Water stored using ASR could be part of the water allocated to Cache County in the BRDA.

Aquifer storage and recovery requires minimal structural elements and has the ability to convey water from the point of recharge to any point of use near the aquifer without the extensive canals, piping and appurtenances. Aquifers also provide a water quality benefit since they have a natural ability to filter sediment and remove some biological contaminants. To maintain ground water quality, it is necessary to treat surface water to drinking water standards before injecting it into a primary drinking water aquifer. (Utah Division of Water Resources, 2004)

Some of the benefits of ASR that help meet the objectives of the plan are:

- Protects allocated Bear River development water (5,000 to 20,000 acre feet)
- Supplements ground water
- Less costly than storing water above ground
- Provides additional water supply for many communities and irrigators
- Provides a back-up supply during emergencies
- Increases flows in streams to support fish, and riparian habitat during periods of low summer flow

The Utah Geological Survey (UGS) has completed some preliminary studies of potential ASR sites in Cache County, and is continuing some additional studies. More studies are needed to determine the volume of water that can be put into the principal aquifer and stored.

UGS came to the January 16, 2013 Steering Committee meeting and gave a presentation that provided an overview of ASR and talked about specific sites in Cache County that have had some evaluation. A copy of the presentation slides is included with the Steering Committee meeting minutes in Appendix 2-C-iii. Some Cache County sites that could be used for ASR are located:

- Near the mouth of Green Canyon
- In the Logan Island area
- Near the mouth of Providence Canyon
- In Millville along the foothills

5.9.2 Reservoir Development

Build above ground reservoirs to store excess spring runoff water. Reservoirs are used to meet late season irrigation needs for areas that are currently irrigated, environmental needs and future drinking water needs. Some of the benefits of reservoir construction are:

- Uses and protects allocated Bear River development water (Up to 60,000 acre feet)
- Provides additional water supply for many communities and irrigators
- Increased late summer flows for habitat in rivers downstream of the reservoirs

In order to develop the entire Bear River allocation some above ground storage reservoirs will be needed. Development of ASR projects will most likely not store enough water to utilize the Bear River allocation of 60,000 acre feet (Inkenbrandt, 2013).

Specific conceptual reservoir sites were evaluated with different methods of water delivery to determine how well they meet the objectives. The reservoir sites evaluated are at locations that had been evaluated in previous studies. The Reservoir Cost Summary table in Appendix 5-C lists the different reservoirs that were evaluated along with conceptual cost estimates.

Initially, some estimating was done to determine the feasibility of irrigating some of the 70,000 acres of non-irrigated lands that are farmable and are mostly located around the perimeter of Cache County. These areas are typically located above the existing canal systems along the valley benches. In order to feed water to these areas, reservoirs

would need to be built fairly high up in the water shed. The water would then need to be piped to the areas to irrigate. The costs to pipe the water over these distances makes this approach much less feasible than some other approaches. It would be less costly to build the reservoir high up in the water shed, allow the flows to be released down existing natural waterways and then pump the water back up to irrigate the areas above the existing canals. This would also increase summer flows along the natural waterway that is being used to deliver water to the location of the pumps.

Some alternatives were evaluated to assess the feasibility of supplementing irrigation water on lands that are currently being irrigated. There are many areas in the valley that are being irrigated that do not have enough irrigation water in the late summer due to a lack of irrigation water storage. For example there are approximately 50,000 acres of land that are irrigated off of the Logan River and the Bear River. Many of the irrigators have expressed that they would like to have another half foot to a foot of water each year to improve their crop production.

The costs to develop reservoirs that utilize existing delivery systems will be much less than the costs to develop reservoirs that require construction of new water delivery systems.

Prior to constructing a reservoir, a great deal of evaluation needs to be done to analyze the different impacts and benefits that will come with the new reservoir.

5.9.3 Water Conservation Program

Start a campaign to reduce water use in the County by 25% by 2025. Efforts may include holding large water user workshops to promote conservation. Benefits of a water conservation program are:

- Saves 8,400 acre feet of water per year by 2025 and 21,000 acre feet by 2060
- Conserves energy

5.9.4 Bank Water Rights

A water bank is an institution or part of an institution with a goal to move water to where it is needed most within a given region. For example, in Cache County, agricultural land is being developed. Once a piece of agricultural property is developed, less water is needed to meet the demands of that land. The unused water runs down the rivers and out of the County. The rights to the water could be banked for another water user in the region to buy or lease. Water banking provides the following benefits:

- Protects Bear River allocation rights
- Keeps existing water rights for use in Cache County
- Maintains future supply of water rights for Cache County residents
- Makes the water market more transparent and open to citizens use (allows the public to know what water is worth, makes more water available to the general public)

Some ideas of how a water bank would function in Cache County were prepared by Neil Allen (USU Extention) and are included near the end of Appendix 2-C-iii.

5.9.5 Environmental Water Demands Study

A lot of work needs to be done in the County to gain an understanding of the environmental water needs. Some questions that need to be answered are:

- Where are environmental and ecosystem water uses located?
- How are the locations connected physically and hydrologically?
- If an upstream location is disturbed, what are the effects on downstream resources?
- How do uses intersect with nearby landowners/stakeholders?
- What volume and timing of water are needed to maintain environmental benefits?

The environmental water demands study will locate and prioritize wildlife habitat areas and their water demands. Benefits of the study are:

- Help preserve and prioritize critical areas
- Help maintain or improve wildlife habitat

A description of a potential scope of work to complete an environmental water demands study is given in Appendix 3-D.

5.9.6 Construct Secondary Water Systems

Secondary water systems extend the supply of drinking water to support future growth and reduce the overall water costs. Costs are reduced by using untreated water for outdoor watering and preserving higher quality water for domestic use.

In the future, work should be done to install pressure irrigation pipes from existing canals to homes that are using drinking water for the watering of yards. Also, promote secondary water systems for areas that are developed in the future. Perhaps the greatest benefit is to allow for existing drinking water systems to serve more future growth

5.9.7 Canal Rehabilitation Program

Many of the irrigation canals in the county are old and deteriorated. These canals do not efficiently deliver water and may present safety risks. Many decades have passed since the canals were constructed and they need attention. A canal rehabilitation program should be started to dedicate some resources each year to line, pipe, or restore prioritized segments of existing canals. This program is good because it:

- Benefits many water entities
- Creates more efficient delivery of water to irrigators

5.10 Analysis of Water Management Organizations

The recommended projects identified are regional (effect multiple water entities) and require a regional form of management that can provide the financial means, resources and coordination between existing water entities to be completed. A regional organization is needed to make equitable and efficient use of water. The Bear River allocation is a large regional resource that needs to be managed on a regional level. Watershed boundaries, not just political boundaries, need to be considered when establishing water management boundaries.

5.11 Management Alternatives

Four regional management alternatives have been evaluated:

- County Water Manager with more resources to complete needed projects
- Special Service District
- Water Conservancy District
- Current System–Water Manager

Two of the alternatives are forms of districts, special service or water conservancy. Information about these two types of districts is given in Utah Code Annotated Section 17B and 17D. A summary of the differences between the two types of districts is given in a table in Appendix 5-D. There are four types of local districts included in the table with one of those being a conservancy district. Conservancy districts were the only type of local districts included in the final evaluation of management alternatives because the other types do not fit as well to manage both irrigation and drinking water. The table can be used as a guide to locate sections of the state code that cover specific topics related to districts. The table is not comprehensive and should be used accordingly.

5.12 Management Objectives

The objectives used to evaluate the management alternatives are based on input from the Steering committee and are divided into the following four categories:

- Water Supply
- Governance
- Implementation
- Environment

Table 5.2 shows the objectives used in the analysis and the corresponding metrics that were used to measure how well the objectives are met by a given alternative. Some objectives have more than one metric.

Table 5.3: Objectives and Metrics for Evaluation of Management Structures

Objective Type	Objective	Metric (method of measurement)
Water Supply	Protect Bear River Allocation	Water put to beneficial use or in an approved none use status (acre feet)
Governance	Represent Cache County on water legislation issues	Influence with state water coalition and executive task force (scale)
	Represent all County water users	Entities represented on water board for regional water decisions (number)
	Operate and maintain water systems on a local level	Culinary water systems that make own source, storage, distribution and other local system improvements (number)
	Minimize management costs	*Cost to manage each year ($)
	Fund needed regional water studies and projects	Funding available each year for studies/ projects ($/year)
	Ease of creation	Election required (yes/no)
	Focus on water issues	Board members that are focused on water issues (number)
Implementation	Complete water management projects	Study and develop ASR sites (yes/no)
		Evaluate environmental water demands (yes/no)
		Study and develop above ground storage sites (yes/no)
		Implement water conservation program to achieve 25% water conservation (yes/no)
		Water banking (yes/no)
		Implement canal rehabilitation program (yes/no)
		Secondary water studies and installation (yes/no)
	Promote collaboration	Facilitates cooperation between municipalities and irrigation companies (complete contracts for projects) (yes/no)
		Steering committee members that support organization (percent)
Environment	Maintain or improve environmental quality	Water developed to improve wildlife habitat and fish flows (acre-feet)

5.13 Key Objectives

The objectives used to evaluate the management alternatives were not weighed. However, during the stakeholder input process it became evident that there are a few key objectives in the evaluation of a water management organization that are important to a large group of the stakeholders. These are to represent Cache County on water legislation issues and complete the recommended regional projects

5.13.1 Represent Cache County on Water Legislation Issues

Utah water laws and legislation are frequently changed and updated. In the water community, there are organizations experienced in water management and water issues that provide guidance to legislators as they vote to modify or establish new water law. Three major organizations that have a strong influence on the formation of Utah water law are:

- The Executive Water Task Force
- The Water Development Commission
- The Utah Water Coalition

The **Executive Water Task Force** makes recommendations on:

- Ground water management
- Water right enforcement
- Administration of ground and surface water
- Stream flows and water conservation

The **Water Development Commission** was created to determine the state's role in the protection, conservation, and development of the state's water resources. This Commission makes recommendations to the legislature and governor on:

- How the water needs of the state's growing municipal and industrial sectors will be met
- Impacts of federal regulations and legislation on the ability of the state to manage and develop its water rights
- How the state will fund water projects
- Whether the state should become an owner and operator of water projects
- How the state will encourage the implementation of water conservation programs

The **Utah Water Coalition** is made up of numerous groups involved in the water community but is influenced and sponsored in large part by water conservancy districts throughout the state. The coalition meets frequently and providence input to state legislatures on proposed legislation dealing with water issues in the state.

Water conservancy districts have significant and meaningful influence in water legislation and policy making and are often sought out by both lawmakers and state officials to provide input. One example of water legislation is the Bear River Development Act (BRDA). Cache County needs a plan to have a stronger voice on water legislation issues such as the BRDA.

5.13.2 Complete the Needed Regional Projects

A management structure needs to be in place that has the resources and leadership necessary to collaborate with water entities and complete needed regional projects.

5.14 Explanation of Evaluation of Management Alternatives Table

Table 5.4, Evaluation of Management Alternatives, was created to evaluate the four alternatives. The evaluation is based on the desired objectives including the ability to complete needed regional projects. The table is organized the same way as the table used for the Evaluation of Project Alternatives. A description of each of the areas given in the table is found in Section 5.6 of this report. The evaluation table is also included in Appendix 5-E.

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Table 5.4: Evaluation of Management Alternatives

MANAGMENT ALTERNATIVES	OBJECTIVES																	
	Water Supply	Governance							Implementation									Environment
	Protect Bear River Allocation	Represent Cache County on water legislation issues	Represent all County water users	Operate and maintain water systems on a local level	*Minimize management costs	Fund needed regional water studies and projects	Ease of creation	Focus on water issues	Complete water management projects							Promote collaboration		Maintain or improve environmental quality
	METRICS (methods of measurement)																	
	Water put to beneficial use or in an approved none use status (acre feet)	Influence with state water coalition and executive task force (Scale)	Entities represented on water board for regional water decisions (number)	Culinary water systems that make own source, storage, distribution and other local system improvements (number)	*Cost to manage each year ($)	Funding available each year for studies/ projects ($/year)	Election required (yes/no)	Board members that are focused on water issues (number)	Study and develop ASR sites (yes/no)	Evaluate environmental water demands (yes/no)	Study and develop above ground storage sites (yes/no)	Implement water conservation program to achieve 25% water conservation (yes/no)	Water banking (yes/no)	Implement canal rehabilitation program (yes/no)	Secondary water studies and installation (yes/no)	Facilitates cooperation between municipalities and irrigation companies (complete contracts for projects) (yes/no)	Steering committee members that support organization (percent)	Water developed to improve wildlife habitat and fish flows (acre-feet)
	COLOR KEY																	
	None	None	None	None	$400,001 to $500,000	None	Yes	None	None	None	None	None	None	None	None	None	less than 15%	None
	1 to 5000	Low	No Board	1 to 10	$300,001 to $400,000	$30,000		Low	Low	Low	Low	Low	Low	Low	Low	Low	16% to 30%	Low
	5,001 to 20,000	Medium	Culinary water users	11 to 20	$200,000 to $300,000	$30,000 to $150,000		Medium	Medium	Medium	Medium	Medium	Medium	Medium	Medium	Medium	30% to 65 %	Medium
	More than 20,000	High	Culinary and irrigation water users	More than 20	less than $200,000	$150,000 to $700,000	No	High	High	High	High	High	High	High	High	High	More than 65%	High
MANAGEMENT STRUCTURES																		
Water Manager with more Resources (additional $120,000 for projects)	15,000	Low	No water board	23	$185,000	$30,000 to $150,000	No	Low	Med	Med	Low	Low	None	Low	Low	Med	6%	Med
Special Service District	5,001 to 20,000	Med	Culinary Water Users	23	$350,000	$150,000 to $700,000	Yes	Med	High	High	High	Medium	High	High	High	High	18%	High
Water Conservancy District	60,000	High	Irrigation and Culinary	23	350,000	$150,000 to $700,000	Yes	High	High	High	High	High	High	High	High	High	70%	High
Continue with Current System (Water Manager)	5,000	Low	No water Board	23	$185,000	$30,000	No	Low	Low	Low	None	None	None	None	None	Low	6%	Low

*Low values are preferred and are shown in a darker color than higher values.

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5.15 Management Costs

The current budget for the County water department is $185,000. Based on the operating costs of similar existing water districts, the annual water budget to operate a district could be around $350,000 depending on many organizational factors. Many of the cost factors to manage a district are uncertain at this time. The costs could be greater if part time water attorneys and engineering consultants are utilized in a given year. The management costs of the county manager system compared to a district management system are probably closer than they appear. This is because the annual estimated budget for a water district includes some items that may not be accounted for in the $185,000 County water budget such as:

- Annual accounting
- Bank service charges
- Office space
- Printing and reproduction costs
- Insurance
- Employee retirement benefits
- Utility bills
- Travel costs (vehicle fuel and maintenance)

With the above listed items factored in, the costs to manage a district are much closer to the costs of a county water manager system. The main cost differences of having a district may come in the form of paying for board members. Section 17B-1-307 of the Utah Code states that board members can be paid up to $5,000 per year if they are not currently being paid to serve on another municipal or county legislative body.

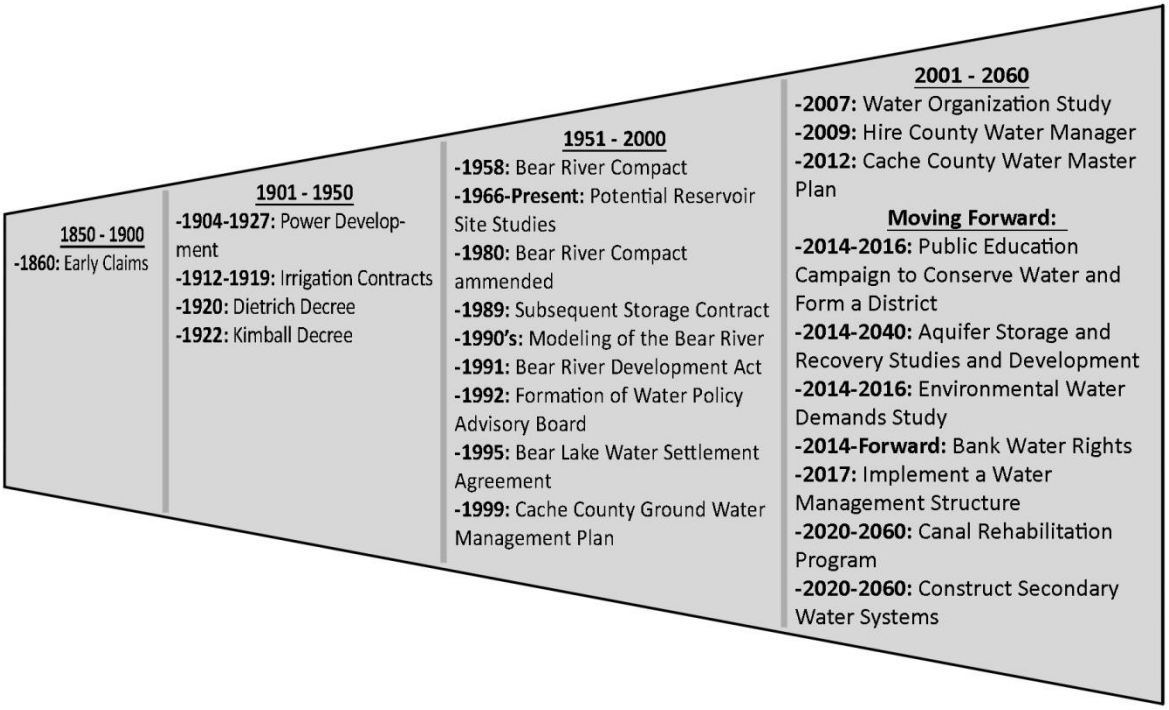
5.15.1 Recommended Form of Management

A conservancy district is the recommended form of management because it is the best organization to meet the objectives identified in Table 5.3. More specifically, a conservancy district:

- Protects the Bear River water allocation through planning and development
- Provides a stronger voice for Cache County on water legislation issues
- Promotes water conservation
- Provides representation for both irrigators and drinking water users
- Allows for banking of water rights
- Facilitates cooperation between communities and irrigation companies to complete regional projects
- Provides a governing board that is 100% focused on water issues
- Allows individual communities and irrigation companies to manage their own water systems
- Provides structure needed to make water purchase contracts and agreements that are needed
- Provides a funding source to plan for and help complete needed regional water projects

A district represents an increase in resources and a greater voice on state water issues. An increase in resources is needed to match the increase in future water needs in Cache County. Figure 5.1 shows how water activity has increased in the County in the past, and how it will continue to increase moving forward.

Figure 5.1: Future Water Demands



In the past a District has not been needed in Cache County, however the water needs have changed. The County is growing, water supplies are limited, water conservation needs to be improved and more water needs to be developed. Additionally, Cache County residents need to be more united on water issues and in utilizing the water resources in order to protect and retain those water resources for continued use in the future. In 2008 a water manager was hired to help manage the increasing water needs. The addition of a County Water Manager was a great start and has helped greatly to meet the increased needs to this point. The County now needs to increase the level of management again to efficiently manage current water resources and to develop additional future water resources. The county manager does not have the authority to write contracts that are required to protect the water resources.

As a separate entity from the County and municipalities, a conservancy district may assess a property tax to meet the increased water needs. The maximum tax allowed by a conservancy district is 0.02%. This tax rate would generate $1,100,000 in annual revenue. Based upon this tax amount:

- The tax on a residence of average value ($104,000) would be a $20.80 per year
- Operational costs of a small district without infrastructure (Based on Bear River Conservancy District 2012 Budget) could be approximately $350,000 to 450,000 annually.
- Remaining budget for studies and projects could be up to $650,000 annually.

5.16 Conservancy District Changes

The County has tried to implement a conservancy district twice previously. Both instances were unsuccessful for various reasons. This prompts the question, what makes it possible to create a conservancy district now? Below are several items that create a more favorable situation for implementation of a district now than in the past.

- **Water conservancy board members can now be elected.** State code was changed in 2010 to allow conservancy district board members to be elected or appointed. Previously, for conservancy districts, board members were appointed. (Utah Code 17B-2a-1005)
- **Conservancy districts are more focused on water conservation.** In 2000, the governor set a goal to reduce the per capita water use 25% by 2050. Since then, many of the conservancy districts have done well at this through commitment of resources to educate the public about water conservation. State-wide, Utah has we have conserved 18%, but only 6% has been conserved in Cache County. Cache County citizens should be more engaged in conservation, especially to be considered for funding of regional projects by UDWRe.
- **County population has changed by more than 30%**. The population for the County given in the 2000 census was 91,391. The 2010 census population for the County was 112,656 with a projected population for 2013 of 120,046. This increase in population results in an increase in demand and reduction in excess supply.
- **Groundwater Management Plan enacted in September 1999**. This Plan limits the amount of water that can be withdrawn from County aquifers. Existing rights (typically agricultural water rights) have to be used as replacement water. A conservancy district will allow for more efficient conversion of water from agricultural to municipal use with the ability to bank water rights. A conservancy district is needed to have the resources and focus to develop the Bear River allocation. The developed allocation will help preserve agricultural land by giving an alternative source for water rights for areas that currently have no water rights (bench areas) as these areas are developed.
- **Bear River development plans for the Wasatch Front have progressed.** Property has been purchased for a pipeline corridor from Box Elder County to Salt Lake County. Reservoir sites in Box Elder County and Cache County are being evaluated for construction by conservancy districts along the Wasatch Front. Reservoir and pipeline projects will not be completed until around 2035 because it takes that long to plan a project of that magnitude.

With the need to protect our existing water resources and provide water for future growth a conservancy district is needed now to generate the funds sufficient to implement the objectives outlined in this plan.

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6 CONCLUSIONS AND RECOMMENDATIONS

6.1 Conclusions

Careful evaluation of Cache County's existing water resources and increasing demands from population growth provide a clear picture of the County's water needs. This clarity provides the foundation to create a solid and sustainable plan for the future that includes a system to manage water resources in the County.

The master plan conclusions are:

6.1.1 General Conclusions

- Citizens of Cache County find water use for agricultural, municipal land environmental purposes important
- Environmental water demands are not known at this time
- Without water conservation efforts, Cache County water demand will exceed supply by 2040
- With water conservation, water supply may be extended 20 years
- Conservation is a cost effective way to extend water resources
- Even with conservation efforts, the Bear River Water Allocation will need to be developed in the future to meet demands
- Long term water supply will only be met by working on regional projects with water purveyors to meet future demands
- Efforts promoting water conservation and ASR should be taken immediately
- Continued education regarding water issues in Cache County are essential to move forward
- A water conservancy district has the best ability to oversee water issues in Cache County
- More resources and effort need to be put toward water development and management in order to secure adequate water supplies in the future
- Regional projects to utilize the Bear River Allocation will take multiple years to develop and fund

6.1.2 Municipal and Industrial (M&I)

- A few communities in Cache Valley are experiencing water supply shortages for municipal purposes now
- By 2030, more than one-third of the municipal water systems will have annual water shortages and more than half will be approaching potential peak day shortages
- Water efficiency projects including canal lining and secondary water systems will further the use of culinary water for municipal purposes
- Individual water systems want to manage their own water systems

6.1.3 Agricultural

- Shortages of irrigation water occur constantly in the late summer
- Water rights are not being fully retained for use in Cache County as agricultural lands are being developed

6.1.4 Environmental

Environmental water demands are not yet quantified and, as a water master plan objective, should be to meet the need.

6.2 Recommendations

In order for the vision of the plan and steering committee to take effect, actions based upon the plan conclusions must be taken. The recommended actions for the County to pursue over the next 50 years are listed below in the 50 year plan. A more specific immediate five year action plan follows and provides the higher priority actions that should be focused on over the next five years. General recommendations and philosophies are also listed to guide the County as water actions are planned and implemented in the future.

6.2.1 50 Year Plan

Following is a list of actions to complete in the next 50 years. Each action item includes a summary description, timeline, approximate cost and potential funding sources to aid with implementation. Some actions will achieve immediate results and benefits while others will take a significant amount of time to implement.

6.2.1.1 Public Education Campaign

Complete a public education campaign to inform the public of the master plan results, benefits of water conservation, determine water conservation programs to implement and the benefits of a water conservancy district in Cache County.

- **Timeline:** 2014 through 2016
- **Approximate Cost:** $300,000
- **Funding:** None at this time

6.2.1.2 Aquifer Storage and Recovery (ASR) (Assume 10,000 acre feet)

Focus on development of ASR sites where feasible. Locations that have had preliminary studies competed are located; in Millville along the foothills; in the Logan Island area (River Park Well); near the mouth of Green Canyon; near the mouth of Providence Canyon.

- **Timeline:** 2014 through 2040
- **Approximate Capital Cost:** $4,000,000 (assuming use of existing wells or infiltration, If additional wells are needed costs could be more)
- **Evaluation, environmental and contracting:** $400,000 (assumed 10% of total cost)
- **Funding:** 50% Grant – WaterSMART Program

6.2.1.3 Environmental Water Demands Study

Locate and prioritize wildlife habitat areas and their water demands.

- **Timeline:** 2014 through 2016
- **Approximate Capital Cost:** $200,000 to $250,000
- **Funding:** None at this time

6.2.1.4 Bank Water Rights

Bank water rights made available during conversion from agricultural to municipal or through Bear River Development.

- **Timeline:** 2014 forward
- **Approximate Cost:** $50,000 to $75,000 per year
- **Funding:** The initial startup of the bank could be covered in the WaterSMART Grant Program but the yearly cost will have to come from the bank or other outside sources.

6.2.1.5 Form a Water Conservancy District

Form a conservancy district that meets the needs of Cache County based on public input received during the information campaign.

- **Timeline:** 2016
- **Approximate Cost:** $30,000
- **Funding:** None. Expenses paid back through district revenue after district formation

6.2.1.6 Implement a Long Term Water Conservation Program

Implementation of the long-term water conservation strategies identified and selected through the public education campaign and other efforts.

- **Timeline:** 2017 Forward
- **Approximate Cost:** $120,000 per year
- **Funding:** 50% Grant for program development - Water Conservation Field Service Program

6.2.1.7 Reservoir Development (Assume 50,000 acre feet)

Plan timing of reservoir development and approach, identify reservoir sites, complete environmental studies, compete needed water contracts for development.

- **Timeline:** 2014 through 2060
- **Approximate Capital Cost:** $230,000,000
- **Evaluation, environmental and contracting:** $23,000,000 over 50 to 60 years (assumed 10% of total cost)
- **Funding:** Entities contracting for agricultural water pay 25% of construction and environmental mitigation costs, State of Utah will pay for 75% of costs.

6.2.1.8 Canal Rehabilitation Program

Develop a program to for canal companies to apply for and receive funding to rehabilitate existing canals for more efficient water usage. Pressure irrigation delivery systems may be included in this program.

- **Timeline:** 2020 forward
- **Approximate Cost:** $2,500,000 to $3,000,000 per year
- **Funding:** WaterSMART Grant Program and participant cost share.

This program could be implemented before 2020 if sufficient funds are available to complete the higher-priority projects.

6.2.2 Immediate Five Year Action Plan

Over the next five years, focus on completing actions as described in this five year action plan. The five year plan concentrates on the following five key objectives that should be addressed in order of priority as listed:

1- Water Conservation
2- District Formation
3- Aquifer Storage and Recovery (ASR) (Bear River Development)
4- Environmental Demand Studies/Storage (Bear River Development)
5- Water Rights Banking

Figure 6.1 provides an overview of the specific actions that should be taken in each of the next five years to meet the objectives. The highest priority objectives are shown at the base of the bars in the chart. The chart gives an indication of the anticipated costs to complete the actions listed for each objective in each year.

Appendix 6-A-i tabulates the 5-year plan with more specifics about what actions should be completed for each objective each year, the expected results of those actions and the estimated costs.

Figure 6.1: 5-Year Action Plan

As mentioned, the objectives and actions at the bottom of the chart in Figure 6.1 have the highest priorities. The two objectives with the highest priority are to improve water conservation and to form a district. These two objectives can be met through a joint public education and consensus building campaign over the next three years. This campaign is recommended to:

- Begin water conservation efforts now in order to enhance awareness amongst the community and further secure the potential for state funding on future water projects
- Educate public with regard to the water needs of Cache Valley and the need for an organization (conservancy district) to represent those needs and protect water allocated for use in Cache Valley
- Create a water conservancy district

The following strategies should be implemented in the three-year public education campaign:

- Use the momentum and organization from the Water Master Plan to meet the goals. This includes continued input from the CCWMP Steering Committee
- Share the knowledge of the Master Plan Team and Steering Committee gained from the master planning process with leaders in each community to create consensus and buy-in
- Invite community leaders to educate their constituents with regard to the goals and promote efforts to attain those goals

- Reinforce efforts by community leaders to reach the goals through County support of educational information and countywide programs to reach the goals
- Promote conservation and education/organizational goals together to reduce time spent and expenses
- A detailed list of tasks for the three year public education campaign is given in Appendix 6-A-ii

6.2.3 General Recommendations and Philosophies

- Participate in state water planning meetings such as the Executive Water Task Force and Bear River Development planning meetings – ongoing
- Review opportunities for partnering with other conservancy districts on water storage projects –ongoing
- Allow existing water systems to continue to function within their service area with a conservancy district to provide regional support and resources for operational needs, interconnection projects and future water development
- Inform the public of the master plan and the results of the plan through wide distribution of the Informational Pamphlet (Copy located in report binder pocket)
- Review the action plan items of this report regularly to make sure the objectives of the plan are being met moving forward

7 BIBLIOGRAPHY

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Utah Division of Water Resources. (2004). *Bear River Basin Planning for the Future.*

Utah Division of Water Resources. (2009). *Bear River Basin 2009 Inventory.*

Utah State University. (2013, May). Identifying Environmental Water Demands for Cache County.

Appendix 2-A

List of Participants

A comprehensive list of stakeholders that participated in the public process through interviews or attendance at planning meetings.

CACHE COUNTY
WATER MASTER PLAN

Individuals Interviewed or that Participated in the Master Plan Stakeholder Process

Individual	Representing
Alan Luce	North Logan City
Ann Armstrong	USU PHD Student
Art Moss	Logan Hollow Canal
Bill Baker	River Heights City
Bill Bower	Citizen
Bill Cox	Rich County Commissioner
Bill Young	Logan City
Bob Barrett	Fish and Wildlife
Bob Fotheringham	Cache County
Bob Oakes	Retired USU Professor
Boyd Humpherys	Providence Pioneer Irrigation Company
Brent Jensen	Hyrum City
Bret Christensen	Richmond Irrigation Company
Brian Carver	BRAG
Bruce Bishop	USU
Bruce Karren	North Cache Soil & Conservation District
Bryan Dixon	Environment
Clair Allen	Web Irrigation Company
Clark Israelson	USU
Claudia Conder	PacifiCorp
Colleen Gnehm	Logan River Commissioner / Logan North Field
Connely Baldwin	Pacificorp
Cory Yeates	Cache County
Craig Buttars	Cache County
Craig Petersen	Cache County
Darek Kimball	Richmond
Darin Evans	Summit Creek Commissioner
Dave Evans	Summit Creek Irrigation Canal
David Beazer	Millville Irrigation
David Rosenberg	USU
David Stevens	USU
David Zook	Nibley City
Don Hartle	Wellsville City
Donna Spillett	Logan Island Irrigation Co.
Doug Clausen	River Heights City
Douglas Jackson-Smith	USU Sociology
Ed Cottle	West Cache Irrigation Co.
Eric Millis	Division of Water Resources
Evan L. Olsen	Water Policy Advisory Board
Gary Larsen	Millville City

Glen Stringham	Blacksmith Fork River Water User
Gordon Younker	Utah Association of Conservation Districts
Gordon Zilles	Cache County
Grant Koford	Amalga Town
Greg Hansen	Little Bear River Commissioner
Jack Draxler	State Legislator
Jeff Gittins	Smithfield Irrigation Co.
Jeff Hall	Lewiston City
Jim Gass	Smithfield City
Jim Watterson	Bear River Commissioner
Jim Williamsen	Spring Creek Water Company
Joan Degiorgio	Nature Conservancy
Joanna Endter-Wada	USU
Joe Fuhriman	Nibley Irrigation
Jon Hardman	Mendon City
Jon White	Cache County / Blacksmith Fork Soil & Conservation District
Josh Runhaar	Cache County
Kathy Robison	Cache County
Keith Shaw	Logan Island Irrigation Canal
Kerry Schwartz	Bureau of Reclamation
Leah Meeks	USU Civil Engineering
Lee Atwood	Paradise Town
Lee Cammack	J-U-B Engineers
LeGrand Bitter	Utah Association of Special Districts
Lyle Hillyard	State Legislator
Lynn Lemon	Cache County
Marisa Egbert	Division of Water Resources
Mark Anderson	Attorney for UASD
Marla Trowbridge	Trenton Town
Marlowe Adkins	Richmond City
Max Pierce	Cornish Town
Mike Grunig	Hyde Park City
Nancy Mesner	USU
Nick Galloway	Benson Water Culinary District
Niel Allen	USU Extension
Paul Inkenbrandt	Utah Geological Survey
Paul James	Hyrum City
Peter E. Kung	Logan River Water Association
Randy Eck	Providence City
Ray Bankhead	Wellsville-Mendon Conservancy District
Richard Bay	Jordan Valley Water Conservancy District
Rick Reese	Benson Irrigation Co.
Roland Jeppson	Spring Creek Water Company

Ron Salvesen	Hyrum City
Sarah Null	USU
Scott Leishman	Wellsville East Field Irrigation Canal
Scott Tripp	Skyline Irrigation Canal
Sharon Vaughn	USFWS Bear River MBR
Steve Allen	Goaslind Spring Water Works Company
Steve Thatcher	Spring Creek Cache Irrigation Co.
Tage Flint	Weber Basin Water Conservancy District
Thad Erickson	Cache County Water Policy Advisory Board
Todd Adams	Division of Water Resources
Tony Jensen	Southwest Irrigation
Val Potter	Cache County
Voneen Jorgensen	Bear River Water Conservancy District
Will Atkin	Division of Water Rights
Zac Covington	BRAG

Appendix 2-B

Stakeholder Interviews

i: Stakeholders Interviewed

A complete list of interviews conducted.

ii: Irrigation Stakeholder Meeting

A complete list of irrigators that were invited and a list of those that attended the meeting.

iii: Summary of Stakeholder Interviews

A summary of key points gathered during the stakeholder interviews.

CACHE COUNTY
WATER MASTER PLAN

Cache County Water KPI Meetings - April 30, 2012 – June 28, 2012

Drinking Water Systems

- **Amalga Town**
- **Benson Water Culinary District**
- **Cornish Town**
- **Goaslind Spring Water Works Company**
- **High Creek Culinary Water System**
- **Hyde Park City**
- **Hyrum City**
- **Lewiston City**
- **Logan City**
- **Mendon City**
- **Millville City**
- **Newton Town**
- **Nibley City**
- **North Logan City**
- **Paradise Town**
- **Providence City**
- **Richmond City**
- **River Heights City**
- **Smithfield City**
- **South Cove Water Supply**
- **Trenton Town**
- **Wellsville City**
- **Division of Water Rights**

Water Commissioners

- **Bear River**
- **Summit Creek**
- **Logan River**
- **Blacksmith Fork River**
- **Little Bear River**

Others

- **Pacific Corp**
- **Utah Association of Special Districts**
- **Bear River Water Conservancy District**
- **Weber Basin Water**
- **JVWCD**
- **Senator Hillyard**
- **Cache County**
- **Rich County**

List of People Invited to Irrigators Meeting

Casey Jensen
Mountain Home Irr. Co.
781 E 12100 N
Cove, UT 84320

Jason Westover
Cub River Irrigation Co.
201 N 2400 W
Lewiston , UT 84320

Ed Cottle
West Cache Irr. Co.
1207 South 400 East
Trenton, UT 84338

Darin Evans
Summit Creek Commissioner
236 S. 200 W.
Hyde Park, UT 84318

David Erickson
Smithfield North Bench Ditch Co.
360 W 7800 N
Smithfield, UT 84335

Jon Meikle
Logan & Northern Irr. Co.
4650 North 1000 East
Hyde Park , UT 84318

Vaughan Richardson
Chambers Spring Irrigation Co.
106 W. 400 S.
Smithfield, UT 84335

Peter Küng
Logan NorthWest Field Irr. Co.
346 N 400 W
Logan, UT 84321

Jim Waterson
Benson Bear Lake Irrigation Co.
4705 W 3800 N
Benson, UT 84335

Jane Davis
Providence Logan Irr. Co.
545 River Heights Blvd
River Heights, UT 84321

Chris Allen
Coveville Irrigation Co.
12616 N 1200 E
Cove, UT 84320

Brett Christensen
Richmond Irrigation Co.
P.O. Box 156
Richmond, UT 84333

Lynn Buttars
Clarkston Irrigation Co.
127 N Main
Clarkston, UT 84305

Joseph Larsen
Newton Water Users Association
Box 94
Newton, UT 84327

Jeff Gittins
Smithfield Irr. Co.
152 W 200 S
Smithfield, UT 84335

Wendell Munk
Bench Irrigation Co.
5228 N 2400 W
Benson, UT 84335

Steve Seamons
Hyde Park Irrigation Co.
260 North 200 East
Hyde Park, UT 84318

Wayne Cardon
Logan Cow Pasture Water Co.
3046 N 4000 W
Benson, UT 84335

Art Moss
Logan Hollow Irrigation Co.
1238 Island Drive
Logan, UT 84321

Ron Zollinger
Spring Creek Water Co.
1000 River Heights Blvd
River Heights, UT 84321

Clair Allen
Webster Irr. Co.
1149 E 12700 N
Cove, UT 84320

Wyndon Ward
Skyline Irr. Co.
565 S 250 E
Richmond, UT 84333

Dan Cooper
Clarkston Town
50 S Main Street
Clarkston, UT 84305

Gilbert Duncan
Smithfield West Bench Irr. Co.
69 N 200 W
Smithfield, UT 84335

Jim Huppi
Logan, Hyde Park, Smithfield
Irrigation Co.
85 Quail Way
Logan , UT 84321

Thomas V Reese
King Irrigation Co.
809 E 400 S
Smithfield, UT 84335

Colleen Gnehm
Logan North Field Irrigation Co.
195 West 1800 North
Logan, UT 84341

Rick Reese
Benson Irrigation Co.
4043 N 2499 W
Benson, UT 84335

Donna Spillett
Logan Island Irrigation Co.
138 W 300 S
Logan, UT 84321

David Olsen
Providence Blacksmith Fork
Irrigation Co.
298 E 2100 S
Providence, UT 84332

Boyd Humpherys
Providence Pioneer Irrigation Co
328 Riverdale Ave
Logan, UT 84321

Tony Jenson
Logan Southwest Field Irr. Co.
1090 West 1000 South
Logan, UT 84321

Kent Souter
Logan River & Blacksmith Fork Irrigation Co.
997 S 3200 W
Logan, UT 84321

Steve Thatcher
Spring Creek Cache Irrigation Co.
2727 W 1800 S
Young Ward, UT 84321

Edwin Nelson
College Irrigatin Co.
2352 S Hwy 89-91
Logan, UT 84321

Roy J Ropelato
Garr Spring Water Co.
304 E 300 S
Millville , UT 84326

Legran Mathews
Millville Irrigation Co.
153 S 200 E
Logan, UT 84321

Bob Miller
Millville Canyon Irrigation
P.O. Box 6
Millville, UT 84326

Paul Leishman
Nibley Blacksmith Fork Irr. Co.
136 N 100 E
Wellsville, UT 84339

Scott Leishman
Wellsville East Field Irrigation & Canal Co.
2808 W 5000 South
Wellsville, UT 84339

Kay Murray
Mendon South Canal Co.
185 S 100 W
Wellsville, UT 84339

Bill Fletcher
Mendon North Irrigation Ditch
560 N 100 W
Mendon, UT 84325

Justin J Anderson
Mendon Central Irrigation Co.
166 S 100 E
Mendon, UT 84325

Quinn Murray
Wellsville-Mendon Conservancy Dist. (canal)
691 S 200 W
Wellsville, UT 84339

John Kerr
Wellsville City Irr. Co.
42 N. 100 E
Wellsville UT, 84339

W Wayne Bankhead
Wellsville North Field Irr. Co.
780 S Center
Wellsville, UT 84339

Kent Larsen
Hyrum Blacksmith Fork Irr. Co.
462 N Center
Wellsville, UT 84339

Derle Nielsen
Hyrum Irrigation Co.
155 S. 100 E
Hyrum, UT 84319

Jeff Clawson
Porcupine Highline Canal Co.
900 E. 6600 S.
Hyrum, UT 84319

Jon Lee
Paradise Irrigation & Reservoir Co.
PO box 156
Paradise, UT 84328

Roy Bankhead
Wellsville-Mendon Conservancy Dist. (canal)
190 East 800 South
Wellsville, UT 84339

Howard Furiman
Clear Creek Ditch Co.
2400 S. HWY 165
Logan, UT 84321

Keith Meikle
Logan, Hyde Park, Smithfield Canal
4614 N. 1000 E.
Smithfield, UT 84335

Greg Hansen
Little Bear River Commissioner
538 N. Main Street
Brigham City, UT 84302

Glenn Stringham
Blacksmith Fork River
50 S. 100 E.
Millville, UT 84326

Irrigators Meeting June 4, 2012
Attendance

Scott Leishman	Wellsville East Field Irrigation Canal
Ray Bankhead	Wellsville Mendon Conservation District
Art Moss	Logan Hollow Canal
Gordon Younker	Utah Association of Conservation Districts
Boyd Humpherys	Providence Pioneer Irrigation Company
Peter E. Kung	Logan River Water Association
Colleen Gnehm	Logan North Field
Keith Shaw	Logan Island Irrigation Canal
Scott Tripp	Skyline Irrigation Canal
Dave Evans	Summit Creek Irrigation Canal
Rallin Anderson	Logan River Blacksmith Fork Irrigation Company
Bret Christensen	Richmond Irrigation Company
Rick Reese	Benson Irrigation Company
Joe Fuhriman	Nibley Irrigation
Tony Jensen	Southwest Irrigation

Key Themes from Situational Assessment

A. Key Themes
    a. Current Conditions in Cache County
        i. Storage of spring runoff
        ii. There are conflicting views and history of conflicts between some cities about the management of water and tied to specific issues of wastewater treatment, fire protection, redundancy of culinary and secondary systems, etc.
        iii. Cache County does cloud seeding that gives 10-15% more snow pack.
        iv. Working relationships between organizations and individuals have improved in general over the past 10 years. This though is still a major challenge.
    b. Canal Companies
        i. Canal companies struggle to maintain canals, have access to canals, etc.
        ii. Delivery systems are not accurate.
        iii. Problems with storm water management and relationships with cities. History of conflict that ongoing rule changes will likely only exacerbate.
        iv. Agriculture holds the power of water rights today. Drilling new wells is very challenging. As agriculture turns to urban use, how will the water turn from agriculture to urban.
        v. Question about who maintains canals in the cities.
    c. Water Availability
        i. Varying opinions about the need for future water. Those that have plenty today have not thought through potential changes or laws that may come and the potential impacts (i.e. no longer being able to sprinkle with culinary, TMDL's, ESA, etc.).
        ii. Categories
            1. Flood Irrigation. Concerns that piping or changing flood irrigation practice will impact local springs or aquifer.
            2. Pressurized Secondary Water. Piped water has impacts to local springs and aquifer as delivery moves away from non-lined canals and flood irrigation. People know that this is likely their future for irrigation at homes and for agriculture. This though is not part of their master plans.
            3. Culinary. Expensive treated water being used in many cities to irrigate. Water will have to be treated in the future.
            4. Reuse. Central Utah Water Project has a requirement from the federal government to use reclaimed wastewater.
            5. Storm Water. Many identify this as the single biggest water issues between canal companies and municipalities.
        iii. Water development should be paid for by new users and new growth.
        iv. Threats
            1. TMDL's
            2. ESA, Invasive Species

        3. Lack of funding for development of water projects
    v. Major role of PacifiCorp is management of Bear River water. They are the primary management of this water for irrigation, flood control, etc.

d. Future Organization
    i. Conservancy District
        1. General lack of understanding about what a District is and how it functions.
        2. The county has too many responsibilities and can't effectively focus on water to the extent needed.
        3. If cities are going to be part of a District, they don't want to have to pay for a service that they don't see a benefit from.
        4. The number one strategy of Districts on the Wasatch Front to maintain water availability is conservation. This is accompanied by aggressive education and outreach about water management.
        5. Majority of those interviewed support the creation of a District.
        6. Laws to create have been improved (i.e. taxation without representation is no longer an issue).
        7. Merging with Box Elder is a definite possibility.
        8. Possible to create Box Elder, Cache, and Rich County Conservancy District.
        9. Opposition to creation of a District: Those that already have a lot of water (small cities on east side of county).
        10. All Districts are moving from taxation to revenue generation from wholesale water distribution.
        11. Most work is done in culinary water and pressurized secondary water.
        12. Provides a stronger relationship with the state legislature.
        13. WBWCD and JVWCD already are buying property and ROW to build their treatment facility and distribution system. Starts in West Haven, Utah.
        14. Cities that currently generate revenue with water want to continue to be able to do so.
        15. The various water systems in each community need to commonly be connected together within each city and amongst the various communities.
        16. Must have representation from all communities

e. Bear River
    i. Who will pay? Cost is likely one of the biggest issues.
    ii. Bear River Development is happening right now. Demands for the availability of this water vary from 10 to 20 years from today.
    iii. Must be managed in conjunction with Idaho and Wyoming as well as PacifiCorp.
    iv. West side of Cache County will likely benefit the most from Bear River development.
    v. May be some challenges with communities on the east side of the county perceiving having to pay for water development that benefits the people on the west side of the valley.

vi. Must have a Conservancy District before Bear River water is developed. JVWCD and WBWCD both were formed to provide the formal organization to pay back the loan for the development of water that is supplied to both Conservancy Districts.

f. Education
    i. Culture Shift. Water users moving from agriculture to urban. Challenges with this interface. Farmers want to preserve right to farm yet they may want to sell to development if next generation doesn't want to farm, etc.
    ii. The majority of the public is uninformed about water.
    iii. People do not show up to support and provide manpower to manager irrigation water.
    iv. Rights
        1. Keep water rights with property
        2. Developers try to break up water shares
        3. Need for a public education campaign about water rights and shares.

B. List of Priorities
C. Stakeholders and Organizations
    a. Cities:
        i. Logan
        ii. North Logan
        iii. Hyde Park
        iv. Smithfield
        v. Richmond
        vi. Lewiston
        vii. Clarkston
        viii. Nibly
        ix. Hirum
        x. Paradise
        xi. Wellsville
        xii. Mendon
        xiii. Newton
        xiv. Trenton
        xv. Amalga
        xvi. Providence
        xvii. River Heights
        xviii. Millville
        xix.
    b. Counties: Cache, Rich and Box Elder
    c. Water Districts:
        i. Goslind Spring
    d. Conservancy Districts:
        i. Bear River Water Conservancy District

        ii. Jordan Valley Water Conservancy District
        iii. Weber Basin Water Conservancy District
    e. Division of Water Rights
    f. Water Commissions
        i. Blacks Smiths Fork
        ii. Logan River
        iii. Bear River
        iv. Little Bear River
        v. Summit Creek
    g. Bear River Small Pumpers
    h. Summit Creek Water
    i. PacifiCorp
    j. Utah Association of Special Districts
    k. Senator Hillyard
    l. Canal Companies:
        i. Bear River Canal Company
        ii. Cub River Canal Company
        iii. Bear River Pump Company
    m. Bear Lake Preservation Advisory Committee
    n. Bear Lake Watch
    o. Bear River Bird Refuge
    p. Bear Lake Regional Commission
    q. Utah State University
    r. Envision Cache County
    s. Audubon Society

D. Acts, laws and master plans
    a. Bear River Development Act
    b. Bear River Compact
        i. Agreement about how much each state can develop
    c. PacifiCorp (1912)
        i. Encumbrances
    d. Ground Water Management Plan (1999)
    e. State Water Master Plan
    f. Logan City Water Conservation Plan
    g. Endangered Species Act
    h. PacifiCorp litigation about dredging

Appendix 2-C

Steering Committee Meetings

Complete copies of the meeting minutes and presentations for four steering committee meetings that were held.

i: Steering Committee Meeting Minutes – July 18, 2012

Review of synthesized data collected through the key interviews and meetings and establishment of ground rules.

ii: Steering Committee Meeting Minutes – October 25, 2012

Review of preliminary forecasted water supplies and demands, overview of Bear River Development Act and current development plans and activities and panel discussion about districts.

iii: Steering Committee Meeting Minutes – January 16, 2013

Bear River operations, ASR and water banking presentations, update on water supplies and demands and instant pole.

iv: Steering Committee Meeting Minutes – April 24, 2013

Presentation of draft master plan results and feedback from the steering committee.

CACHE COUNTY
WATER MASTER PLAN

CACHE COUNTY

Cache County Water Master Plan

Steering Committee Kick Off Meeting Minutes

7/18/2012

Cache County Water Master Plan
Steering Committee Meeting Agenda
July 18, 2012

Meeting Attendees:

- Roland Jeppson – Spring Creek Water Company
- Jim Williamsen – Spring Creek Water Company
- Gary Larsen – Millville City
- Alan Luce – North Logan City
- Josh Runhaar – Cache County
- David Zook – Nibley City
- Clair Allen – Web Irrigation Company
- Colleen Gnehm – Logan River Water Commissioner
- Bill Young – Logan City
- Grant Koford – Amalga City
- Glen Stringham – Blacksmith Fork
- Bill Baker – River Heights City
- Marlowe Adkins – Richmond City
- Jim Watterson – Benson Bear Lake Irrigation Company/Bear River Water Commissioner
- Lee Atwood – Paradise Town
- S. Bruce Karren – Cub River Irrigation Company/North Cache Conservation District
- Jon Hardman – Mendon City
- Brent Jensen – Hyrum City
- Clark Israelson – Utah State University
- Max Pierce – Cornish Town
- Bill Bower – Citizen
- Donna Spillett – Logan Island Irrigation Company
- Stephen Thatcher – Spring Creek Irrigation Company
- Evan L. Olsen – Water Policy Advisory Board
- Claudia Conder – PacifiCorp
- Jim Gass – Smithfield City
- Greg Hansen – Little Bear Irrigation Company/Little Bear River Water Commissioner
- Will Atkin - Utah Water Rights
- LeGrand Bitter – Utah Association of Special Districts
- Darin Evans – Summit Creek Water Commissioner
- Rick Reese – Benson Irrigation Company
- Don Hartle- Wellsville City
- Jeff Gittins – Smithfield Irrigation Company
- David Rosenberg – Utah State University
- Thad Erickson – Cache County Water Policy Advisory Board

1. **Welcome and Introductions**
   a. Committee members introduced themselves and explained what they would like to get out of the process. Below is a summary of the feedback received:
      i. Ensure people have a stake in the plan
      ii. Desire to have water representation at the state level
      iii. Find out what is going on with the County Water Master Plan
      iv. Protect the aquifer
      v. Protect irrigation water
      vi. Protect municipal rights

vii. Protect water rights
viii. Community development
ix. Find out the results of the Situational Assessment
x. To be a part of the solution
xi. Learn general information about water in Cache County
xii. Discuss federal agency encroachment (USFS)
xiii. Protect water (springs)
xiv. Coordination in case of future water related accidents
xv. History of water in Cache County
xvi. Discuss municipal and agricultural water challenges
xvii. Secure Cache County's share of the Bear River (winter storage)
xviii. Discuss priority rights and Water quality

2. Roles and Responsibilities of Steering Committee

a. Proposed Steering Committee Meetings:
   i. Kickoff Meeting – Cache County Water Overview
   ii. Technical Meeting
   iii. Problem Solving Session
   iv. Review of Draft Water Master Plan
b. Purpose and Goals of the Steering Committee
   i. Provide Guidance For:
      - Future projects
      - Completion of future reports, actions and projects
      - Water improvement funding
      - Organizational structure to manage water in the County
      - Plan to gain a greater voice with the State Legislature
   ii. Educating and building consensus with stakeholders
   iii. The County emphasized that its purpose is not to push committee members in a certain direction, but rather receive guidance on how to confront future water challenges and opportunities.
c. Steering Committee Ground Rules and Communication
   i. Take good minutes and get them back to the committee
   ii. Focus on broader/County issues, not just those from one specific organization
   iii. Communicate effectively outside of the meeting, and don't editorialize information
   iv. Speak with respect
   v. Be aware of time constraints
d. Steering Committee Charter
   i. A Steering Committee Charter will be developed based on the feedback received in the meeting. The charter will be distributed to committee members once it is completed.

3. Brief History of Cache County Water – Bob Fotheringham

a. Brief overview of the history of water in Cache County. Please see the presentation slide entitled "A Historical Overview" for an outline of this discussion.

4. Project Overview – Chris Slater

a. Overview of the Master Plan approach thus far and planned future meetings for the master plan. Please see the presentation slide entitled "Project Overview and Schedule" for an outline of this topic.

5. **Review Situational Assessment**
    a. Review of the assessment interview map, and interviewees
    b. Overview of the key themes derived from the assessment. Please see the presentation slides for an overview. Topics discussed were:
        i. Current Conditions
            - The group discussed the reoccurring themes and perception of conditions derived from the situational assessment.
        ii. Water Availability
            - Water availability varies depending what part of Cache County is being discussed. Water resources differ from the east end of the valley from the west.
        iii. Improvement Strategies
            - Opinions regarding attitudes towards several improvement strategies covered in the situational assessment were discussed. Please see the slide entitled "Improvement Strategies" to see the ratings attributed to the strategies from several situational assessment interviewees.
        iv. Organization and Management
            - The importance of a management system in order to develop Cache County's allocation from the Bear River development act was discussed. Please see the slides entitled "Organization & Management" and section 8-e of these minutes for more information on this topic.
        v. Conservancy District Support
            - District perceptions, questions and information were discussed. An evaluation of attitudes towards conservancy districts from the situational assessment can be found in the slide entitled "Conservancy District Support."
        vi. Bear River
            - The Bear River Development Act was discussed, including management requirements and allocation information. Please see the slide entitled "Bear River."
        vii. Education
            - The importance of education regarding Cache County's water resources and challenges was discussed. A greater understanding of water rights, priorities and issues by the public will be necessary for Cache County to achieve its goals. See the slide entitled "Education."

6. **Master Plan Focus and Prioritization**
    a. The committee discussed the lessons learned from the situational assessment tied to Master Plan priorities.
        i. See presentation slide entitled "Priorities"

7. **Potential Roadblocks to Successful Master Plan**
    a. Natural disaster could change resources, priorities and focus of Master Plan
    b. Environmental issues
    c. Lack of education
        i. Discussion on how to better educate people regarding the County's water challenges and opportunities.

d. Inaccurate information

8. **Feedback from Committee:**
   a. **Storage:** Discussion regarding potential reservoir sites and storage options. Suggestions and topics included:
      i. Revisit the Barrens site.
      ii. Store the water out of state.
         - Utah DWRe could have potential concerns with development of water out of state.
         - There are challenges associated with storing water across state lines.
      iii. Utilize aquifer storage and recovery methods
         - Two sites in the county have been identified where aquifer storage and recovery could work.
      iv. Further information was requested regarding the potential cost of constructing a reservoir.
      v. Building dam(s) in the canyon to take advantage of the potentially compatible geology.
      vi. Consider geology and safety with potential dam sites.
   b. Canal and Storm Water Management
      i. Concerns arose over Cache County canals' continued capacity to carry storm water.
      ii. Responsibility for maintenance and who should be liable if there is a canal breach or other disaster
      iii. Maintenance and improving access to canals
   c. Agricultural/Urban Interface
      i. The importance of balancing water use benefits and rights between agricultural and urban interests.
      ii. Agricultural users should be fairly compensated when water rights are transferred from agricultural uses to other uses.
      iii. Cost sharing challenges and opportunities
      iv. When farmers become developers or sell agricultural land for development, there is a need to transfer water. Discuss about how this should this happen so that it is fair for all parties involved
   d. Bear River Water Development
      i. 60,000 acre feet were allocated to be developed by Cache County or a Water Conservancy District.
      ii. Importance of taking measures to secure the valley's allocation.
      iii. Bear River allocation could potentially benefit the agricultural sector.
      iv. Discussion questions:
         - Should the developed water be managed by the County or through a District?
         - What is the approximate duration of the regulatory process that must be followed to build a reservoir?
         - What is Idaho's long term interest in the Bear River?
         - The public needs to be educated on how the Bear River water is managed. It is a complicated system.
         - What is the current capacity of the reservoirs? Is dredging an option to increase storage capacity?

- The development of the Bear River could provide the opportunity to sell any excess water. Could the water be developed and sold to the Wasatch Front?

e. **Management**
   i. The management of the Bear River Water Development Act allocation is more than just a one person job.
   ii. Only the County or a Conservancy District can develop Cache County's allocated share from the act
   iii. Committee members communicated interest in learning more details about conservancy districts, including:
      - Updated laws and regulations concerning conservancy districts
      - Funding (can you reclaim the cost spent to run a district?)
      - Management protocol
      - How would we keep control?
      - Benefits
      - Can a conservancy district tell an irrigation company what to do with its water?
      - Can we use a special service district to get what we need?
   iv. Need to have a good plan to fund needed projects
   There are new Conservancy District laws
   v. Discussion about how other conservancy districts perceive Cache County and Cache County water users.
   vi. We could use the county to manage water instead of having another layer of government.

f. **General**
   i. The Master Plan should address recommended actions during a prolonged drought.
   ii. Coordinate with Idaho entities that have faced or are facing similar challenges and opportunities and learn from their efforts.
   iii. Can we gather storm water and store it in a reservoir?

g. **Potential Project Road Blocks**
   i. Environmental Issues
   ii. Lack of education of the public.
   iii. Lack of direction
   iv. Lack of community support

9. Next Steps

a. The next meeting will be held in October 2012. Notifications will be sent out prior to the meeting. Some of the items to be part of the next meeting are:

   i. Presentation of water supply and demand projections from the Division of Water Resources study (dependent on progress of the Division).
   ii. Panel discussion to answer the steering committee questions regarding future water management organization for Cache County.
   iii. Rough estimates of reservoir construction cost information to gain a better understanding of PacifiCorp's role in the current management of the Bear River.

Steering Committee Meeting

July 18, 2012

Master Plan Purpose

- Master Plan Purpose
  - Evaluate existing water resources and demands
  - Determine future water demands
  - Educate and build consensus
  - Create a plan for the future
  - Recommend methods to manage water resources in the County

Steering Committee Purpose and Goals Discussion

- Provide Guidance For:
  - Future projects
  - Completion of future reports, actions and projects
  - Water improvement funding
  - Organizational structure to manage water in the County
  - Plan to gain a greater voice with the State Legislature
- Educating and building consensus with stakeholders

Steering Committee Meetings

- Meeting 1: Kickoff Meeting – Cache County Water Overview
- Meeting 2: Technical Meeting
- Meeting 3: Problem Solving Session
- Meeting 4: Review of Draft Water Master Plan

CACHE COUNTY
WATER MASTER PLAN

Steering Committee Ground Rules

CACHE COUNTY
WATER MASTER PLAN

Steering Committee Charter

A Historical Overview

1850-1900

- **1860:** Early Claims

1901-1950

- **1904-1927:** Power Development
- **1912-1919:** Irrigation Contracts
- **1920:** Dietrich Decree
- **1922:** Kimball Decree

1951-2000

- **1958:** Bear River Compact
- **1966-Present:** Potential Reservoir Site Studies
- **1980:** Bear River Compact amended
- **1989:** Subsequent Storage Contract
- **1990's:** Modeling of the Bear River
- **1991:** Bear River Water Development Act
- **1995:** Bear Lake Water Settlement Agreement
- **1999:** Cache County Ground Water Management Plan

Project Overview and Schedule

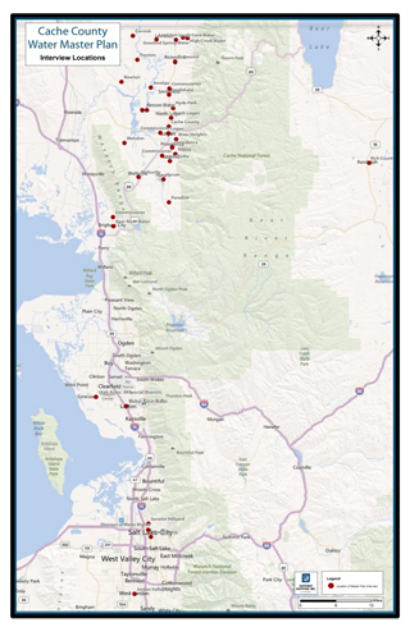
2012

- **March 1:** Bear River Small Pumpers Meeting
- **March 8:** Team Kickoff Meeting
- **March 28:** Presentation at Utah Mini Water Users Conference
- **April 4:** Attend North Cache Conservation District Meeting
- **April 30:** Started Stakeholder Interviews
- **May 29:** Irrigation Stakeholder Meeting
- **June 4:** Report to Joint Council (Logan City, Cache County)
- **July 10:** Report to County Council
- **July 18:** Steering Committee Meeting #1
- **September:** Supply and Demand Data from DWRe
- **October:** Steering Committee Meeting #2
- **October:** County Council Update

2013

- **January:** Steering Committee #3
- **January:** County Council Update
- **April:** Steering Committee Meeting #4 - Review Draft Master plan
- **May:** Present Plan to County Council

Situational Assessment



Assessment Key Themes

Current Conditions

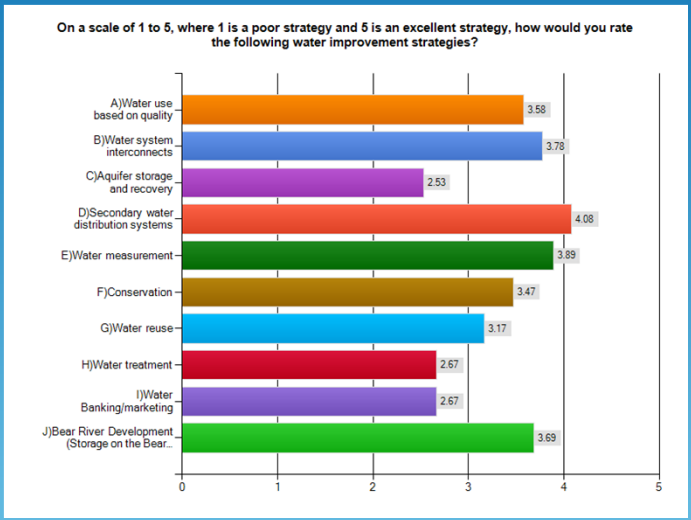
- Storage of spring runoff
- Differing views on water history, management and issues
- Delivery systems may not be accurate in measuring available and deliverable water
- Working relationships have improved in the last 10 years
- Canal maintenance is a challenge
- Challenges with storm water management
- Challenges tied to the conversion of agricultural rights for urban use

Water Availability

- Varying opinions about the need for future water. Those that have plenty today have not thought through potential changes or laws that may come and the potential impacts (i.e. no longer being able to sprinkle with culinary, TMDL's, ESA, etc.).
  - Flood Irrigation
  - Pressurized Secondary Water.
  - Culinary
  - Reuse
  - Storm Water

Improvement Strategies

(19 Respondents)



Organization & Management

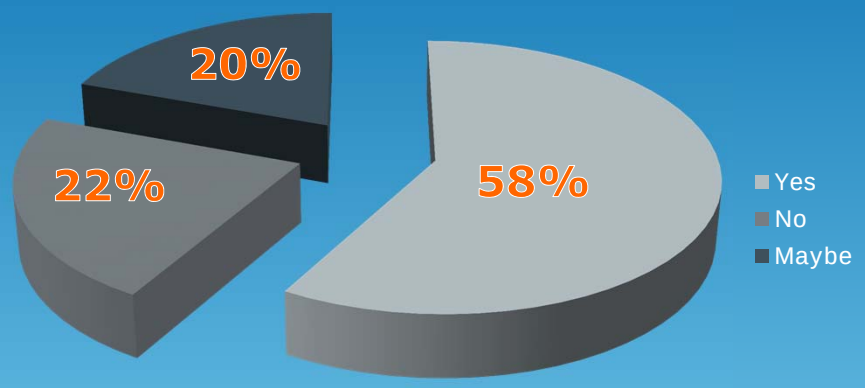
- Concerns about legislative representation with current system.
- There needs to be a management system that protects Cache County's current and future water resources at the local and state level.
- PacifiCorp plays major role in current management of Bear River

Organization & Management

- Most common management system recommendations included
  - Form a Conservancy District (Merge with Box Elder, Multi-County)
    - Laws to create and manage a district have changed
  - Form a County-based organization with municipal/irrigation representation.
  - Remain the same (County Manager)
- General lack of understanding of what a district is and how it functions
- The County has too many responsibilities, and can it manage water to the extent needed

CACHE COUNTY WATER MASTER PLAN

Conservancy District Support



CACHE COUNTY
WATER MASTER PLAN

Bear River

- Bear River Development is happening now!
- High support for development of Bear River.
- How do we develop it and who pays?
  - Pay based on allocation.
  - Use grants to help pay.
  - Everyone in County pays.
  - New development helps pay.
- West side of County likely benefits the most.
- Must be managed in conjunction with other stakeholders (PacifiCorp, Wyoming, Idaho, etc.).
- In order to develop a resource on the scale of Cache County's Bear River allocation, the Bear River Water Development Act requires that the development be managed by the County or a Conservancy District.

CACHE COUNTY
WATER MASTER PLAN

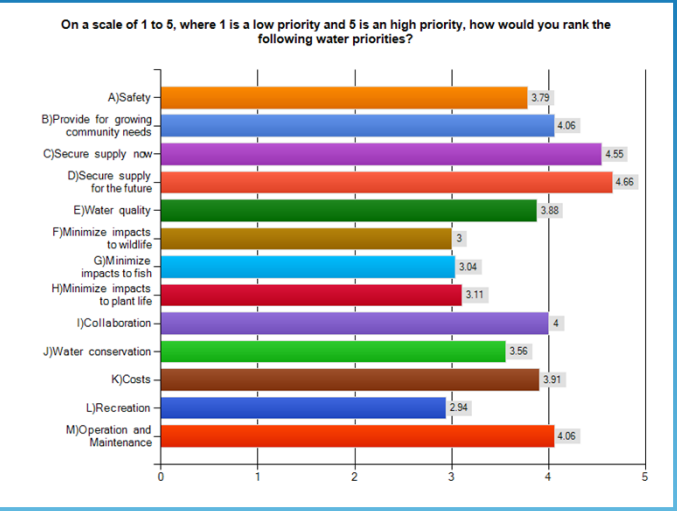
Education

- The majority of the public is not informed enough about water.
- Cache County is experiencing a culture shift. Change from agricultural to urban/commercial
- Rights
  - Keep water rights with property
  - Developers try to break up water shares
  - Need for a public education campaign about water rights and shares.
- Lack of future public support for system maintenance

Master Plan Focus and Prioritization

CACHE COUNTY
WATER MASTER PLAN

Priorities



Other priorities included: public education, water rights security, conversion of water rights and accountability.

Potential Road Blocks Discussion

Next Steps

- Share the information from today, and bring us feedback
- Schedule next meeting – What do you need?
- We will send the Charter and meeting minutes for your review.
- Please take the Steering Committee Evaluation Survey before leaving!

Thank You!

CACHE COUNTY

Cache County Water Master Plan

Steering Committee No. 2 Meeting Minutes

10/25/2012

Cache County Water Master Plan
Steering Committee Meeting Agenda
10/25/2012

Meeting Attendees:

- Marisa Egbert – State DWRe
- Bob Oaks – Groundwater Consultant
- Clair Allen – Web Irrigation Co.
- Marla Trowbridge – Trenton Town Co.
- Don Hartle- Wellsville City
- Jim Williamson – Spring Creek Water Co.
- Alan Luce – North Logan City
- Will Atkin – Water Rights
- Scott Tripp – City Creek Irrigation
- Sharon Vaughn – USFWS Bear River MBR
- Todd Adams – Utah Water Res.
- Eric Millis – Utah Water Res.
- Gary Larsen – Millville City
- Darek Kimball – JUB Engineers/Richmond
- Claudia Conder – Pacificorp
- Legrand Bitter – UASD
- David Zook – Nibley City
- David Rosenberg – USU
- Rick Reese – Logan River Benson
- Lee Atwood – Paradise Town
- Kerry Schwartz – Bureau of Reclamation
- Bob Fotheringham – Cache County
- Josh Runhaar – Cache County
- Andrea Armstrong – USU
- Mark Anderson – UASD
- Connely Baldwin – Pacificorp
- Max Pierce – Cornish Town
- L . Bruce Karren – NCCD
- Zac Covington – BRAG
- Thad Erickson – Water User
- Jon Hardman – Mendon City
- Glen Stringham –Water User
- Voneene Jorgensen – BRWCD
- Donna Spillett – Logan Island Irrigation Company
- Leah Meeks – USU Civil Engineering
- Jim Gass – Smithfield
- David Beazer – Millville Irrigation
- Bill Young – Logan City
- Randy Eck – Providence City
- Jon White – Cache County
- Lee Cammack –J-U-B Engineers
- Chris Slater - J-U-B Engineers
- Trevor Datwyler - J-U-B Engineers
- Dan Adams – The Langdon Group
- Joshua Palmer – The Langdon Group
- Tage Flint - WBWCD

1. **Welcome and Introductions**
2. **Meeting Purpose and Agenda Review**
3. **Review Meeting Requests from Meeting #1**
    a. Discuss formation of a Water Conservancy District
    b. Clarification of the current laws regarding the formation of Water Conservancy Districts.
4. **Review of Preliminary DWRe Data – Todd Adams (see attached slides)**
    a. Forecasted Water Supplies and Demands (Refer to slide 3 of the Population Projections and Water Demands presentation attached to these minutes)
        i. DWRe does not do population projections, but uses the governor's office numbers. 2008 was the last population projection. A draft of the 2010 population projection numbers was released four months ago. The estimated projection for year 2060 is

268,731. They have not broken the numbers out by communities yet, just Cache County as a whole. The projected population numbers for the communities may still change in the next few months.

ii. Based on the data that was compiled in 2008:
    1. The projected total potable municipal and irrigation water demand in Cache County for year 2060 was 71,000 acre-feet.
    2. The State of Utah set a goal in year 2000 to reduce water demand by 25% by the year 2025. If that goal is met, and based on the 2008 data, we will need 53,000 acre-feet at year 2060.

iii. Based on the new preliminary population projections that were released four months ago, the estimates DWRe and J-U-B have put together for this project are:
    1. 57,000 acre-feet needed by 2060.
    2. 43,000 acre-feet needed if the goal of 25% water conservation is reached.

iv. The water supply is currently projected to stay at 52,500 acre-feet per year. This does not account for any secondary water supplies.

v. As mentioned, the statewide water conservation goal of 25% reduction was set in the year 2000. Currently Utah has achieved 18% water use reduction since the year 2000.

vi. 2010 population values are being published currently. The current supply is roughly 52,500 ac feet. This is provisional data.

vii. If individual cities have population values different than the governor's office is projecting, this can be modified in the model by contacting the Division of Water Resources or Chris Slater at JUB, but the bottom line (overall population) for Cache County has to remain the same.

viii. The secondary water is calculated based on green space, lot size, and evapotranspiration, etc. since there are not meters on most secondary systems.

b. Does transferring the water shares from the canal company to the City reduce the diversion right the canal company has?
    i. Yes, this could reduce the right.
    ii. As the cities grow, the conversion from agricultural water rights to municipal water rights will be a complicated issue to deal with.

c. Any additional questions for Todd Adams at the Department of Water Resources should be written on the meeting evaluation form. The presentation will be emailed to the group as well.

5. Bear River Water Development Act Update – Eric Millis (See attached slides)

a. Current status: In 1991 the Bear River development act was passed by the state legislature. The amount of water available for development in the Bear River Basin and in the state of Utah was divided as listed below.
    i. Cache County or a Conservancy Dist. in Cache County – 60,000 acre-feet per year
    ii. BRWCD (area of Box Elder County)– 60,000 acre-feet per year
    iii. WBWCD (area of Weber and Davis County) – 50,000 acre-feet per year
    iv. JVWCD (area of Salt Lake County)– 50,000 acre-feet per year

b. The majority of the need is projected to occur around year 2035, though Cache and Box Elder may have an earlier need. The development of projects takes a long time.

c. Since the Washakie Reservoir site was investigated 20 years ago, advances in science have shown that the site is not ideal due to site constraints, water quality issues etc. Additional sites are being investigated.
d. Reservoir sites:
    i. 45 possibilities.
    ii. The list has recently been reduced to nine sites.
    iii. Currently in the process of working with the involved agencies and putting together a combination of reservoirs that meet the criteria.
    iv. Current sites being investigated:
        1. Whites Valley
        2. Fielding
        3. Washakie
        4. Cub River,
        5. Above Cutler,
        6. Hyrum enlargement
        7. Temple Fork,
        8. Willard – north side of reservoir,
        9. East side of Promontory.
    v. There would need to be a pipeline to tie these reservoirs together. A recommended alignment has been developed.
e. Answers to Questions:
    i. Willard Reservoir: will be an additional reservoir. Increasing the capacity of the existing reservoir is a separate issue.
    ii. The correlation between the reservoirs outside of Cache Valley and in the Valley would be done by exchange.
    iii. Water would probably not be pumped from Promontory to Cache County. It would be taken from the Bear River in Cache County in the form of an exchange.
    iv. The sites up Blacksmith Fork were removed from the short list because of the low water supply and high environmental impacts.
    v. Finances:
        1. It's expensive no matter where the reservoir is built.
        2. Where are the finances going to come from to build these reservoirs?
            a. This is being discussed in the legislature right now. The need will be the driving factor for the reservoirs. They will be built when needed, so it fits the need of everyone involved in the project.
    vi. Aquifer Storage and Recovery (ASR):
        1. Can water be stored under the ground or does it have to be reservoir?
            a. This is being looked at now.
    vii. Balance all three entities (Rich County, Cache County, Box Elder County)
        1. The water in Bear Lake is what immediately benefits Cache County.
        2. How do the reservoirs west of the valley benefit Cache County?
            a. The water stored in the reservoirs west of Cache Valley will reduce the demand on the Bear River, leaving more water in Bear Lake that can in turn be used in Cache County via exchange.

viii. Studies on ASR are currently being completed. Hopefully in the next month the results will be presented at the county council meeting.

6. Organizational Structure – Alternatives and Panel Discussion

a. Evaluation Criteria ***(refer to the attached proposed metrics table)***

b. Presentation of Management Alternatives (county wide or multiple smaller districts)
   i. Form a Conservancy District
   ii. Form a Special Service District
   iii. County management with more staff and resources
   iv. Continue with current system (County Water Manager)

c. Panel:
   i. Tage Flint (General Manager - WBWCD)
   ii. Mark Anderson (Attorney for UASD)
   iii. Voneene Jorgensen (General Manager – BRWCD)
   iv. Legrand Bitter (Executive Director UASD) –

d. Utah Association of Special Districts (UASD)
   i. Created in 1989
   ii. 400 districts throughout Utah
   iii. 120 districts in Utah that provide water service, 24 are water conservancy district.
   iv. Functions as a resource for districts
   v. Contact LeGrand Bitter at UASD with concerns and questions.
   vi. Provides training on statutory framework for organizing districts.
   vii. Acts as legislative representative.

e. Cache County conservancy district history
   i. Conservancy district has been turned down twice.
   ii. Have the rules changed?
   iii. Should we re-evaluate this?
   iv. This was largely turned down in the past due to taxation. Conditions may have changed relating to water development
   v. Why it failed in 1980's and 1990's: Did not pass because of taxation issue of appointed board, they could not be voted out. Taxation without representation. The creation procedure has changed since then.

f. There are two different ways to form a district (See Utah Code Annotated Title 17B):
   i. Petition to County or municipality to request the service desired.
      1. Must be signed by 33% of registered voters by total private land area and be equivalent to at least 25% of the value of the total property. 25% by value
   ii. Through City Councils
      1. Go to city councils, convince them that this is desired by the community.
      2. Have councils pass a resolution for the process. The resolution can spell out how the board of trustees is to be appointed. Specify they are to be appointed, elected, etc. The people behind the movement get to choose whether they want the officials appointed or elected.
      3. Hold public hearings etc.

        4. There is a protest period of 60 days – threshold for protest is much lower than for petition. If 25% of registered voters protest, it is turned down. Or if voters with 25% area and 15% value protest, then it is turned down. If not protested, then it goes to next election. If needed signatures are obtained in petition, doesn't have to go to election.

g. Conservancy District:
    i. Functions independent and separate from other government entities.
    ii. Governed by own board of officials.
    iii. Can tax, but tax rate is limited by state code. Tax authority sits with the elected board of trustees.
    iv. To form, you must show that over half of the people are in favor. If you can show that about 67% are in favor by doing a petition, you may not be required to take a vote.

h. Special Service District:
    i. Functions under the control of the governing body (the county or municipality where the district is located)
    ii. Governed by elected officials. The county or municipality that creates the Special Service District has control. They may appoint a board.
    iii. Cannot tax unless voted for by the public
    iv. To form, an election is not required, but public hearings are.

i. Which option will get the job done best? Get the funding, representation, etc?
    i. Whichever option the state approves.

j. To get taxing authority project must be approved by voters.

k. Partnering with another district?
    i. Yes, can be annexed into district.
    ii. Still have to have public hearings etc.
    iii. Doesn't abbreviate the process much, but is slightly simpler.

l. Boards
    i. Weber Basin and Bear River Water Conservancy Districts have appointed boards.
    ii. None of the special service districts have elected boards currently in the state.
    iii. The BRWCD has 10 board members, 1 board member from each of 8 different geographical regions in the district and 2 board members that represent the irrigation companies.

m. Funding: Does it all come from property tax or where?
    i. BRWCD –
        1. Water revenue, impact fees, and property taxes fund the district.
        2. Because they are a young water conservancy district, they have bonded 5 times for projects.
        3. When getting a water revenue bond, have to engineer projects so that water revenue will pay back bonds.
        4. Property taxes can be used to fill in the gap as needed. The costs come up front but the revenue comes in time.
        5. Bonded with DWR on low interest loans paid back in time.
        6. Always been able to meet obligations thus far.
        7. Nobody likes taxes, but everyone likes water.
        8. BRWCD tax is $23/year.

    ii. Young districts are dependent on property taxes to begin with because of the high upfront cost of infrastructure.
    iii. WBWCD tax revenue is less than 25% of the total revenue.

n. A water management plan could be used as a land use planning tool amongst communities. What influence does the board think they have on the land use planning?
    i. The district doesn't have much say on the land use planning; just a resource to provide water once the land is developed.

o. Example: Mendon needs more water. They don't have a source. How does the district handle this? If water district has a line that is 5 miles from this location, what obligation does the district have to run a line out there?
    i. If they are not a taxed area of the district, the district has little obligation to run infrastructure to them. If it is taxed, then they have obligation.
    ii. Willard example:
        1. Came to BRWCD district to see if they could provide water for 800 acre development.
        2. The district applied for water rights, designed infrastructure, and built the system.
        3. Growth was going well until 2008, and then all development stopped.
        4. Now there is a brand new water system ready for when development picks up again.
    iii. Can county/municipalities develop their own sources in areas where districts exist?
        1. Yes – they can still develop their own sources, but it's often cheaper to go with the district.
        2. There is a stipulation for districts that says they have to monitor the wells for 2 years to ensure that the district isn't negatively affecting surrounding wells.
    iv. In unincorporated areas if a district installs a water line past a home, the homeowner can connect to the new line if desired and if they have paid the associated fees (impact etc.).

p. How do existing canal companies, cities retain control when a district is formed?
    i. WBWCD does not hold potable water, just secondary so they're not competing with the cities ever.

q. It might be possible to form a special district in Cache County; a water conservancy district has a negative connotation with the name.
    i. Doesn't have to be a water conservancy district, it can be an improvement district.

r. Small City: Which is better of alternatives? Special district, conservancy district, county manager etc.
    i. In the case of WBWCD, the district was formed to develop water supply for communities that couldn't do it on their own. Most of them receive water from outside their city limits. It was a tool to go outside of their municipality and supply the water from a longer distance away.
    ii. Bear River Development Water:
        1. Communities can't act on their own to get any of this water.
        2. The state engineer has said there is no more water.
        3. If you want to be part of the Bear River Development Act, you better have a district of some sort.
    iii. Without the WBWCD, growth on the Wasatch front would have been stopped due to lack of water.

s. Is there one of the options (special district, water conservancy district, etc.) that would be preferred for participating in the Bear River Development Act?
    i. They could both work, but the County option is not a preferred option generally.
        1. Counties do not typically provide municipal type services.
        2. Once a municipality acquires a water right, it cannot sell it.
        3. A district can hold, trade, and exchange water rights much more efficiently than a municipality.

7. Next Steps

a. Meeting #3 Goals
b. Review of PacifiCorp Management Responsibilities
c. Future Water Development Strategies

Steering Committee Meeting

OCT. 25, 2012

Master Plan Purpose

- Master Plan Purpose
  - Evaluate existing water resources and demands
  - Determine future water demands
  - Educate and build consensus
  - Create a plan for the future
  - Recommend methods to manage water resources in the County

Steering Committee Ground Rules

- Steering Committee Ground Rules and Communication
  - A. Take good minutes and get them back to the committee
  - B. Focus on broader/County issues, not just those from one specific organization
  - C. Communicate effectively outside of the meeting, and don't editorialize information
  - D. Speak with respect
  - E. Be aware of time constraints

Items From Last Meeting

1. Further information was requested regarding the potential cost of constructing a reservoir.
2. Committee members communicated interest in learning more details about water management alternatives (which will be covered in our panel discussion), including:
   - A. Updated laws and regulations concerning conservancy districts
   - B. Funding (can you reclaim the cost spent to run a district?)
   - C. Management protocol
   - D. How would we keep control?
   - E. Benefits
   - F. Can a conservancy district tell an irrigation company what to do with its water?
   - G. Can we use a special service district to get what we need?

CACHE COUNTY
WATER MASTER PLAN

Forecasted Water Supply and Demand

Todd Adams - Utah Department of Water Resources

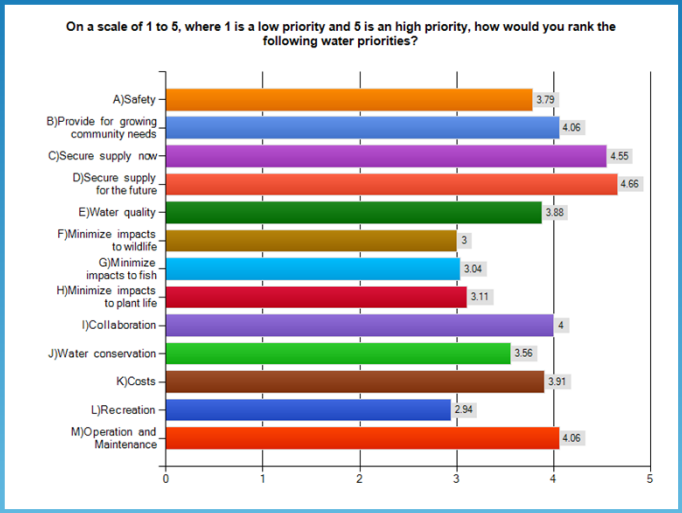
CACHE COUNTY
WATER MASTER PLAN

Bear River Development Act Information

Eric Millis - Utah Department of Water Resources

CACHE COUNTY WATER MASTER PLAN

Evaluation Criteria Discussion



Other priorities included: public education, water rights security, conversion of water rights and accountability.

CACHE COUNTY WATER MASTER PLAN

Proposed metrics to measure achievement towards water management objectives

OBJECTIVE	METRIC(S)
Water Supply	
Provide secure water supply now	• Number of Cache County communities with water moratoriums in 2012 •
Provide secure water supply in the future	• Number of Cache County communities with water moratoriums in 2032 • Number of communities in 2032 that can still provide water should a source fail •
Provide for growing needs of communities	• Meet the demands of each community's forecasted growth through 2032 •
Implementation	
Fund water improvement projects	• Cache County uses Bear River water allocation (acre-feet developed) • Number of water system interconnects • Communities that benefit pay for improvement project •
Minimize costs of management	• Cost of management (dollars/acre-foot of developed water) •
Governance	
Operate and maintain water systems on a local level	• All water wholesaling done through contract • Number of communities represented on a decision making board • Each community can still make water source, storage, distribution and other local system improvements •
Governance (continued)	
Represent all water users in the County	• Acre-feet of water developed/saved for agricultural, municipal, environmental, hydro power, recreation and other beneficial uses. •
Represent Cache County on water legislation issues	• Legal standing according to state law • Money and resources to lobby •
Promote collaboration	• Number of interconnects • Number of interlocal agreements • Number of contracts •
Protect water rights	• Acre-feet of approved new, change, and re-use applications •
Additional Objectives	
Educate the public	• Per capita water use • Money, people and facilities available to work with Cache County citizens on water rights and water conservation •
Protect water quality	• Projects comply with existing TMDLs •
Maintain or improve environmental quality (for fish, wildlife, people)	•
Others?	

CACHE COUNTY WATER MASTER PLAN

Potential Alternatives

- Form a Conservancy District (County wide or multiple smaller districts)
- Form a Special Service District
- County management with more staff and resources
- Continue with current system (County Water Manager)

CACHE COUNTY WATER MASTER PLAN

Panel Discussion

- Weber Basin Water Conservancy District – Tage Flint
- Utah Association of Special Districts – LeGrand Bitter
- Bear River Water Conservancy District – Voneen Jorgensen
- Utah Association of Special Districts – Mark Anderson

CACHE COUNTY
WATER MASTER PLAN

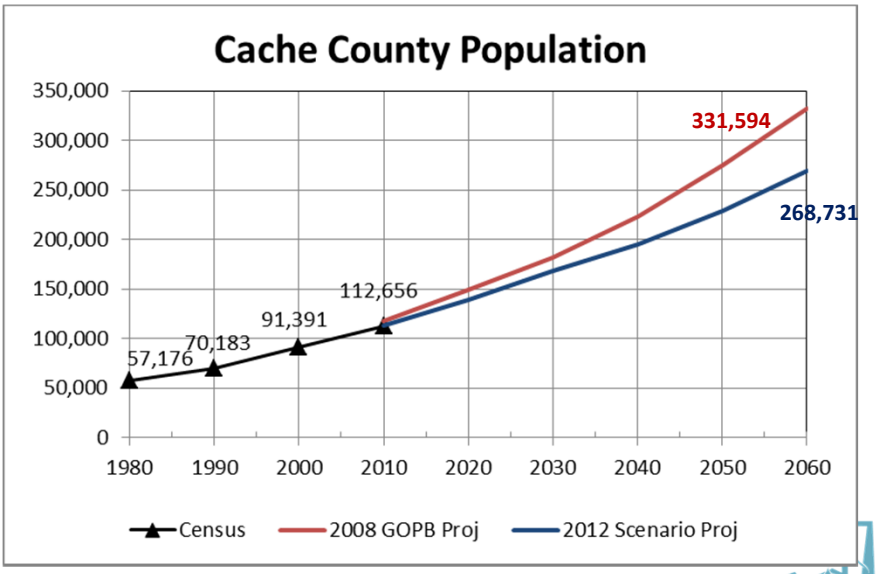
Next Steps

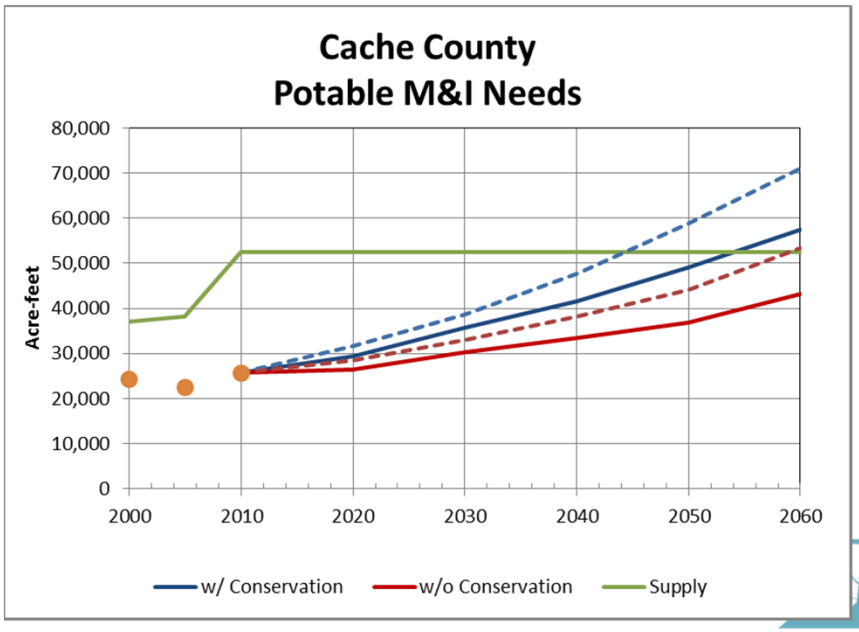
- Meeting #3 Goals
- Review of PacifiCorp Management Responsibilities
- Future Water Development Strategies

CACHE COUNTY
WATER MASTER PLAN

CACHE COUNTY
WATER MASTER PLAN

Population Projections & Water Demands

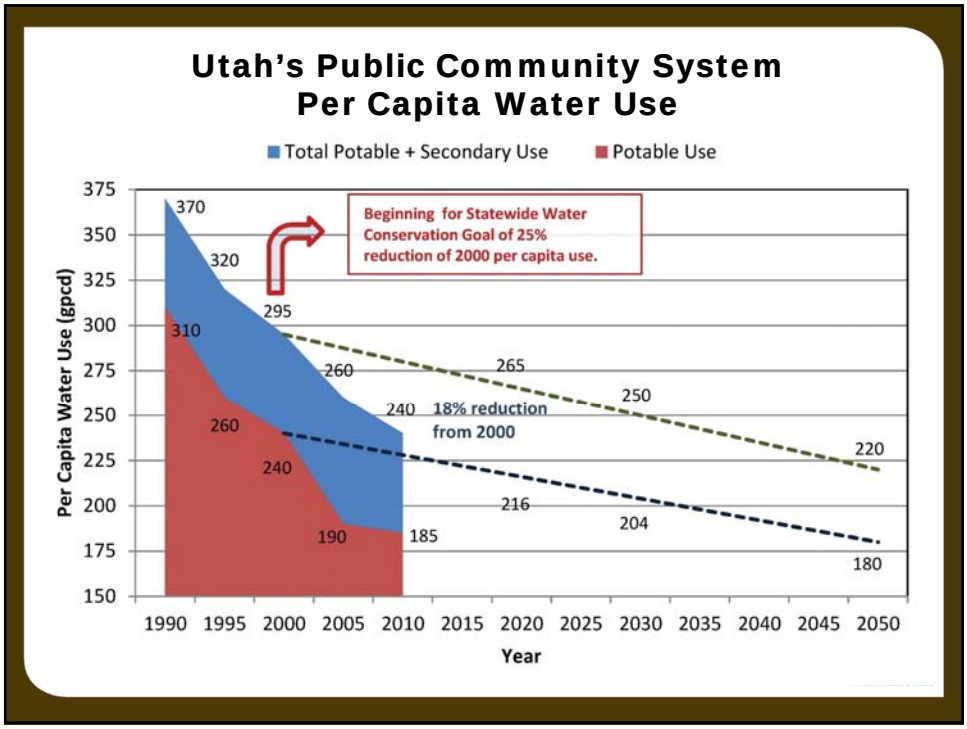




Population and Water-Related Trends and Projections - 3

TABLE 10 (continued)
PROJECTED CULINARY M&I DEMAND AND SUPPLY
FOR PUBLIC COMMUNITY WATER SYSTEMS
Bear River Basin
(acre-feet /year)

Name	Reliable System/ Source Capacity[1]	2020 Population	2020 Demand*	2020 Surplus Deficit ()	2050 Population	2050 Demand*	2050 Surplus Deficit ()
Cache County							
Amalga Municipal Water System	559	587	649	(90)	950	900	(341)
Benson Water Culinary District	147	577	105	42	1,048	164	(17)
Clarkston Municipal Water System	471	826	387	84	1,530	615	(144)
Cornish Municipal Water System	99	257	85	14	576	162	(63)
Goaslind Spring Water Works Co.	401	60	11	390	60	9	392
High Creek Culinary Water System	64	85	19	45	85	16	48
Hyde Park Culinary Water System	1,244	3,787	467	777	6,573	695	549
Hyrum City Water System	4,771	8,457	2,703	2,068	14,049	3,848	923
Lewiston Culinary Water System	705	2,457	705	0	4,175	1,026	(321)
Logan City Water System	13,758	59,587	16,455	(2,697)	87,166	20,632	(6,874)
Mendon Culinary Water System	294	1,782	204	90	1,997	196	98
Millville City Water	454	1,973	390	64	3,352	568	(114)
Newton Town Water	158	1,045	171	(13)	1,555	218	(60)
Nibley City	406	4,238	617	(211)	4,549	567	(161)
North Logan Culinary System	2,986	9,043	1,275	1,711	12,555	1,517	1,469
Paradise Town	190	1,093	160	30	1,688	212	(22)
Providence City Corp. Water	3,748	13,512	2,972	776	17,888	3,373	375
Richmond City	919	2,592	448	471	4,562	676	243
River Heights City Water System	1,208	1,657	573	635	3,328	987	221
Smithfield Municipal Water System	2,311	12,601	2,052	259	16,899	2,359	(48)
South Cove Water Supply	182	73	19	163	202	16	166
Trenton City	577	595	96	481	999	138	439
Wellsville City	4,022	3,574	583	3,439	6,068	848	3,174
County Totals		**130,458**	**31,145**	**8,529**	**191,854**	**39,743**	**(69)**


Utah's Public Community System
Per Capita Water Use
Total Potable + Secondary Use
Potable Use
Beginning for Statewide Water Conservation Goal of 25% reduction of 2000 per capita use.
18% reduction from 2000
Per Capita Water Use (gpcd)
Year
375
350
325
300
275
250
225
200
175
150
1990
1995
2000
2005
2010
2015
2020
2025
2030
2035
2040
2045
2050
370
320
295
310
260
240
260
240
190
185
265
250
220
216
204
180

Bear River Development Project

Cache County Water Master Plan Steering Committee
October 25, 2012

Current Status

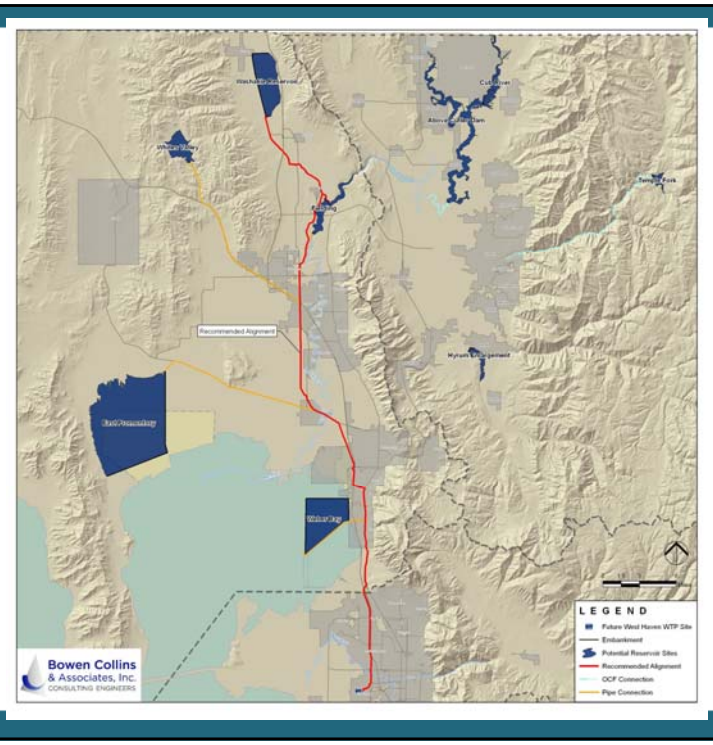
- Majority of the need is 2035 though Cache and Box Elder may have an earlier need
- Objects on the calendar are closer than they appear
- Realities of the Washakie Reservoir site investigation
- Agencies involved are meeting to define a project that works for all
  - Reservoir Sites
  - Pipeline Alignment

Involved Agencies

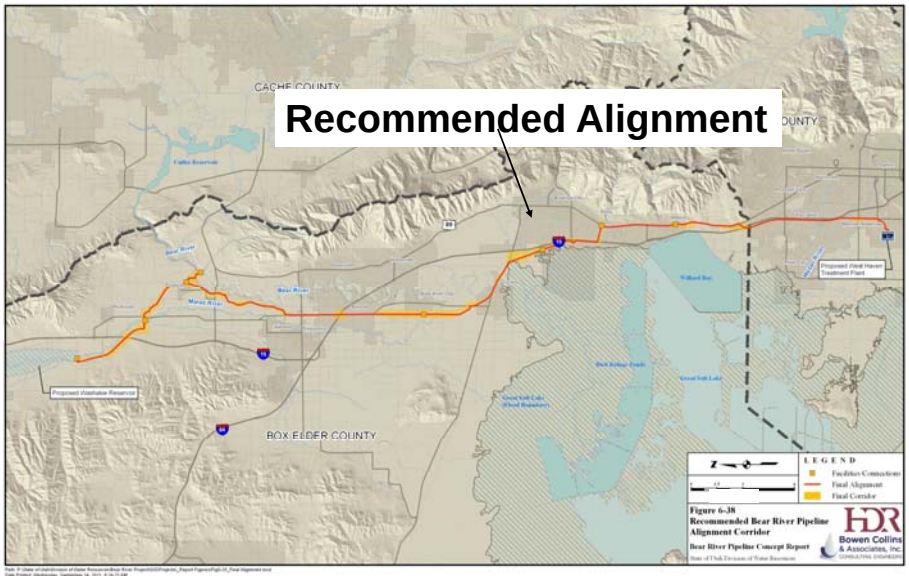
- Cache County
- Bear River Water Conservancy District
- Weber Basin Water Conservancy District
- Jordan Valley Water Conservancy District
- Bowen-Collins Associates with HDR Engineering is our consultant

Reservoir Selection Criteria

- Need at least 240,000 ac-ft of storage
- Phasing of site development
- Social considerations essential
- Overall cost is essential
- Overall project performance is essential



Recommended Alignment Corridor



Questions?

CACHE COUNTY

Cache County Water Master Plan

Steering Committee No. 3 Meeting Minutes

1/16/2013

Cache County Water Master Plan
Steering Committee Meeting Minutes
1/16/2013

Meeting Attendees:

- Clark Israelsen – USU Extension
- Paul Inkenbrandt – Utah Geological Survey
- Brent Jensen – Hyrum City
- Evan Olsen – Young Ward
- Mike Grunig – Hyde Park City
- Doug Jackson-Smith – USU
- Niel Allen – USU Extension
- Colleen Gnehm – Logan River
- Stephen Thatcher – Young Ward
- Eric Klotz – Utah Division of Water Resources
- Ron Salvesen – Hyrum City
- Joan Degiorgio – The Nature Conservancy
- Bryan Dixon – Environmentalist
- Paul James – USU
- Zan Murray – J-U-B ENGINEERS
- Marisa Egbert – State DWRe
- Marla Trowbridge – Trenton Town Co.
- Don Hartle- Wellsville City
- Alan Luce – North Logan City
- Will Atkin – Water Rights
- Scott Tripp – City Creek Irrigation
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- Max Pierce – Cornish Town
- Zac Covington – BRAG
- Jon Hardman – Mendon City
- Jim Gass – Smithfield
- Bill Young – Logan City
- Chris Slater - J-U-B Engineers
- Trevor Datwyler - J-U-B Engineers
- Dan Adams – The Langdon Group
- Joshua Palmer – The Langdon Group

1. Welcome and Introductions

2. Operation of the Bear River – Claudia Conder, PacifiCorp

a. **See appendix for attached slides from presentation.**
b. Priorities are first irrigation, then power, and finally, flood control.
c. In 2000, there was a three state agreement (merger agreement) that took place to maintain historic practices to alleviate state concerns about change to operations.
d. If a conservancy district is formed, and a reservoir is created on a tributary to the Bear River, would Pacific Corp be involved in managing the reservoir?
    i. Not necessarily, but they would likely be interested in the process.
e. Considering the costs associated with pumping water into Bear Lake, is it profitable to produce power today?
    i. Power is secondary to irrigation. Even without the power, the operation is necessary for irrigation purposes.

3. Breakout Sessions

a. Aquifer Storage and Recovery - Paul Inkenbrandt, UGS

- **i. See appendix for attached slides from presentation**

b. Water Banking - Niel Allen, USU Irrigation Extension Specialist

- **i. See appendix for attached slides from presentation**
- ii. The following questions were asked during the presentation
  1. Can water banking be done with Native American tribes that have water rights along the Bear River?
     a. Their water rights are treated differently. Some tribes lease their water rights; some have recently sold their rights. It takes a lot of agreements to make it work.
  2. Bear River is already kind of a water bank, how does Cache County work into that system?
     a. There are a lot of laws concerning the Bear River already that must be taken into consideration. If there are communities that need the water, unless they're big enough to build the facilities themselves, they're very limited. A conservancy district gives people more flexibility to share the water as needed. Change applications can be formal and informal. A formal agreement with the state is not necessary if only area water is used.
- ***iii. After the meeting, Niel Allen compiled some ideas for a Cache County water bank which are attached.***

4. Breakout Session Lessons Learned

a. ASR
   - i. ASR solution is more suited to peaking changes, could be used in high water years, or as climate changes occur. It could be used to shift storage from snowpack to underground storage.

b. Water Banking
   - i. Reasonable use – People are storing water on the south end of the Colorado river (a lot of water)
   - ii. We really don't have that much room for storage (in the ground)

c. PacifiCorp Presentation
   - i. Differences between storage and storage capacity

5. Lunch

6. Review of Updated Data from DWRe (See presentation slides 9 and10)

a. Two types of systems:
   - i. Public Community Water Systems with at least 15 connections and 60 people living year round
   - ii. Public Non-community Water Systems - enough public goes to these systems that the State wants to regulate them: Beaver Mountain, Sherwood Hills, USU, etc.

b. State Engineer sends out a water audit to each community water system every year in January
   - i. Due in April

    ii. The State gets about 85% response
    iii. Every five years DWRe does a more detailed survey of water systems
    iv. Demands are split into the following categories to arrive at more comprehensive numbers and estimates
        1. Residential
        2. Commercial
        3. Institutional
        4. Industrial

c. Population
    i. Difficult to estimate, census helps
    ii. Can divide into census tracks
    iii. Utah is the second highest water user in the country

d. Secondary use
    i. Rarely metered at the customer level and sometimes not at the source either
    ii. Estimated by asking secondary company (usually don't know, but can help make some guiding assumptions)
    iii. Don't count agricultural use, since it is modeled separately
    iv. Ask culinary system what percentage of users use potable water for outdoor irrigation
    v. Get average lot size and irrigation size, then multiply by water use (24" to grow grass in Utah) total to get municipal and industrial total.

e. Source
    i. As population grows, this tells us how much you can deliver to the users **(See the figure on slide 10 of the attached meeting presentation slides)**

f. Reliable Supply vs. Maximum Supply
    i. Maximum Supply
        1. What a system can provide to a growing water system

g. Lower curve **(See the figure on slide 10 of the attached meeting presentation slides)**
    i. Typical water use pattern

h. Wells, spring, and surface sources:
    i. Springs
        1. Maximum water supply is the lesser of the water right, or average yearly supply of the spring
        2. If you had a water right of 100 ac-ft/yr but the source only produces an average 50 ac-ft/yr, DWRe will use 50 acft/yr.
        3. Ask the water supplier how much they use the spring. If it's used all the time, then it's considered a reliable supply = 100% maximum supply. If used less, then the result is a lower percentage.
    ii. Surface
        1. Less of the water source or the treatment capacity. Reliable = maximum
    iii. Wells
        1. 50% maximum supply = reliable supply. Example: if 100 ac ft/yr is the max supply, DWRe will use 50 ac-ft/yr in projections.

i. This model is not a tool for designing a water system, but is good for planning purposes.

j. Why don't we use the minimum spring flow rather than the maximum supply?
    i. This is evaluated based on input from the staff of the water systems. Will look at more after the meeting with individual cities.
k. Future demands based on projected growth in unincorporated areas of Cache County are added to existing non-community water systems like Benson and High Creek.
l. Showed maps that indicate which water systems have adequate source capacity, in each of the next 5 decades, to meet projected demands assuming no additional conservation in the future **(See attached meeting presentation slides 11-16).**
m. Showed maps that indicate which water systems have adequate source capacity, in each of the next 5 decades, to meet projected demands assuming 25% conservation over the next 50 future years **(See attached meeting presentation slides 17-22).**
n. The model is based on total volume within a year, not a peak day.
o. The model is based on the assumption that you are doing nothing to increase your water supply into the future. You may have means to make improvements to your water supply. Further development of water rights etc.
p. Non-use water rights may or may not be used in these calculations based on what the city reports to the state. In conservation plans the state is getting more information on the non-use rights.
q. Conservation: Cache County is not conserving right now, our per capita use staying the same or maybe even going up
r. Can you send maps of what the cities' sources are (springs, wells etc…)?
    i. Yes.
s. We want to evaluate efforts needed to ensure a sustainable water supply in the future
t. Regional projects take a lot of time to develop
u. Does the data include water that a community may own in an irrigation company?
    i. Kind of. Not in the potable supply, but it helps you with the secondary demand.
v. As we develop more supply, what impact might that have on the riparian areas, rivers etc. (environmental concerns)? How does this enter into the calculations?
    i. As we think about the future of Cache Valley, we want to maintain the environment, riparian areas.
w. Legislator's goal is to get 25% conservation by 2060, if we're already at 18% state wide, what is a realistic goal? Could we conserve more than 25%?
    i. Possibly, but the low hanging fruit is easier to attain due to the efficiency measures. The first 18% of conservation might have been a lot easier to attain than the next 7%.
x. What is going on in Cache County? Why are we not conserving more?
    i. Most communities have more management.
    ii. Other communities that have conservancy districts have a conservation requirement
    iii. Cache County still has large rural lots, with secondary systems. Water is relatively cheap, so there is not much incentive to conserve right now.
y. Trenton has incentives to repair leaks such as free aerators for bathroom and kitchen sinks.
z. Logan's water use per capita was 300 gallons per day (gpcd) in the 90's. With tank replacements and water line replacements, usage has decreased to 240 gpcd in recent years. Logan is showing a significant decrease, why is county increasing?
    i. Culinary use is going down, but secondary is going up

aa. Irrigated acres in Cache County
    i. Map that shows irrigated acres and non-irrigated acres in Cache County **(see meeting presentation slide 23)**
    ii. There are some irrigable lands in the county that currently are not being irrigated **(see meeting presentation slide 24).**

7. Evaluation of Future Alternatives and Actions

a. Project alternatives:
b. The first part of evaluating alternatives is to identify objectives
c. Based on input from the steering committee these objectives have been identified **(See meeting presentation slide 25)**
d. The objectives can be separated into four main categories:
    i. water supply
    ii. implementation
    iii. environment
e. Metrics (methods of measurement) are needed to be able to measure and quantify how well a given alternative meets the objectives.
f. Aquifer storage and recovery (ASR) at the mouth of Green Canyon is listed in the table **(see meeting presentation slide 28)**
    i. As an example, ASR would help put water to beneficial use, which is the first metric given in the table.
    ii. We can look at the other metrics listed from left to right across the table to see how well the ASR project helps meet those metrics.
g. Question: Are the examples on the sheet just random examples, or the best, or the worst?
    i. We have not had time to evaluate alternatives yet. These are some preliminary ideas that we have listed; we'd like any additional input from the steering committee.
    ii. The actual evaluation of the alternatives will be more in depth.
h. Can we send project ideas?
    i. Yes. Send the ideas to Chris Slater
i. Once we have identified some project alternatives, we need to evaluate what kind of water institution (water management structure) will allow us to implement the alternatives and meet other objectives that have been identified that are tied to water governance.
j. Potential institutions: is there a water institution (management structure) that should be in place to help us achieve the objectives?
k. Can you send out the last spreadsheet in minutes?
    i. Yes (*see attached DRAFT copies of the evaluation of alternative tables. The potential institutions table cannot be filled in until the first table is completed. Both tables are draft copies and do not represent a comprehensive evaluation of the alternatives)*
l. If our goal is 25% conservation, do we have an objective that is conservation?
m. List of proposed dams in the plan?
    i. There are about 55 dams that the Division of Water Resources is looking at preliminarily.
n. How many are in Cache County?

        i. About half of them.
    o. Education is important as the process moves forward

8. Instant Poll Survey

a. The meeting participants answered a list of questions about water issues and needs using instant poll machines
b. The poll questions and responses are located in the appendix

9. Next Meeting

a. The next steering committee meeting is tentatively scheduled to be held on **April 24th 2013**
b. The time and place for the meeting will be sent to all of the steering committee members as we get closer to April.

CACHE COUNTY
WATER MASTER PLAN

Steering Committee Meeting

Jan. 16, 2013

Meeting Agenda

- **Welcome and Introduction (10 min) -** Dan Adams
- **Operation of the Bear River - presentation (20 minutes) –** Connely Baldwin
- **Breakout discussions (20 min.) -** Dan Adams
  - **Aquifer Storage Recovery** - Paul Inkenbrandt
  - **Water Banking** - Niel Allen
- **Items learned from breakout discussions (10 min.) -** Dan Adams
- **LUNCH (20 min.)**
- **Review of updated data from DWRe (25 minutes) –** Todd Adams & Eric Klotz
- **Discussion about evaluation of future alternatives and actions (25 min.) –** Chris Slater
- **Instant poll survey (20 minutes) –** Joshua Palmer
- **Next meeting – April or May 2013 (5 minutes) –** Dan Adams

Master Plan Purpose

- Master Plan Purpose
  - Evaluate existing water resources and demands
  - Determine future water demands
  - Educate and build consensus
  - Create a plan for the future
  - Recommend methods to manage water resources in the County

Steering Committee Ground Rules

- Steering Committee Ground Rules and Communication
  - A. Take good minutes and get them back to the committee
  - B. Focus on broader/County issues, not just those from one specific organization
  - C. Communicate effectively outside of the meeting, and don't editorialize information
  - D. Speak with respect
  - E. Be aware of time constraints

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Operation of the Bear River

Connely Baldwin - PacifiCorp

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Breakout Sessions

Aquifer Storage and Recovery
Paul Inkenbrandt

Water Banking
Niel Allen

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Breakout Session
Lessons Learned Discussion

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Review of Updated DWRe Data

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Supply Demand Calculations

DEMANDS						SUPPLY			
YEAR	Population	Potable Total (Ac-ft/yr)	Secondary Total (Ac-ft/yr)	M&I Total (Ac-ft/yr)	Total GPCD	Reliable Potable Supply (Ac-ft/yr)	Secondary Supply (Ac-ft/yr)	Total Supply (Ac-ft/yr)	Total Supply Surplus (Ac-ft/yr)

Water Supply Demand Chart

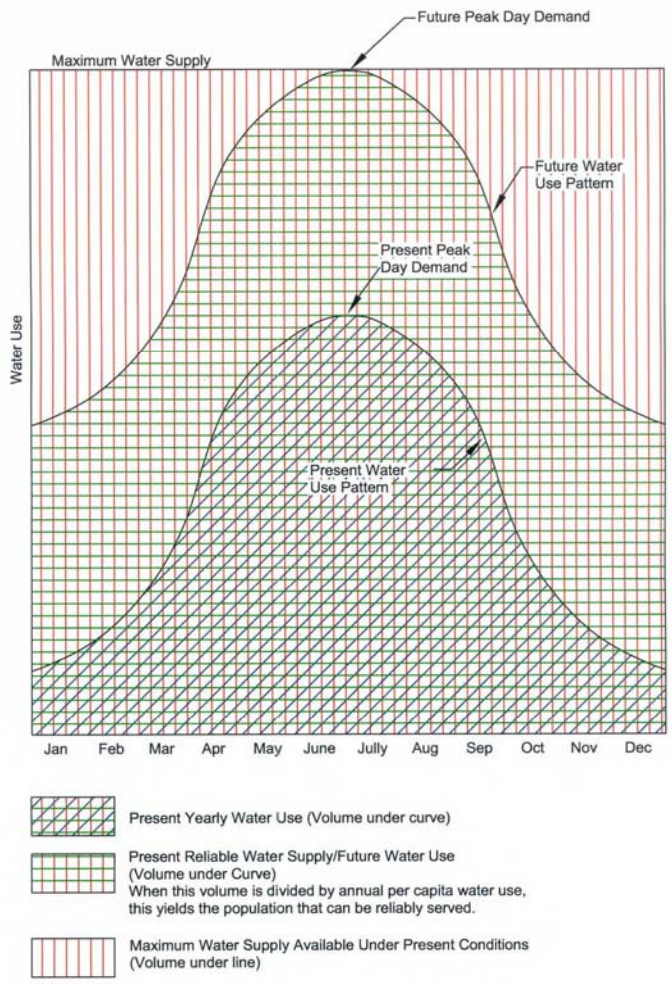

Figure 4. Water Supply and Use Hydrograph

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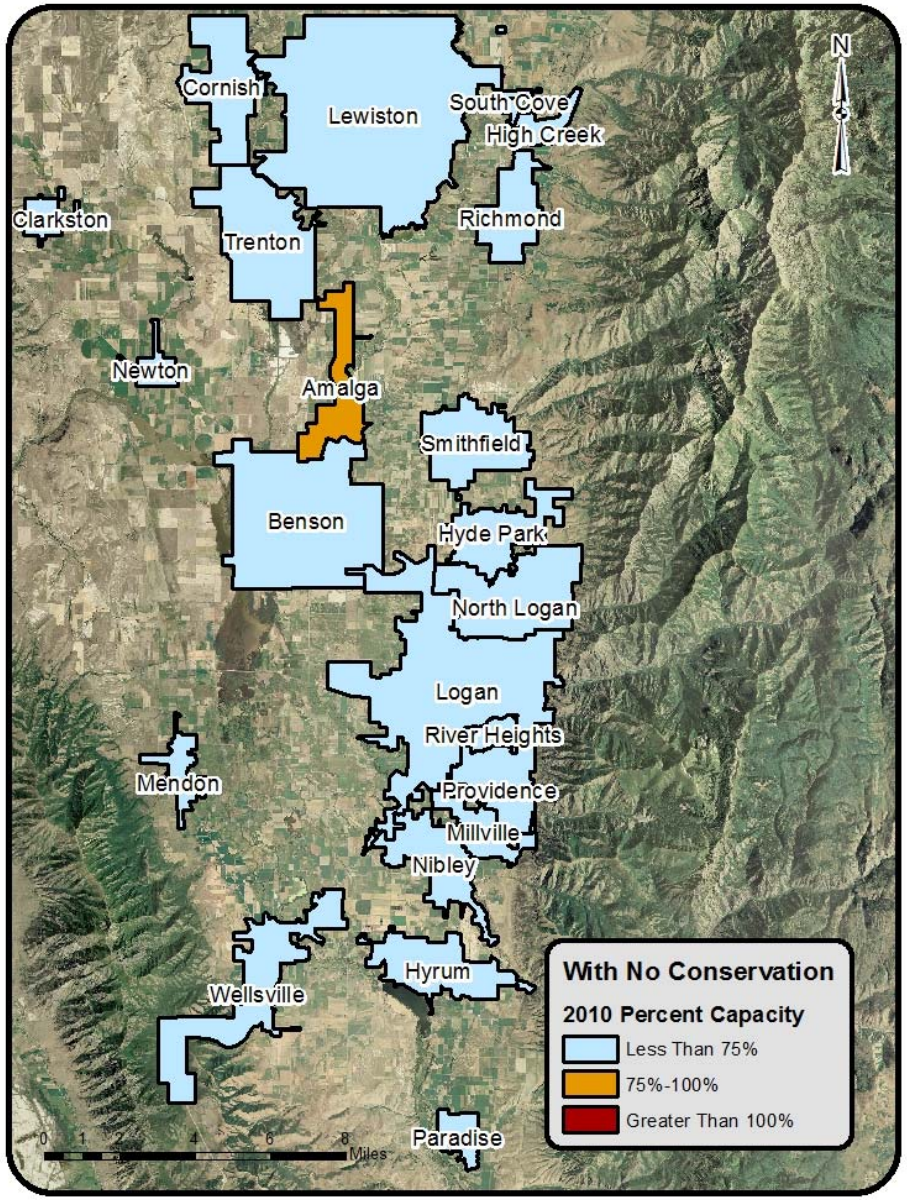

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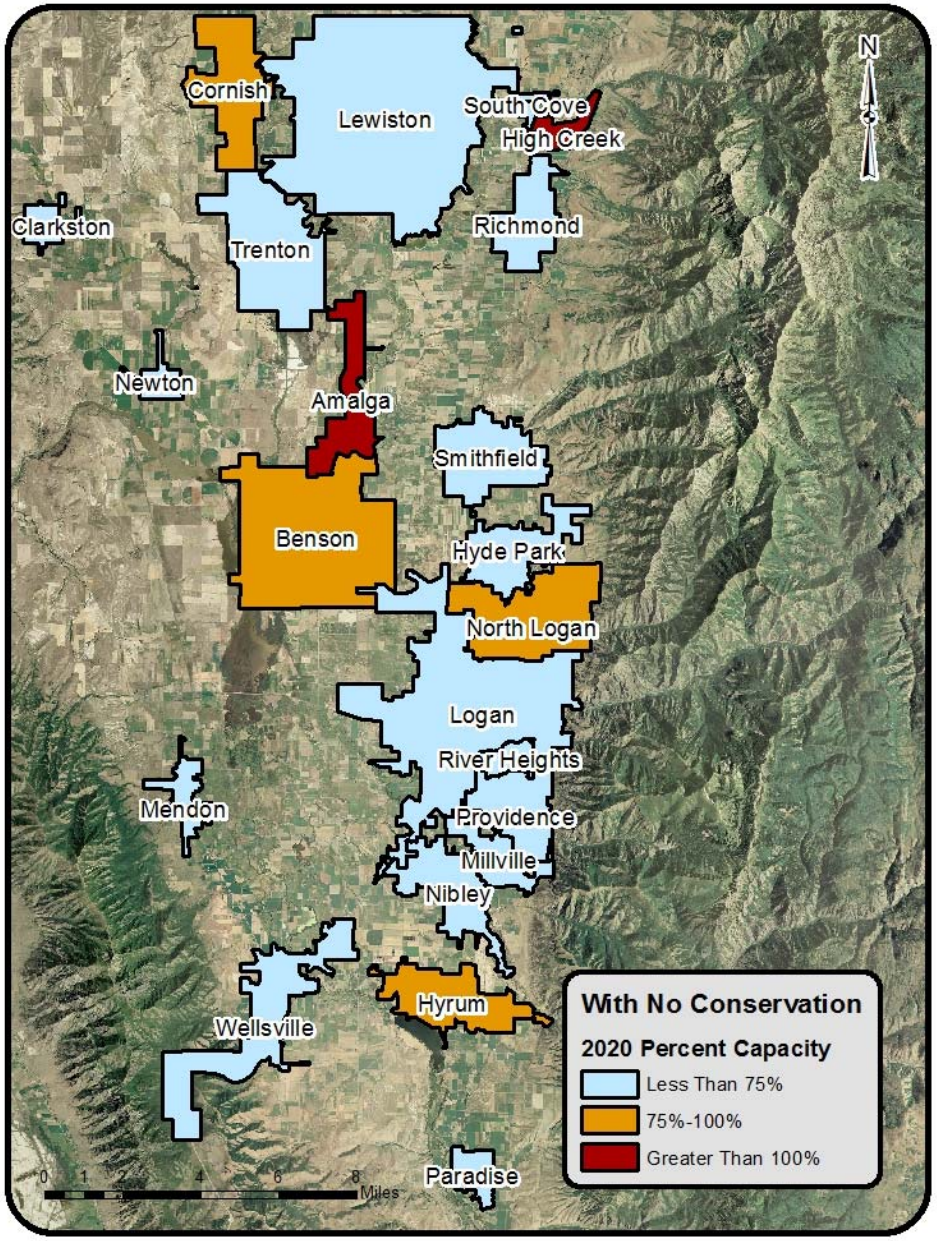

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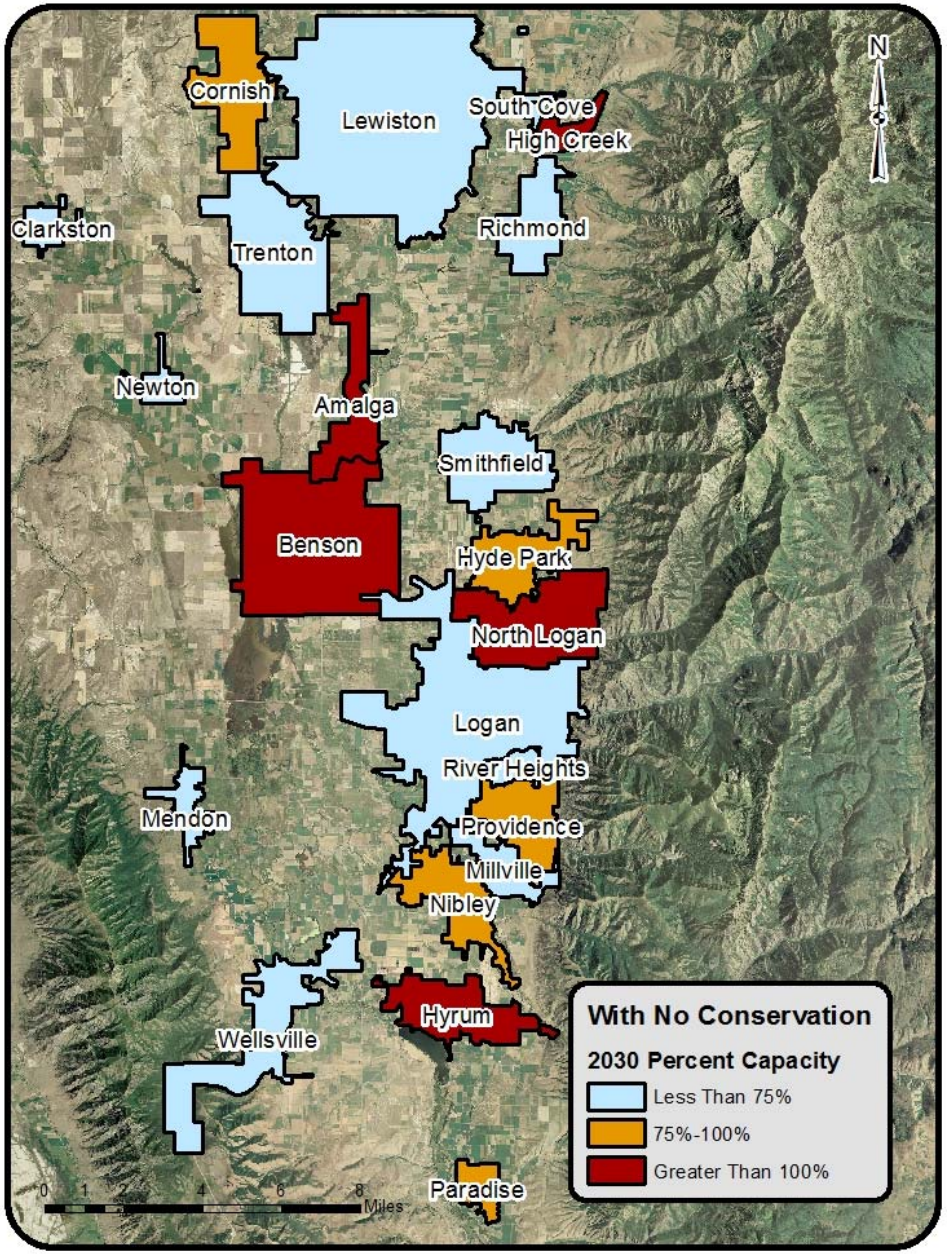

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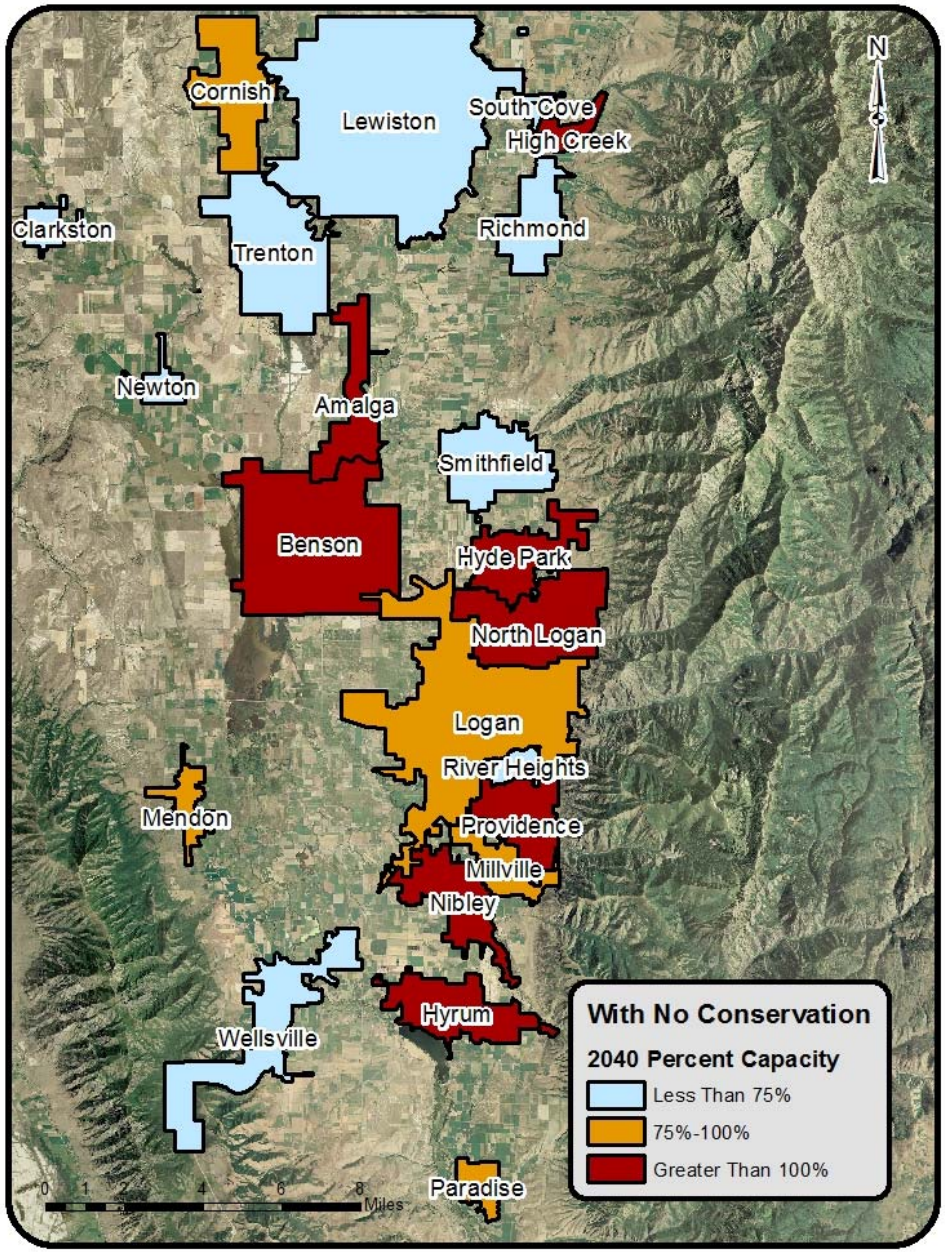

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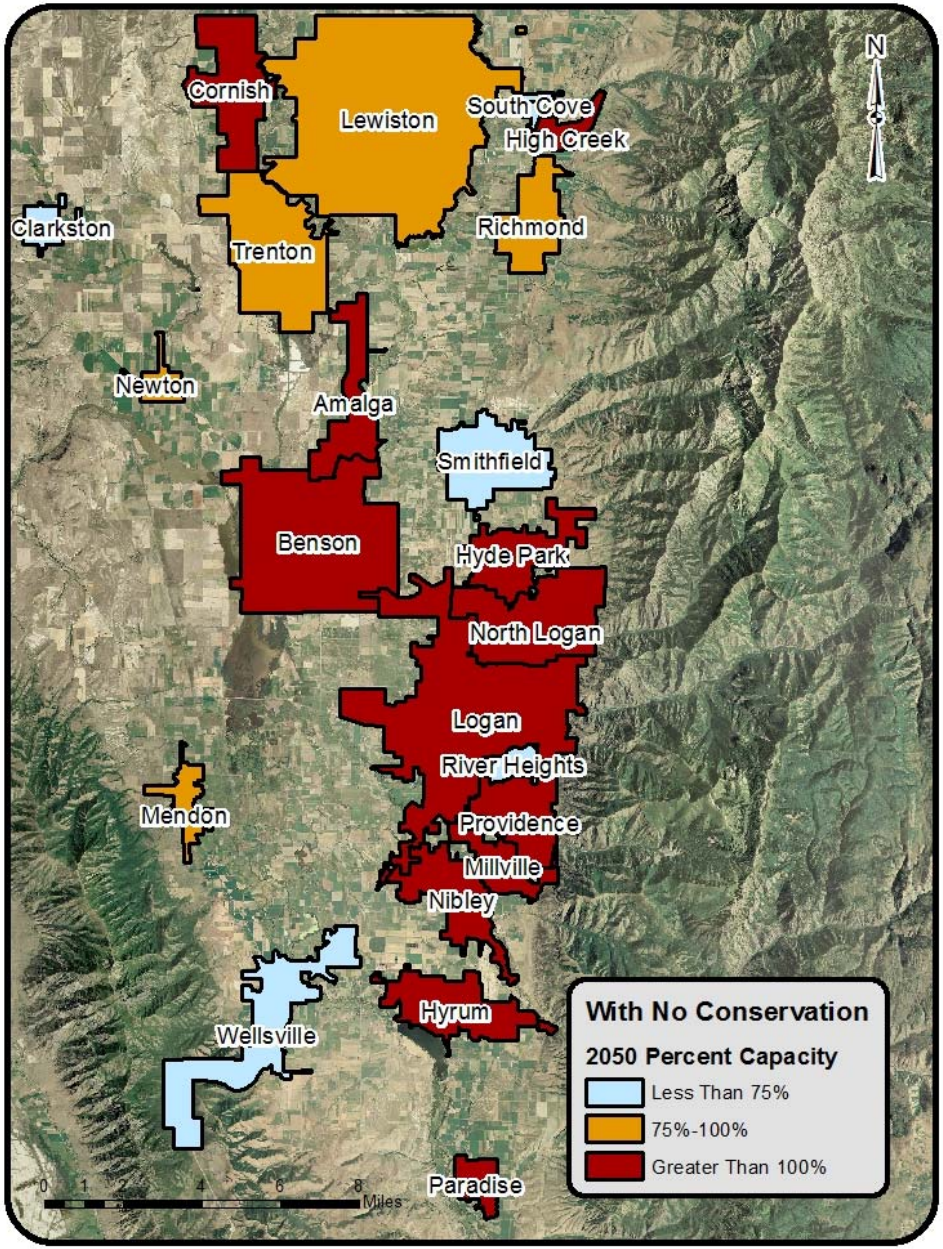

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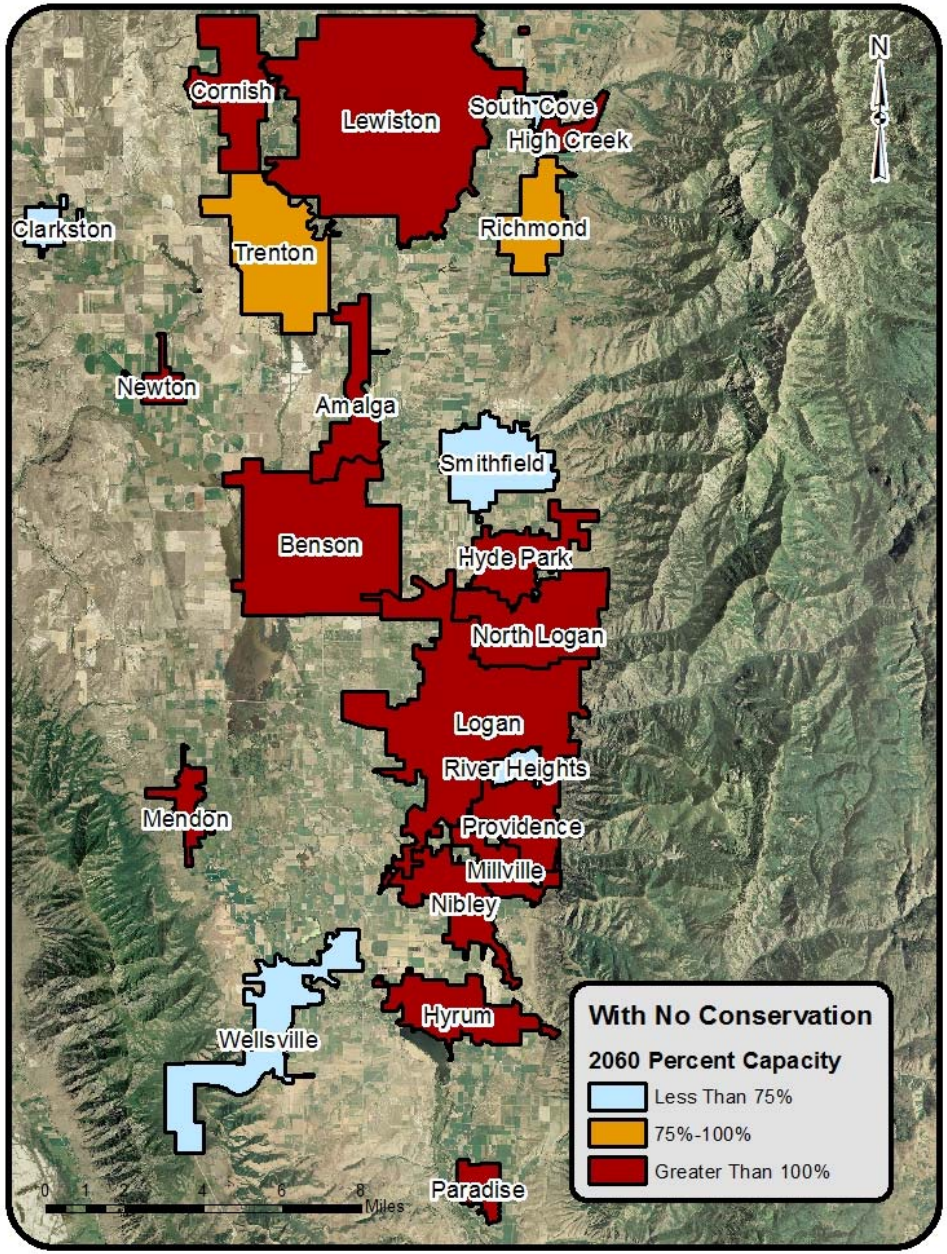

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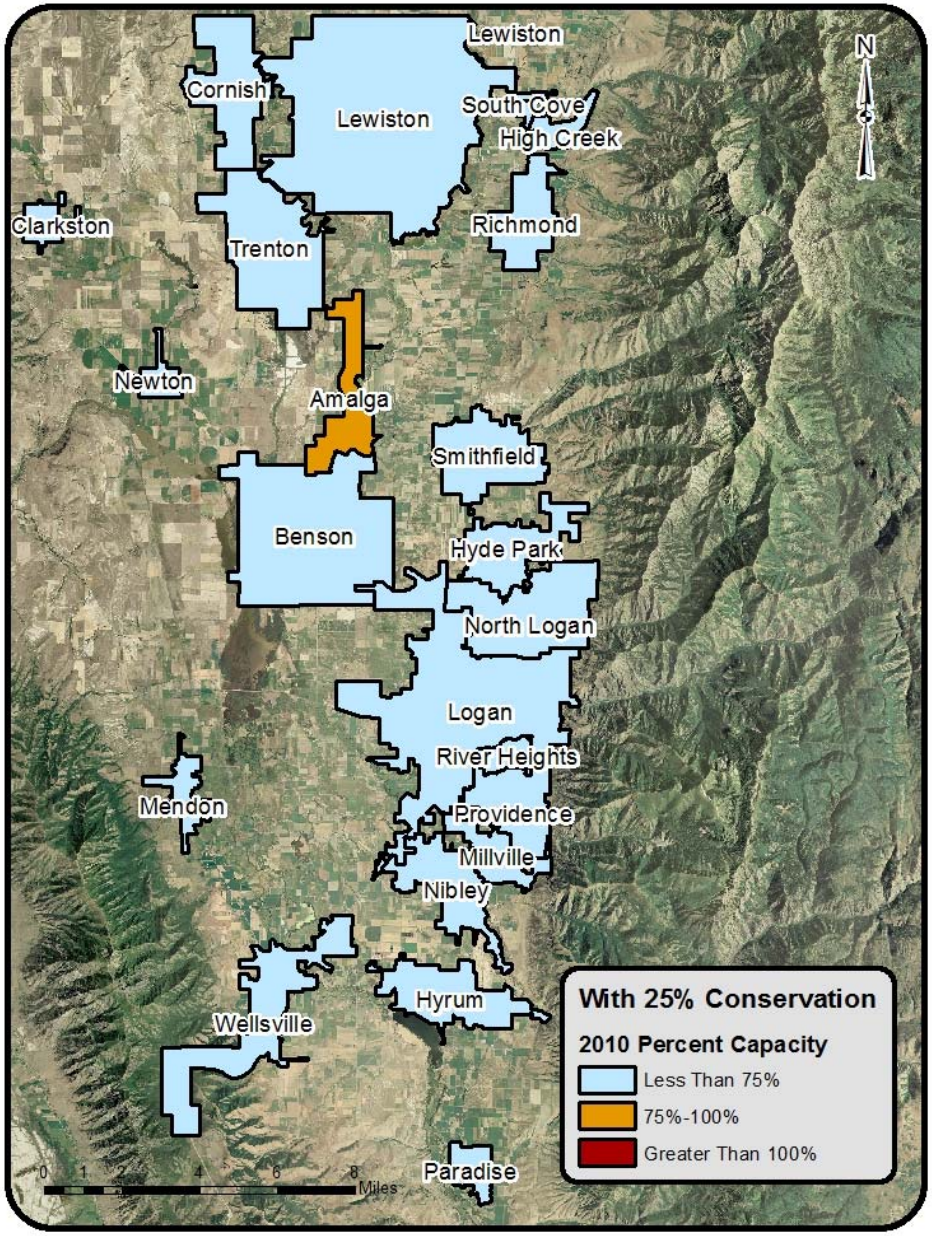

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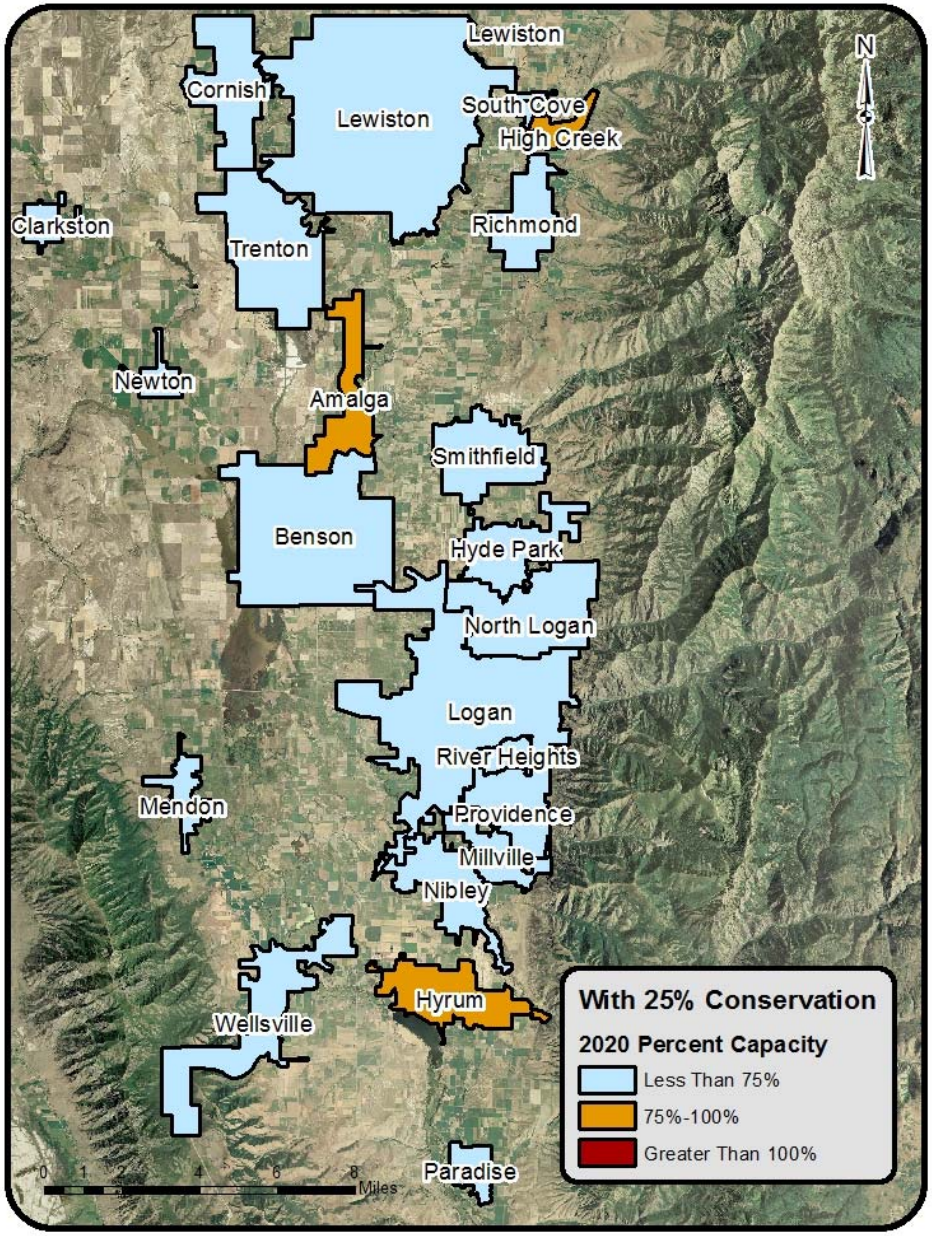

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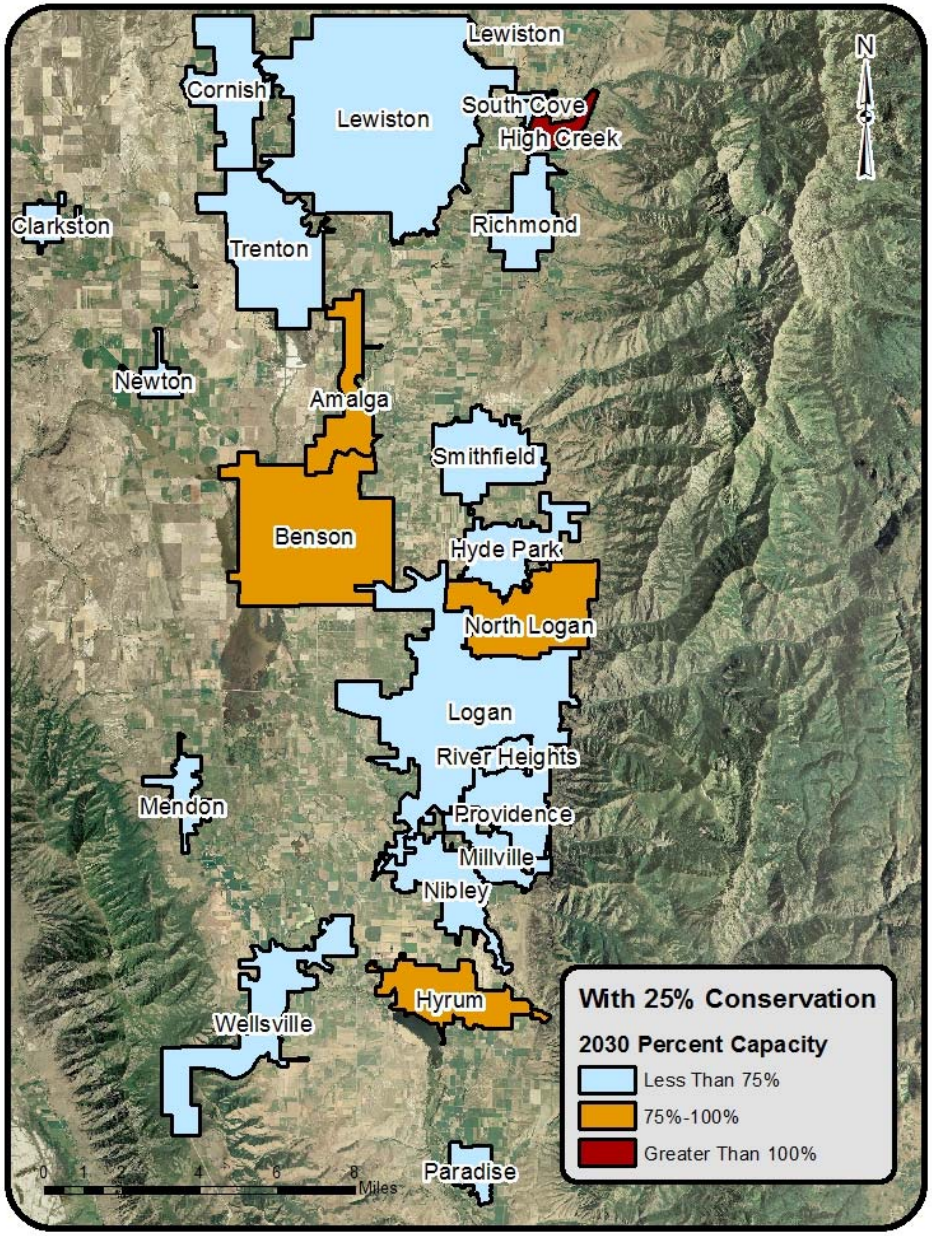

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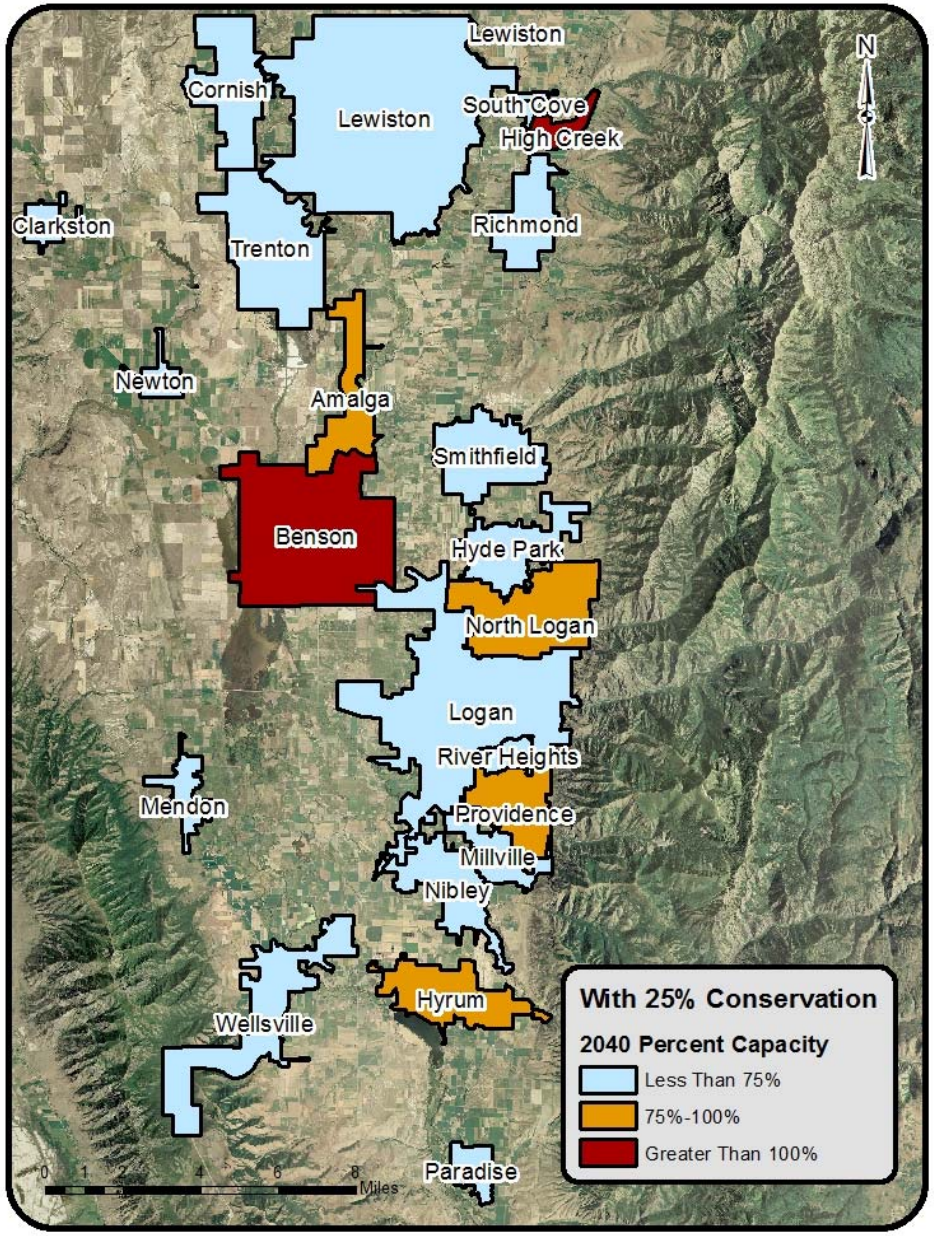

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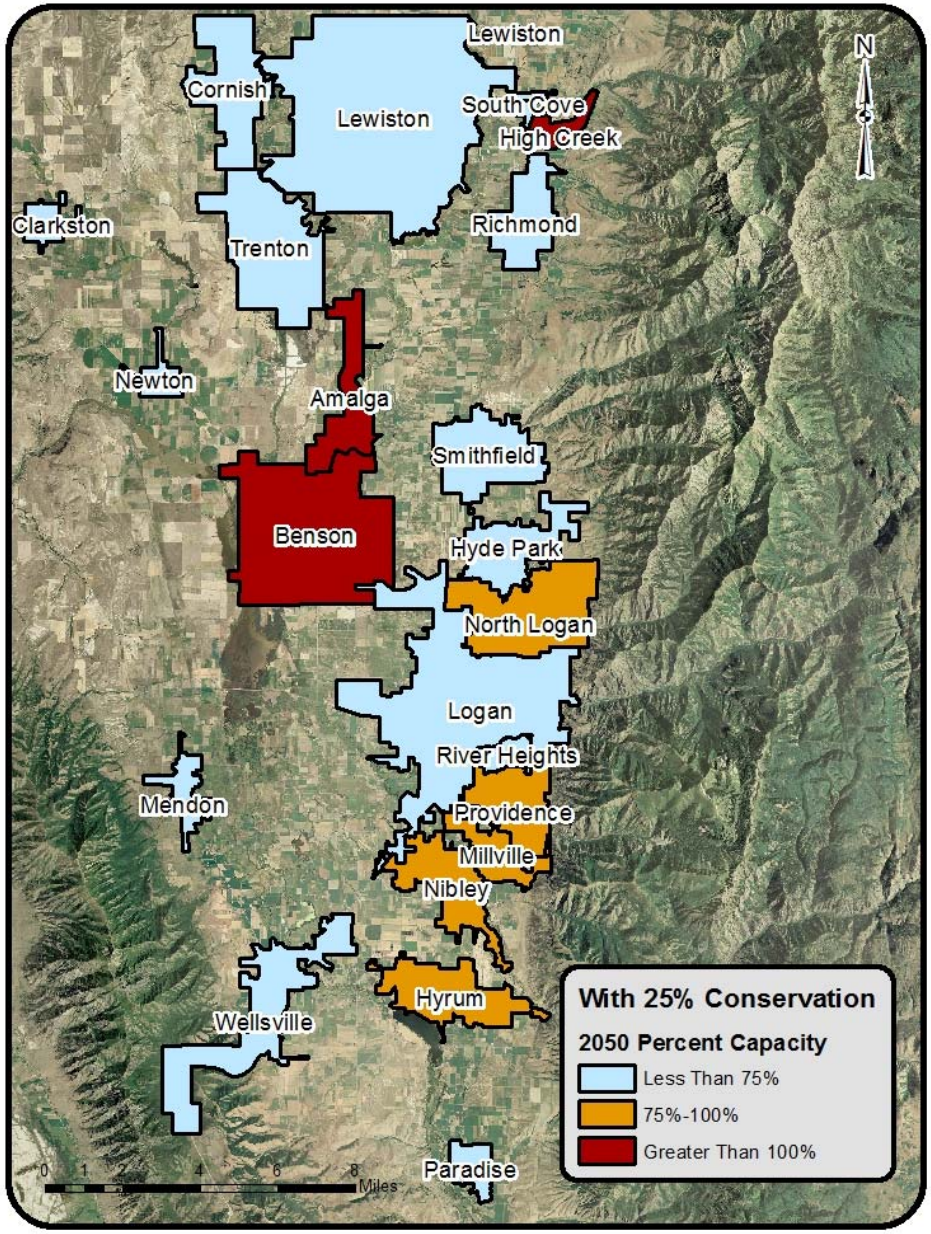

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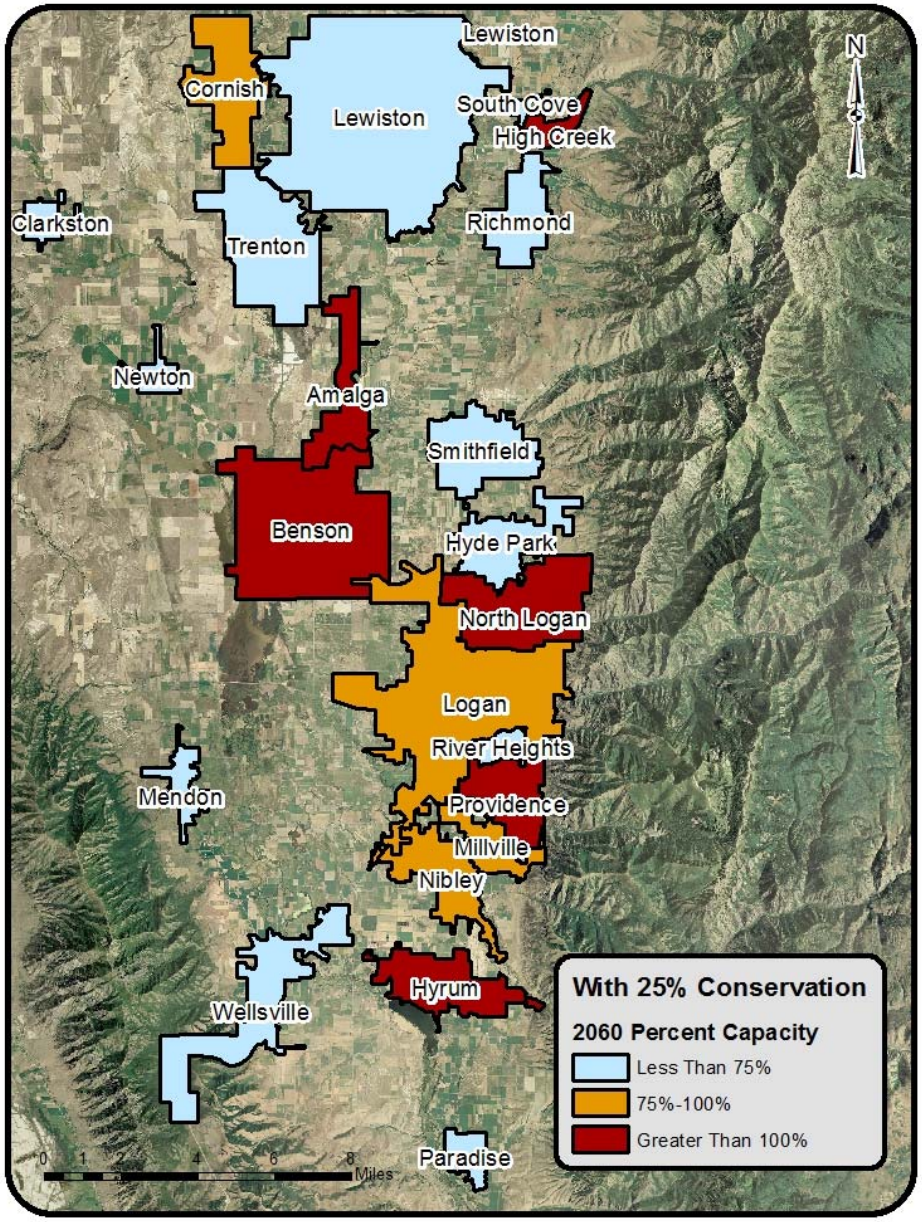
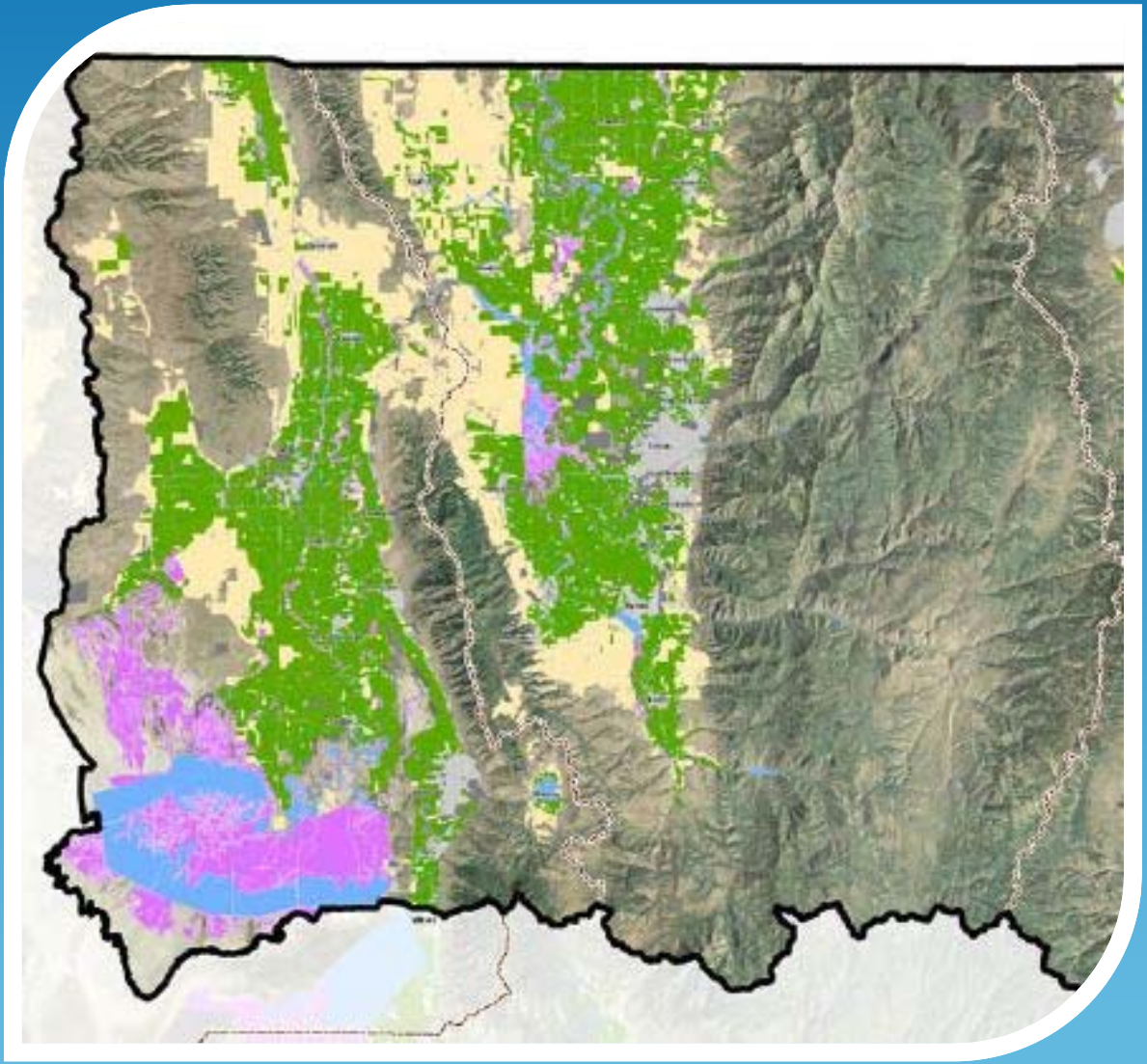
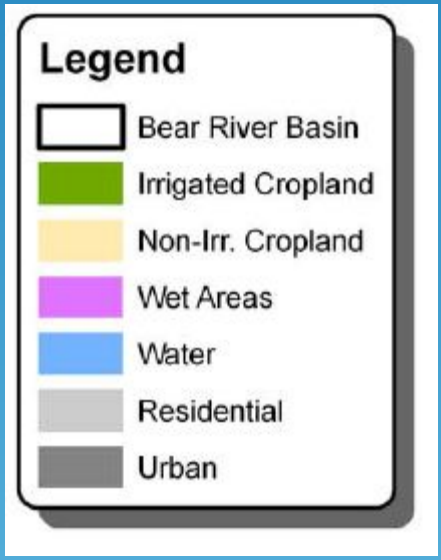


CACHE COUNTY
WATER MASTER PLAN

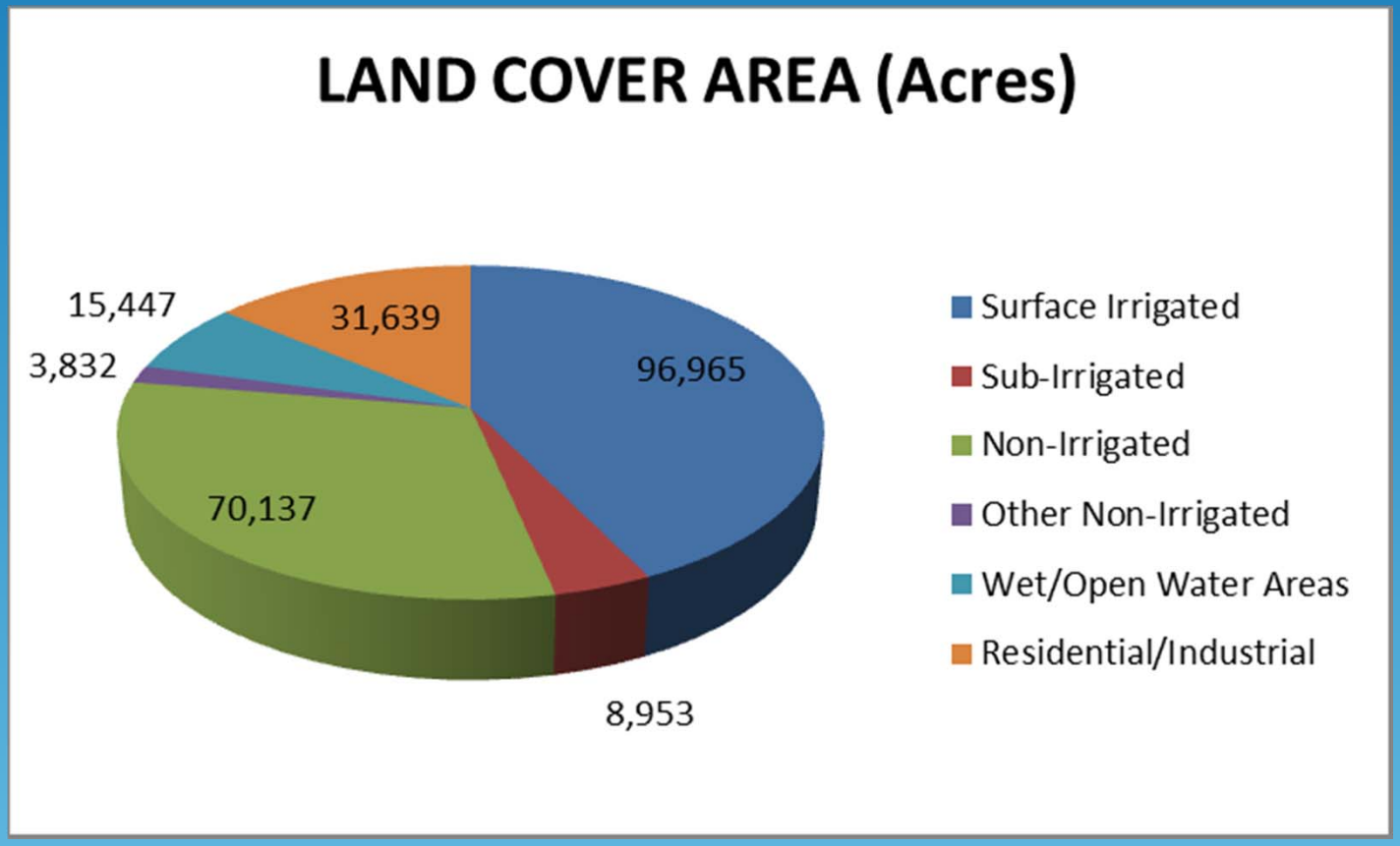
Water Related Land Uses





Source: Division Of Natural Resources Bear River Basin 2009 Water Related Land Use Inventory

Water Related Land Uses



Source: Division Of Natural Resources Bear River Basin 2009 Water Related Land Use Inventory

Evaluation Alternatives & Future Actions

Project Alternatives

OBJECTIVES											
Water Supply						Implementation				Environment	
Protect water allocated to County and provide for future needs	Provide adequate reliable future culinary supply	Provide adequate reliable irrigation supply now and in the future	Provide adequate irrigation storage capacity	Maintain existing irrigation delivery systems	Make efficient use of available water resources	Minimize costs to develop water	Promote collaboration and focus on regional projects	Keep existing water rights owners whole	Educate the public about the current water situation and any future anticipated problems	Protect water quality and drinking water sources	Maintain or improve environmental quality

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Evaluation Alternatives & Future Actions

Project Alternatives

OBJECTIVES																		
Water Supply									Implementation					Environment				
Protect water allocated to County and provide for future needs		Provide adequate reliable future culinary supply		Provide adequate reliable irrigation supply now and in the future	Provide adequate irrigation storage capacity	Maintain existing irrigation delivery systems	Make efficient use of available water resources		Minimize costs to develop water	Promote collaboration and focus on regional projects	Keep existing water rights owners whole	Educate the public about the current water situation and any future anticipated problems		Protect water quality and drinking water sources		Maintain or improve environmental quality	
METRICS (methods of measurement)																		
Water put to beneficial use or in approved non-use status (acre-feet)	Bear River water developed (acre-feet)	Redundant sources for community systems (number)	Communities with adequate supply to year 2060 (number)	Reliable irrigation supply added (acre days)	Average yield from storage facilities (acre-feet per year)	Canals dredged, lined, or reconstructed (linear feet)	Residential units with secondary water (%)	Residential water use (gallons per capita per year)	Development cost ($ per acre-feet per year)	Entities involved in a project (number)	Water rights applications without protest or with resolved protest (number)	Providers that can explain how long their water supply will last (number)	County residents who can state where their water comes from (number)	Complies with required environmental processes (yes/no)	Enhances water source protection (yes/no)	Water developed to maintain or improve wildlife habitat (acre-feet)	Riparian environment protected (acres)

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Evaluation Alternatives & Future Actions

Project Alternatives

PROJECT ALTERNATIVES	OBJECTIVES																	
	Water Supply									Implementation					Environment			
	Protect water allocated to County and provide for future needs		Provide adequate reliable future culinary supply		Provide adequate reliable irrigation supply now and in the future	Provide adequate irrigation storage capacity	Maintain existing irrigation delivery systems	Make efficient use of available water resources		Minimize costs to develop water	Promote collaboration and focus on regional projects	Keep existing water rights owners whole	Educate the public about the current water situation and any future anticipated problems		Protect water quality and drinking water sources		Maintain or improve environmental quality	
	METRICS (methods of measurement)																	
	Water put to beneficial use or in approved non-use status (acre-feet)	Bear River water developed (acre-feet)	Redundant sources for community systems (number)	Communities with adequate supply to year 2060 (number)	Reliable irrigation supply added (acre days)	Average yield from storage facilities (acre-feet per year)	Canals dredged, lined, or reconstructed (linear feet)	Residential units with secondary water (%)	Residential water use (gallons per capita per year)	Development cost ($ per acre feet per year)	Entities involved in a project (number)	Water rights applications without protest or with resolved protest (number)	Providers that can explain how long their water supply will last (number)	County residents who can state where their water comes from (number)	Complies with required environmental processes (yes/no)	Enhances water source protection (yes/no)	Water developed to maintain or improve wildlife habitat (acre-feet)	Riparian environment protected (acres)
Water Storage Projects																		
Aquifer storage and recovery at mouth of Green Canyon	✓	✓	✓	✓							✓	✓			✓			✓

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Evaluation Alternatives & Future Actions

Project Alternatives

PROJECT ALTERNATIVES	OBJECTIVES																	
	Water Supply									Implementation					Environment			
	Protect water allocated to County and provide for future needs		Provide adequate reliable future culinary supply		Provide adequate reliable irrigation supply now and in the future	Provide adequate irrigation storage capacity	Maintain existing irrigation delivery systems	Make efficient use of available water resources		Minimize costs to develop water	Promote collaboration and focus on regional projects	Keep existing water rights owners whole	Educate the public about the current water situation and any future anticipated problems		Protect water quality and drinking water sources		Maintain or improve environmental quality	
	METRICS (methods of measurement)																	
	Water put to beneficial use or in approved non-use status (acre-feet)	Bear River water developed (acre-feet)	Redundant sources for community systems (number)	Communities with adequate supply to year 2060 (number)	Reliable irrigation supply added (acre days)	Average yield from storage facilities (acre-feet per year)	Canals dredged, lined, or reconstructed (linear feet)	Residential units with secondary water (%)	Residential water use (gallons per capita per year)	Development cost ($ per acre feet per year)	Entities involved in a project (number)	Water rights applications without protest or with resolved protest (number)	Providers that can explain how long their water supply will last (number)	County residents who can state where their water comes from (number)	Complies with required environmental processes (yes/no)	Enhances water source protection (yes/no)	Water developed to maintain or improve wildlife habitat (acre-feet)	Riparian environment protected (acres)
Water Storage Projects																		
Aquifer storage and recovery at mouth of Green Canyon	✓	✓	✓	✓							✓	✓			✓			✓
Construct Temple Fork reservoir	✓	✓		✓	✓	✓		✓	✓		✓				✓			✓
Construct Cub River near Richmond reservoir	✓	✓		✓	✓	✓		✓	✓		✓				✓			✓
Irrigation Projects																		
Construct secondary water system in Logan	✓	✓				✓		✓	✓			✓			✓			✓
Enclose Crockett Canal east of Logan Center Street					✓		✓		✓		✓	✓			✓			
Culinary Water Projects																		
Interconnect Mendon and Wellsville	✓		✓	✓							✓	✓			✓		✓	✓
Other																		
Water bank -- trade, exchange, or lease water rights to meet changing needs	✓										✓	✓			✓		✓	
Visit each city council to discuss their water outlook									✓		✓		✓		✓	✓		

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Evaluation Alternatives & Future Actions

Potential Institutions

POTENTIAL INSTITUTIONS	OBJECTIVES																					
	Water Supply		Governance							Implementation									Environment			
	Protect water allocated to County and provide for future needs		Represent Cache County on water legislation issues	Represent all County water users	Operate and maintain water systems on a local level	Protect existing water rights holders	Minimize management costs	Fund needed regional water projects		Promote collaboration	Complete water management projects								Protect water quality and drinking water sources		Maintain or improve environmental quality	
	METRICS (methods of measurement)																					
	Water put to beneficial use or in an approved non-use status (acre-feet)	Bear River water developed (acre-feet)	Money available to lobby with the legislature ($)	Entities represented for regional water decisions (number)	Systems that make own source, storage, distribution and other local system improvements (number)	Water rights applications without protest or with resolved protest (number)	Cost ($ per year per $100,000 of property ownership)	State money available/ reserved for County water users ($)	Funding for water improvement projects ($)	Water systems that support institution (number)	Aquifer storage and recovery at mouth of Green Canyon (yes/no)	Construct Temple Fork reservoir (yes/no)	Construct Cub River near Richmond reservoir (yes/no)	Construct secondary water system in Logan (yes/no)	Enclose Crockett Canal east of Logan Center Street (yes/no)	Interconnect Mendon and Wellsville (yes/no)	Water bank -- trade, exchange, or lease water rights to meet changing needs (yes/no)	Visit each city council to discuss their water outlook (yes/no)	Projects that comply with required environmental processes (%)	Completed projects that enhance water source protection (number)	Water developed to maintain or improve wildlife habitat (acre-feet)	Riparian environment protected (acres)
1. County Management with more staff and resources	✓	✓			✓	✓				✓	✓	✓	✓	✓	✓	✓		✓	✓	✓		
2. Special Service District	✓		✓		✓	✓		✓	✓	✓				✓	✓	✓	✓	✓	✓	✓	✓	✓
3. Water Conservancy District	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
4. Continue with current System					✓	✓								✓	✓			✓				

DRAFT

PacifiCorp in the Bear River Basin:

The co-development of irrigation and hydropower. How a power company came to be an irrigation supplier

January 16, 2013

PACIFICORP ENERGY
A DIVISION OF PACIFICORP

Overview

- Brief History and Background
- Law of the River: Major Agreements
- Operations

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PACIFICORP ENERGY
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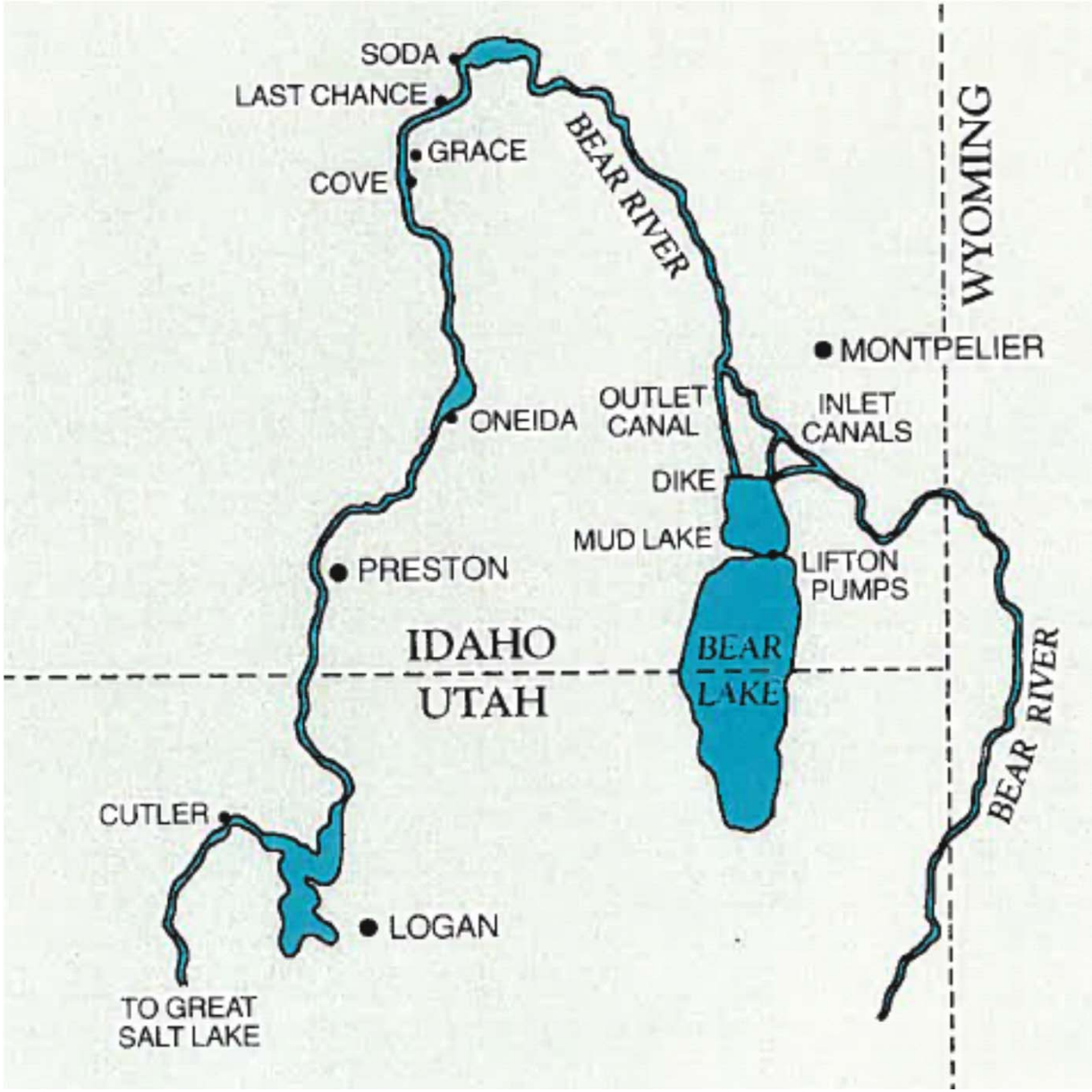
Context – Bear Lake and Bear River Hydro Plants



Brief History

- Late 1890s - Increasing electricity demand exceeded supply of small tributary hydro plants and lead to the use of Bear River for hydro power generation
- 1907 Grace Idaho hydroelectric plant on the Bear River completed.
- 1907 Bear Lake permit issued by federal government, BUT was subject to irrigation as primary use for the water.

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Brief History - continued

- 1912 Utah Power and Light formed - irrigation deliveries from Bear Lake cemented by an agreement to deliver 900 cfs during the summer to Bear River Canal Company in Box Elder County.
- Other agreements followed and today about half of Bear Lake water is delivered to Bear River Canal Company.
- Bear Lake water is supplemental to natural flow, but vital. Needed every year except rare very high flow years.

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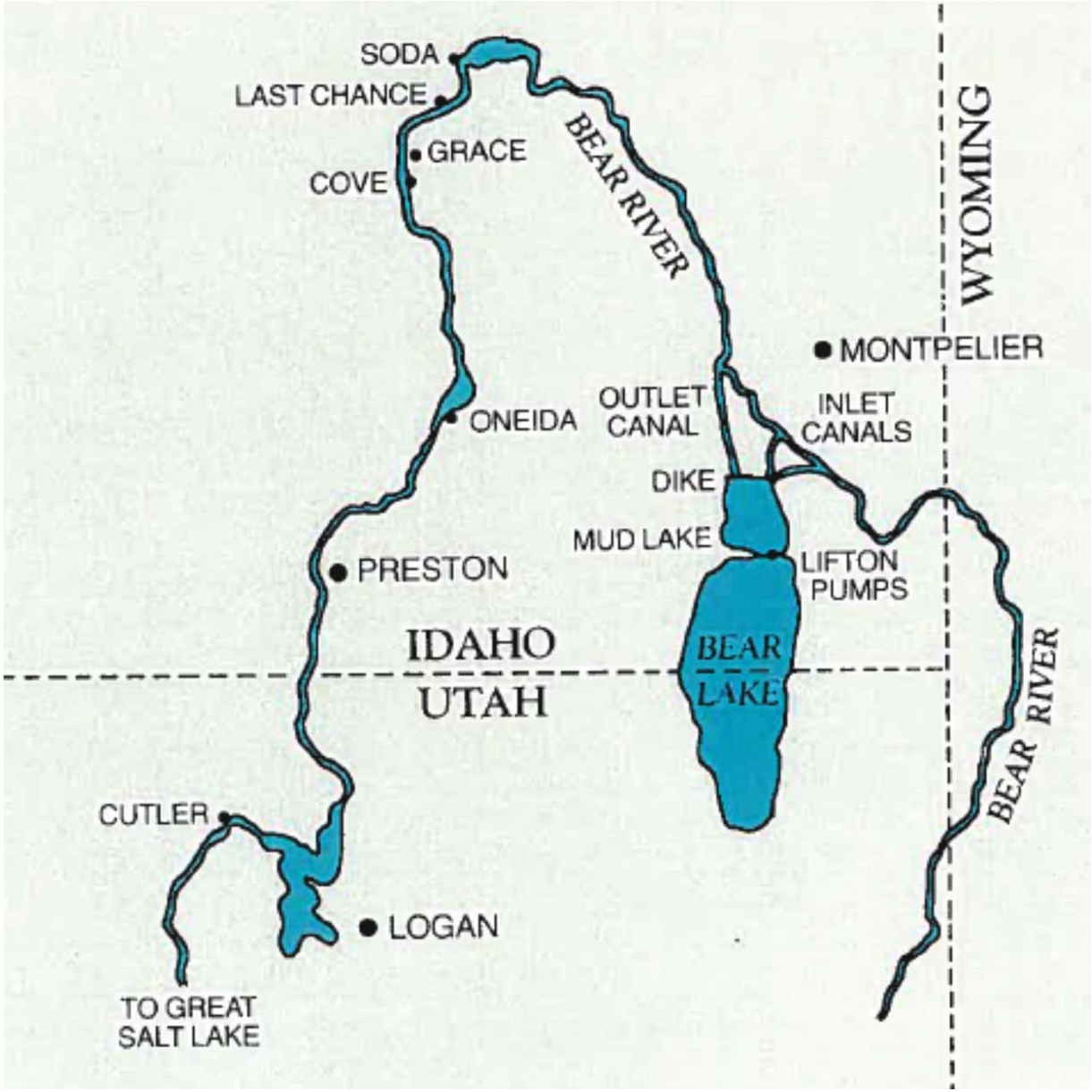
Timeline of Bear River Development

- 1907 Grace
- 1917 Lifton Pumps
- 1917 Cove
- 1921 Oneida
- 1924 Soda
- 1927 Cutler



Law of the River: Major Agreements

- 1898 Original federal legislation governing Bear Lake development – “power, as subsidiary to … irrigation”
- 1955 Bear River Compact (amended in1980) established “irrigation reserve”
- Early 1970s and mid 1980s Two flood-related lawsuits imposed duty to operate Bear Lake also for flood control.
- 1995 Bear Lake Settlement Agreement (amended and restated in 2004) – established annual irrigation allocation (rationing)
- 2000 “Three-State” Agreement (aka Merger Agreement) – “maintain historic practices” to alleviate state’s concerns about change to operations

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Current Operations

- Power releases from Bear Lake are subsidiary to irrigation (and now flood control)
- Irrigation coordination to conserve Bear Lake storage water
- Hydropower at Soda Springs, (Last Chance), Grace, Oneida and Cutler plants.

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Timeline of Typical Bear Lake Operations

- Winter through Spring Runoff – Store all water possible up to flood control target
- Late Spring – Pass inflow for irrigation or flood control
- Summer – Pump Bear Lake to release for irrigation or flood control
- Fall – evaluate need to evacuate flood control storage
- Winter – store for irrigation or release for flood control based on target elevation. Releases must be steady and unchanging in the coldest months due to downstream icing concerns.

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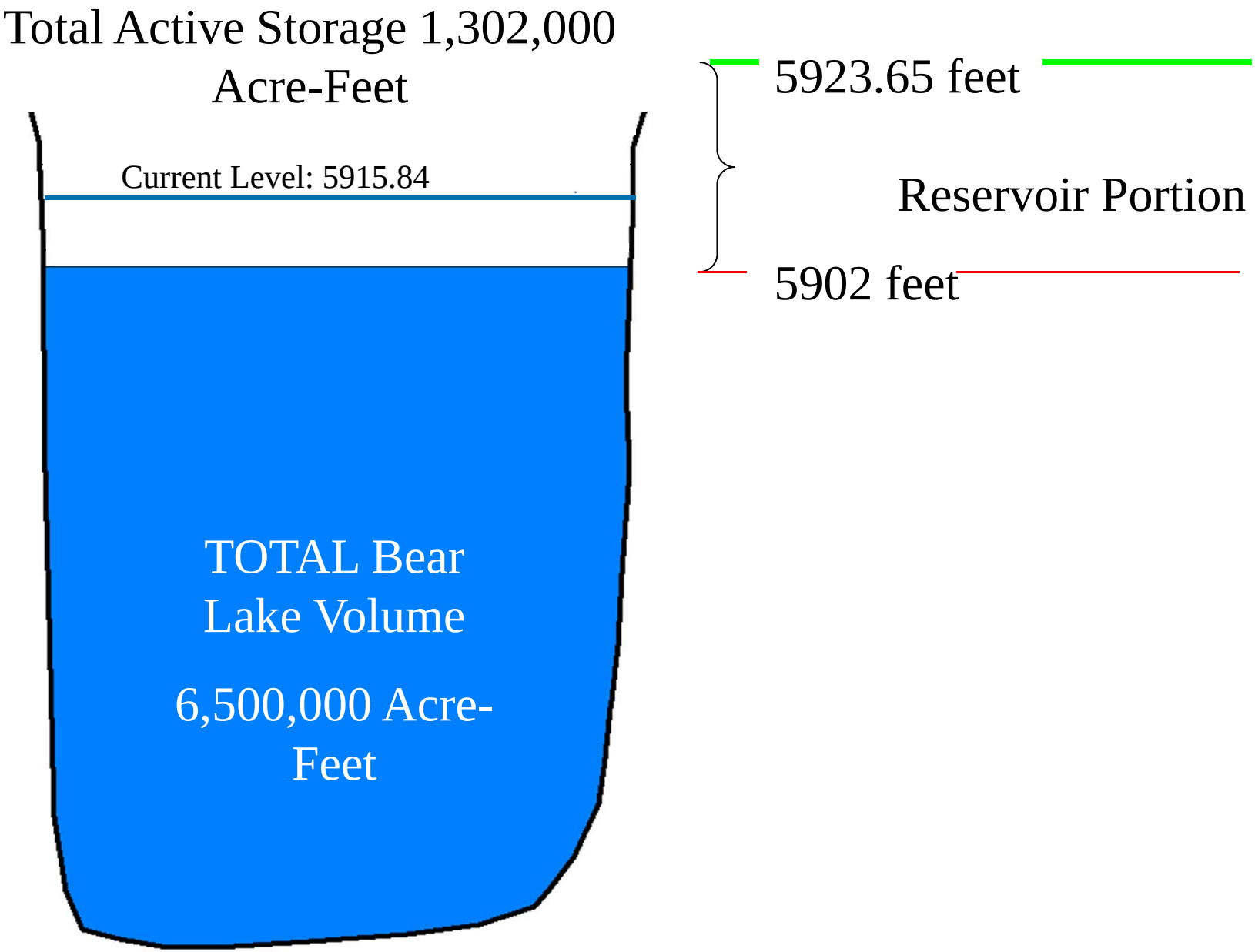
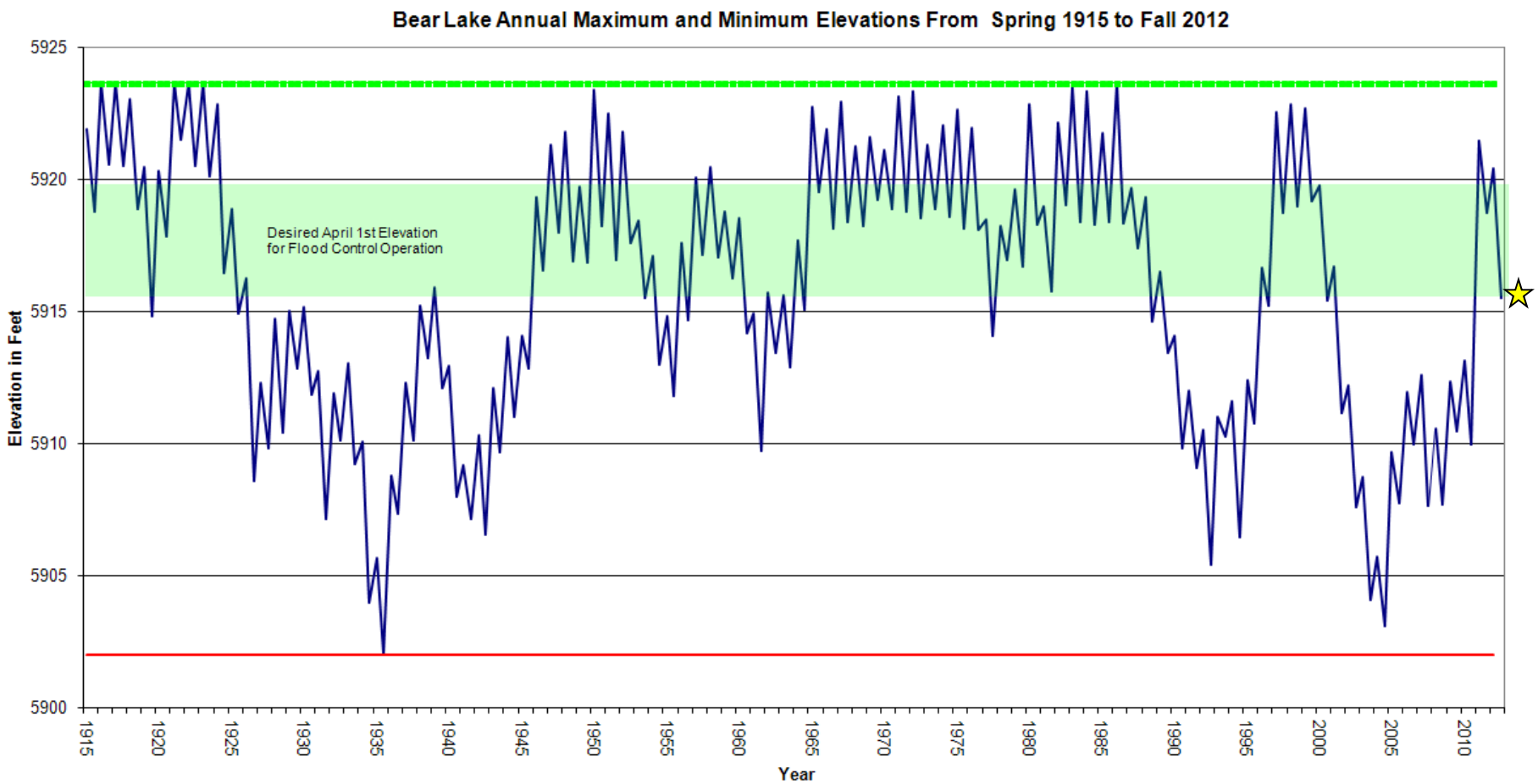
Bear Lake Volumes and Key Elevations



Bear Lake Historical Annual Max/Min Elevation



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Cache Valley Aquifer Storage And Recovery

Paul C. Inkenbrandt
paulinkenbrandt@utah.gov

Cache County

UTAH DNR GEOLOGICAL SURVEY

Outline

- What is Aquifer Storage and Recovery (ASR)?
- Where is ASR being used?
- Can we use it in Cache Valley?
- How much water can we store?
- Where does the water go?
- What needs to be done?

What is Aquifer Storage and Recovery (ASR)?

- Use and management of aquifers as water storage sites
- Adding surface water to the subsurface
- AKA Conjunctive Use

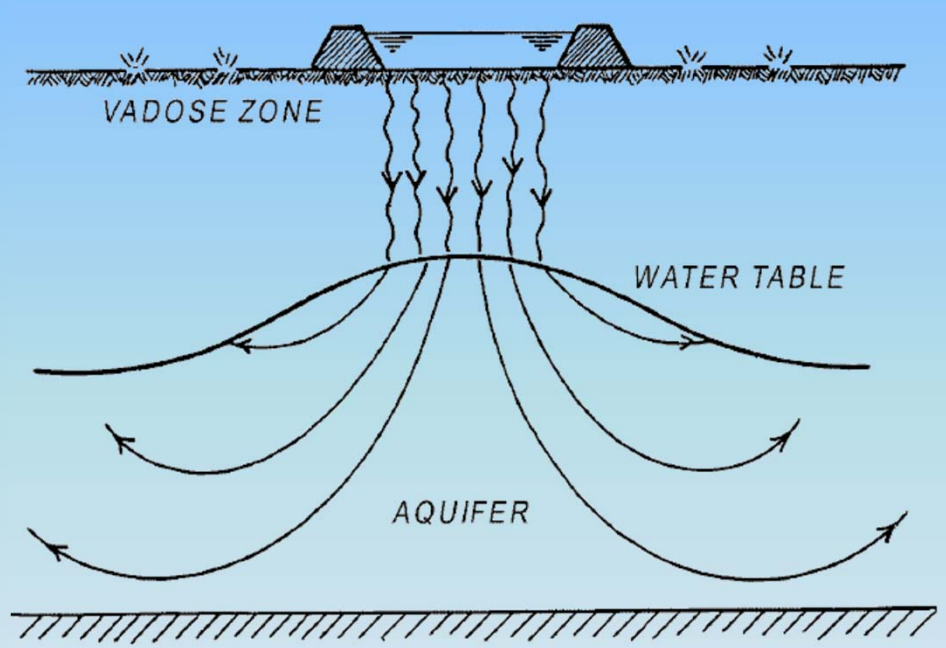
- Two ways to store water:
  - Infiltration area/pit
  - Injection well

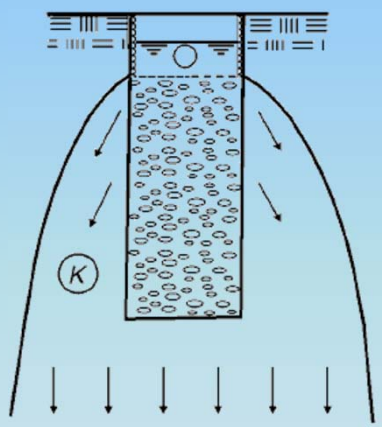
What is Aquifer Storage and Recovery (ASR)?

Surface spreading/infiltration area

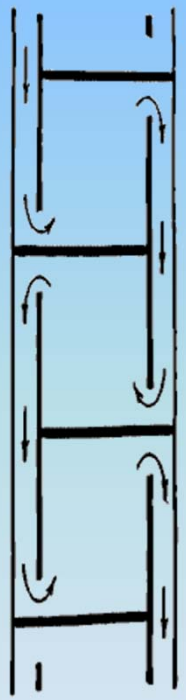
Induce recharge by infiltrating water into known recharge zones where vertical permeability is high

Maintenance – sedimentation in basins





Bouwer, 2002

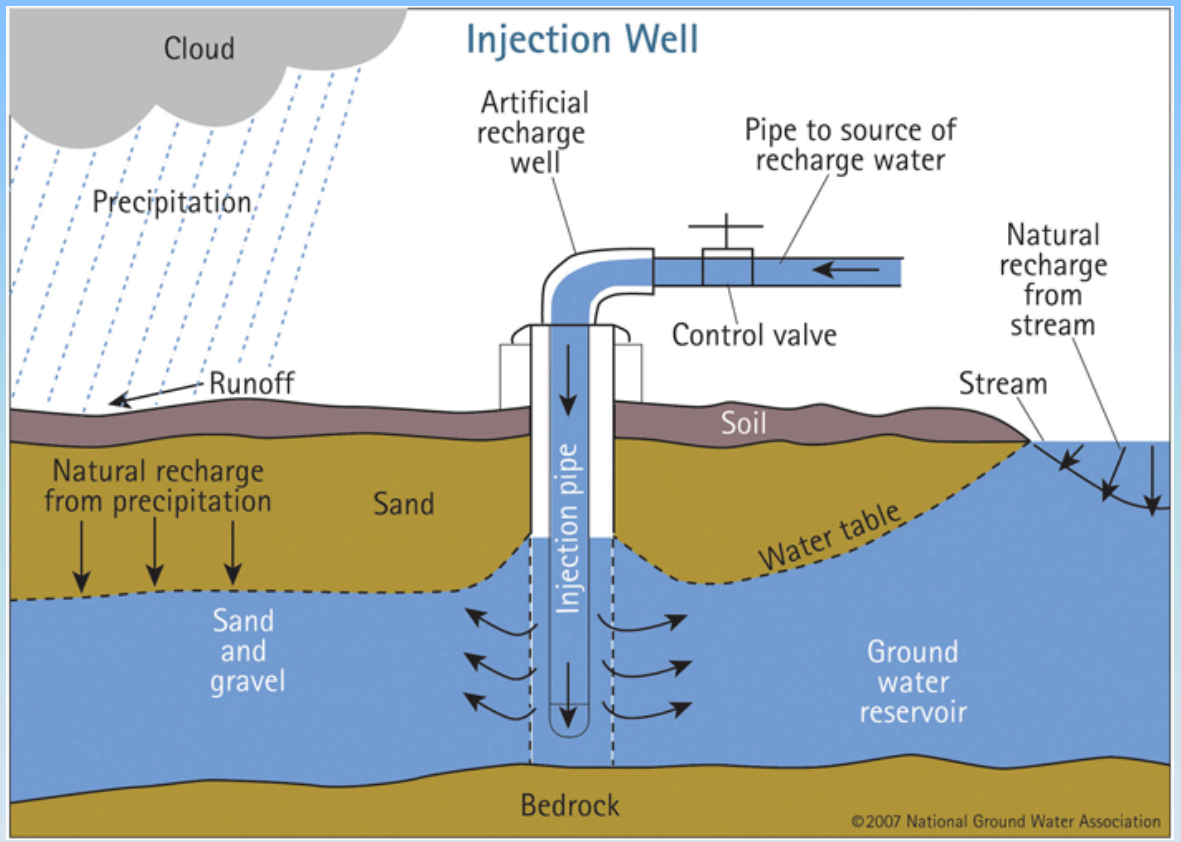


What is Aquifer Storage and Recovery (ASR)?

Injection well

Induce recharge injecting water into a well

Maintenance – clogging of screen



What is Aquifer Storage and Recovery (ASR)?

http://www.ngwa.org/Fundamentals/hydrology/Pages/Principles-of-induced-infiltration-and-artificial-recharge.aspx

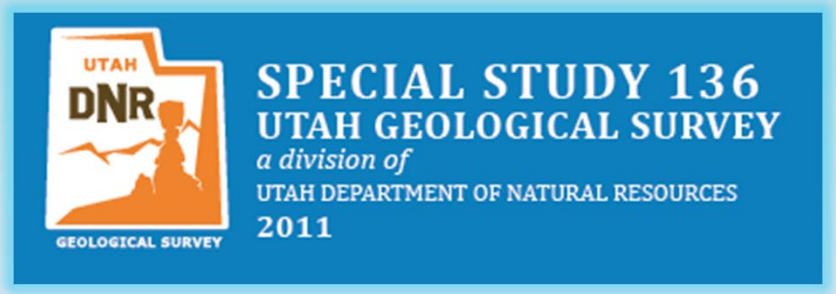
- **Conserve and dispose of runoff and flood waters**
- **Supplement the quantity of groundwater available**
- **Reduce or eliminate decline in the water level of groundwater reservoirs**
- **Store water to reduce costs of pumping and piping**
- **Store water in off-seasons for use during the growing seasons**
- **Remove suspended solids by filtration through the ground**

Photo: HJ News

Where is ASR being used?

- Jordan Valley Water Conservancy District (Utah County)
- Brigham City Corporation (Box Elder County)
- Washington County Water Conservancy District (Washington County)
- Leamington Town (Millard County)
- Weber Basin Water Conservancy District (Weber County)

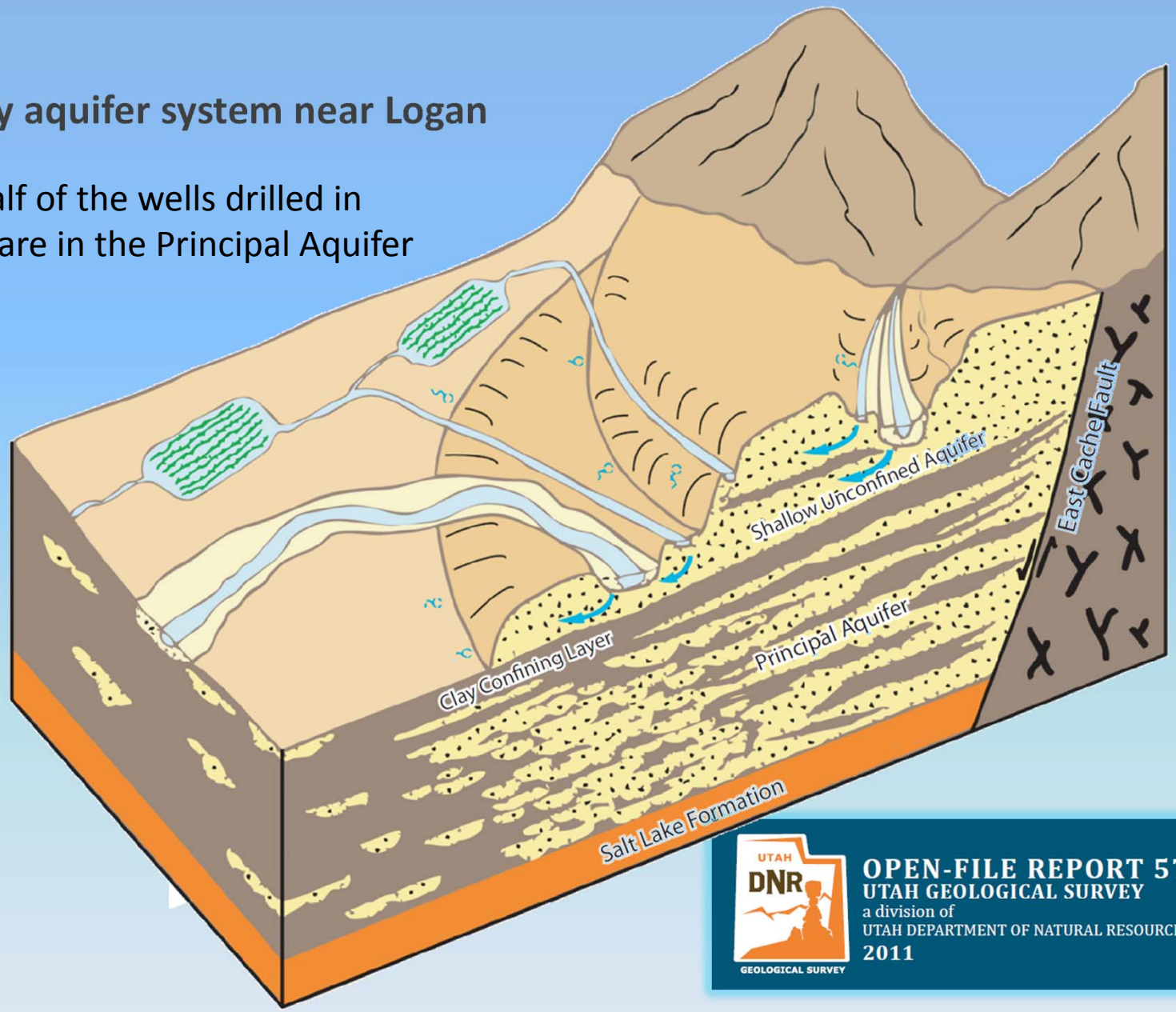
http://www.waterrights.utah.gov/groundwater/asr/ASRlist.asp
http://le.utah.gov/UtahCode/section.jsp?code=73-3b



Can we use it in Cache Valley?

Cache Valley aquifer system near Logan

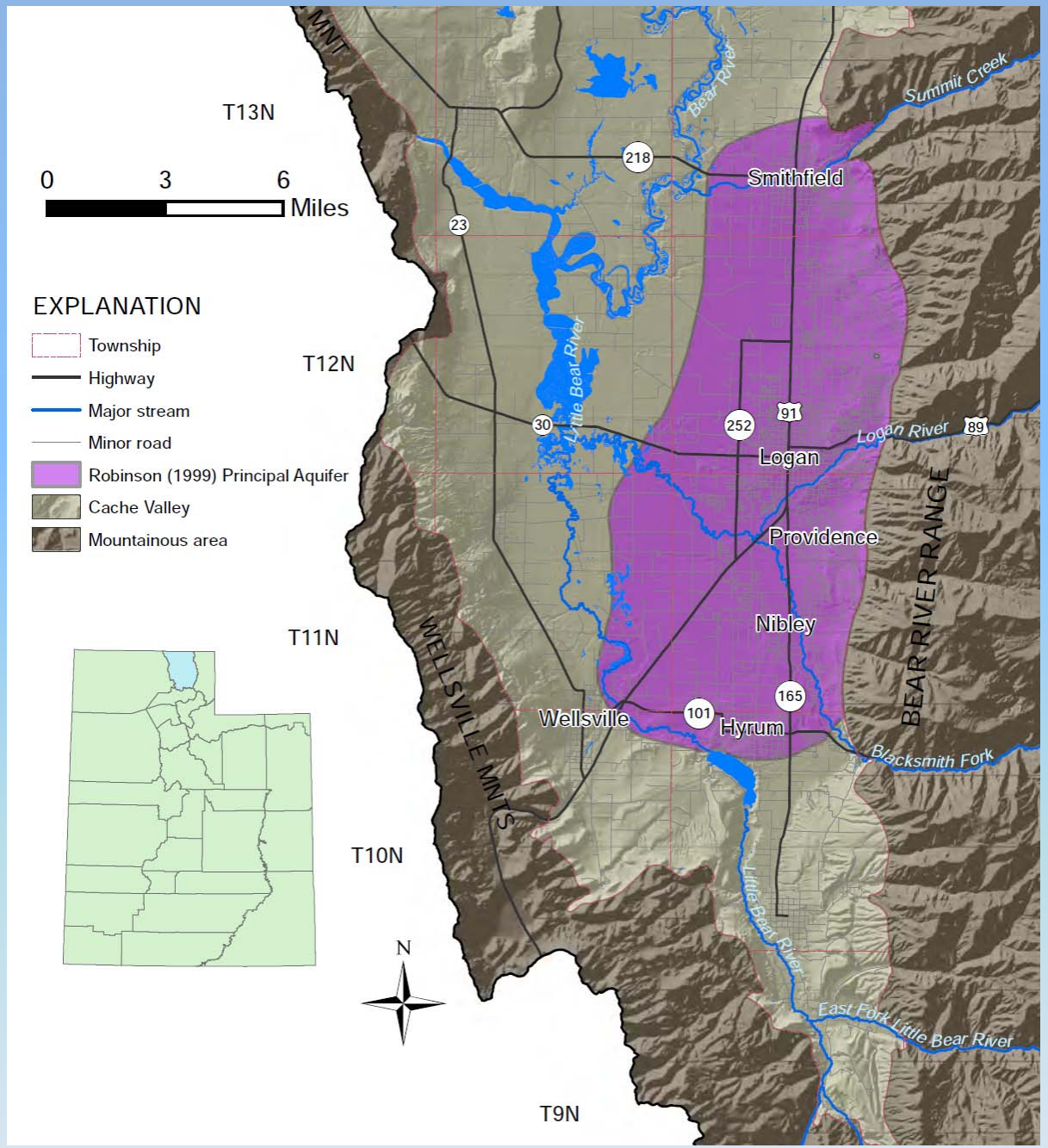
More than half of the wells drilled in Cache Valley are in the Principal Aquifer



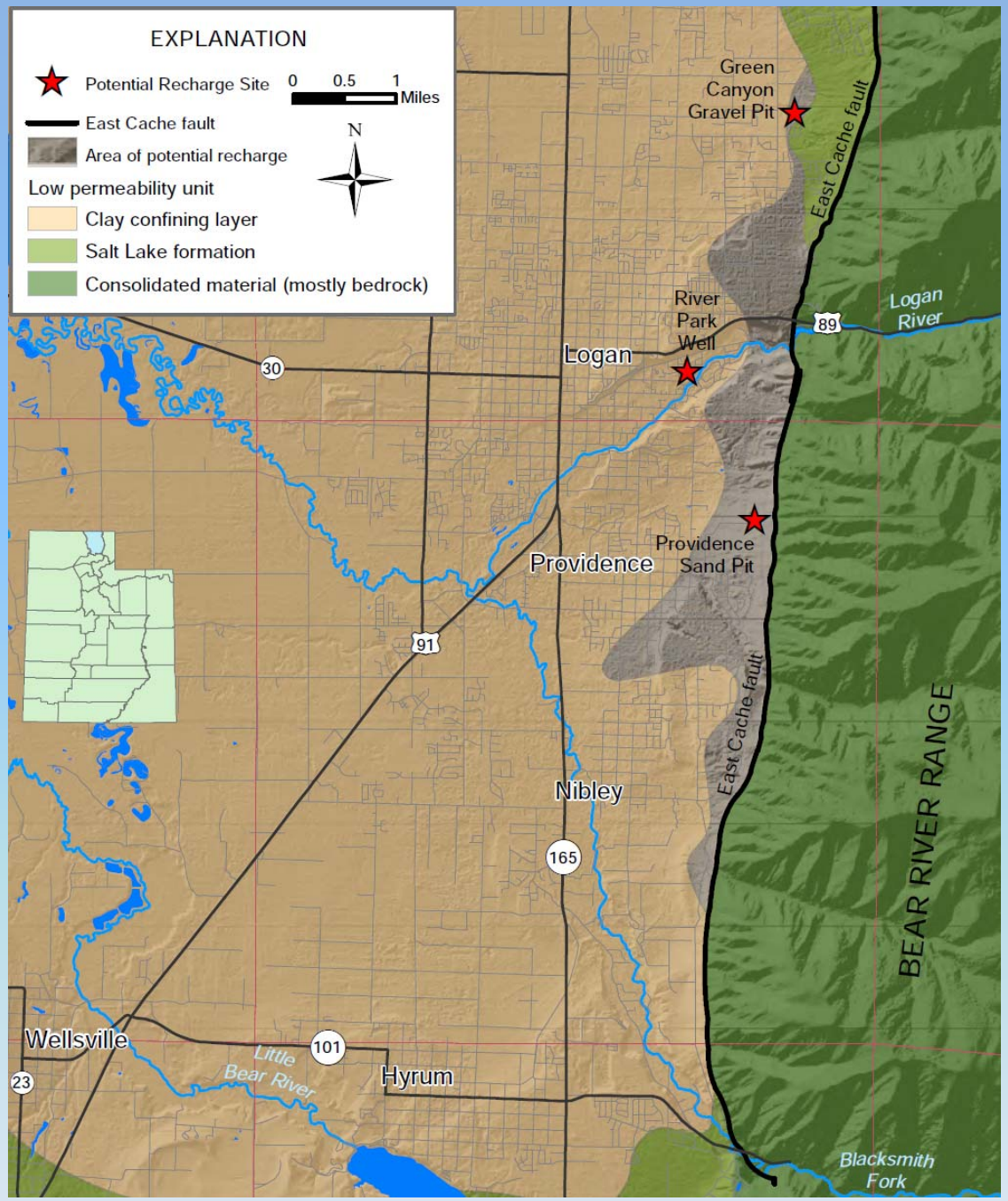
OPEN-FILE REPORT 579
UTAH GEOLOGICAL SURVEY
a division of
UTAH DEPARTMENT OF NATURAL RESOURCES
2011

Can we use it in Cache Valley?

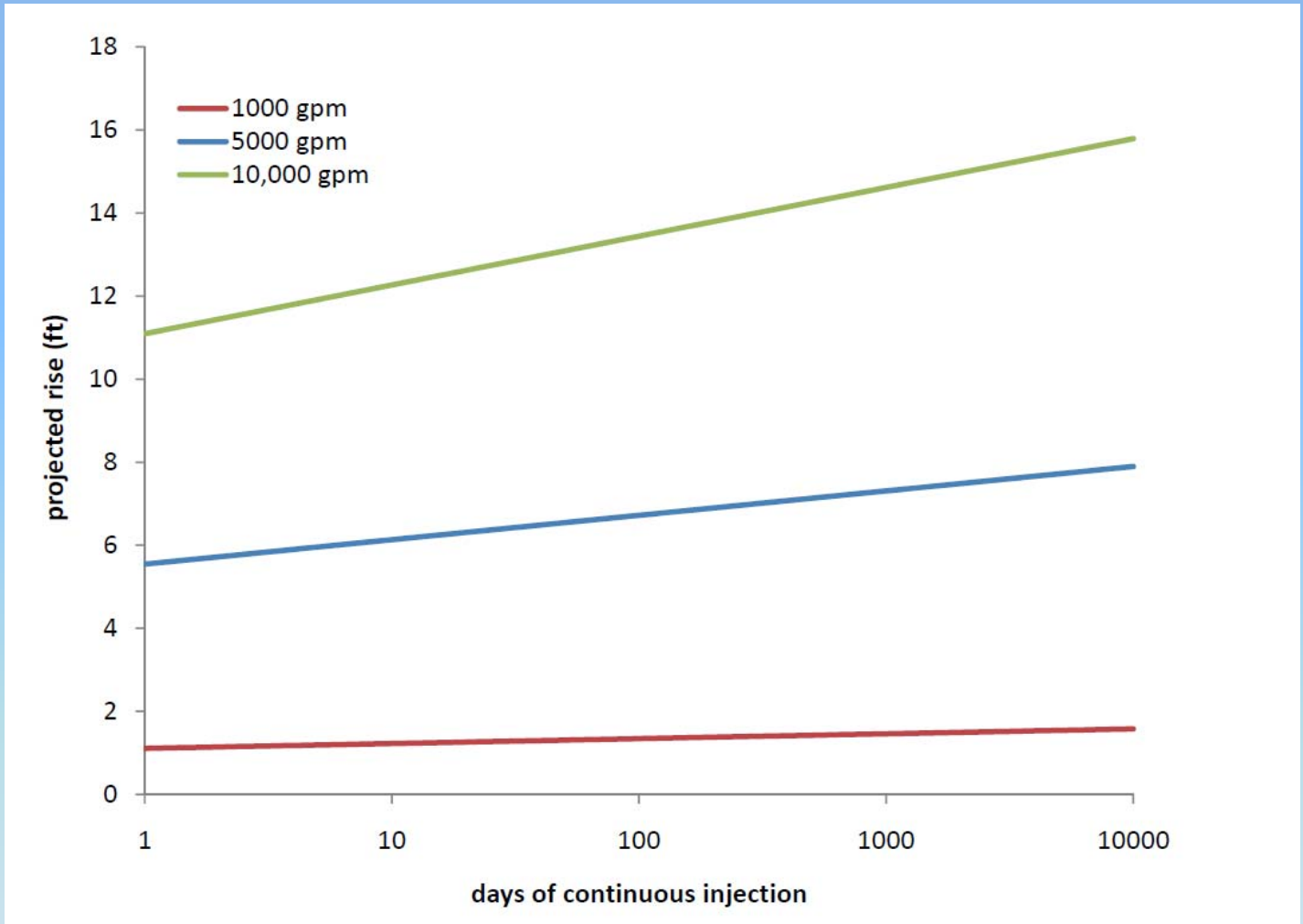
Has potential to benefit:
Smithfield
Hyde Park
N. Logan
Logan
River Heights
Providence
Millville
Nibley
Hyrum



Can we use it in Cache Valley?

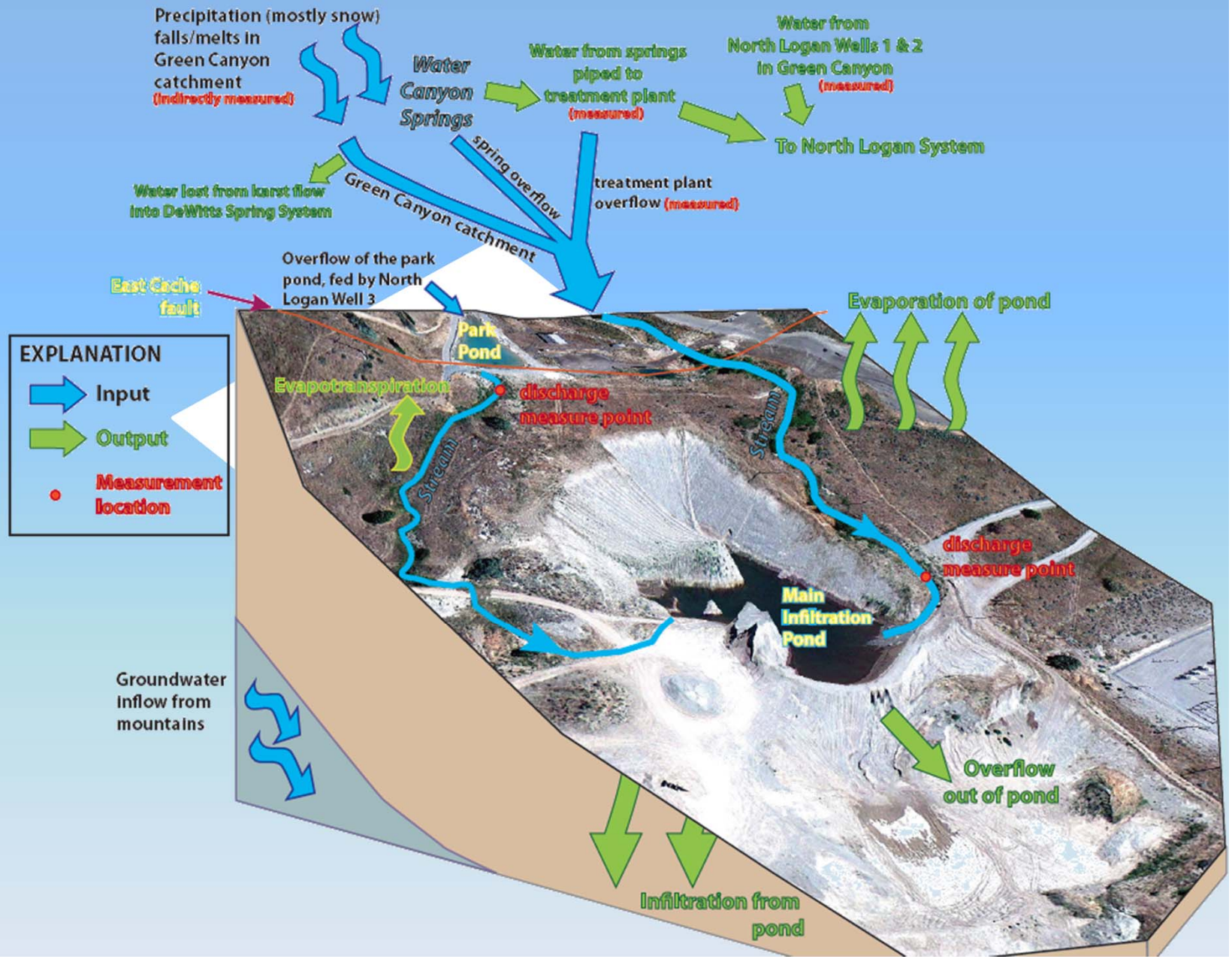


How much can we store?



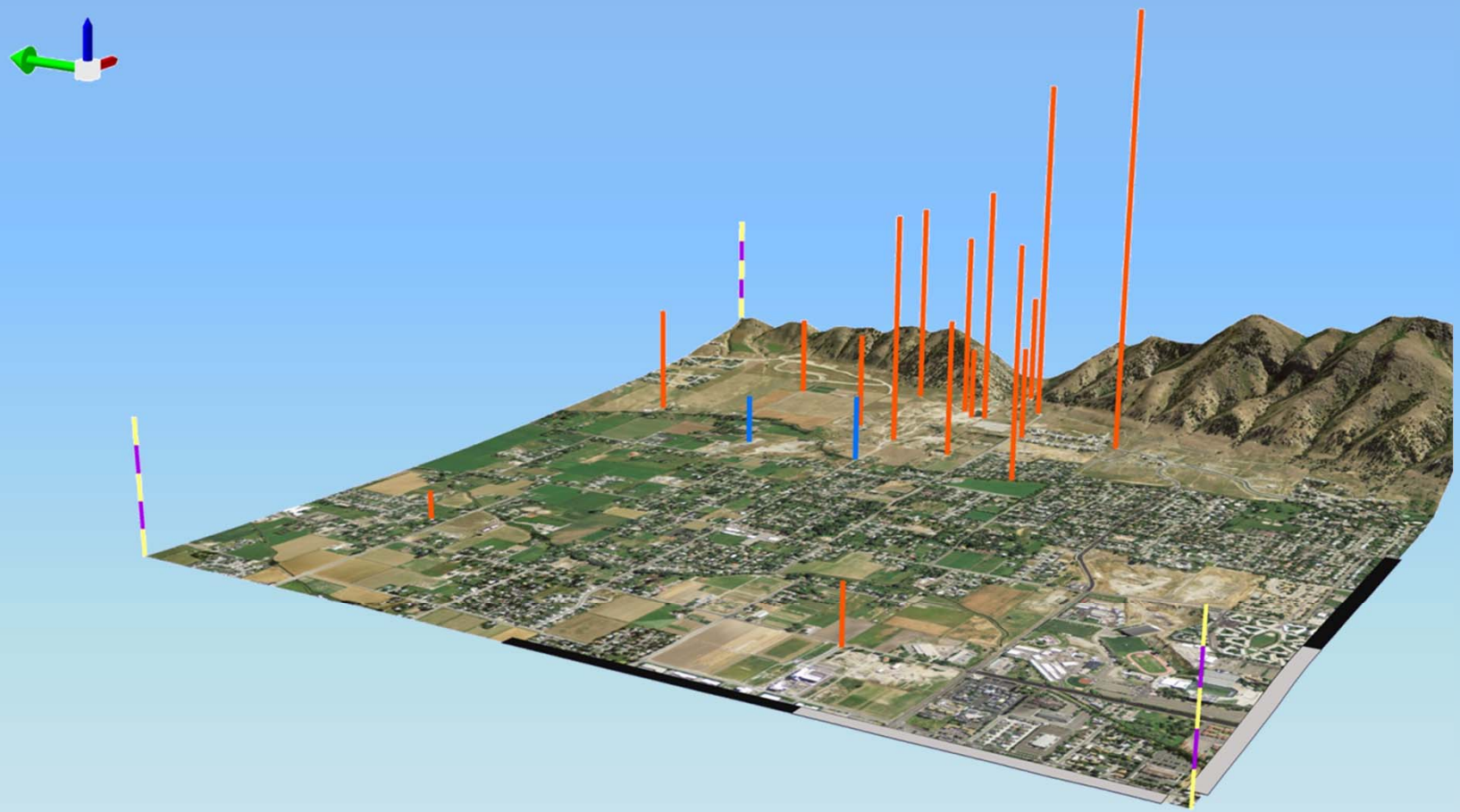
The estimate for storage capability depends on the extent of the confining layer, the distribution of storativity, and the amount of pumping from other wells.

Where does the water go?



Where does the water go?

Where does the water go?



What needs to be done?

- Examine possibility of using Logan wells
  - Injection test
  - Chemistry Samples
- Further explore the gravel pit
  - Observation well
  - Chemistry
  - Flow measurement and control

Questions?

Water Banks

Presentation to
Cache Valley Water Master Plan
Steering Committee

January 16, 2013

By Niel Allen
Irrigation Extension Specialist
Utah State University

What are Water Banks?

- An institutional mechanism that facilitates the legal transfer and market exchange of surface, groundwater, and storage water rights.
- Water banks can pool water supplies from willing sellers and make them available to willing buyers.
- Water banks can provide administrative and technical functions, for example:
  - Determine feasibility of transfers, leases, or sales.
  - Establish quantity of bankable water.
  - Identify who can participate in the bank, if necessary.
  - Set contract terms and/or prices.
  - Facilitate legal and regulatory requirements.

Examples Water Banks (Transfer/Leases/Market)

- Irrigation Company – Renting or Selling of Shares to others
  - Same Purpose of Use (irrigation).
  - Same Place of Use (Company water right).
  - Same Period of Use (defined irrigation season).
  - Same Point of Diversion (canal or pipeline heading).
  - Same diversion and Consumptive Use (CU) of water.
  - Recognized and approved by irrigation company.
  - Can be part of by-laws.
  - In general, no approval by State Engineers Office required.

Examples (Storage Bank)

- Arizona Water Banking Authority (Groundwater Storage)
  - Existing depleted aquifers
  - $15-36/ac-ft to store and $122-163/ac-ft to deliver
  - Direct recharge or in-lieu recharge.
  - Central Arizona Water – store unused allocation
  - Southern Nevada Water Authority (SNWA) Water
    - Storage agreement that includes water exchange
    - Currently SNWA has stored 600,000 of 1,250,000 AF agreement. The water is from Nevada's unused Colorado River water allocation (four times annual allocation).
    - When Nevada uses the water it will be by exchange
    - SNWA also participates in groundwater banks with MWD (70,000 AF) and local groundwater (330,000 AF)

Examples Water Banks (Transfer/Leases)

- Between Irrigation Companies, Water Districts, Indian Tribes, Water Agencies, etc.
  - Imperial Irrigation District (seller) and San Diego County Water Authority (buyer)
    - Different POD, POU, Beneficial Use (Irrigation to Municipal)
    - No permanent Transfer of Use (however is long-term)
    - Colorado River Intentionally Created Surplus Criteria
    - Involves many water users, State and Federal agencies
  - Moapa Indian Reservation (seller) and Southern Nevada Water Authority (buyer)
    - Different POD, POU, Beneficial Use (Irrigation to Municipal), different Period of Use
    - Many agencies involved including State Engineer's Office

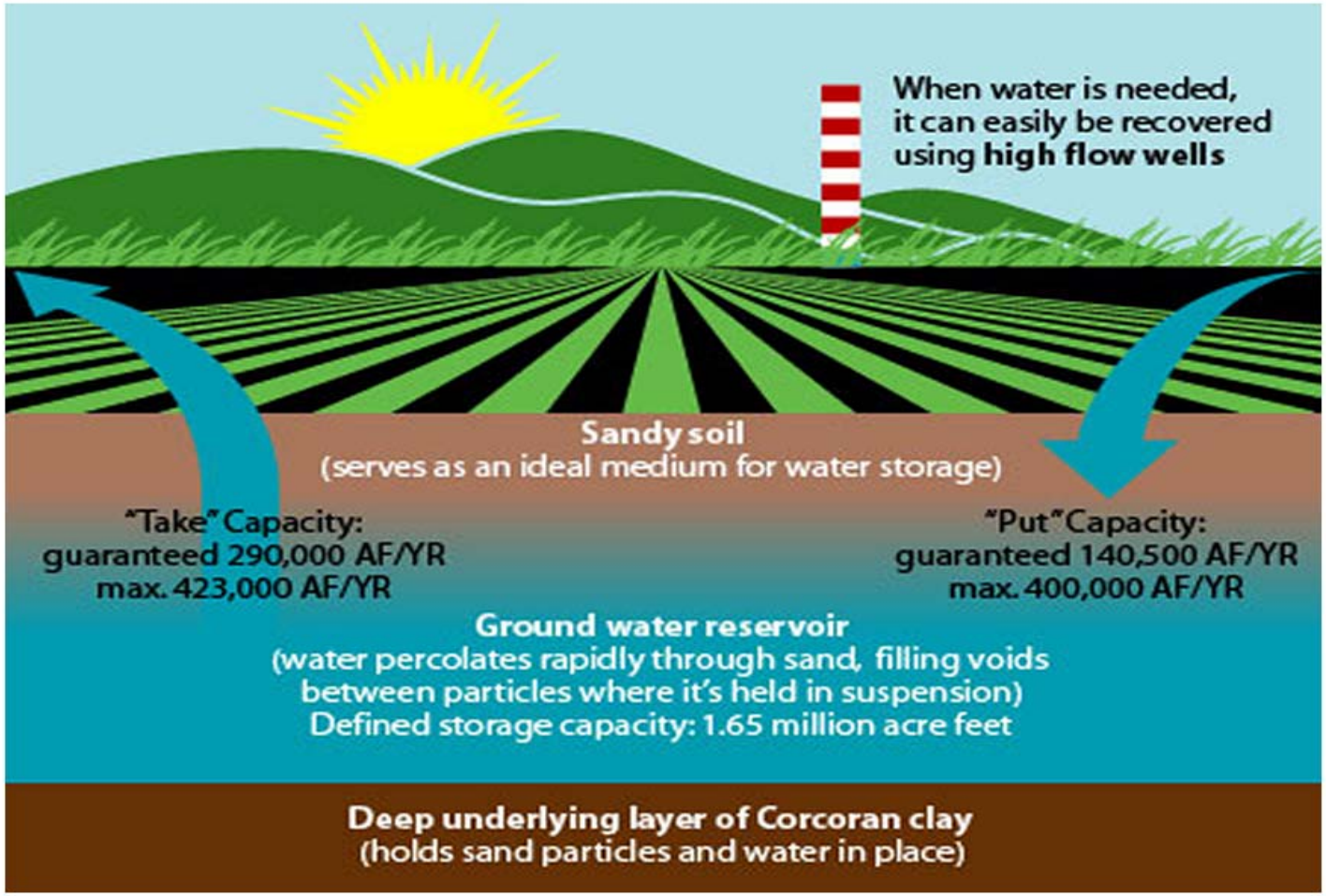
State Examples (Transfer/Market)

- California State Water Bank
  - State operated
  - Used primarily during drought
  - Generally Northern California to Southern California
- Idaho Water Rental Pool (Idaho Water Supply Bank)
  - On average only 11 percent of deposited water is rented (approx. $17/ac-ft)
  - Shoshone Bannock Tribe Water Right
    - Irrigation and Instream Flow
  - Payette River

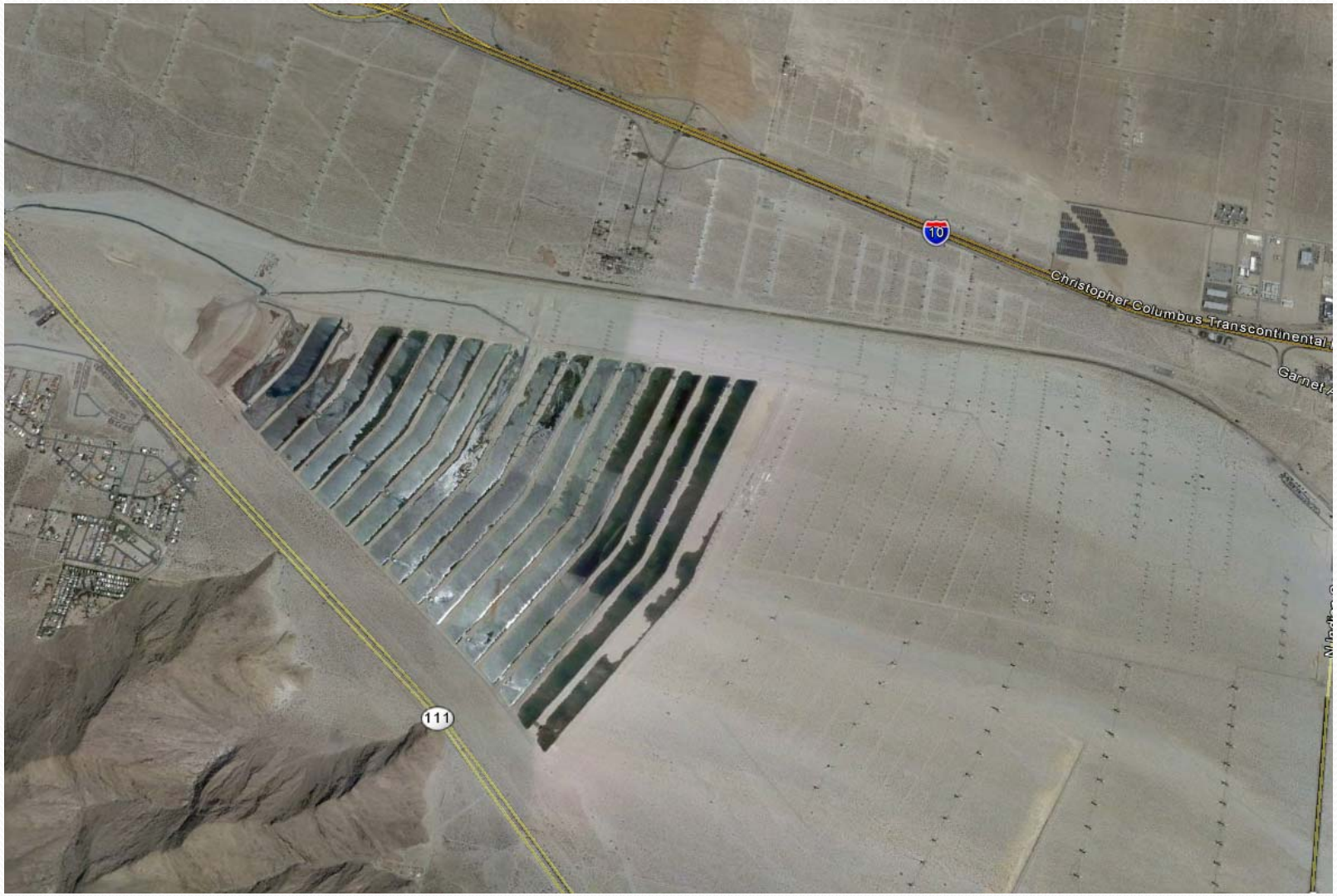
Examples (Storage Bank)

- Semi-Tropic Water Bank District (Groundwater Storage)
  - Pay to put it in
  - Pay to take it out
  - In-lieu component (take surface in lieu of groundwater or visa-versa)
  - Kern Water Bank Authority
    - Pay to put it in
    - Pay to take it out

Semitropic Water Storage District



Coachella Valley Water District's Whitewater Spreading Area constructed in 1973 has infiltrated over 2 million acre-feet. Banks Colorado River Water. Improves groundwater conditions.



Benefits of Water Banks

- Can facilitate non-permanent transfer of water rights
  - Versus buy and dry (agriculture to municipal)
  - However, some agreements have a decades-long time period while others are annual.
- Facilitates the movement of water from those with excess water to those with water shortages.
- Has components of free-market (willing participants).
- Some Water Banks provide the structure for small water right holders to participate who otherwise would be limited.
- Provides for input from many agencies and affected parties.
- Can generate funds for irrigation and water system improvements.

Obstacles to Water Banks

- Cost Issues:
  - Can require new facilities to transfer water.
  - Can require expensive environmental studies due to changes in use and point of diversions.
  - Costs of administration.
- Water accounting can be difficult due to consumptive use and losses.
- Without storage it can only operate on an annual basis.
- Need to have a market with sellers and buyers.
- Need to have laws that accommodate the transactions

Water Banks and Water Law

- Often require changes or amendments to existing laws.
- Reasonable beneficial use is the basis of the water right.
  - What is reasonable?
  - What conservation measures are implied in water right?
  - Intentionally created surplus criteria (USBR Lower Colorado River).
  - In theory water right diversion quantity changes with crops or fallowing (e.g., It is not reasonable to irrigate fallowed land the same as an alfalfa field.).

Water Banks and Water Law

- Is it legally possible?
  - Can water rights change in point of diversion, place of use, and purpose of use?
  - Is groundwater storage of banked water a beneficial use?
  - Does it fit with established decrees and laws?
- Rights of non-used or undeveloped water. Can you lease water you have not used? (Issue for Bear River)
- Will it harm others rights or the environment?

Questions Concerning the Establishment of a Water Bank

- It there a need (i.e. a demand for a water bank)?
- Are there willing participants (buyers and sellers)?
- Are institutions or organizations in place to facilitate water bank transactions.
  - State-based individual-to-individual is handled through the State Engineer's Office
  - Interstate, Compacts, Regional, District, and County can be more complex
- Are physical facilities available to move and/or store water, if not can they be built?

Questions Concerning the Establishment of a Water Bank

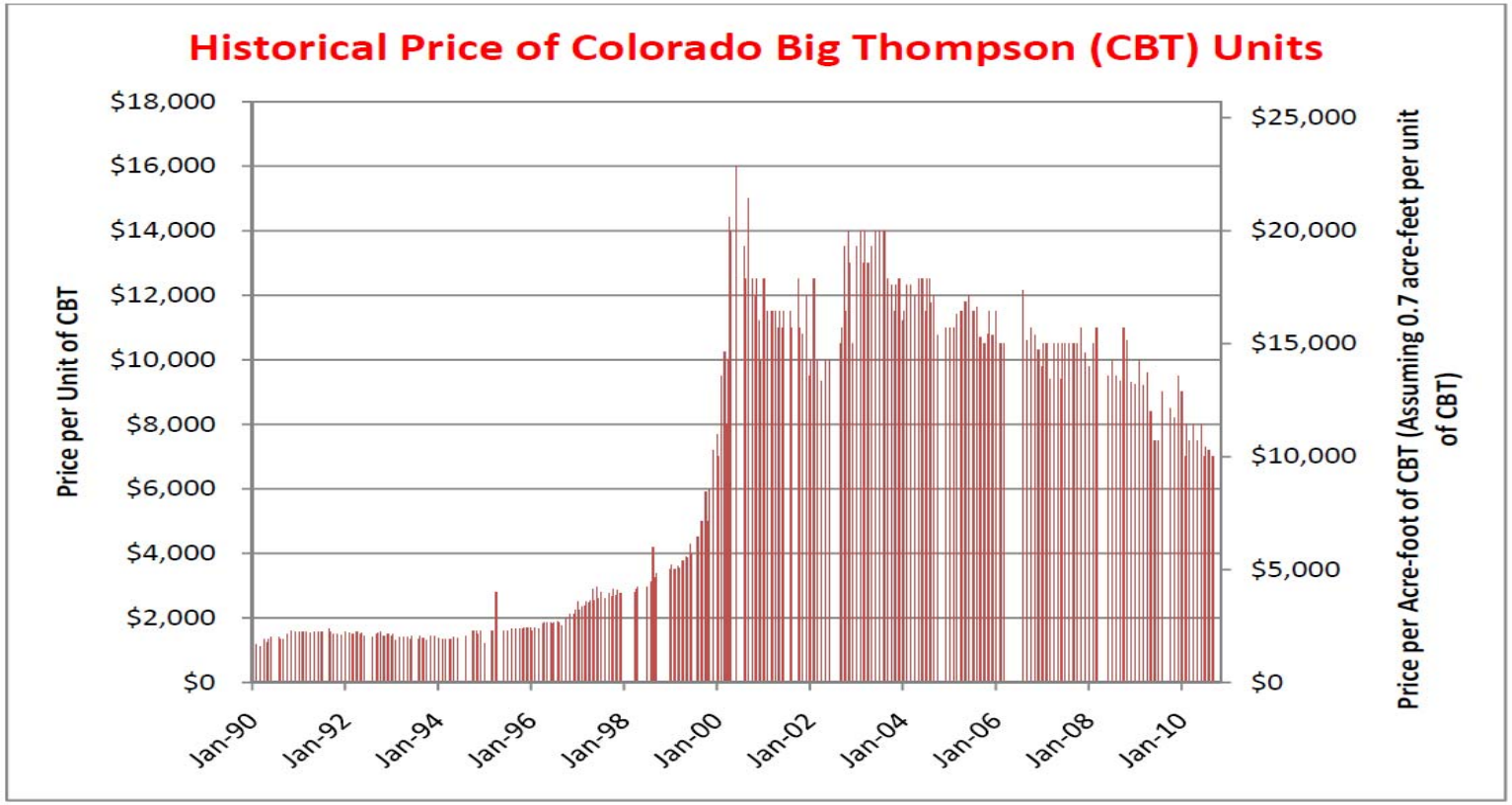
- What entity will operate the water bank (existing or new)? Water Conservancy District
- Are participants willing to pay for operation and water costs?
- How is consumptive use and movement of water accounted for?

Risks of a Water Bank

- Not all water banks are successful.
  - May need to establish contracts prior to development of a water bank.
- It is hard to anticipate the demand for water.
- Annual water prices, supplies, and demands can vary drastically from year-to-year.
- Challenges or protests by those who could be impacted.
- Without storage and long term agreements, only operate on an annual basis. This makes planning more difficult.

Example of Price Changes (from Leonard Rice Engineers)

Colorado Big Thompson Water Rights Price Trends



In 2011 the City of Fort Collins rented 15,500 AF of water to agriculture users, with its CBT water renting for $30/AF. Often developers purchase water and turnover to city.

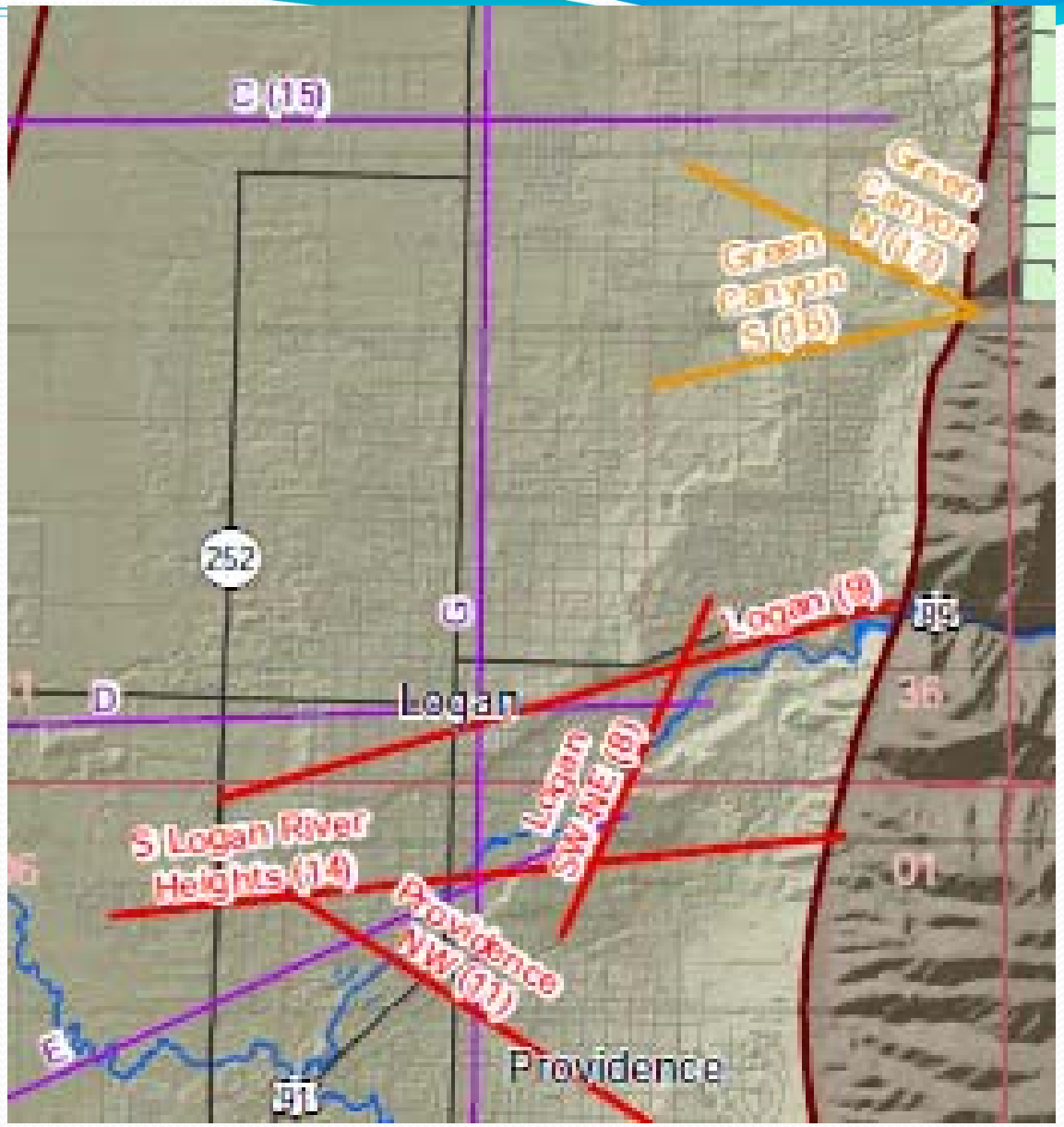
Is a Water Bank for Right for Cache County?

- Should be investigated.
- Question to consider:
  - What needs to occur before a water bank is established?
  - How much will it cost?
  - Who will use the water bank?
    - Only Cache County water users or will it be for other water users to participate in?
  - Can it help protect Cache County's water Bear River's allocation?

Groundwater Artificial Recharge-Recovery

- Groundwater Artificial Recharge-Recovery
  - Small in quantity due to limited available groundwater storage. However, some communities may just need a small quantity of water.
  - Potential lose of water in relationship to water recharged – Recharge recovery ratio (recovered/recharged)

Location Map of Geological Cross-sections near Logan, Utah



Groundwater Banking in Cache Valley

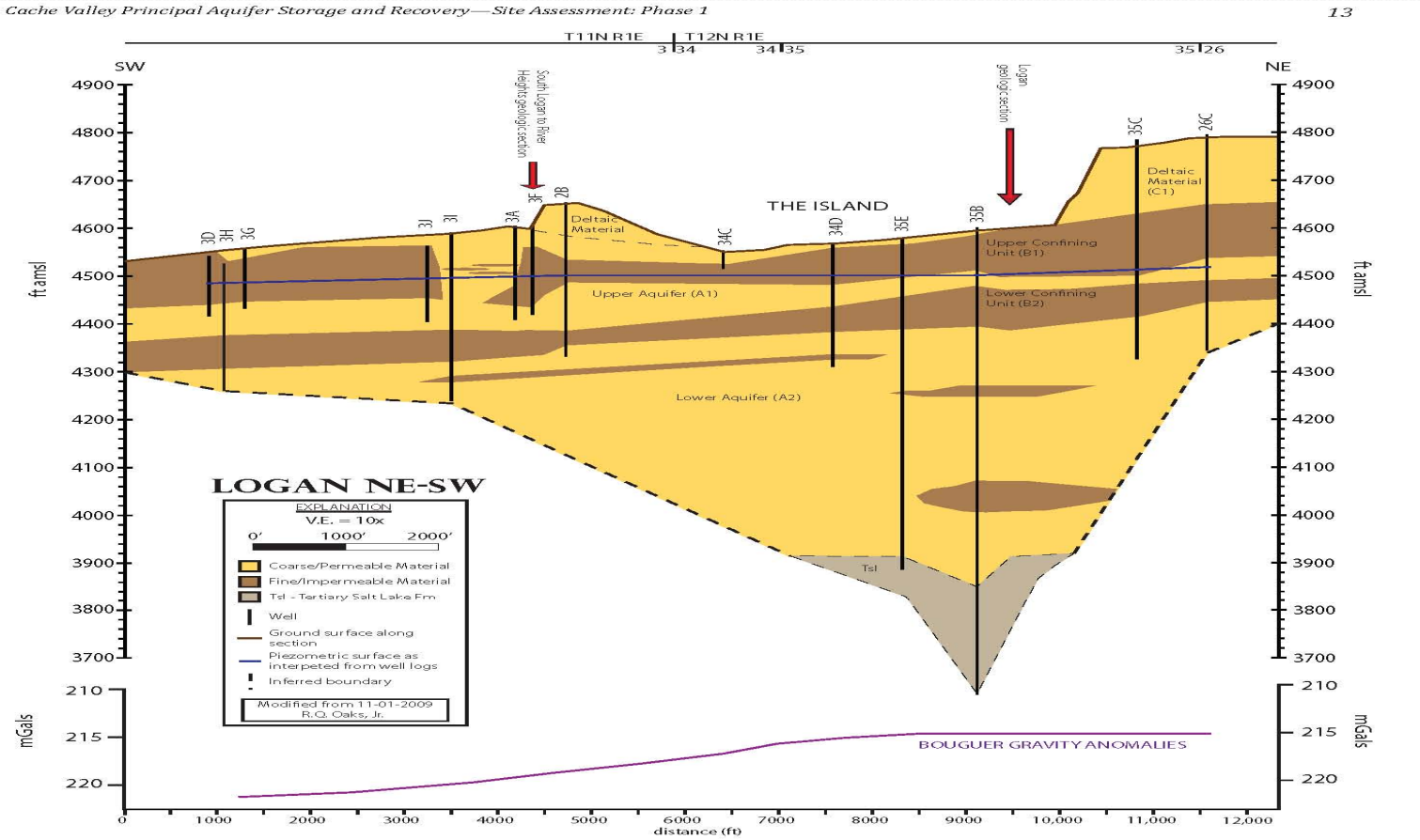


Figure 8. Northeast to southwest geologic section of Logan area basin fill. See figure 7 for location of section.

Groundwater Banking in Cache Valley

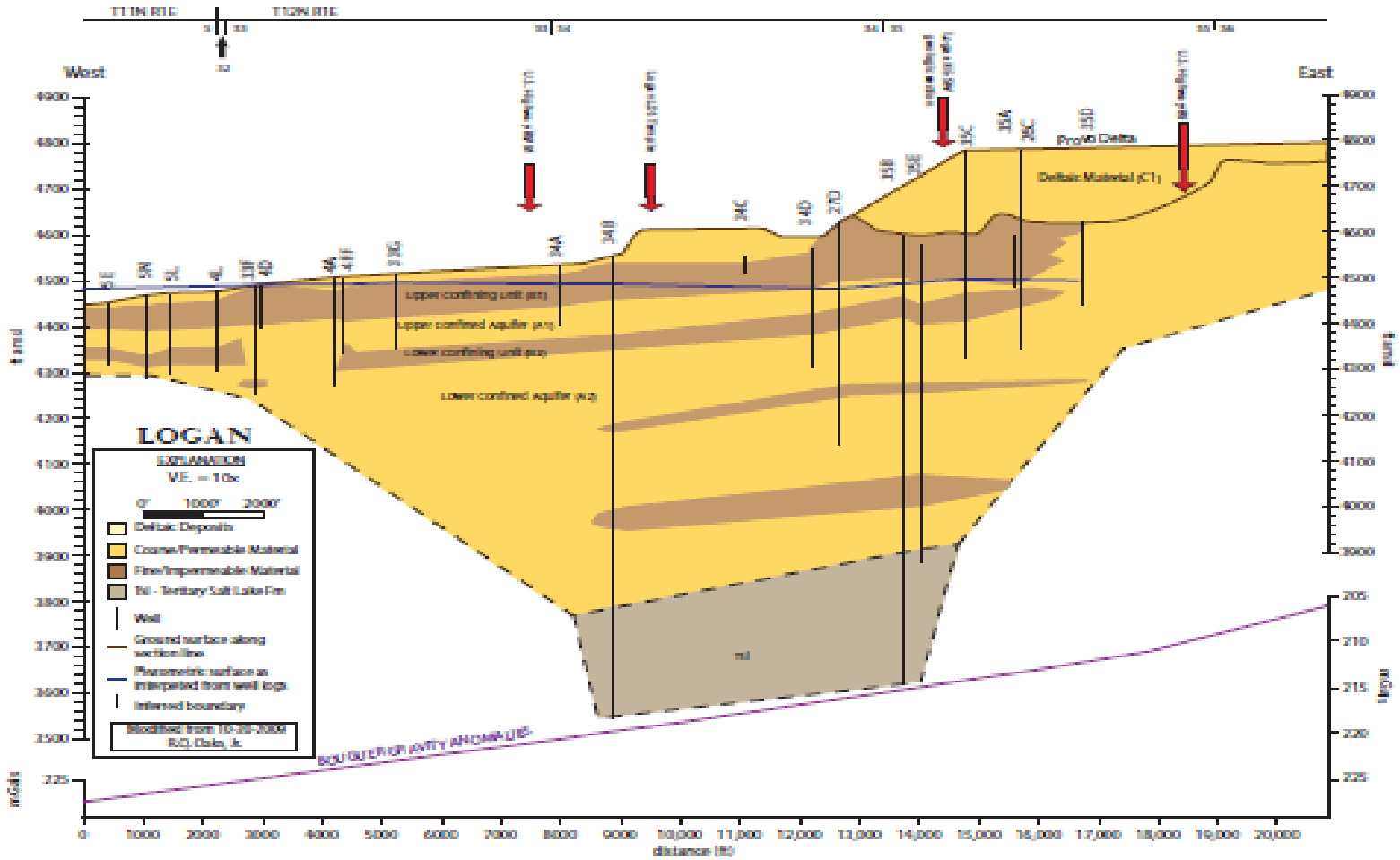


Figure 9. West-southwest to east-northeast geologic section of Logan area basin fill. See figure 7 for location of section.

Groundwater Banking in Cache Valley

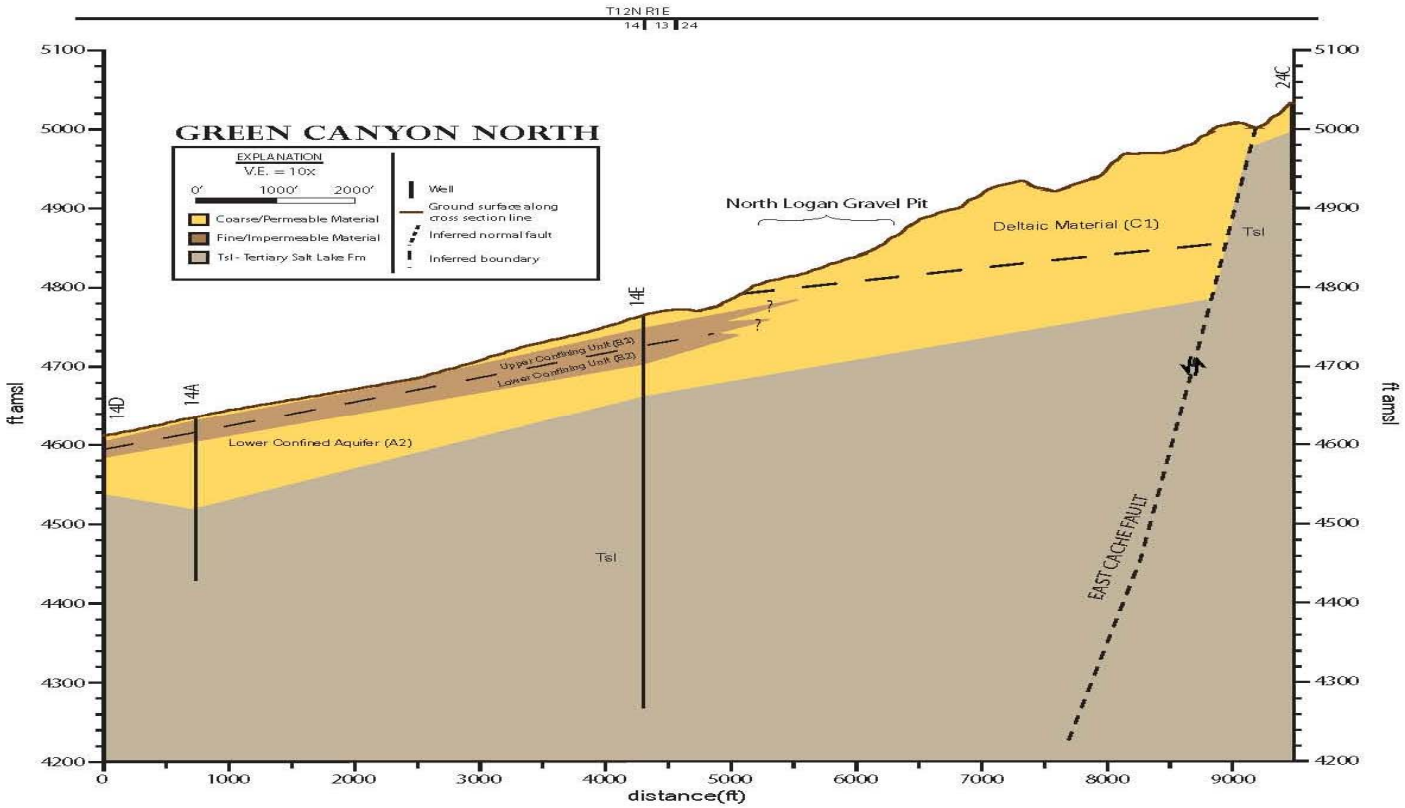


Figure 17. *Southeast to northwest geologic section of Green Canyon area basin fill. See figure 7 for the location of the section.*

Surface Water Reservoir(s) Bank

- Surface Storage
  - Suitable Reservoir sites
  - Large Capacity (a couple of hundred thousand acre-feet)
  - Water users or general population willing to pay the cost to store water for future use
  - Willingness to engage in multi-year and costly planning

Surface Water Reservoir(s) Bank

- Utah only
  - Including all Wasatch Front
  - Including only Bear River Water Conservancy District, Cache County, Jordan Valley Water Conservancy District, and Weber Basin Water Conservancy District.
  - Water generally moves to higher populations due to ability to pay
  - Can protect Cache Valley's water right
  - The more participants the greater the ability to finance water facilities.

Water Banks and Leasing

- Upstream water rights can generally be used downstream
- Downstream water rights can usually, but not always be used upstream
- Example of the Lower Colorado River
  - California had to cut back from >5 million acre-feet/year to compact allocation of 4.4 million acre-feet. The same scenario could occur on the Bear River.

Bear River Water Market (Water Bank)

- Wyoming, Idaho, and Utah
  - Provides a larger pool of water
  - Provides more storage flexibility (Existing reservoirs on Bear River and Bear Lake)
  - More complicated due to multi-state issues and more water users.
- Cache County only
  - Agreements between towns and cities
  - Agreements between irrigation companies and towns
  - Bear River water development projects
  - Integration of groundwater in the pool of water

Questions

- Cache County Water Bank?
  - Water Supply of 60,000 AF per year
  - Contracts with Municipalities and others (In and out of County)
  - Provides Infrastructure
  - Provides Management
- How is it different than a Water Conservancy District?

Ideas for a Cache County Water Bank

Problem Statement

Cache County has potential problems concerning management of the water rights in the county.

1. Cache County's groundwater is considered fully appropriated, by law, regardless of the hydrological balance. This is because in September 1999 the State Engineer concluded that the mass balance of water moving through Cache County needs to remain constant. Thus the groundwater is considered fully appropriated, because removing any additional groundwater would reduce flows out of the Valley. September 1999 is the 'date certain' that is to be utilized for the bases of water rights in Cache County. Surface and groundwater are both included in the 1999 decision by the State Engineer. If groundwater pumping is to increase, then there needs to be an equivalent decrease in surface water use.

2. The County has worked to get water banking into statute with some success under Title 17 Utah Code; however there is no implemented mechanism that is in place to protect and measure historical water uses that no longer occur in Cache County attributed to the reduction of irrigated lands. Cache County completed mapping the out of production of land converted from irrigation since September of 1999. The mapping shows that during the last 13 years the agricultural irrigated land base in Cache County has decreased 7,661 acres[1]. A portion of the reduced depletion flows out of the county and down the Bear River. During times of controlled distribution of flows this decreases the amount of water Idaho is required to release across the Stateline to meet obligations in Box Elder and Weber Counties. In essence, Cache County has lost the use and value of its historical water use to Idaho and others and it may be difficult to regain the use of the water.

3. Cache County has been allocated 60,000 acre-feet per year for development from the Bear River or its tributaries. Most of this water is not available for use in Cache County without development of water storage to winter flows and spring runoff along with facilities to distribute the water to users. The water is now currently unaccounted for and flows downstream. Additionally, some of the water facilities being planned to utilize the developed water do not facilitate water use in Cache County.

Water Bank Description

A water bank agency is an entity formed to account for and conduct transactions concerning changes in water uses. In Cache County a water bank could be used to help facilitate water leases with or without

[1] Personal Communication with Robert Fotheringham, Cache County Water Manager on January 23, 2013.

additional water storage. The water banking function could be administered as part of a public agency such as a water conservancy district or as an independent agency. The water bank organization would verify and post water that is available for lease. Water users with a need to rent water would contact the water bank organization to begin discussions concerning water leases. The water bank would determine if the water can be delivered to the lessee and help negotiate the contract terms. The value of the water for the downstream users would depend on the competing water uses, because currently Cache County can't store the water and prevent it from going down stream. The water bank organization would also monitor to see that the leased water was not used by water right holder. A procedure and mechanism would need to be in place to facilitate the delivery of water to the lessee. The new use of the water would need to be recognized as a beneficial use or storage for later beneficial use. Another possible function of a water banking agency is to help administer the use of the Utah's undeveloped allocation of the Bear River, although this function could also be administered by another agency.

Objectives

The major objectives of a Cache County water banking agency are listed below:

1. Preserve and account for historical water uses on the tributaries and on the Bear River.
2. Facilitate water leases, transfers, and exchanges.
3. Account for transfers from surface to groundwater diversions or for groundwater to surface water diversions. The bank would allow the exchange of surface water rights for groundwater rights upon reasonable demonstration of no additional depletion and other criteria of needed.
4. Provide a mechanism for the accounting and utilizing of the 60,000 AF allocation of Bear River water to Cache County.

Examples of water that could be deposited into the water bank:

- A landowner with water share or water rights to irrigate 500 acres of irrigated pasture decides to discontinue irrigating and changes the land use non-irrigated wildlife habitat. In this case the historical irrigation consumptive use could be deposited in the water bank.
- Farmers in XYZ Irrigation Company puts 1,000 acres into the conservation reserve program for 10 years. The land is no longer irrigated and the water is not used on other land within the irrigation district. The consumptive use portion of the water right could be deposited into the water bank.
- A developer purchases 160 acres of irrigated land and develops commercial and industrial property that is almost entirely covered with parking lots and building. The reduction on consumptive use could be deposited in the water bank.

Examples of withdrawals from the water bank:

- ABC Irrigation Company (or city) in Cache Valley needs an additional 1,000 acre-feet of water to meet the irrigation demands and facilities are in place for the irrigation company (or city) to receive and use the water. The company or city would purchase the water at an agreed upon price for the irrigation demand. If
- Bear River Wildlife Refuge needs and additional 1,000 acre-feet to enhance wildlife habitat. The Wildlife Refuge could purchase the water and increase their annual diversion by 1,000 acre-feet.
- Weber County Water Conservancy District could use 1,000 acre-feet of water and wants to make sure that the water can be delivered (not diverted by other users). The District could purchase and utilize or store the water.

Water Bank Functions

Functions of a water banking entity can include some or all of the following functions.

- Administration of Water Leases - Establish legal authority through proper jurisdiction to help manage water transactions.
- Enroll or Establish Participants – The water bank would establish its presence and authority and would be recognized with the capacity to help administer water transactions.
- Determine of Reduced Consumptive Use – The determination of amount of water available for lease is the reduced consumptive use. This would require determination of historical consumptive use and in the case of land use changes, the consumptive use of the new land use. This most likely would be the responsibility of the entity leasing the water. The bank would allow the exchange of surface water rights for groundwater rights upon reasonable demonstration of no additional depletion and other criteria of needed.
- Find Willing Leasers and Lessees– The success of a water bank is contingent upon on willing participants that have water to lease and participants to will lease water. If no downstream users lease the water it will flow downstream and be utilized or flow into the Great Salt Lake.
- Verify Water Deliveries – The leased water may travel by many diversions on its way to the lessee. Verifying that water is not inadvertently or intentionally diverted by other is a function that is often assigned to a river commissioner. Communicating information concerning water transactions to river operators is needed to efficiently lease or transfer water.
- Enforce Diversions – When a water lease transaction has occurred there needs to be documentation and enforcement of decreased diversions by the individual or entity leasing the water.
- Facilitate Legal and Regulatory Requirements – This would involve working with governmental agencies to ensure that water leases are legal and in accordance with laws and regulations. There would also be notification, permission, and reporting requirements.

CACHE MASTER WATER PLAN SURVEY (01/16/13)

Question # 1 (Practice Question) - How do you feel about Coach Gary Andersen leaving USU?
a. A man's got to do what a man's got to do
b. I hope the Wisconsin cheese treats him well
c. He really did us wrong
d. I don't care

Question # 2 - What kind of public education do you think is most important?
(11%) a. Improve understanding of Bear River development
(23%) b. To improve water conservation
(54%) c. Improve understanding of water resources and supply and demand projections for Cache County
(11%) d. Improve understanding of different water institutional structures

Question # 3 - How would you categorize the construction of water system interconnects as a strategy?
(9%) a. Poor
(44%) b. Average
(15%) c. Above average
(32%) d. Excellent

Question # 4 - How would you categorize aquifer storage and recovery as a strategy?
(12%) a. Poor
(27%) b. Average
(39%) c. Above average
(18%) d. Excellent
(03%) e. No Answer

Question # 5 - How would you categorize construction of reservoirs as a strategy?
(24%) a. Poor
(21%) b. Average
(26%) c. Above average
(29%) d. Excellent

Question # 6
How would you categorize construction of secondary water systems as a strategy?
(6%) a. Poor
(21%) b. Average
(44%) c. Above average
(29%) d. Excellent

Question # 7 - How would you categorize improving canal delivery systems as a strategy?
(0%) a. Poor
(29%) b. Average
(41%) c. Above average
(29%) d. Excellent

Question # 8 - How would you categorize water banking as a strategy?
(17%) a. Poor
(34%) b. Average
(26%) c. Above average
(23%) d. Excellent

Question # 9 - How would you categorize water reuse as a strategy?

(17%) a. Poor
(23%) b. Average
(40%) c. Above average
(20%) d. Excellent

Question # 10 - How would you categorize surface water treatment for potable uses as a strategy?
(29%) a. Poor
(54%) b. Average
(9%) c. Above average
(6%) d. Excellent

Question # 11 - Should Bear River water allocation be protected for future use in Cache County?
(94%) a. Yes
(6%) b. No

Question # 12 - When should greater efforts be started to protect the Bear River water that is allocated for Cache County?
(85%) a. Now
(3%) b. About 10 years from now
(6%) c. About 25 years from now or even later
(6%) d. We don't need any greater efforts to protect the allocated water

Question # 13 - Should Bear River water be developed in Cache County?
(76%) a. Yes
(24%) b. No

Question # 14 - How should Bear River water development be managed?
(24%) a. Through Cache County
(67%) b. Through a conservancy district
(6%) c. Should not be developed
(3%) d. Other

Question # 15 - How should regional projects be implemented?
(35%) a. Inter-local agreements
(53%) b. Formation of a District
(9%) c. Let Bob Fotheringham take care of it
(3%) d. Other

Question # 16 - If the same institutional structure is kept in place, please indicate your level of concern about water supply within the next 50 years.
(9%) a. Not concerned
(21%) b. Mildly concerned
(41%) c. Concerned
(29%) d. Very concerned

Question # 17 - What should we do to gain a stronger voice on state legislative water issues?
(65%) a. Form a district or districts
(15%) b. Hire a lobbyist
(9%) c. Don't do anything
(9%) d. Other
(3%) e. No Answer

Question # 18 - What institution should be in place to implement needed projects?

(70%) a. Conservancy District
(18%) b. Water Special Service District(s)
(6%) c. County with more resources
(6%) d. Current system (County Water Manager)

Question # 19 - Based on the information that you have assimilated during this master plan, do you now believe water planning and infrastructure development is:
(44%) a. More important
(0%) b. Less important
(56%) c. I feel the same
(0%) d. Other

Question # 20 - Based on feedback given by water entities in a survey conducted in 2007, Cache County learned that there is a desire to protect the allocated 60,000 acre feet for future needs. After going through this process, do you think the preservation of that allocation is:
(6%) a. Less important
(38%) b. Just as important
(12%) c. More important
(44%) d. Absolutely critical

CACHE COUNTY

Cache County Water Master Plan

Steering Committee No. 4 Meeting Minutes

4/24/2013

Cache County Water Master Plan
Steering Committee Meeting Minutes
4/24/2013

Meeting Attendees:

- Bill Young – Logan City
- Bob Fotheringham – Cache County
- Bob Oaks – Groundwater Consultant
- Bryan Dixon –Environment
- Chris Slater - J-U-B Engineers
- Clair Allen – Web Irrigation Co.
- Claudia Conder – Pacificorp
- Dan Adams – The Langdon Group
- David Rosenberg – USU
- Don Hartle- Wellsville City
- Douglas Jackson-Smith – USU
- Evan L. Olsen
- Gary Larsen – Millville City
- Jim Williamson – Spring Creek Water Co.
- Joan Degiorgio –TNC
- Jon Hardman – Mendon City
- Josh Runhaar – Cache County
- Joshua Palmer – The Langdon Group
- Kerry Schwartz – Bureau of Reclamation
- L. Bruce Karren – NCCD
- Lee Atwood – Paradise Town
- Lynn Lemon – Cache County
- Marisa Egbert – State DWRe
- Marla Trowbridge – Trenton Town Co.
- Max Pierce – Cornish Town
- Niel Allen –USU Extension
- Randy Eck – Providence City
- Scott Tripp – City Creek Irrigation
- Thad Erickson – Water User
- Todd Adams – Utah Water Res.
- Trevor Datwyler - J-U-B Engineers
- Voneene Jorgensen – BRWCD
- Will Atkin – Water Rights
- Zac Covington – BRAG

Cache County Water Master Plan
Steering Committee Meeting Minutes
4/24/2013

1. **Welcome and Introductions**
2. **Evaluation Overview (See attached meeting slides)**
    a. **Three areas of water use**
        i. Environmental water needs
        ii. Municipal
        iii. Agricultural
    b. **Objective criteria developed through stakeholder feedback**
        i. Water Supply
            1. Adequate storage
            2. Maintain existing irrigation
            3. Efficient use of resources
        ii. Implementation
            1. Collaboration – regional aspect
            2. Cost
            3. Conservation
        iii. Environment
            1. Wildlife
            2. Stream Flows
            3. Long term environmental security
    c. **Priorities**
        i. Make effective use of current water resources
        ii. Secure Bear River allocation
        iii. Increase county wide understanding of water needs
        iv. Determine management structure
    d. **Evaluation**
        i. Based on information gathered during the interviews of key stakeholders and input from the steering committee, a list of objectives was developed with associated metrics
        ii. Many projects were evaluated based on how well they meet the objectives
3. **Master Plan Recommendations** (**Given in no particular order. See descriptions on the second page of attached handout)**
    a. **Aquifer Storage and Recovery (ASR) Projects**
        i. Determine what studies need to be done first
        ii. A lot of studies need to be completed before implementing ASR at a site to verify that the hydrology and geology are good
    b. **Reservoir Development**
        i. Irrigation storage is needed now
    c. **Water Conservation Campaign**
        i. If we were to conserve 25% of municipal and industrial water between now and 2060, we would save approximately 21,000 acre feet a year (based on preliminary projections from Division of Water Resources)
        ii. The Division is finishing a few changes to some of the projections based on feedback from some of the communities

d. **Construct Secondary Water Systems**
    i. This will extend the water supply
e. **Canal Rehabilitation Program**
    i. Developing a program to rehabilitate the canals one segment at a time will make water delivery more efficient to irrigators
f. **Water Banking**
    i. When land is converted from agricultural to residential, less water is used per acre
    ii. A water bank could help utilize this water in areas of the county which are without water
    iii. About 41 square miles of agricultural land is to be converted to residential property in "Envision Cache County" study
    iv. There are other banking benefits beside just doing the conversion from ag to municipal
g. **District Organization Study**
    i. Effort to increase understanding of city council members and other government officials and the residents of the county about water issues within the County
h. **Environmental Water Needs Study**
    i. More data needs to be compiled and evaluated to quantify the environmental water needs and prioritize areas to help us maintain the quality of the environment
i. **Organizational Structure (See second page of attached handout)**
    i. Conservancy District
        1. Protects Bear River water allocation
        2. Provides a stronger voice on legislative issues
        3. Promotes water conservation
        4. Provides representation for irrigators and drinking water users
        5. May function as a water bank
        6. Facilitates cooperation between communities and irrigators for completion of regional projects
        7. Provides a funding source to plan for and help complete needed regional water projects
        8. Allows individual communities and irrigation companies to manage their own water systems
        9. Provides a local governing water board that is 100% focused on water issues
j. **Themes covered during the recommendations discussion included:**
    i. Reservoirs
        1. Could implementing conservation efforts put off the need to develop expensive reservoirs?
        2. Conservation will help but we also have some needs right now for agricultural purposes during the late summer months that require more storage
    ii. Conservancy Districts
        1. Look into the reasons why the conservancy district failed in the past. A lot of the reasons have changed
        2. Taxation without representation was an issue, legislation has changed in this aspect

3. Washington County Conservancy District is an example of a conservancy district where everyone pays in and everyone's interests are met
4. There are multiple ways you can form a conservancy district
5. In order to form one that meets all our needs a study should be done to determine what will serve us the best
6. The Water Statutory Act gives you authority to maintain your infrastructure
7. A major benefit of a conservancy district is that it allows you to plan your water for many years ahead to help protect your water

iii. Canal Improvements

1. As canals are improved, existing trees along the canals may be affected. What kind of evaporation increases would there be along the canals if there was no shade from the trees?
2. An evaluation would need to be done to identify the increase in evaporation losses

4. Recommendation/Next Steps

a. 0-5 Years

i. Conduct district organization study
ii. Evaluate environmental water demands
iii. Form a district based on results of organization study

b. 6-10 Years

i. Start water conservation program
ii. Start banking water rights
iii. ASR studies and development
iv. Planning and studies for above ground storage
v. Secondary water feasibility studies

c. 11-20 Years

i. Planning and studies for above ground storage
ii. Implement irrigation canal rehabilitation program
iii. Construct secondary water systems

d. 21-50 Years

i. Construction of above ground storage reservoirs

e. Themes covered during the recommendations discussion included:

i. Bear River Development Act

1. Covers the entire Bear River drainage basin in Utah (i.e. Logan River, Cub River, etc), not just the water in the actual Bear River
2. Legislation states that 25% of construction and environmental mitigation costs for agricultural uses will be repaid by entities contracting for agricultural water
3. We shouldn't use the "who's paying" reasoning to determine which projects are better
4. There is no stated time frame for when the allocation expires
5. The allocation stays in place but it would be better to have some organization looking over it.

6. The water is likely to be used by someone sometime
7. A plan to put the allocation to beneficial use would help protect it
8. If there's not a huge demand for the Bear River water, there is opportunity to lease water to those who may need it sooner
9. There are cities in Idaho downstream of Palisades reservoir that lease water they own in the reservoir. They use groundwater for their municipal water
10. If we don't develop and use Bear River water here, growth may occur somewhere else

ii. Existing Reservoir Dredging
1. The project team looked into the possibility of dredging some of the existing reservoirs in Logan Canyon, but very little storage could be added at those locations through dredging.

5. Review of survey results

a. Joshua Palmer gave an overview of the survey results

i. The specific projects on the survey are representative of the project types that are proposed
i. 16 steering committee members took the survey
ii. All projects received an above average score
iii. Water banking and water conservation campaign scored the highest

6. Committee Feedback on Recommendations (Themes during the discussion)

a. Recommended Schedule

i. Efforts to conserve water should start as soon as possible
ii. A district would improve conservation efforts after formation
iii. We should do what we can now to start conserving water
iv. Some of the projects might be joint projects and happen at the same time

b. Conservancy District

i. The board members were about 8 for and 2 against a district last time
ii. Dee Hansen called Cache County the best groundwater reservoir in the state, so why haven't we developed it?
iii. Maybe politically we just haven't arrived there yet
iv. In a poll before the last district election 65% of the county was for a conservancy district, then there was some controversy
v. Glad to hear there have been changes to the structure
vi. Realistically if we're going to be able to develop the water (sell, or use), we're going to have to be able to store the water
vii. If we have to raise a lot of funds the only way to do it is through a conservancy district
viii. We need to educate the public that we need a conservancy district so we can compete with the Wasatch front areas that are going to want the water in the future
ix. We need to do a better job of responding to objections
x. The County Council has too much going on to be able to focus adequate attention on the water issues

xi. Water projects and the organizational structure need to be worked on at the same time
xii. A different name like "Modern Water Conservancy District" could be used to differentiate from the water buffalo of the 50's
xiii. Put bullet points of the benefits of the water conservancy district to include in a water bill (very simplified) so people will actually read it and start thinking about it
xiv. Make an effort to include people who are opposed to a water conservancy district
xv. What are other water districts charging per person?
xvi. Timing of election is key
xvii. What is the opposition today?
xviii. Should give personal invitation to opposition to attend an open house
xix. Just the label water conservancy district raises opposition
xx. If people realize that a water conservancy district will allow Newton, Trenton, etc. to have water, we wouldn't have to be building new subdivisions in North Logan etc.
xxi. Some have the notion that a "large machine" comes with high operating costs
    1. After interviewing Jordan Valley and Weber Basin, it has been stated that they have reduced their operating expenses dramatically, so there is little funded by taxes
    2. Past opposition may have been simply that we don't need that large of a management structure
    3. Phase the approach so it's not a huge organization up front.
xxii. Cost benefit – what's it going to cost me, and how am I going to benefit?
xxiii. Educate public that our water is very precious
xxiv. The state legislature could vote in their next session and the Bear River allocation could be gone
xxv. We need to convey to the public that we need to protect the water while we can
xxvi. We don't have a majority in the state legislature
xxvii. Convey the sense of urgency - other counties are already purchasing ROW for Bear River development
xxviii. There are no agricultural people left in the Utah legislature
xxix. Cost to preserve and protect our water – there is a cost to regain our water if we lose it as well. Should put a cost to what happens if we do nothing and lose the water
xxx. Gathering information from the public about their views and using GIS to map where different views are expressed could be a good tool
xxxi. Focus on what's new, why is this needed etc. People may feel like the outcome will be the same so why even show up to vote
xxxii. We now have better information with regards to population growth projections as compared with the times when past efforts to form a district were made
xxxiii. Could look at aerial images to see what the County was like 40 years ago compared with today

c. Bear River Development

i. Bob has been attending Bear River development meetings with the other entities that are listed in the development act

ii. Development act itself needs to be included in the master plan

d. Handout Feedback

i. Too small, make it bigger
ii. Separate info into Bear River Development Act, then water master plan.
iii. Disclaimer that projects, management structures etc. aren't listed by priority
iv. List projects and recommendations in order of importance or even alphabetical so they're not prioritized
v. Change the proposed time frame to 0-5, 0-10, and 0-10 years
vi. State year of water conservation start
vii. Include cost/ac-ft for projects (magnitude)
viii. Include website and number to contact water manager
ix. Demonstrate that we know the opposition
x. List projects that conservancy districts have made possible

e. ASR

i. How many injection wells are there in the state and how successful are they?
    1. There are maybe 10 statewide
ii. Do you have to treat the water when you inject it?
    2. It depends on the water quality as well as the aquifer it's going into.
    3. A good example is Brigham City. They inject water from Mantua into their well and improve the quality of the water in the well

7. Master Plan Next Steps

a. Complete master plan draft

b. Present master plan to County Council in work session

i. We are considering going before the council on May 28th but nothing is scheduled yet
ii. Steering Committee would like to know when the County Council work session will be held

c. Integrate council comments

d. E-mail a copy of the draft report or post it on the ftp site for steering committee review

e. 20 day comment period on draft after release for steering committee

f. Final Revisions

g. Release Final Master Plan

CACHE COUNTY WATER MASTER PLAN

RECOMMENDATIONS

THE PURPOSE of the Cache County Water Master Plan is to evaluate existing water resources and demands, determine future demands, and educate and build consensus to create a plan for the future. The following recommendations are based on feedback from several municipal, irrigation, environmental and state representatives combined with technical analysis.

AREAS OF FOCUS

- Environmental
- Municipal
- Agricultural

PRIORITIES

WATER
Management Structure

INCREASE
County-Wide Understanding of Water Needs

W.I.S.E.

SECURE
Cache County's Bear River Allocation

EFFICIENT
Use of Current Water Resources

RECOMMENDATIONS

- Conservancy District
- Aquifer Storage & Recovery (ASR)
- Reservoir Development
- Water Conservation Program
- Public Education
- Water Banking
- Environmental Studies

RECOMMENDATIONS:

PROJECTS:
- ASR Projects
- Reservoir Development
- Water Conservation Campaign
- Public Education Campaign
- Construct Secondary Water Systems
- Canal Rehabilitation Program
- Water Banking

STUDIES:
- District Organization Study
- Environmental Water Demands Study

ORGANIZATIONAL STRUCTURE:
- Conservancy District

DETAILS ON BACK

PROJECTS:

Aquifer Storage and Recovery (ASR) Projects: ASR stores excess spring runoff water in the ground to be removed for use during dry periods.

- Uses and protects allocated Bear River development water (5,000 to 20,000 acre feet)
- Supplements ground water
- Less costly than storing water above ground
- Provides additional water supply for many communities and irrigators

Some sites that could be used for ASR are located near the mouth of Green Canyon, in the Logan Island area, near Providence Canyon, and in Millville along the foothills.

Reservoir Development: Build above ground reservoirs to store excess spring runoff water. Reservoirs are used to meet late season irrigation needs for areas that are currently irrigated, environmental needs and future drinking water needs.

- Uses and protects allocated Bear River development water (Up to 60,000 acre feet)
- Provides additional water supply for many communities and irrigators
- Increased late summer flows for habitat in rivers downstream of the reservoirs

Water Conservation Campaign: Campaign to reduce water use in the county by 25% by year 2060. Efforts may include holding large water user workshops to promote conservation.

- Saves 21,000 acre feet of water per year in Cache County by year 2060
- Conserves energy

Construct Secondary Water Systems: Install pressure irrigation pipes from existing canals to homes that are using drinking water for the watering of yards. Promote secondary water systems for areas that are developed in the future.

- Allows for existing drinking water systems to serve more future growth demands on potable water

Canal Rehabilitation Program: Line, pipe, or restore prioritized segments of existing canals each year.

- Benefits many water entities
- Creates more efficient delivery of water to irrigators

Water Banking: A water bank is an institution or part of an institution with a goal to move water to where it is needed most within a given region. For example, in Cache County agricultural land is being developed. Once a piece of agricultural property is developed, less water is needed to meet the demands of that land. The unused water runs down the rivers and out of the County. The rights to that water could be banked for another water user in the region to buy or lease.

- Protects Bear River allocation rights
- Keeps existing water rights for use in Cache County
- Maintains future supply of water rights for Cache County residents
- Helps water users more easily understand the worth of water

STUDIES:

District Organization Study: Meet with county and city leaders and local state representatives to present findings of the master plan and present options to form a district. May also include open houses, and town hall meetings to answer questions and find out concerns. Evaluate possibility of forming a district and options for formation of a district.

- Informs local leaders and county residents of the Cache County water situation and future needs
- Builds consensus for future water institutional structure

Environmental Water Demands Study: Locate and prioritize wildlife habitat areas and their water demands.

- Helps maintain or improve the quality of our environment
- Helps maintain or improve wildlife habitat

ORGANIZATIONAL STRUCTURE:

CONSERVANCY DISTRICT

An organization created for the purpose of providing the conservation and development of water on a regional level.

- Protects Bear River water allocation through planning and development
- Provides a stronger voice for Cache County on water legislation issues
- Promotes water conservation
- Provides representation for both irrigators and drinking water users
- May function as a water bank
- Facilitates cooperation between communities and irrigation companies to complete regional projects
- Provides a funding source to plan for and help complete needed regional water projects
- Allows individual communities and irrigation companies to manage their own water systems
- Provides a local governing water board that is 100% focused on water issues

NEXT STEPS:
Years from now

0-5

Conduct district organization study
Evaluate environmental water demands
Form a district based on results of organization study

6-10

Start water conservation program
Start banking water rights
ASR studies and development
Planning and studies for above ground storage
Secondary water feasibility studies

11-20

Planning and studies for above ground storage
Implement irrigation canal rehabilitation program
Construct secondary water systems

21-50

Construction of above ground storage reservoirs

This schedule is an estimate and could change based on funding availability and other factors.

Appendix 2-D

Reports to County Council

Summaries for three updates to the council on the master plan progress.

i: Cache County Council Meeting Notes –May 2012

ii: Cache County Council Meeting Notes –July 10, 2012

iii: Cache County Council Meeting Notes –December 11, 2012

CACHE COUNTY
WATER MASTER PLAN

Cache County Water Master Plan-May 29, 2012

- Working with Bob Fotheringham for the past three or four months on the Master Plan. The Plan will be completed next summer.

PURPOSE

- Outline how to utilize and conserve water resources in the County as efficiently as possible now and in the future.

GOALS

- Evaluate existing and future water resources and demands
- Educate and build consensus
- Create a plan for the future
- Recommend methods to manage water resources in the county

BEAR RIVER

- The Bear River Development Act passed in 1991 gave direction for the Division of water resources to "develop the surface waters of the Bear River and its tributaries."
- How should the Bear River water resource be used/developed in Cache County and how should it be managed?

CURRENT PROJECT STATUS

- Gathering information
    - Stakeholder interviews (Stakeholder Input)
        - Current needs and challenges
        - Future needs and practices
        - Bear river development
        - How should water be managed in Cache County?
    - DWRe compiling the current and future water resource and demand information. Technical Supply and demand data)
        - I talked to Todd Adams today, they have collected the current 2010 individual water system water use information and will have the current report done very soon.
        - The water use projections will be based on the projections in the 2010 census projections that will come from the Association of Bovernment and will then be given to the GOPB. That will be done sometime around the middle of July.

FUTURE STEPS

- Create a plan for the future through an analysis of alternatives based on future projected shortages, stakeholder input and by evaluating alternatives using a weighted criteria matrix.

- We will have key stakeholder meetings about every three months to evaluate alternatives and options moving forward.
- Based on the key stakeholder input and technical data, we will develop a recommendation for the organizational structure needed to manage water resources in the county and to gain a greater voice with the state legislature on water issues

SCHEDULE

- Key stakeholder meetings and presentations to the County Council to be held quarterly throughout the master plan.
- Recommendations – March 2013 to April 2013 Review recommendations with stakeholders - culinary water systems, irrigation systems, county council)

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Memo

CACHE COUNTY WATER MASTER PLAN

To: Cache County Council

From: Chris Slater

CC:

Date: 7-10-12

Re: CCWMP – Progress Update

The Cache County Water Master Plan (CCWMP) is progressing. We have completed interviews with 37 project stakeholders to gather feedback with regards to water issues in Cache County. The interviews focused on understanding the stakeholder's needs, priorities and feelings with regards to the following four areas:

- Past and current water challenges and water situation
- Projected future water needs and water improvement strategies
- Bear River Development Act
- Management of water in Cache County

Some general themes that have come from the interviews are:

- There is not enough current irrigation water storage
- Many of the communities on the west side of the valley have more water challenges than the communities on the east side
- There is a need for a greater understanding of the Bear River Development Act
- Cache County needs to have a stronger voice on water issues

We are now organizing a steering committee made up of many of the people that were interviewed along with some other stakeholders identified through the interview process. This steering committee will meet four times over the next year at master plan milestones to establish group goals and provide feedback. The four meetings are planned as follows:

1. **Kickoff Meeting -** Overview of the 37 stakeholder interviews (cities, irrigators and others)

2. **Technical Meeting -** Review Division of Water Resources Supply and Demand Forecasts

3. **Problem Solving Session -** Prioritize future efforts and outline water strategies

4. **Review of Draft Water Master Plan –** Gather feedback from the steering committee on the final Master Plan

The kickoff meeting will be held in the Cache County Administration Building in the large room on the first floor. The meeting will be Wednesday July 18th, from 11:00 am to 1:00 pm. We want to invite one or two County Councilman to attend our steering committee meetings.

Please let us know if you have any questions.

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Memo

CACHE COUNTY WATER MASTER PLAN

To: Cache County Council

From: Chris Slater

CC: Bob Fotheringham

Date: 12-11-12

Re: CCWMP – Progress Update

The Cache County Water Master Plan (CCWMP) is progressing. We last came before the council in July to tell you a little about the plan and a steering committee that has been formed to provide guidance as we complete the master plan. The steering committee is made up of representatives from the communities, the irrigation companies and other key water experts in the county. The steering committee has now met twice and will meet again in January or February.

The steering committee first met on July 18, 2012 and:

- Identified the roles and responsibilities of the committee
- Set ground rules for communication
- Set goals - The goals of the committee are to provide guidance for:
    - Determining how to confront future water challenges and opportunities
    - Planning of future reports, actions and projects
    - Identifying the organizational structure to manage water in the County
    - Educating and building consensus with stakeholders
- Reviewed key themes that came from key person interviews

- Received input from the steering committee. Some of the input helped us identify things that should be discussed at the second meeting including:

    - Bear River Water Development
    - Water Management Options

The second steering committee meeting was held on October 25, 2012. The following items were part of the meeting.

- Review of preliminary water supply and demand data from the Division of Water Resources (DWRe)

    - Governor's office of planning and budget has changed the population projections for Cache County. We are currently working with Bear River Association of Governments and the Division of Water Resources to update the projections county wide and then community by community.

- Bear River development update from DWRe, Eric Millis

- Expert panel to answer questions about water management options. The panel was made up of:

    - Tage Flint (General Manager – Weber Basin Water Conservancy District)
    - Mark Anderson (Attorney for Utah Association of Special Service Districts)
    - Voneene Jorgensen (General Manager – Bear River Water Conservancy District)
    - Legrand Bitter (Executive Director of Utah Association of Special Service Districts)

At the third steering committee meeting we will:

- Hear an updated report from DWRe on the water supply and demand projections.

- Talk about water strategies to implement to help meet the future needs

- Learn more specifically about:
    - Aquifer Storage and Recovery (ASR)
    - Bear River Development
    - Water Banking
    - Public Education

- Conduct an instant poll of the steering committee members to see how they feel about some key issues after completing three of our committee meetings.

We will hold a fourth steering committee meeting this spring. The meeting will be used to present a draft master plan to the committee and receive feedback on the draft conclusions and recommendations.

More detailed information about the master plan and the steering committee meetings can be reviewed by accessing an ftp site using the following information:

Site: ftp://ftp.jub.com
Username: CCWMP
Password: MasterPlan1

Appendix 2-E

Additional Meetings

Presentation slides from two Northern Utah Mini Water Conference presentations and notes from two meetings held with USU staff members.

i: Northern Utah Mini Water Users Conference Presentation 2012

ii: Northern Utah Mini Water Users Conference Presentation 2013

iii: USU Staff Meeting November 7, 2012

iv: USU Staff Meeting November 30, 2012

CACHE COUNTY
WATER MASTER PLAN

Cache County Water Master Plan

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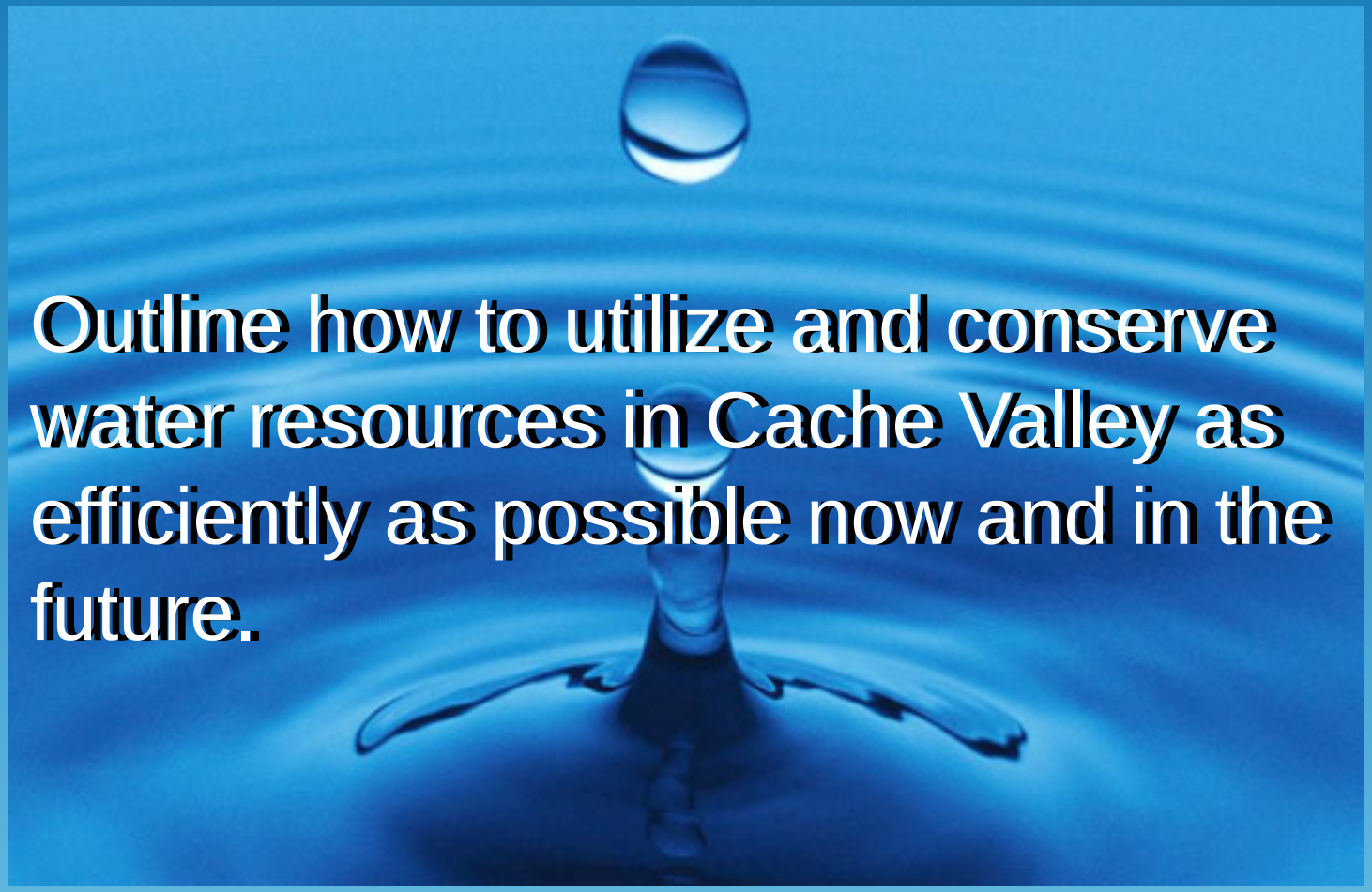
Cache County Water Master Plan

Discussing Water Rights…. A Western Pastime

MASTER PLAN PURPOSE

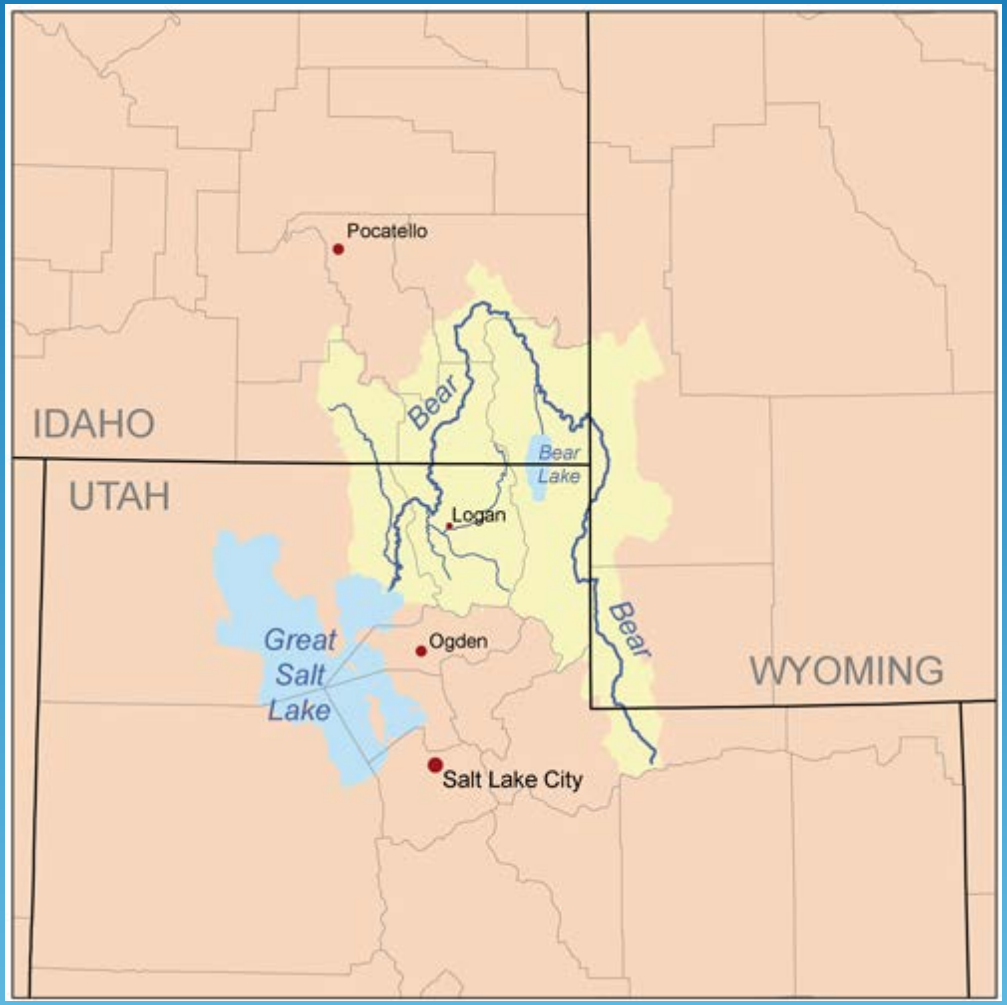


Outline how to utilize and conserve water resources in Cache Valley as efficiently as possible now and in the future.

MASTER PLAN GOALS

- Evaluate existing water resources and demands
- Determine future water demands
- Educate and build consensus
- Create a plan for the future
- Recommend methods to manage water resources in the county

BEAR RIVER: An Important Resource



MASTER PLAN SCHEDULE

March - June 2012

- Gather resource data
- Stakeholder interviews

June 2012 – February 2013

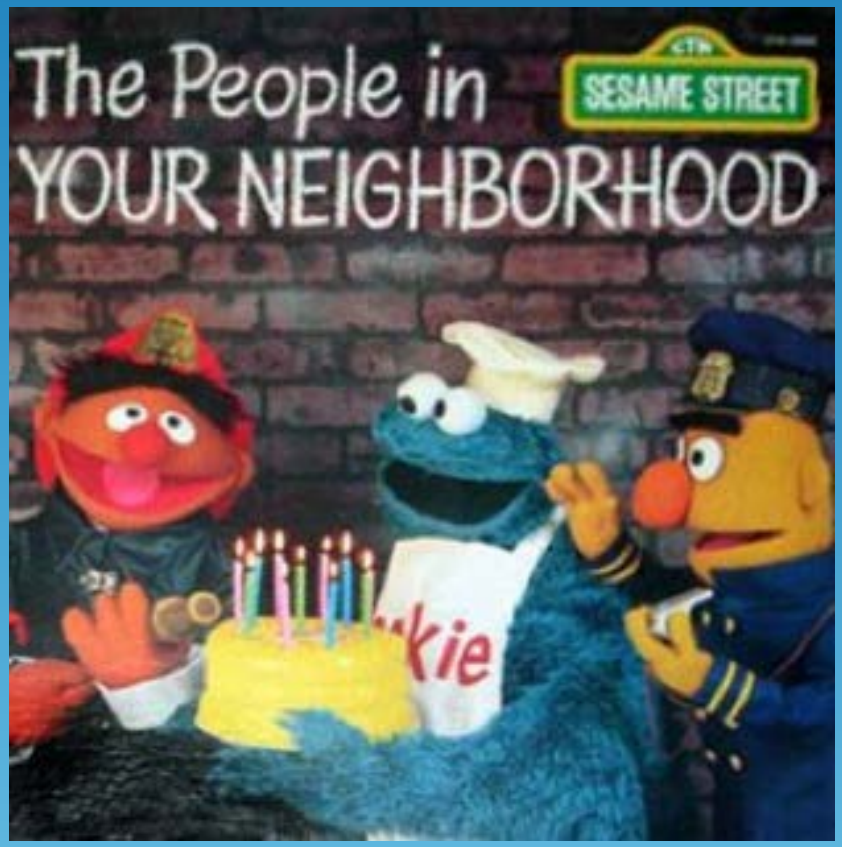
- Analysis of alternatives using objective criteria

March – April 2013

- Review recommendations

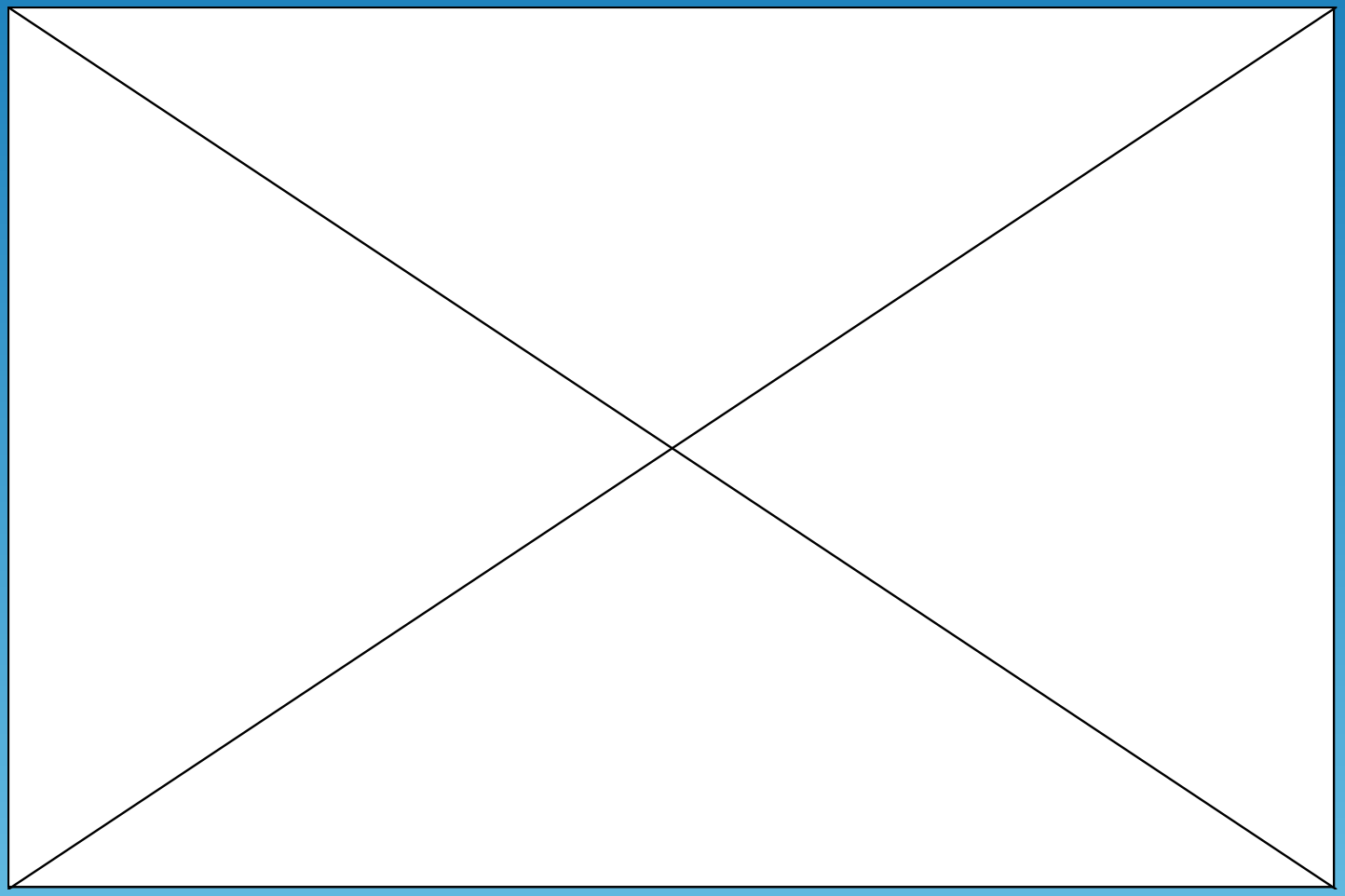
Water Panel

Who Are



?

Is the Glass Half Full or Half Empty?

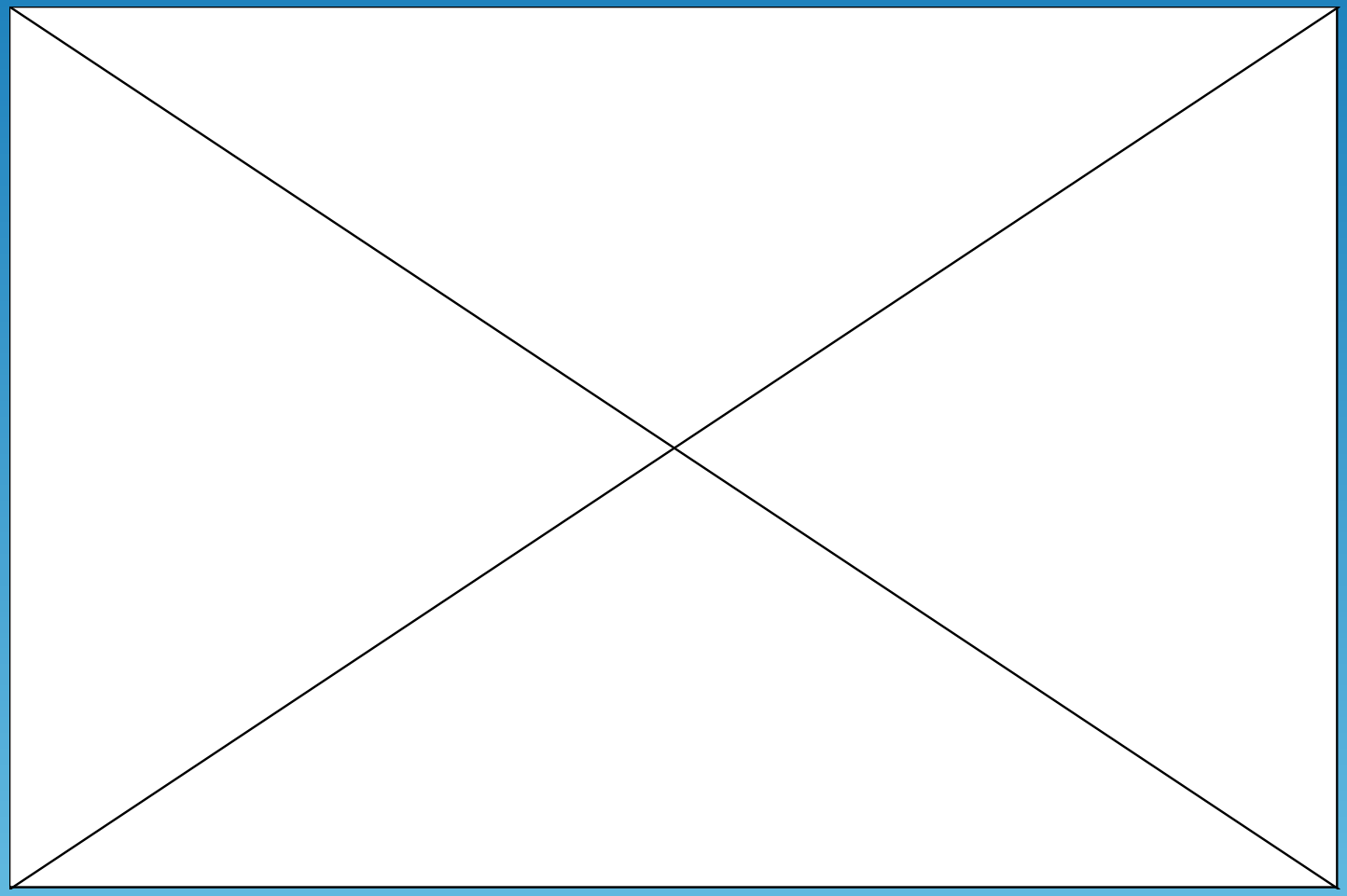


Priorities Discussion

What are the biggest challenges to water stability in Cache County within the next 20 years?

What are the solutions to these challenges?

What factors do you think will play the greatest role in water stability over the next 20 years?



Key Questions To Consider

- How should Bear River water be developed in the future?
- How can we build consensus among water users?
- How can we be heard by the state legislature on water issues that are important to us?
- How can water improvements be funded?

Thank You!

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Northern Utah Mini Water Conference

April 4, 2013

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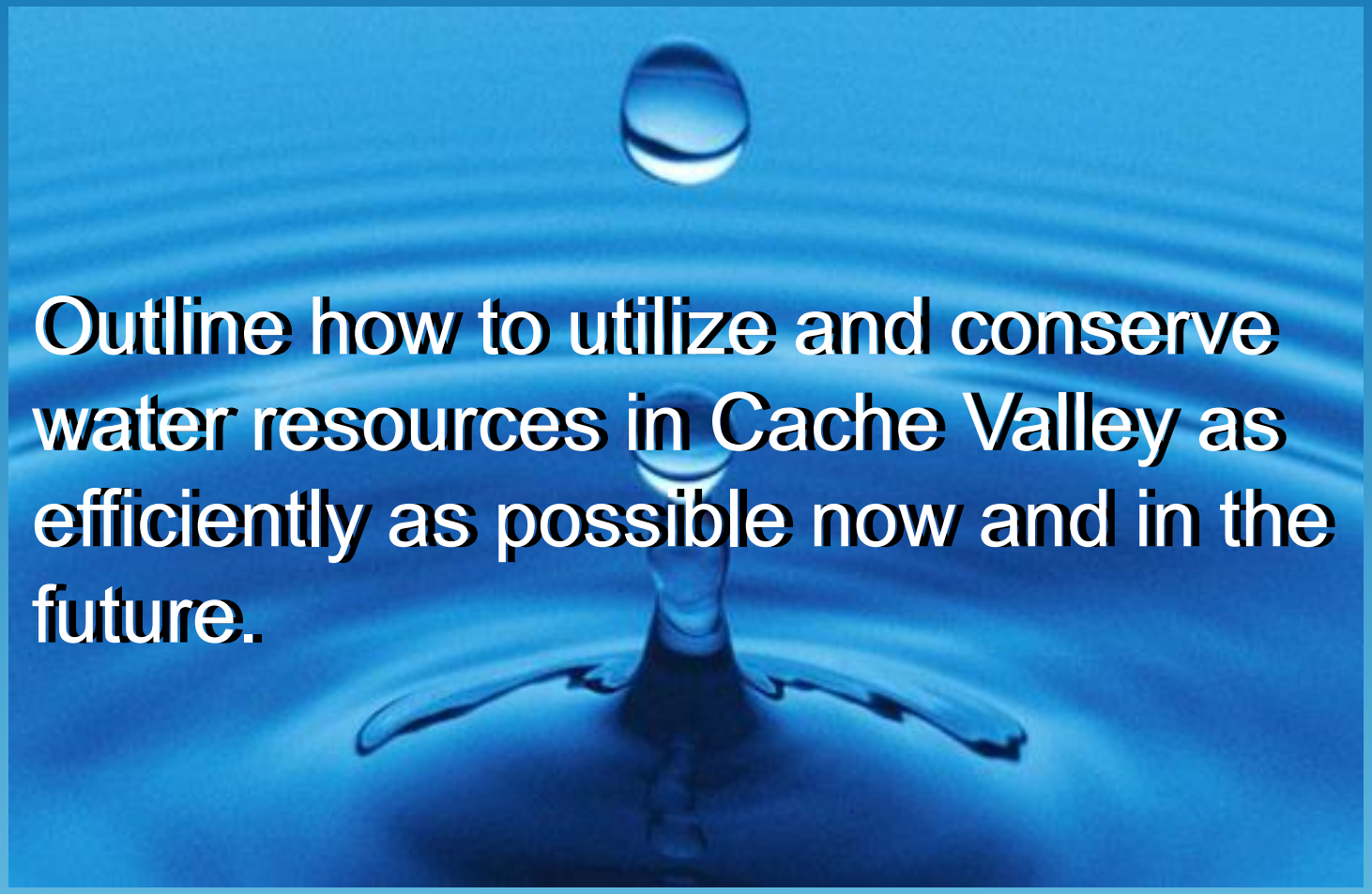
MASTER PLAN PURPOSE



Outline how to utilize and conserve water resources in Cache Valley as efficiently as possible now and in the future.

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Efficient Use of Water Resources

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MASTER PLAN GOALS

- Evaluation of water supply and demands
- Educate and build consensus
- Create a plan for the future
- Recommend methods to manage water resources in the county

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MASTER PLAN PROCESS

- Evaluate existing water resources and demands
- Stakeholder involvement
  - Interviews
  - Formation of steering committee

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KEY OBJECTIVES

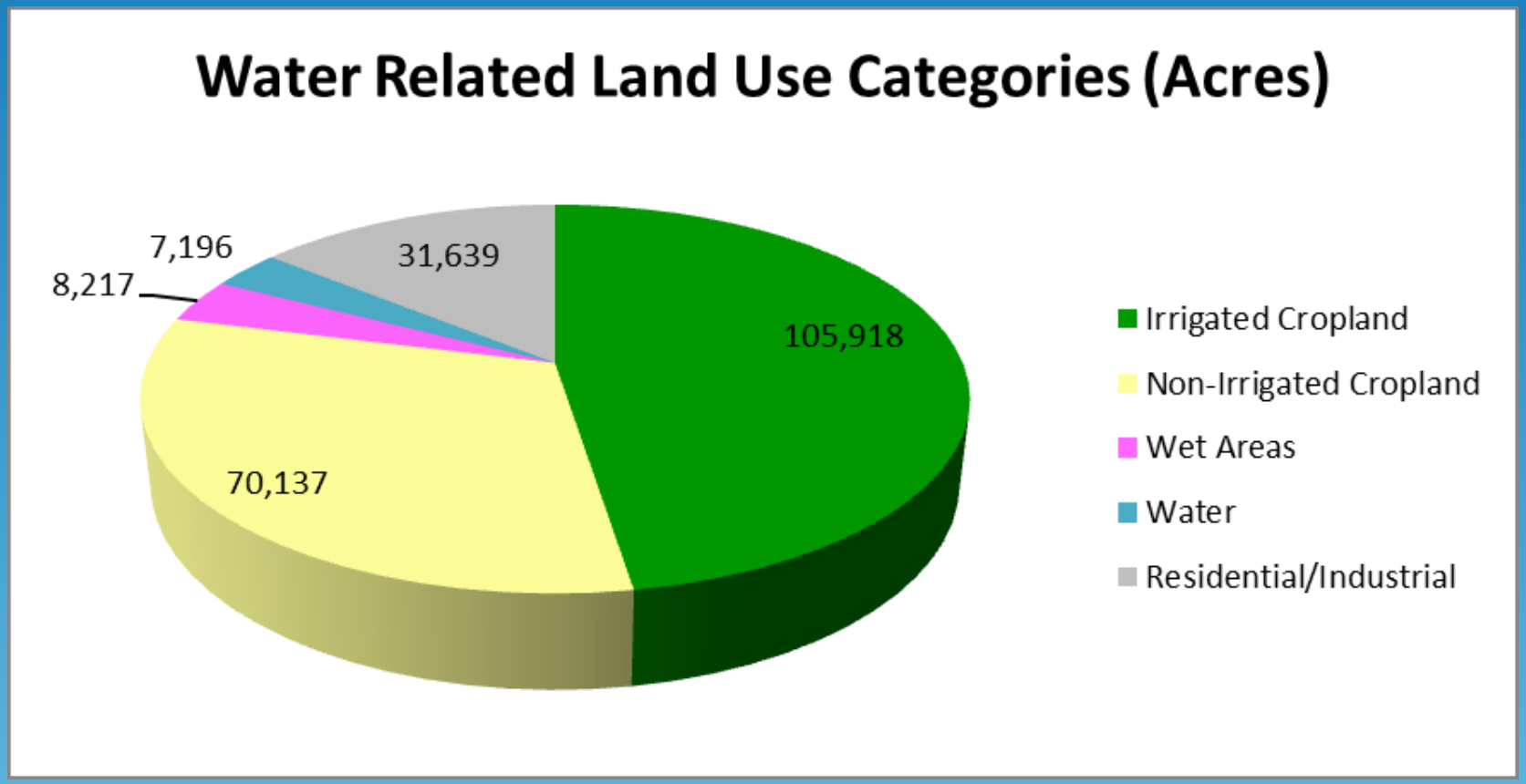
- Provide reliable water supply
- Protect Bear River allocation
- Promote collaboration
- Educate the public
- Protect the environment

Agricultural Water

- Provide reliable water supply
  - Agricultural

Agricultural Needs

Water Related Land Uses



Source: Division Of Natural Resources Bear River Basin 2009 Water Related Land Use Inventory

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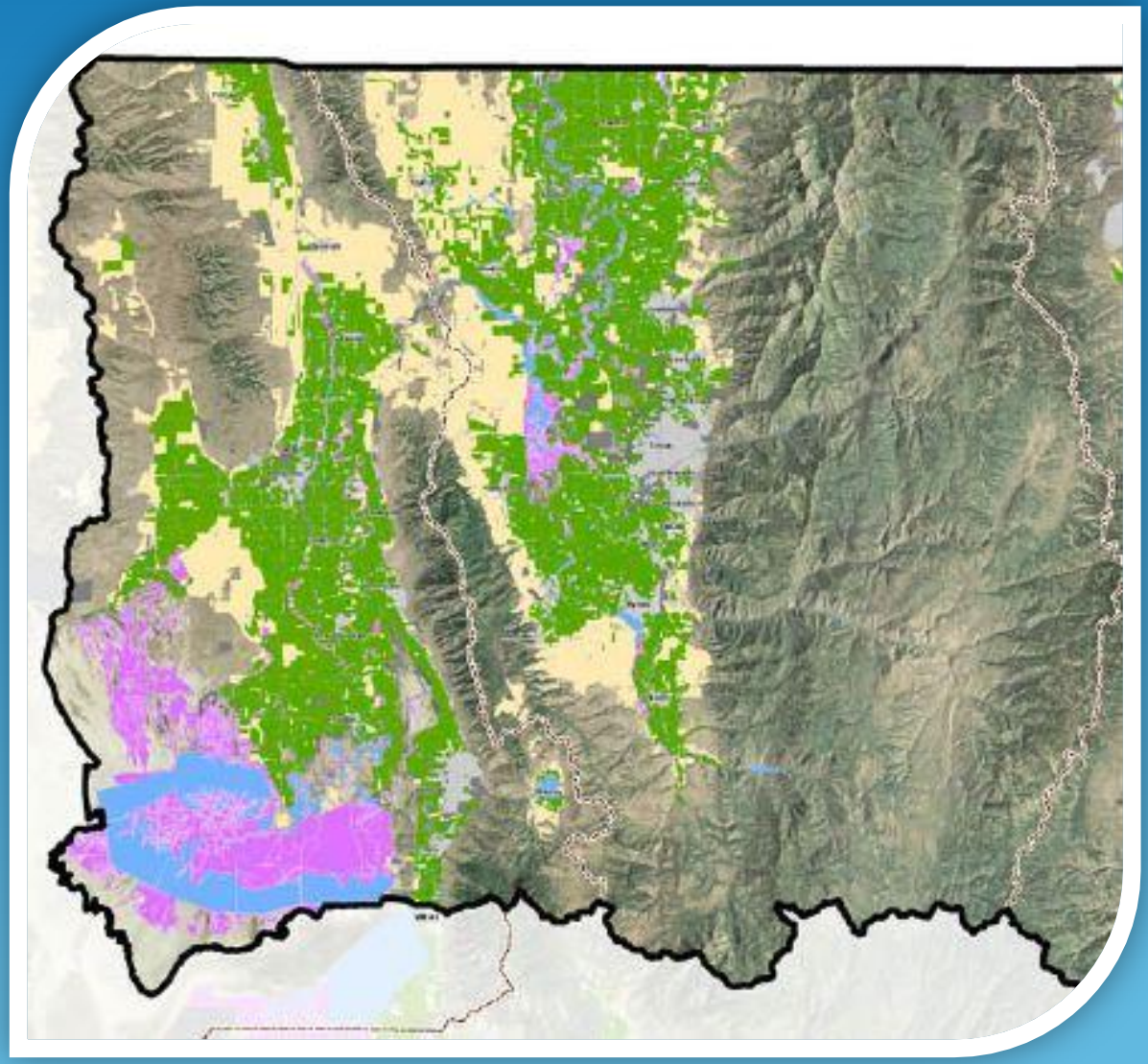
Agricultural Needs

Water Related Land Uses



Source: Division Of Natural Resources Bear River Basin 2009 Water Related Land Use Inventory

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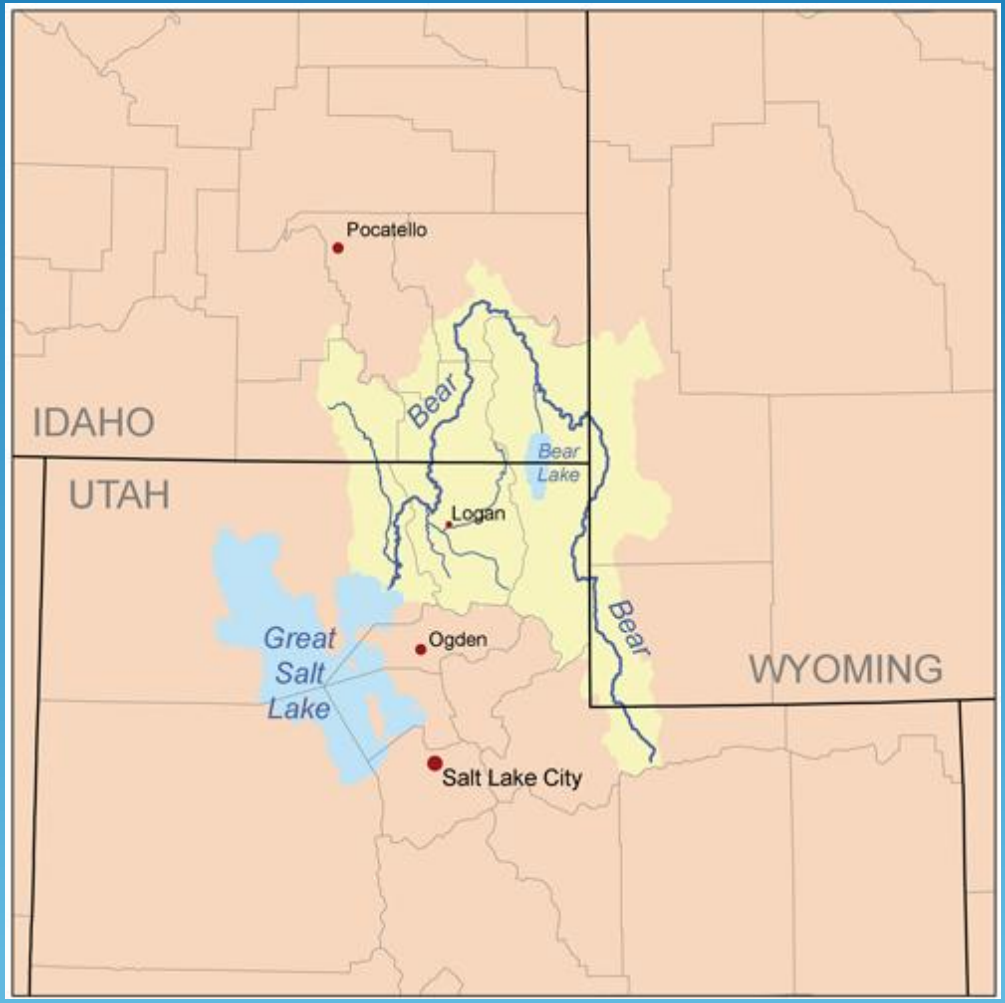
BEAR RIVER: An Important Resource



Bear River Development

Bear River Development Act Allocations (Acre-feet)	
Bear River Conservancy District	60,000
Jordan Valley Water Conservancy District	50,000
Weber Basin Water Conservancy District	50,000
Cache County and any water conservancy district in Cache County	60,000

Bear River Development

- Plans for Bear River development are being made now
- Entities contracting for agricultural water pay 25% of construction and environmental costs
- Project costs allocated to recreation, fish and wildlife, and flood control shall be paid entirely by the state.

Advantages of More Developed Bear River Water

- Maintain stream flows
- More crop production in late times of agricultural season
- More secure water supply to meet future needs
- Maintain or improve environmental quality in Cache County
- More flexibility and options to control where new growth occurs

Thank You!

Cache County Water Master Plan – USU Staff Update Meeting

November 7, 2012

Group Discussion

- Environmental Demands
  - Key Points
    - Beneficial use should not just be agricultural or urban
    - More key points need to be developed around environmental demand
  - Action Items
    - David/Chris meet with Nancy to develop the key points
- 60,000 Acre Feet
  - Key Points
    - What is the supply/demand? What is the gap? It must be defined based on the need.
    - What is the environmental use?
    - If you don't use it, do you lose it?
    - Be specific about what the water uses are
  - Action Items
    - Chris/Bob call Todd Adams to set date for receiving DWRe information
- Climate Change
  - Key Points
    - Future water availability is uncertain
    - The plan needs to have a contingency based on climate change
    - May need to do a sensitivity analysis
  - Action Items
    - Bob find GSL committee study used to determine the effect of climate change on the Bear River
    - David will review the GSL committee study and determine if results should be incorporated
    - David will share GSL committee study with Sarah Null for additional review
    - Chris review questions about this study with Todd Adams. Find out if DWRe factors climate change in supply projections.
- Bear River Water Development Act
  - Key Points
    - Use caution about not looking too much at the planning process based solely on the BRWDA
  - Action Items
    - Study ASR
    - USU professors review the alternative evaluation matrix (to be posted to an ftp site)
- Incorporation of Existing Studies and Plans (USU, State, etc.)

    - Key Point
        - Make sure the study team is using all pertinent data from other studies
    - Action Items
        - David will research the current USU studies and see what would be pertinent to the master plan.
        - David will ask university staff members if they want to submit any previous work that has been done by the University that they feel should be reviewed, and see which studies or information are relevant to the current CCWMP
        - David continue to coordinate with USU to identify other studies or information that USU identifies as helpful to the current master plan
            - Chris to include all references that David identifies and include in the master plan
- Transparency and Ongoing USU Engagement
    - Key Points
        - University wants to have enough information to help in commenting and evaluation
        - Continue to ensure that the planning process is open and transparent so that it builds trust in the process and the data
        - Critical to continue to keep USU staff involved throughout the planning process
        - Engage USU staff with specific inquiries about specific needs so that the USU experts can help
        - Ensure that there is proper education to the public at large about components of the master plan and recommendations
    - Action Items
        - Chris post current master plan information and future information to ftp site and invite USU to review
        - Notify USU staff of the future steering committee meetings to be held at the master plan milestones
- Future Organizational Structure
    - Key Points
        - The data and needs should be studied first and this information should then drive the future organizational structure. Don't study what the organization should be first in the planning process.
        - Let the objectives guide what the management structure is (what we are trying to do in the future as Cache County residents)…
    - Action Item
        - A great master plan!
        - Create the matrix and evaluate the alternatives based on the matrix
        - Have USU staff review the evaluation matrix prior to the January 2013 meeting

Other Action Items

- Chris establish an ftp site and post master plan information
- Chris extend invitation ftp site and all available data to USU and the Steering Committee
- Cache County to create a webpage on the Cache County website that has an introduction to the CCWMP and then hosts all of the CCWMP information as well as a link to the ftp site. Chris will provide an introduction to the CCWMP for the website.

Meeting With USU 11-30-12

Environmental Needs and Demands:

What are some beneficial uses for the environmental applications, issues with climate change:

Climate change:

Bob sent out report about climate change.

Sarah: There is some "low hanging fruit" that would be a mistake to ignore relating to climate change. This may be dealing with the amount of precipitation as snowpack, and the time that runoff occurs will be earlier. Runoff is happening sooner, and we're not holding as much in the snowpack.

What does climate change do to us:

Sarah: Higher likelihood of wetter winters, more precipitation in rain, less snow. Flooding potential higher. Dries up sooner in the spring, more droughts.

How do you manage it?

Sarah: We are lucky to have groundwater storage here, because we don't have the evaporation losses. Groundwater storage is a lot nicer than building a reservoir.

The challenge with ASR is how to get the water into the aquifer. Wells are often easier to get the water into the principal aquifer. You have to treat the water before you inject it into the well. Surface spreading doesn't require treatment.

Is there a thought of more reservoirs that are smaller? Sarah: A lot of the hydro climate people are thinking a lot more micro storage reservoirs rather than a large reservoir.

So more reservoirs like out in the central part of the valley?

Have you talked to Joe Weaton about the work he has done in the Weber Basin?

Beavers creating retention in the system… Change the environment… Beaver needs wood. Relieve the trapping pressure. Reinforce the beaver dams.

Does Joe's research show that total flow out the bottom changes? Not yet.

Do you have any other thoughts on climate change? Items we could include in the water projections? Input to the division's water accounting methods. You could increase the demands to account for the increased ET rates caused by the higher temperature. You could do a sensitivity analysis to see how much things changed based on the changes.

If you could quantify the increased demands: Use WEEP to model the changes to the ET (rainfall runoff model).

Sarah has ET model running into Great Salt Lake. Maybe be able to extract useful data for Cache County.

Delta change approach. Sensitivity analysis. Set up scenario saying if we change this much, what are the effects. What changes will actually hurt us? What will the impacts be?

Ex: If spring runoff occurs 15 days earlier… what happens, what happens if 20 days earlier?... A smart user can get WEEP to tell you the sensitivity to the different variables: timing, temperature….

Say certain conditions occur, what are the adjustments we'll have to make?

Adaptively managing the watershed…. – it's hard

Avoid crises, think about change in use. – follow up on comment with Bob.

A few years ago there was a concern about not being able to deliver the water needed. They convinced farmers to shift away from the high water consumptive crop that year.

DWRe is doing this model, do we need to meet with them to see how we can implement this into their model?

Yes, but probably won't be incorporated this year. From his data, apply climate change issues, and write suggestions for the future.

Cache County and the other counties have an allocation from the legislature. If Cache County gets 60k Ac-ft, how much of it needs to be dedicated to environmental services?

What do we have right now? There are a lot of common benefits. Have riparian corridors, preserving temperature,

Protect against building right up next to the riparian areas.

Manage riparian areas to make sure they're healthy, and you can often use the same water downstream. The water quality may be even better after floating through.

Most of the Bear River corridor is private property. This will present a greater challenge for creating riparian environment.

If you identify in the WMP critical riparian areas, then you can limit building in the flood plains etc.

In 2000 is when Pacific Corp stopped the power surge drawing from the reservoirs.

You could quantify the area of land that is currently "wetland" in riparian corridors.

One of the things we've identified as an objective is "improving the environment…." How can we measure if we're improving the environment?

Surveys of user information, willingness to pay, talk about what species we're talking about – temperature tolerances, salinity tolerances… Water quality thresholds.

Riparian areas: Pole some wildlife people in, look at wildlife connectiveness. Maintain or improve the existing corridors…

A lot of GIS work is done on habitat, vegetation, etc…

Talk to Joan Dijorjio – look at the conservation plan do see what they're planning…

Dissolved oxygen is a good parameter to measure.

Mike Allred with DWQ is over monitoring the TMDL on the cutler reservoir.

Talk to Joan about metrics to use.

Fisheries – metric to measure.

Educate the public: Ways to measure if we're improving in this method:

Education rarely changes behavior. Measure the changes in behavior over time rather than the education by itself. Often it's economics that controls. Youth education is often more valuable, instilling ethics and values, awareness.

In master plan identify stormwater requirements upcoming in the future. Not till county hits 225,000 population.

Focus on a program we can participate in. (further public education etc…)

Do meaningful outreach/education, not just putting a check in the box.

Help people understand the impact of water quality, where their water comes from. Connect their water supply to the rivers…. Where does your drink come from.

If you think things might be bond funded, working in terms of education…. Teach people that if we don't do things now, it will cost more in the future.

Tie it to things they value. Fish water etc….

If you're interested in outreach campaigns let USU know because it could be a project… There used to be grants etc from the EPA, they've gone away now. A campaign could be valuable. Educating people on water is hard.

Appendix 3-A

Existing Supply and Demand

Existing Municipal and Industrial supply and demand estimates provided by the Utah Division of Water Resources (DWRe).

i: DWRe Supply and Demand Methodology and Assumptions

A summary of the methods used and assumptions made by DWRe to evaluate the municipal and industrial (M&I) water supplies and demands. The summary comes from a portion of a DWRe report prepared in November 2007 entitled "Municipal and Industrial Water Supply and Uses in the Bear River Basin."

ii: DWRe 2010 Supply and Demand Estimates

A summary of the existing M&I demand versus the supply for each of the individual water systems in the County

CACHE COUNTY
WATER MASTER PLAN

WATER SUPPLY AND USE METHODOLOGY

Background

Over the past 45 years, the Division of Water Resources (DWRe) has employed various procedures to obtain municipal and industrial (M&I) water use data. In recent years, these procedures have become more comprehensive. When the DWRe began water planning in the 1960's, available data consisted mainly of supplies and uses for the state as a whole. At that time, Utah's agricultural water uses far exceeded M&I uses. M&I water use was calculated simply by multiplying estimated per capita water use rates by census population data.

By the early 1980's, M&I diversions made up a larger percent of all statewide water uses and the entire water community increased their focus on M&I water supplies and uses. The Division of Water Rights (DWRi) and the Division of Drinking Water (DDW) launched a program to collect yearly, statewide M&I data from each public community water system. The procedure involved mailing a survey designed to query major public water suppliers about their sources of water supply. Additionally, the United States Geological Survey (USGS) began M&I water use studies. The DWRe relied on both data sources in its planning efforts by the late 1980's.

With the preparation of the State Water Plan Basin reports, and the increasing focus on water conservation, the DWRe saw the need to verify and improve the quality and quantity of the available data. The first method used included assisting the DWRi and the DDW in the improvement of their M&I data collection program. Currently, the collection of water use data is a joint effort between all three divisions, administered by the DWRi. Additionally, the DWRe began verifying the accuracy of the data through yearly field surveys, as described in the following four sections.

Data Collection Methodology for Public Community Water Systems

Each year, the DWRe targets several hydrologic basins for M&I water supply and use analysis. The most recent water use information supplied by the DWRi is the basis used to begin the study. Prior to 2003, this information was submitted using a standard form by each water supplier. An example of the water use data form for Enoch is found in **Appendix A**. Since 2003, the program has been updated, allowing for the water suppliers to electronically submit their data.

The DWRe staff contact the manager or operator of each community water system (as defined by the DDW) to schedule a data collection and analysis meeting. These meetings are necessary because data often is not reported (either on the water use forms or electronically) in the detail required for a complete M&I water use study. During these meetings, staff clarifies and collects additional data as needed. Total water supply and usage of the water systems are calculated based on information gathered during these meetings. When data is not available, it is necessary to estimate a part or all of the system use.

A secondary objective of these meetings is to instruct the operator or manager on how to most accurately and effectively complete the water use data form and/or submit their information electronically. This methodology has been used since 1992.

Water Supply

Potable Water

Two factors define the potable water supply for public community water systems: maximum developed potable water supply available under present conditions and reliable potable water supply. The maximum developed potable water supply available under present conditions is defined as the water resource that is presently being utilized. It is limited by a mechanical constraint (such as pump capacity or pipe size), a hydrologic constraint (such as reliable stream flow or groundwater safe yield) or a legal constraint (such as a water right or legal contract).

The lesser amount of water supply, due to these three constraints, is considered to be the maximum developed potable water supply available under present conditions used in this analysis.

The determination of well pump capacities, average annual spring flow estimates, treatment plant capacities, and water right information aid in the calculation of this value. It should be noted that, due to the complexity of water rights, contracts, exchanges, etc., a detailed search of water right limitations associated with each entity is not within the scope of this study.

The reliable potable water supply is defined as the capacity to meet peak day demands, expressed as an annual volume. It is valuable in determining future water supply capacities of the particular community water system sources (wells, springs, etc.). **The reliable potable water supply is calculated by adding together the maximum developed water supply capacity of surface sources, one-half of the maximum yield of wells or their pump capacities (unless otherwise indicated by the system manager), and a percentage of the average annual flow of spring sources.** The percentage of the spring source flows range between 50% and 100%. The determination of the percentage is based on information provided by the water supplier.

On page 12, **Figure 4** graphically presents the relationship between the maximum developed potable water supply and the reliable potable water supply of a system. By quantifying the maximum developed and the reliable potable water supply of a system, the total population that a system may potentially support can be determined. The current total yearly water use is the volume under the lower curve (*Present Water Use Pattern*). The future total yearly water use is the volume under the upper curve (*Future Water Use Pattern*). The latter volume is equivalent to the reliable developed potable water supply.

The maximum developed potable water supply under present conditions is the volume under the upper line (*Maximum Water Supply*) in **Figure 4**. This amount is a

theoretical annual volume based upon a maximum daily flow rate (limited by the water right or system capacity). Consequently, the peak day demand point on the future water use curve (*Future Peak Day Demand*) cannot exceed this upper limit. Due to the fluctuating nature of some sources (particularly springs), and the fact that most culinary water system storage tanks are designed to store only about one day of water demand, not all of the total maximum developed potable water supply is available to meet future water needs.

It is important to note that the reliable potable water supply is a theoretical annual volume based upon the current daily peak demand flow rate of any one system, under its current demand conditions. Additional supply may be made available by lowering and/or increasing the size of existing well pumps, pumping existing wells for longer durations, increasing storage capacity and/or distribution pipe sizes. However, being based only on current conditions, these systematic changes may cause operational problems during times of peak demand. Therefore, the DWRe uses the reliable potable water supply only as a reference tool to quantify the annual amount of water that can be delivered by each community water system.

For planning purposes, the reliable potable water supply is essential for estimating what population base each system can theoretically support with current demand patterns. It is also a guideline to help predict the approximate timing of future system improvements in order to meet any increase in demand.

Secondary Water

Deliveries of non-potable (secondary) water are an important component of the water use within the boundaries of public community water systems. However, quantifying the available supply of this water is difficult. In Utah, many of the secondary water systems are part of a larger agricultural irrigation system. Hence, the theoretical supply includes both agricultural and M&I water. Currently, separating M&I secondary from agricultural water is mostly estimated, due to the lack of and/or absence of metering, particularly at the level of individual property connections.

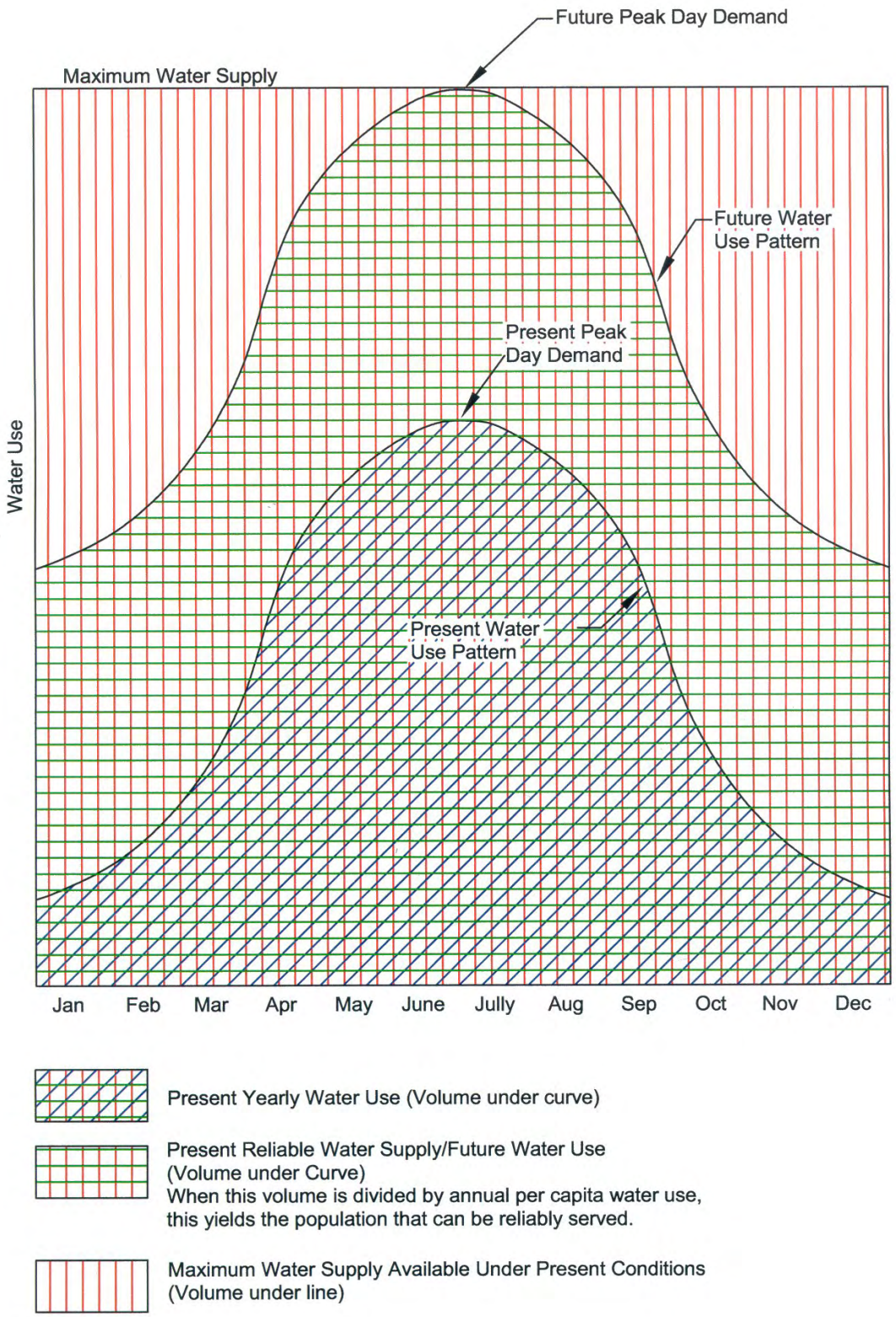


Figure 4. Water Supply and Use Hydrograph

With secondary water use becoming more prevalent for outdoor landscaping, estimating the available supply of this water is becoming increasingly more important. **For planning purposes, the DWRe assumes that the supply for M&I secondary irrigation is simply equal to the current use.**

Water Use

Present water use, as defined herein, is the developed water supply that is actually delivered by the distribution system from surface or subsurface sources. Water use is divided into four categories: residential, commercial, institutional and industrial.

Residential

The staff collects data about the number of residential connections and the amount of water used by those connections from a water system representative. Water use in this category is divided into three subcategories: culinary-outdoor, culinary-indoor, and secondary-outdoor. While most systems will meter the total culinary residential water use, indoor and outdoor use are rarely metered separately. Secondary water use is rarely metered. Therefore, the DWRe usually estimates these subcategory totals.

Typically, culinary indoor use will be estimated first. One method to estimate the indoor use is to review residential meter reading totals for the system from the winter months, if available. Since outdoor watering typically does not occur during the winter months, it can be assumed that the water used in winter months is for indoor use only. The winter water use is then used to determine the total yearly indoor use.

When the above method does not yield a reasonable value for indoor use, the per capita indoor water use for a system can be estimated by using an equation that was developed in a detailed residential study, “Identifying Residential Water Use”,

completed by the DWRe in 2001. The mathematical equation that was developed is as follows:

$$GPCD_{Indoor} = 90.3 / P_{PH} + 42.3$$

where:

$GPCD_{Indoor}$ = gallons per capita day (per capita indoor water use)

P_{PH} = persons per household (US Census Bureau)

The total yearly indoor water use is then calculated for the system by multiplying the result of the above equation by the current population. Outdoor culinary water use can then be estimated by subtracting the total yearly indoor water use from the given total residential culinary water use.

Because very few entities meter secondary outdoor water use, the DWRe staff estimates the outdoor secondary water use by using the average lot size, percent irrigated, percent of residences that are supplied by separate secondary (pressurized and ditch) irrigation systems, water right-duty rates (volume of water required for turf growth) in the area, and other related information for each system. In determining residential secondary use, care is taken to not include irrigation water use for small pastures or farm fields that can often be found adjacent to residences, particularly in rural communities.

Commercial

For most systems, the system operator can separate metered commercial water use data from the total water use. In cases where this data is not available, or is extremely difficult to obtain, the DWRe staff attempts to estimate commercial water use by inventorying commercial businesses in the area and using published commercial water use estimates. The DDW and the Utah State Water Lab, among others, publish these estimates. In some rural communities where there are a relatively small number of commercial connections, the businesses are visited individually by the DWRe staff and asked about their water use.

Some commercial facilities use secondary water to irrigate outside landscapes. This is especially typical for commercial golf courses. Again, it is typical that secondary water is not metered. The DWRe staff estimates this use by multiplying the size of the irrigated area by a water right-duty rate or the evapotranspiration (ET) rate with assumed application efficiency percentage. The ET used is indicative of the amount of water, in inches, necessary for turf growth.

Institutional

Institutional water use is water used for city, county, state and federal government facilities, parks, municipal golf courses, schools, hospitals, churches, military facilities, as well as fire hydrant testing and other municipal losses in the water system. Because this water use is often not metered, the process to acquire this data is difficult. The system operator is asked to provide information about city facilities such as the number and size (irrigated acreage) of parks, schools, churches, and municipal golf courses. Water right-duty rates and/or the ET, with appropriate efficiencies, are used to calculate the amount of water that is needed to irrigate these areas. Estimates of leakage and water use for testing of system facilities are also included in this category.

Industrial

Industrial water use is defined as water used in the production of a product. Therefore, such commercial establishments as dairies, mink farms, and greenhouses, as well as stockwatering, are included in this category, provided a community water system serves them. Industrial water use within community water systems is calculated with the same process used to calculate commercial water use data discussed earlier.

Data Collection Methodology for Public Non-Community Water Systems

The DWRe staff attempts to contact each non-community system and/or make a personal visit to these systems. Non-community systems rarely meter their water use, so the DWRe staff estimate the annual water use. Questions are asked to determine the types of facilities on the system, population served, water source information, irrigation of outside areas, etc. This data, along with information found in water-related publications, is used to determine water use. The maximum and reliable water supplies for these systems are relatively small, often not available and are therefore not included in this study. However, for planning purposes, the DWRe assumes that the water supply for these systems is equal to their water use.

Data Collection Methodology for Self-Supplied Industrial Water Systems

Although self-supplied industries are included in the Non-Community Water Systems category as defined by the DDW, the DWRe has divided them into a separate category due to their importance. The category is equivalent to the DDW's Non-Community, Non-Transient category.

Water use is acquired for self-supplied industries by using data from the DWRi's Industrial Water Use Form and/or electronically submitted data. The DWRi collects

annual water use data from most of the major self-supplied industrial water users in the state. This data is confidential. Therefore, the data presented in this M&I study is only presented as county totals. As with other non-community systems, the maximum and reliable water supplies are often not available and are not in the scope of this study. For planning purposes, the DWRe assumes that the water supply for these systems is equal to their water use.

Data Collection Methodology for Private Domestic Water Systems

Private domestic systems are residences that are not connected to any public community or non-community water system. They are usually supplied by individual wells. To determine the water use data for this category, the population of those served by private domestic systems is estimated. This population is estimated by subtracting the population served by community water systems from the county population data acquired from the Governor's Office of Planning and Budget (GOPB). The remainder is assumed to be the population that is served by private domestic systems. The per capita water use rate for this category is assumed to be the same as the rate for the public community system residential category for that county. To determine the total water use by private domestic systems, the estimated population is then multiplied by this rate. Again, the maximum and reliable water supplies for private wells, being relatively small, are not in the scope of this study. Similarly, for planning purposes, the DWRe assumes that the water supply for these systems is equal to their water use.

DEFINITIONS OF WATER TERMS

Water is supplied by a variety of systems for many types of users. The general term supply is defined as the amount of water available. Municipalities own most of the individual water supply systems. However, in some cases the owner/operator is a private company, state or federal agency. Thus, a "public" water supply may be either publicly or privately owned and supply treated and/or untreated water.

Water Supply Terms

Maximum Developed Potable Water Supply - The annual volume of potable (culinary) water which is the lesser of the hydrologic capacity of the water source, the physical capacity of the water system, or the amount allowed by the collective water rights. (See pages 8-10 for a more detailed explanation)

Reliable Potable Water Supply - The annual volume within the maximum developed water supply that is available to meet peak demands. This is generally calculated as 100% of the maximum supply from surface water sources, 50% of the maximum yield of wells, and between 50% and 100% of the average annual spring flows. When this number is divided by the average per capita usage, the resulting number represents the theoretical maximum population that the water source can serve. (See pages 8-10 for a more detailed explanation)

Municipal and Industrial Water Supply - Includes all water (potable and non-potable) supplied for residential, commercial, institutional, light industry, and self-supplied industries. This supply is delivered by public community systems, public non-community (transient and non-transient) systems, self-supplied industrial systems, unregulated Indian water systems and private wells.

Types of Water

Potable Water – Includes water meeting all applicable Federal, State, and Local drinking water requirements for residential, commercial, institutional and industrial uses. It is also referred to as culinary water supply.

Secondary Water – Includes water not meeting safe drinking water requirements. It is also referred to as non-potable (non-culinary) water. This water is usually delivered by pressurized or open ditch systems for irrigation of privately and publicly owned landscapes, gardens, parks, cemeteries, golf courses and other open areas. Sometimes called "dual" water systems, they are installed to provide an alternative to irrigating with culinary water for these outdoor areas. Although Irrigation companies most often provide this water, public community systems may deliver this water as well. Self-supplied industries can also use secondary water for industrial processes.

Water System Categories

Public Community Water System - Provides potable and/or non-potable water by either a privately or publicly owned water system which serves at least 15 service connections used by year-round residents or regularly serves at least 25 year-round residents. Water from the public community water supplies may be used in both indoor and outdoor applications for residential, commercial, institutional, and industrial purposes.

Public Non-Community Water System - Provides potable and/or non-potable water by either a privately or publicly owned water system of one of two types: transient and non-transient. Transient systems are systems that do not serve 25 of the same non-resident persons per day for more than six months per year. Examples include campgrounds, RV parks, restaurants, convenience stores, etc. Non-transient systems are systems that regularly serve 25 of the same non-resident persons per day for more than six months per year. Examples include churches, schools and industries. This report categorizes industrial non-transient systems as self-supplied industries.

Self-Supplied Industrial System - Provides potable and/or non-potable water for use by individual privately owned industries (usually from their own wells or springs).

Private Domestic System – Provides potable and/or non-potable water from privately owned wells and/or springs for use by individual homes.

Water Use Terms

Water is used in a variety of ways and for many purposes. It is often said that water is "used" when it is diverted, demanded, withdrawn, depleted or consumed. But it is also "used" in place for such things as fish and wildlife habitat, recreation and hydropower production. **Water use in this report is defined as "delivered" water.** A table that shows the basin's M&I water deliveries and depletions is provided in **Appendix B**.

In the previous water supply section, the word "use" can be interchanged with the word "supply" to define the current demand associated with those definitions. Some additional water use terms are as follows:

Commercial Use - Use normally associated with small business operations that may include drinking water, food preparation, personal sanitation, facility cleaning and maintenance and irrigation of facility landscapes. Examples include retail businesses, restaurants and hotels.

Industrial Use - Use associated with the manufacturing or production of products. The volume of water used by industrial businesses can be considerably greater than water used by commercial businesses. Examples include manufacturing plants, oil and gas producers, mining companies, mink farms and dairies.

Institutional Use - Use normally associated with general operation of various public agencies and institutions (i.e. schools, municipal buildings, churches) including

drinking water, personal sanitation, facility cleaning and maintenance and irrigation of parks, cemeteries, playgrounds, recreational areas, golf courses, and other facilities. The amount of water used by cities for outside irrigation of public areas typically is not metered.

Residential Use - Use associated with residential cooking, drinking water, washing clothes, miscellaneous cleaning, personal grooming and sanitation, irrigation of lawns, gardens and landscapes, and washing automobiles, driveways and other outside residential facilities. Examples include single-family homes, apartments, duplexes and condominiums.

Other Water Terms

Consumption - Water evaporated, transpired or irreversibly bound in either a physical, chemical or biological process. Consumed water results in a loss of the original water supplied.

Consumptive Use - Losses of water brought about by human endeavors when used for residential, commercial, institutional, industrial, agricultural, power generation, and recreation. Naturally occurring vegetation, fish and wildlife also consumptively use water.

Deliveries - Water already within a system that is being provided to an individual connection, whether potable or non-potable and/or metered or not. The connection can be for residential, commercial, institutional, and/or industrial uses. **For the purpose of this report, the delivered water amount is equivalent to water use.**

Depletion - Water consumed and made unavailable for return to a given designated area, river system or basin. It is intended to represent the net loss to a system. The terms consumption and depletion are often used interchangeably but are not the same. For example, water exported from a basin is depletion from the basin system

but is not consumed in the basin. The exported water is available for use (consumption) in another basin or system. Water diverted to irrigate crops in a given system, but not returned for later use, is depletion. Precipitation that falls on irrigated crops is not considered a part of the supply like surface water and groundwater diversions. For this reason, precipitation falling on and consumed by irrigated crops is not considered as being depletion from the system.

Diversion - Water diverted from supply sources such as streams, lakes, reservoirs or groundwater for a variety of purposes, including cropland irrigation, as well as residential, commercial, institutional and industrial uses.

Withdrawal - Water withdrawn from supply sources such as lakes, streams, reservoirs or groundwater. This term is normally used in association with groundwater withdrawal. The terms *diversion* and *withdrawal* are often used interchangeably.

Base Year Year 2010	Population	Potable Total	Secondary Total	M I Total	Total GPCD	Reliable Potable Supply	Secondary Supply	Total Supply	Total Supply Surplus
Cache County									
Amalga Town Culinary Water System	530	661	5	666	1,122	686	5	691	25
Benson Water Culinary District	747	169	50	219	262	348	50	398	178
Clarkston Town Culinary Water	800	211	83	293	327	1,049	83	1,132	838
Cornish Town Water	290	92	44	136	420	142	44	186	50
Goaslind Spring Water Works Co.	60	6	12	18	269	394	12	406	388
High Creek Culinary Water System	129	49	2	51	352	66	2	68	17
Hyde Park City	3,830	712	340	1,052	245	1,417	340	1,757	706
Hyrum City	7,550	4,278	1,400	5,678	671	6,382	1,400	7,782	2,104
Lewiston City	1,770	711	96	807	407	1,612	96	1,708	900
Logan City	48,000	8,957	1,820	10,777	200	16,652	1,820	18,472	7,695
Mendon City Culinary Water System	1,400	171	190	361	230	356	190	546	184
Millville City Water	1,900	444	54	498	234	825	54	879	382
Newton Town Water	800	219	187	406	453	246	187	433	27
Nibley City	5,400	836	300	1,136	188	2,499	300	2,799	1,663
North Logan Water	8,250	1,435	235	1,670	181	1,727	235	1,962	292
Paradise Town	900	111	290	401	397	497	290	787	386
Providence Town Water System	7,000	2,069	100	2,169	277	4,076	100	4,176	2,006
Richmond City Corp.	2,470	700	300	1,000	361	1,388	300	1,688	688
River Heights City	1,930	516	34	550	254	2,099	34	2,133	1,582
Smithfield City	9,600	1,685	1,405	3,090	287	5,976	1,405	7,381	4,291
South Cove Water Works Co., Inc.	70	7	22	29	369	197	22	219	190
Trenton Town Corp. Water	500	165	48	213	381	225	48	273	60
Wellsville City Corp.	3,400	1,473	20	1,493	392	5,730	20	5,750	4,257
Cache County summary for Base Year 2010	**107,326**	**25,677**	**7,037**	**32,713**	**272**	**54,586**	**7,037**	**61,623**	**28,909**

Appendix 3-B

Annual Volume of Ideal Irrigation Supply

A breakdown of flood irrigated acres and sprinkler irrigated acres with estimated annual volumes of water needed for those acreages and a total ideal volume of irrigation supply needed in the County.

CACHE COUNTY
WATER MASTER PLAN

ESTIMATED ANNUAL VOLUME OF WATER NEEDED FOR IRRIGATION

	Flood	Sprinkle	Sub-irrigated	Total	Source
Agricultural Irrigated Areas (Acres)	**32,178**	**64,787**	**8,953**	**105,918**	DWRe 2009 Land use inventory
Feet of irrigation water required per year	2.50	2.50			USU Extension Service recommended Application Rates 1996
Efficiency factor	1.70	1.25			
Total water applied outside per year (Feet)	4.25	3.13			
Estimated Acre feet of Water	**137,000**	**202,000**		**339,000**	

Appendix 3-C

Identifying Environmental Water Demands

Preliminary environmental and ecological water uses fact sheet and overview of a potential pilot study to determine where rivers and riparian areas provide environmental benefits, how they are connected, and quantify the volume and timing of water needed to maintain these benefits.

CACHE COUNTY
WATER MASTER PLAN

Identifying Environmental Water Demands for Cache County

May 2013

Dr. David E. Rosenberg, Dr. Sarah Null, Dr. Nancy Mesner, Dr. Joanna Endter-Wada
Utah State University

This fact sheet lists many important environmental and ecological uses of water in Cache County, Utah and the environmental benefits derived from those uses. We overview a pilot/scoping study to determine where rivers and riparian areas provide environmental benefits, how they are connected, plus quantify the volume and timing of water needed to maintain these benefits. We also estimate the cost to undertake such a study. This type of study will be needed to sustainably and cost-effectively develop water in Cache County over the coming 50 years in ways that both protect and enhance the County's water resources and unique environmental features. The work can also simultaneously identify the environmental and economic impacts of and benefits from water development strategies proposed in the County's Water Master Plan.

Important Environmental Water Uses and Associated Benefits

Use: Provide Ecosystem Habitats

- Riparian and wetland areas
  - Wildlife habitat
  - Maintain water temperature
  - Flood damage reduction
  - Protect property (and value)
  - Recharge groundwater
  - Maintain flow during dry periods
- In-stream
  - Regulate water quality (temperature, phosphorus, nitrogen, etc.)
  - Support fisheries (sport, native)
  - Support aquatic ecosystems and habitats

Use: Support Recreation Opportunities

- Hunting
- Fishing
- Boating/water skiing
- Birding
- Hiking
- Aesthetic values

Key Questions to Answer before Developing the County's Water Resources

1. Where are environmental and ecosystem water uses located?
2. How are the locations connected physically and hydrologically? If an upstream location is disturbed, what are the effects on downstream resources?
3. How do uses intersect with nearby landowners/stakeholders?
4. What volume and timing of water are needed to maintain environmental benefits?

Suggested Pilot/Scoping Study Method to Answer the Key Questions

1. Pick a few key pilot sites where multiple environmental benefits are co-located (e.g., Bear River bottoms along the Bear River, a headwaters stream like the Logan or Blacksmith fork where the river leaves the mountains and enters Cache Valley).
2. Identify environmental water uses present at each site, connectivity, and volume and timing of water needed to maintain services.
3. Gather prior existing environmental and ecosystem data within the County (e.g., USU research in Temple fork, Logan River, Cub River, Curtis Creek, Little Bear, Bear River TMDL, Cutler Reservoir TMDL, PacifiCorp recreation study for Cutler Reservoir, etc.)
4. Use prior existing data to upscale findings from pilot sites to entire Cache County.
5. Identify locations requiring further study to improve up-scaling.

Estimated Cost for Pilot/Scoping Study: $200,000 -- $250,000.

- e.g., 3-years to support 4-6 part-time personnel
- Limited primary data collection at pilot sites

Appendix 3-D

Endangered Species List

Summary of the threatened species and the species that are listed as candidates in the State of Utah including a list for Cache County.

CACHE COUNTY
WATER MASTER PLAN

FEDERALLY LISTED AND PROPOSED ENDANGERED, THREATENED AND CANDIDATE (1) SPECIES AND CRITICAL HABITAT IN UTAH - SPECIES LIST BY COUNTY

Tuesday, April 02, 2013

County	Common Name	Scientific Name	Federal Status
BEAVER			
	California condor (4)	*Gymnogyps californianus*	Endangered
	Frisco buckwheat	*Eriogonum soredium*	Candidate
	Frisco clover	*Trifolium friscanum*	Candidate
	Greater sage-grouse	*Centrocercus urophasianus*	Candidate
	Least chub (3)	*Iotichthys phlegethontis*	Candidate
	Ostler's peppergrass	*Lepidium ostleri*	Candidate
	Utah prairie dog	*Cynomys parvidens*	Threatened
	Western yellow-billed cuckoo	*Coccyzus americanus occidentalis*	Candidate
BOX ELDER			
	Goose Creek milkvetch	*Astragalus anserinus*	Candidate
	Greater sage-grouse	*Centrocercus urophasianus*	Candidate
	June sucker (5)	*Chasmistes liorus*	Endangered
	Lahontan cutthroat trout	*Oncorhynchus clarkii henshawi*	Threatened
	Least chub (2)	*Iotichthys phlegethontis*	Candidate
	Western yellow-billed cuckoo	*Coccyzus americanus occidentalis*	Candidate
CACHE			
	Canada lynx	*Lynx canadensis*	Threatened
	Greater sage-grouse	*Centrocercus urophasianus*	Candidate
	Least chub (2)	*Iotichthys phlegethontis*	Candidate
	Maguire primrose	*Primula maguirei*	Threatened
	Ute ladies’-tresses	*Spiranthes diluvialis*	Threatened
	Western yellow-billed cuckoo	*Coccyzus americanus occidentalis*	Candidate
CARBON			
	Bonytail (2,6)	*Gila elegans*	Endangered
	Colorado pikeminnow (2,6)	*Ptychocheilus lucius*	Endangered
	Graham's beardtongue	*Penstemon grahamii*	Proposed
	Greater sage-grouse	*Centrocercus urophasianus*	Candidate
	Humpback chub (2,6)	*Gila cypha*	Endangered
	Mexican spotted owl (6)	*Strix occidentalis lucida*	Threatened

County	Common Name	Scientific Name	Federal Status
CARBON			
	Razorback sucker (2,6)	*Xyrauchen texanus*	Endangered
	Uinta Basin hookless cactus	*Sclerocactus wetlandicus*	Threatened
	Western yellow-billed cuckoo	*Coccyzus americanus occidentalis*	Candidate
DAGGETT			
	Bonytail (3)	*Gila elegans*	Endangered
	Canada lynx	*Lynx canadensis*	Threatened
	Colorado pikeminnow (5)	*Ptychocheilus lucius*	Endangered
	Gibbens' beardtongue	*Penstemon gibbensii*	Petitioned
	Greater sage-grouse	*Centrocercus urophasianus*	Candidate
	Humpback chub (3)	*Gila cypha*	Endangered
	Razorback sucker (3)	*Xyrauchen texanus*	Endangered
	Ute ladies’-tresses	*Spiranthes diluvialis*	Threatened
	Western yellow-billed cuckoo	*Coccyzus americanus occidentalis*	Candidate
DAVIS			
	Least chub (2)	*Iotichthys phlegethontis*	Candidate
	Western yellow-billed cuckoo	*Coccyzus americanus occidentalis*	Candidate
DUCHESNE			
	Barneby ridge-cress	*Lepidium barnebyanum*	Endangered
	Black-footed ferret (8)	*Mustella nigripes*	Endangered
	Bonytail (3)	*Gila elegans*	Endangered
	Canada lynx	*Lynx canadensis*	Threatened
	Colorado pikeminnow (3)	*Ptychocheilus lucius*	Endangered
	Graham's beardtongue	*Penstemon grahamii*	Proposed
	Greater sage-grouse	*Centrocercus urophasianus*	Candidate
	Humpback chub (3)	*Gila cypha*	Endangered
	Mexican spotted owl (9)	*Strix occidentalis lucida*	Threatened
	Pariette cactus	*Sclerocactus brevispinus*	Threatened
	Razorback sucker (3)	*Xyrauchen texanus*	Endangered
	Shrubby reed-mustard	*Schoenocrambe suffrutescens*	Endangered
	Uinta Basin hookless cactus	*Sclerocactus wetlandicus*	Threatened
	Ute ladies’-tresses	*Spiranthes diluvialis*	Threatened
	Western yellow-billed cuckoo	*Coccyzus americanus occidentalis*	Candidate

County	Common Name	Scientific Name	Federal Status
EMERY			
	Barneby reed-mustard	*Schoenocrambe barnebyi*	Endangered
	Bonytail (2,6)	*Gila elegans*	Endangered
	California condor (4)	*Gymnogyps californianus*	Endangered
	Colorado pikeminnow (2,6)	*Ptychocheilus lucius*	Endangered
	Greater sage-grouse	*Centrocercus urophasianus*	Candidate
	Humpback chub (2,6)	*Gila cypha*	Endangered
	Jones cycladenia	*Cycladenia jonesii*	Threatened
	Last Chance townsendia	*Townsendia aprica*	Threatened
	Mexican spotted owl (6)	*Strix occidentalis lucida*	Threatened
	Razorback sucker (2,6)	*Xyrauchen texanus*	Endangered
	San Rafael cactus	*Pediocactus despainii*	Endangered
	Southwest willow flycatcher	*Empidonax traillii extimus*	Endangered
	Utah prairie dog (10)	*Cynomys parvidens*	Threatened
	Western yellow-billed cuckoo	*Coccyzus americanus occidentalis*	Candidate
	Winkler cactus	*Pediocactus winkleri*	Threatened
	Wright fishhook cactus	*Sclerocactus wrightiae*	Endangered
GARFIELD			
	Autumn buttercup	*Ranunculus aestivalis*	Threatened
	Bonytail (2,6)	*Gila elegans*	Endangered
	California condor (4)	*Gymnogyps californianus*	Endangered
	Colorado pikeminnow (2,6)	*Ptychocheilus lucius*	Endangered
	Greater sage-grouse	*Centrocercus urophasianus*	Candidate
	Humpback chub (2,6)	*Gila cypha*	Endangered
	Jones cycladenia	*Cycladenia jonesii*	Threatened
	Mexican spotted owl (6)	*Strix occidentalis lucida*	Threatened
	Razorback sucker (2,6)	*Xyrauchen texanus*	Endangered
	Southwest willow flycatcher	*Empidonax traillii extimus*	Endangered
	Utah prairie dog	*Cynomys parvidens*	Threatened
	Ute ladies’-tresses	*Spiranthes diluvialis*	Threatened
	Western yellow-billed cuckoo	*Coccyzus americanus occidentalis*	Candidate
	Winkler cactus	*Pediocactus winkleri*	Threatened
	Wright fishhook cactus	*Sclerocactus wrightiae*	Endangered

County	Common Name	Scientific Name	Federal Status
GRAND			
	Bonytail (2,6)	*Gila elegans*	Endangered
	California condor (4)	*Gymnogyps californianus*	Endangered
	Cisco milkvetch	*Astragalus sabulosus*	Petitioned
	Colorado pikeminnow (2,6)	*Ptychocheilus lucius*	Endangered
	Greater sage-grouse	*Centrocercus urophasianus*	Candidate
	Humpback chub (2,6)	*Gila cypha*	Endangered
	Isely milkvetch	*Astragalus iselyi*	Petitioned
	Jones cycladenia	*Cycladenia jonesii*	Threatened
	Mexican spotted owl (6)	*Strix occidentalis lucida*	Threatened
	Razorback sucker (2,6)	*Xyrauchen texanus*	Endangered
	Southwest willow flycatcher	*Empidonax traillii extimus*	Endangered
	Western yellow-billed cuckoo	*Coccyzus americanus occidentalis*	Candidate
IRON			
	California condor (4)	*Gymnogyps californianus*	Endangered
	Greater sage-grouse	*Centrocercus urophasianus*	Candidate
	Least chub (3)	*Iotichthys phlegethontis*	Candidate
	Mexican spotted owl (6)	*Strix occidentalis lucida*	Threatened
	Southwest willow flycatcher	*Empidonax traillii extimus*	Endangered
	Utah prairie dog	*Cynomys parvidens*	Threatened
	Virgin River chub (3)	*Gila seminuda*	Endangered
	Western yellow-billed cuckoo	*Coccyzus americanus occidentalis*	Candidate
	Woundfin (3)	*Plagopterus argentissimus*	Endangered
JUAB			
	Greater sage-grouse	*Centrocercus urophasianus*	Candidate
	Least chub (2)	*Iotichthys phlegethontis*	Candidate
	Ute ladies’-tresses	*Spiranthes diluvialis*	Threatened
	Western yellow-billed cuckoo	*Coccyzus americanus occidentalis*	Candidate
KANE			
	Bonytail (3)	*Gila elegans*	Endangered
	California condor (4)	*Gymnogyps californianus*	Endangered
	Colorado pikeminnow (3)	*Ptychocheilus lucius*	Endangered
	Coral Pink Sand Dunes tiger beetle	*Cicindela albissima*	Proposed

County	Common Name	Scientific Name	Federal Status
KANE			
	Greater sage-grouse	*Centrocercus urophasianus*	Candidate
	Humpback chub (3)	*Gila cypha*	Endangered
	Jones cycladenia	*Cycladenia jonesii*	Threatened
	Kanab ambersnail (7)	*Oxyloma haydeni kanabensis*	Endangered
	Kodachrome bladderpod	*Lesquerella tumulosa*	Endangered
	Las Vegas buckwheat	*Eriogonum corymbosum var. nilesii*	Candidate
	Mexican spotted owl (6)	*Strix occidentalis lucida*	Threatened
	Razorback sucker (3)	*Xyrauchen texanus*	Endangered
	Siler pincushion cactus	*Pediocactus sileri*	Threatened
	Southwest willow flycatcher	*Empidonax traillii extimus*	Endangered
	Utah prairie dog	*Cynomys parvidens*	Threatened
	Virgin River chub (3)	*Gila seminuda*	Endangered
	Welsh's milkweed (6)	*Asclepias welshii*	Threatened
	Western yellow-billed cuckoo	*Coccyzus americanus occidentalis*	Candidate
	Woundfin (3)	*Plagopterus argentissimus*	Endangered
MILLARD			
	California condor (4)	*Gymnogyps californianus*	Endangered
	Frisco clover	*Trifolium friscanum*	Candidate
	Greater sage-grouse	*Centrocercus urophasianus*	Candidate
	Least chub (2)	*Iotichthys phlegethontis*	Candidate
	Western yellow-billed cuckoo	*Coccyzus americanus occidentalis*	Candidate
MORGAN			
	Canada lynx	*Lynx canadensis*	Threatened
	Greater sage-grouse	*Centrocercus urophasianus*	Candidate
	Least chub (3)	*Iotichthys phlegethontis*	Candidate
	Western yellow-billed cuckoo	*Coccyzus americanus occidentalis*	Candidate
PIUTE			
	California condor (4)	*Gymnogyps californianus*	Endangered
	Greater sage-grouse	*Centrocercus urophasianus*	Candidate
	Utah prairie dog	*Cynomys parvidens*	Threatened
	Western yellow-billed cuckoo	*Coccyzus americanus occidentalis*	Candidate
RICH			

County	Common Name	Scientific Name	Federal Status
RICH			
	Canada lynx	*Lynx canadensis*	Threatened
	Greater sage-grouse	*Centrocercus urophasianus*	Candidate
	Least chub (3)	*Iotichthys phlegethontis*	Candidate
SALT LAKE			
	Canada lynx	*Lynx canadensis*	Threatened
	June sucker (5)	*Chasmistes liorus*	Endangered
	Least chub (2)	*Iotichthys phlegethontis*	Candidate
	Ute ladies'-tresses	*Spiranthes diluvialis*	Threatened
	Western yellow-billed cuckoo	*Coccyzus americanus occidentalis*	Candidate
SAN JUAN			
	Bonytail (2,6)	*Gila elegans*	Endangered
	California condor (4)	*Gymnogyps californianus*	Endangered
	Colorado pikeminnow (2,6)	*Ptychocheilus lucius*	Endangered
	Greenback cutthroat trout	*Oncorhynchus clarkii stomias*	Threatened
	Gunnison sage-grouse	*Centrocercus minimus*	Proposed
	Humpback chub (2,6)	*Gila cypha*	Endangered
	Isely milkvetch	*Astragalus iselyi*	Petitioned
	Mexican spotted owl (6)	*Strix occidentalis lucida*	Threatened
	Navajo sedge	*Carex specuicola*	Threatened
	Razorback sucker (2,6)	*Xyrauchen texanus*	Endangered
	Southwest willow flycatcher	*Empidonax traillii extimus*	Endangered
	Western yellow-billed cuckoo	*Coccyzus americanus occidentalis*	Candidate
SANPETE			
	Bonytail (3)	*Gila elegans*	Endangered
	Colorado pikeminnow (3)	*Ptychocheilus lucius*	Endangered
	Greater sage-grouse	*Centrocercus urophasianus*	Candidate
	Heliotrope milkvetch (6)	*Astragalus montii*	Threatened
	Humpback chub (3)	*Gila cypha*	Endangered
	Least chub (3)	*Iotichthys phlegethontis*	Candidate
	Razorback sucker (3)	*Xyrauchen texanus*	Endangered
	Western yellow-billed cuckoo	*Coccyzus americanus occidentalis*	Candidate
SEVIER			

County	Common Name	Scientific Name	Federal Status
SEVIER			
	California condor (4)	*Gymnogyps californianus*	Endangered
	Greater sage-grouse	*Centrocercus urophasianus*	Candidate
	Heliotrope milkvetch	*Astragalus montii*	Threatened
	Last Chance townsendia	*Townsendia aprica*	Threatened
	Least chub (3)	*Iotichthys phlegethontis*	Candidate
	Utah prairie dog	*Cynomys parvidens*	Threatened
	Western yellow-billed cuckoo	*Coccyzus americanus occidentalis*	Candidate
	Winkler cactus	*Pediocactus winkleri*	Threatened
	Wright fishhook cactus	*Sclerocactus wrightiae*	Endangered
SUMMIT			
	Bonytail (3)	*Gila elegans*	Endangered
	Canada lynx	*Lynx canadensis*	Threatened
	Colorado pikeminnow (3)	*Ptychocheilus lucius*	Endangered
	Greater sage-grouse	*Centrocercus urophasianus*	Candidate
	Humpback chub (3)	*Gila cypha*	Endangered
	Least chub (3)	*Iotichthys phlegethontis*	Candidate
	Razorback sucker (3)	*Xyrauchen texanus*	Endangered
	Western yellow-billed cuckoo	*Coccyzus americanus occidentalis*	Candidate
TOOELE			
	Greater sage-grouse	*Centrocercus urophasianus*	Candidate
	Least chub (2)	*Iotichthys phlegethontis*	Candidate
	Ute ladies’-tresses	*Spiranthes diluvialis*	Threatened
	Western yellow-billed cuckoo	*Coccyzus americanus occidentalis*	Candidate
UINTAH			
	Black-footed ferret (8)	*Mustella nigripes*	Endangered
	Bonytail (2,6)	*Gila elegans*	Endangered
	Canada lynx	*Lynx canadensis*	Threatened
	Clay reed-mustard	*Schoenocrambe argillacea*	Threatened
	Colorado pikeminnow (2,6)	*Ptychocheilus lucius*	Endangered
	Graham's beardtongue	*Penstemon grahamii*	Proposed
	Greater sage-grouse	*Centrocercus urophasianus*	Candidate
	Humpback chub (2,6)	*Gila cypha*	Endangered

County	Common Name	Scientific Name	Federal Status
UINTAH			
	Mexican spotted owl (9)	*Strix occidentalis lucida*	Threatened
	Pariette cactus	*Sclerocactus brevispinus*	Threatened
	Razorback sucker (2,6)	*Xyrauchen texanus*	Endangered
	Shrubby reed-mustard	*Schoenocrambe suffrutescens*	Endangered
	Uinta Basin hookless cactus	*Sclerocactus wetlandicus*	Threatened
	Ute ladies'-tresses	*Spiranthes diluvialis*	Threatened
	Western yellow-billed cuckoo	*Coccyzus americanus occidentalis*	Candidate
	White River penstemon	*Penstemon scariosus albifluvis*	Candidate
UTAH			
	Bonytail (3)	*Gila elegans*	Endangered
	Canada lynx	*Lynx canadensis*	Threatened
	Clay phacelia	*Phacelia argillacea*	Endangered
	Colorado pikeminnow (3)	*Ptychocheilus lucius*	Endangered
	Deseret milkvetch	*Astragalus desereticus*	Threatened
	Greater sage-grouse	*Centrocercus urophasianus*	Candidate
	Humpback chub (3)	*Gila cypha*	Endangered
	June sucker (6)	*Chasmistes liorus*	Endangered
	Least chub (3)	*Iotichthys phlegethontis*	Candidate
	Razorback sucker (3)	*Xyrauchen texanus*	Endangered
	Ute ladies'-tresses	*Spiranthes diluvialis*	Threatened
	Western yellow-billed cuckoo	*Coccyzus americanus occidentalis*	Candidate
WASATCH			
	Bonytail (3)	*Gila elegans*	Endangered
	Canada lynx	*Lynx canadensis*	Threatened
	Colorado pikeminnow (3)	*Ptychocheilus lucius*	Endangered
	Greater sage-grouse	*Centrocercus urophasianus*	Candidate
	Humpback chub (3)	*Gila cypha*	Endangered
	Least chub (3)	*Iotichthys phlegethontis*	Candidate
	Razorback sucker (3)	*Xyrauchen texanus*	Endangered
	Ute ladies'-tresses	*Spiranthes diluvialis*	Threatened
	Western yellow-billed cuckoo	*Coccyzus americanus occidentalis*	Candidate
WASHINGTON			

County	Common Name	Scientific Name	Federal Status
WASHINGTON			
	California condor (4)	*Gymnogyps californianus*	Endangered
	Desert tortoise (6)	*Gopherus agassizii*	Threatened
	Dwarf bear-poppy	*Arctomecon humilis*	Endangered
	Gierisch mallow	*Sphaeralcea gierischii*	Proposed
	Holmgren milkvetch (6)	*Astragalus holmgreniorum*	Endangered
	Las Vegas buckwheat	*Eriogonum corymbosum var. nilesii*	Candidate
	Mexican spotted owl (6)	*Strix occidentalis lucida*	Threatened
	Shivwits milkvetch (6)	*Astragalus ampullariodes*	Endangered
	Siler pincushion cactus	*Pediocactus sileri*	Threatened
	Southwest willow flycatcher (6,11)	*Empidonax traillii extimus*	Endangered
	Virgin River chub (2,6)	*Gila seminuda*	Endangered
	Western yellow-billed cuckoo	*Coccyzus americanus occidentalis*	Candidate
	Woundfin (3,5)	*Plagopterus argentissimus*	Endangered
WAYNE			
	Barneby reed-mustard	*Schoenocrambe barnebyi*	Endangered
	Bonytail (2,6)	*Gila elegans*	Endangered
	California condor (4)	*Gymnogyps californianus*	Endangered
	Colorado pikeminnow (2,6)	*Ptychocheilus lucius*	Endangered
	Greater sage-grouse	*Centrocercus urophasianus*	Candidate
	Humpback chub (2,6)	*Gila cypha*	Endangered
	Last Chance townsendia	*Townsendia aprica*	Threatened
	Mexican spotted owl (6)	*Strix occidentalis lucida*	Threatened
	Razorback sucker (2,6)	*Xyrauchen texanus*	Endangered
	San Rafael cactus	*Pediocactus despainii*	Endangered
	Southwest willow flycatcher	*Empidonax traillii extimus*	Endangered
	Utah prairie dog	*Cynomys parvidens*	Threatened
	Ute ladies’-tresses	*Spiranthes diluvialis*	Threatened
	Western yellow-billed cuckoo	*Coccyzus americanus occidentalis*	Candidate
	Winkler cactus	*Pediocactus winkleri*	Threatened
	Wright fishhook cactus	*Sclerocactus wrightiae*	Endangered
WEBER			
	Canada lynx	*Lynx canadensis*	Threatened

County	Common Name	Scientific Name	Federal Status
WEBER			
	Greater sage-grouse	*Centrocercus urophasianus*	Candidate
	June sucker (5)	*Chasmistes liorus*	Endangered
	Least chub (3)	*Iotichthys phlegethontis*	Candidate
	Western yellow-billed cuckoo	*Coccyzus americanus occidentalis*	Candidate

1 Candidate species have no legal protection under the Endangered Species Act. However, these species are under active consideration by the Service for addition to the Federal List of Endangered and Threatened Species and may be proposed or listed during the development of the proposed project.

2 The species occupies habitat in one or more hydrologic unit (8-digit HUC) within this county. In addition, water depletions from any portion of the occupied drainage basin may adversely affect the species or designated critical habitat of the endangered fish species, and must be evaluated with regard to the criteria described in the pertinent fish recovery programs.

3 The species is not present in this county. However, water depletions from any portion of the occupied drainage basin may adversely affect the species or designated critical habitat of the endangered fish species, and must be evaluated with regard to the criteria described in the pertinent fish recovery programs

4 This species is designated a non-essential, experimental population east of I-15 to 191, and south of I-70. Animals occurring outside the designated areas are protected as Endangered.

5 Introduced, refugia population.

6 Critical habitat designated in this county. Critical habitat shapefiles are available on http://criticalhabitat.fws.gov.

7 Critical habitat proposed in this county.

8 Non-essential, experimental population.

9 Suitable habitat occurs in southern Duchesne County, including Nine-Mile and Argyle canyon.

10 The species is not known to be present in this county, however a portion of this county is within the survey area as defined by the Utah Division of Wildlife Resources.

11 Nests in this county of Utah.

Appendix 4-A

Future Supply and Demand

i: Population Projections

Population projections for each of the communities and for the County as a whole from BRAG and the Governor's Office of Planning and Budget.

ii: Supply and Demand without Conservation

Tables that summarize the supplies versus the estimated future demands based on current per-capita water use for each community on the following years: 2010, 2020, 2025, 2030, 2040, 2050, and 2060. A countywide total is given for each decade as well.

iii: Supply & Demand Maps Without Conservation

Maps that show the water supply versus demand status for each of the M&I water systems at future points in time without improving water conservation.

iv: Supply and Demand with 25% Conservation

Tables that summarize the supplies versus the estimated future demands for each community assuming that water use per capita is reduced by 25% between now and year 2025. The following time frames are tabulated: 2010, 2020, 2025, 2030, 2040, 2050, and 2060. A countywide total is given for each decade as well.

v: Supply & Demand Maps with 25% Conservation

Maps that show the water supply versus demand status for each of the M&I systems at future points in time assuming water use per capita is reduced by 25% between now and year 2025.

CACHE COUNTY
WATER MASTER PLAN

Cache County Population Projections by Community

	Projected Population					
CITY/TOWN	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Amalga	488	540	587	603	930	1,095
Clarkston	666	696	841	983	1,162	1,369
Cornish	288	332	362	384	465	548
Hyde Park	3,833	4,930	6,214	7,552	7,673	8,454
Hyrum	7,609	9,328	11,079	12,794	15,851	19,012
Lewiston	1,766	1,777	2,186	2,555	3,487	3,833
Logan	48,174	57,057	63,943	76,658	92,987	111,717
Mendon	1,282	1,689	2,239	2,555	2,790	3,286
Millville	1,829	2,196	2,593	2,951	3,834	4,673
Newton	789	835	841	983	1,162	1,369
Nibley	5,438	8,796	14,136	15,725	18,597	21,905
North Logan	8,269	11,641	14,964	16,708	18,597	21,905
Paradise	904	1,123	1,334	1,552	1,879	2,236
Providence	7,075	9,050	11,770	13,759	16,273	19,167
Richmond	2,470	2,785	3,026	3,342	4,184	5,203
River Heights	1,734	2,088	2,152	2,258	2,557	3,012
Smithfield	9,495	12,051	15,171	18,307	19,069	21,245
Trenton	464	557	673	786	930	1,095
Wellsville	3,432	4,160	5,036	5,831	7,098	8,444
Balance of Cache	6,651	7,597	8,991	10,274	12,941	14,247
Total	**112,656**	**139,228**	**168,136**	**196,559**	**232,468**	**273,817**
Projected Annual Growth Rate		2.14%	1.90%	1.57%	1.69%	1.65%

Linear forecast based on previous 30 years percent of county population as a whole
Most recent decade in each forecast was weighted at double value
Adjustments were made based on availability of developable resources (land, water)

Conserve 0%	Population	Potable Total	Secondary Total	M I Total	Total GPCD	Reliable Potable Supply	Secondary Supply	Total Supply	Total Supply Surplus
Year 2010									
Cache County									
Amalga Town Culinary Water System	530	661	5	666	1,122	686	5	691	25
Benson Water Culinary District	747	169	50	219	262	348	50	398	178
Clarkston Town Culinary Water	800	211	83	293	327	1,049	83	1,132	838
Cornish Town Water	290	92	44	136	420	142	44	186	50
Goaslind Spring Water Works Co.	60	6	12	18	269	394	12	406	388
High Creek Culinary Water System	129	49	2	51	352	66	2	68	17
Hyde Park City	3,830	712	340	1,052	245	1,417	340	1,757	706
Hyrum City	7,550	4,278	1,400	5,678	671	6,382	1,400	7,782	2,104
Lewiston City	1,770	711	96	807	407	1,612	96	1,708	900
Logan City	48,000	8,957	1,820	10,777	200	16,652	1,820	18,472	7,695
Mendon City Culinary Water System	1,400	171	190	361	230	356	190	546	184
Millville City Water	1,900	444	54	498	234	825	54	879	382
Newton Town Water	800	219	187	406	453	246	187	433	27
Nibley City	5,400	836	300	1,136	188	2,499	300	2,799	1,663
North Logan Water	8,250	1,435	235	1,670	181	1,727	235	1,962	292
Paradise Town	900	111	290	401	397	497	290	787	386
Providence Town Water System	7,000	2,069	100	2,169	277	4,076	100	4,176	2,006
Richmond City Corp.	2,470	700	300	1,000	361	1,388	300	1,688	688
River Heights City	1,930	516	34	550	254	2,099	34	2,133	1,582
Smithfield City	9,600	1,685	1,405	3,090	287	5,976	1,405	7,381	4,291
South Cove Water Works Co., Inc.	70	7	22	29	369	197	22	219	190
Trenton Town Corp. Water	500	165	48	213	381	225	48	273	60
Wellsville City Corp.	3,400	1,473	20	1,493	392	5,730	20	5,750	4,257
Cache County summary for 2010	**107,326**	**25,677**	**7,037**	**32,713**	**272**	**54,586**	**7,037**	**61,623**	**28,909**

Conserve 0%	Population	Potable Total	Secondary Total	M I Total	Total GPCD	Reliable Potable Supply	Secondary Supply	Total Supply	Total Supply Surplus
Year 2020									
Cache County									
Amalga Town Culinary Water System	587	734	6	740	1,122	686	5	691	-49
Benson Water Culinary District	1,358	309	91	400	262	348	50	398	-2
Clarkston Town Culinary Water	836	221	86	307	327	1,049	83	1,132	824
Cornish Town Water	334	107	51	157	420	142	44	186	29
Goaslind Spring Water Works Co.	60	6	12	18	269	394	12	406	388
High Creek Culinary Water System	235	89	4	93	352	66	2	68	-25
Hyde Park City	4,926	918	438	1,356	245	1,417	341	1,758	402
Hyrum City	9,255	5,259	1,721	6,979	671	6,382	1,404	7,786	806
Lewiston City	1,781	718	97	815	407	1,612	96	1,708	893
Logan City	56,851	10,638	2,162	12,799	200	16,652	1,825	18,477	5,678
Mendon City Culinary Water System	1,844	226	251	477	230	356	191	546	69
Millville City Water	2,281	534	65	599	234	825	54	879	280
Newton Town Water	847	232	199	431	453	246	188	434	3
Nibley City	8,734	1,355	487	1,842	188	2,499	301	2,800	958
North Logan Water	11,614	2,025	332	2,357	181	1,727	236	1,963	-394
Paradise Town	1,118	138	361	499	397	497	291	787	288
Providence Town Water System	8,954	2,654	128	2,782	277	4,076	100	4,176	1,393
Richmond City Corp.	2,785	791	339	1,130	361	1,388	301	1,689	559
River Heights City	2,324	623	41	664	254	2,099	34	2,133	1,468
Smithfield City	12,184	2,145	1,788	3,933	287	5,976	1,409	7,385	3,452
South Cove Water Works Co., Inc.	70	7	22	29	369	197	22	219	190
Trenton Town Corp. Water	600	199	58	257	381	225	48	273	17
Wellsville City Corp.	4,121	1,790	24	1,815	392	5,730	20	5,750	3,935
Cache County summary for 2020	**133,699**	**31,717**	**8,762**	**40,479**	**270**	**54,586**	**7,056**	**61,642**	**21,162**

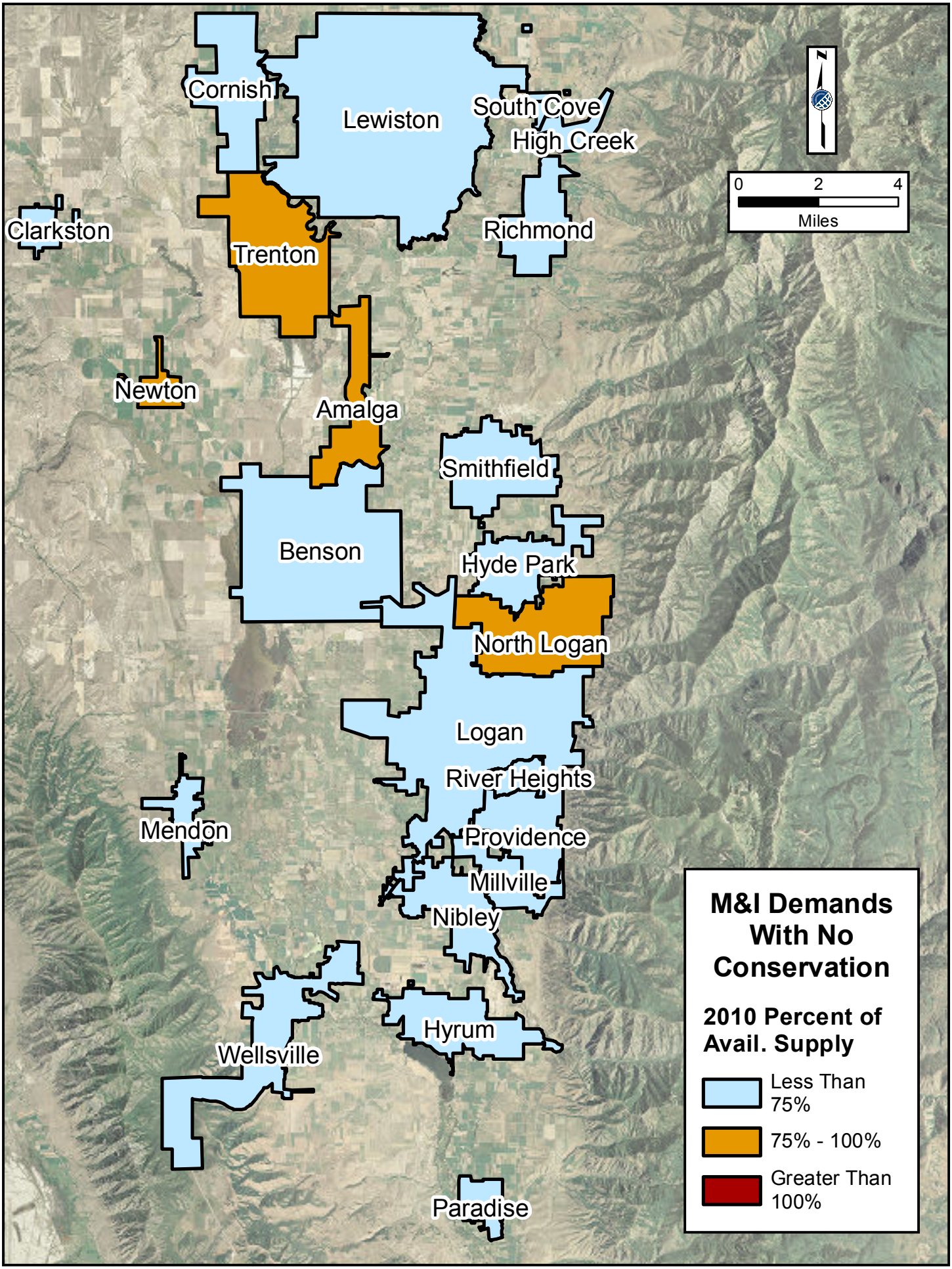
Conserve 0%	Population	Potable Total	Secondary Total	M I Total	Total GPCD	Reliable Potable Supply	Secondary Supply	Total Supply	Total Supply Surplus
Year 2025									
Cache County									
Amalga Town Culinary Water System	612	763	6	769	1,122	686	5	691	-78
Benson Water Culinary District	1,915	434	128	562	262	348	50	398	-165
Clarkston Town Culinary Water	923	243	95	338	327	1,049	83	1,132	793
Cornish Town Water	349	111	53	164	420	142	44	186	22
Goaslind Spring Water Works Co.	60	6	12	18	269	394	12	406	388
High Creek Culinary Water System	332	126	5	131	352	66	2	68	-63
Hyde Park City	5,568	1,034	494	1,529	245	1,417	340	1,757	228
Hyrum City	10,124	5,737	1,877	7,614	671	6,382	1,400	7,782	168
Lewiston City	1,986	798	108	906	407	1,612	96	1,708	802
Logan City	60,281	11,249	2,286	13,535	200	16,652	1,820	18,472	4,937
Mendon City Culinary Water System	2,145	262	291	553	230	356	190	546	-8
Millville City Water	2,487	581	71	651	234	825	54	879	228
Newton Town Water	850	232	199	431	453	246	187	433	2
Nibley City	11,386	1,762	633	2,394	188	2,499	300	2,799	405
North Logan Water	13,272	2,308	378	2,686	181	1,727	235	1,962	-724
Paradise Town	1,223	150	394	545	397	497	290	787	242
Providence Town Water System	10,299	3,044	147	3,192	277	4,076	100	4,176	984
Richmond City Corp.	2,906	823	353	1,176	361	1,388	300	1,688	512
River Heights City	2,360	631	42	673	254	2,099	34	2,133	1,460
Smithfield City	13,761	2,416	2,014	4,430	287	5,976	1,405	7,381	2,951
South Cove Water Works Co., Inc.	70	7	22	29	369	197	22	219	190
Trenton Town Corp. Water	662	219	64	282	381	225	48	273	-9
Wellsville City Corp.	4,555	1,974	27	2,000	392	5,730	20	5,750	3,750
Cache County summary for 2025	**148,126**	**34,911**	**9,697**	**44,608**	**269**	**54,586**	**7,037**	**61,623**	**17,014**

Conserve 0%	Population	Potable Total	Secondary Total	M I Total	Total GPCD	Reliable Potable Supply	Secondary Supply	Total Supply	Total Supply Surplus
Year 2030									
Cache County									
Amalga Town Culinary Water System	637	795	6	801	1,122	686	5	691	-110
Benson Water Culinary District	2,472	561	165	726	262	348	50	398	-329
Clarkston Town Culinary Water	1,010	266	104	370	327	1,049	83	1,132	761
Cornish Town Water	364	116	55	171	420	142	44	186	15
Goaslind Spring Water Works Co.	60	6	12	18	269	394	12	406	388
High Creek Culinary Water System	429	163	7	169	352	66	2	68	-101
Hyde Park City	6,209	1,153	551	1,705	245	1,417	340	1,757	52
Hyrum City	10,993	6,229	2,038	8,267	671	6,382	1,400	7,782	-485
Lewiston City	2,191	880	119	999	407	1,612	96	1,708	708
Logan City	63,712	11,889	2,416	14,305	200	16,652	1,820	18,472	4,167
Mendon City Culinary Water System	2,445	299	332	631	230	356	190	546	-85
Millville City Water	2,694	629	77	705	234	825	54	879	174
Newton Town Water	852	233	199	432	453	246	187	433	1
Nibley City	14,038	2,172	780	2,952	188	2,499	300	2,799	-153
North Logan Water	14,930	2,597	425	3,022	181	1,727	235	1,962	-1,060
Paradise Town	1,328	163	428	591	397	497	290	787	195
Providence Town Water System	11,645	3,442	166	3,609	277	4,076	100	4,176	567
Richmond City Corp.	3,026	857	368	1,225	361	1,388	300	1,688	463
River Heights City	2,395	640	42	683	254	2,099	34	2,133	1,450
Smithfield City	15,338	2,692	2,245	4,937	287	5,976	1,405	7,381	2,444
South Cove Water Works Co., Inc.	70	7	22	29	369	197	22	219	190
Trenton Town Corp. Water	725	240	70	309	381	225	48	273	-36
Wellsville City Corp.	4,989	2,162	29	2,191	392	5,730	20	5,750	3,559
Cache County summary for 2030	**162,552**	**38,191**	**10,656**	**48,847**	**268**	**54,586**	**7,037**	**61,623**	**12,775**

Conserve 0%	Population	Potable Total	Secondary Total	M I Total	Total GPCD	Reliable Potable Supply	Secondary Supply	Total Supply	Total Supply Surplus
Year 2040									
Cache County									
Amalga Town Culinary Water System	655	819	6	825	1,122	686	5	691	-134
Benson Water Culinary District	3,505	797	235	1,032	262	348	50	398	-635
Clarkston Town Culinary Water	1,181	312	122	434	327	1,049	83	1,132	698
Cornish Town Water	387	124	59	182	420	142	44	186	4
Goaslind Spring Water Works Co.	60	6	12	18	269	394	12	406	388
High Creek Culinary Water System	607	231	9	240	352	66	2	68	-172
Hyde Park City	7,546	1,406	672	2,077	245	1,417	341	1,758	-319
Hyrum City	12,695	7,213	2,360	9,574	671	6,382	1,404	7,786	-1,788
Lewiston City	2,561	1,032	139	1,171	407	1,612	96	1,708	536
Logan City	76,381	14,292	2,904	17,196	200	16,652	1,825	18,477	1,281
Mendon City Culinary Water System	2,790	342	380	722	230	356	191	546	-176
Millville City Water	3,065	717	87	805	234	825	54	879	74
Newton Town Water	996	273	233	506	453	246	188	434	-73
Nibley City	15,615	2,423	870	3,293	188	2,499	301	2,800	-493
North Logan Water	16,669	2,907	476	3,383	181	1,727	236	1,963	-1,420
Paradise Town	1,545	191	499	690	397	497	291	787	98
Providence Town Water System	13,613	4,035	195	4,230	277	4,076	100	4,176	-54
Richmond City Corp.	3,342	949	407	1,356	361	1,388	301	1,689	333
River Heights City	2,514	674	44	719	254	2,099	34	2,133	1,414
Smithfield City	18,509	3,258	2,716	5,974	287	5,976	1,409	7,385	1,411
South Cove Water Works Co., Inc.	70	7	22	29	369	197	22	219	190
Trenton Town Corp. Water	847	281	82	362	381	225	48	273	-89
Wellsville City Corp.	5,776	2,510	34	2,544	392	5,730	20	5,750	3,206
Cache County summary for 2040	**190,929**	**44,798**	**12,566**	**57,364**	**267**	**54,586**	**7,056**	**61,642**	**4,278**

Conserve 0%	Population	Potable Total	Secondary Total	M I Total	Total GPCD	Reliable Potable Supply	Secondary Supply	Total Supply	Total Supply Surplus
Year 2050									
Cache County									
Amalga Town Culinary Water System	1,010	1,260	10	1,269	1,122	686	5	691	-578
Benson Water Culinary District	5,698	1,292	381	1,674	262	348	50	398	-1,276
Clarkston Town Culinary Water	1,396	368	144	512	327	1,049	83	1,132	620
Cornish Town Water	468	149	71	220	420	142	44	186	-34
Goaslind Spring Water Works Co.	60	6	12	18	269	394	12	406	388
High Creek Culinary Water System	988	375	15	390	352	66	2	68	-322
Hyde Park City	7,667	1,424	681	2,105	245	1,417	340	1,757	-348
Hyrum City	15,729	8,913	2,917	11,829	671	6,382	1,400	7,782	-4,047
Lewiston City	3,495	1,405	190	1,594	407	1,612	96	1,708	113
Logan City	92,651	17,289	3,513	20,802	200	16,652	1,820	18,472	-2,330
Mendon City Culinary Water System	3,046	372	413	786	230	356	190	546	-240
Millville City Water	3,983	930	113	1,043	234	825	54	879	-164
Newton Town Water	1,179	322	276	598	453	246	187	433	-165
Nibley City	18,467	2,858	1,026	3,884	188	2,499	300	2,799	-1,085
North Logan Water	18,555	3,227	529	3,756	181	1,727	235	1,962	-1,794
Paradise Town	1,871	230	603	833	397	497	290	787	-47
Providence Town Water System	16,100	4,759	230	4,989	277	4,076	100	4,176	-814
Richmond City Corp.	4,184	1,185	508	1,693	361	1,388	300	1,688	-5
River Heights City	2,846	761	50	811	254	2,099	34	2,133	1,321
Smithfield City	19,280	3,384	2,822	6,206	287	5,976	1,405	7,381	1,175
South Cove Water Works Co., Inc.	70	7	22	29	369	197	22	219	190
Trenton Town Corp. Water	1,002	331	96	427	381	225	48	273	-154
Wellsville City Corp.	7,032	3,047	41	3,088	392	5,730	20	5,750	2,662
Cache County summary for 2050	**226,777**	**53,894**	**14,662**	**68,556**	**270**	**54,586**	**7,037**	**61,623**	**-6,934**

Conserve 0%	Population	Potable Total	Secondary Total	M I Total	Total GPCD	Reliable Potable Supply	Secondary Supply	Total Supply	Total Supply Surplus
Year 2060									
Cache County									
Amalga Town Culinary Water System	1,190	1,488	11	1,500	1,122	686	5	691	-809
Benson Water Culinary District	6,690	1,521	449	1,970	262	348	50	398	-1,573
Clarkston Town Culinary Water	1,645	434	170	605	327	1,049	83	1,132	527
Cornish Town Water	551	176	84	260	420	142	44	186	-74
Goaslind Spring Water Works Co.	60	6	12	18	269	394	12	406	388
High Creek Culinary Water System	1,160	441	18	459	352	66	2	68	-391
Hyde Park City	8,448	1,574	752	2,326	245	1,417	341	1,758	-568
Hyrum City	18,864	10,718	3,508	14,226	671	6,382	1,404	7,786	-6,440
Lewiston City	3,842	1,548	209	1,757	407	1,612	96	1,708	-49
Logan City	111,314	20,829	4,232	25,061	200	16,652	1,825	18,477	-6,584
Mendon City Culinary Water System	3,588	440	488	928	230	356	191	546	-382
Millville City Water	4,854	1,136	138	1,274	234	825	54	879	-395
Newton Town Water	1,388	380	325	706	453	246	188	434	-272
Nibley City	21,752	3,375	1,212	4,587	188	2,499	301	2,800	-1,787
North Logan Water	21,855	3,811	624	4,436	181	1,727	236	1,963	-2,473
Paradise Town	2,226	275	719	994	397	497	291	787	-206
Providence Town Water System	18,964	5,621	272	5,893	277	4,076	100	4,176	-1,717
Richmond City Corp.	5,203	1,478	634	2,111	361	1,388	301	1,689	-423
River Heights City	3,352	899	59	958	254	2,099	34	2,133	1,175
Smithfield City	21,480	3,781	3,152	6,933	287	5,976	1,409	7,385	452
South Cove Water Works Co., Inc.	70	7	22	29	369	197	22	219	190
Trenton Town Corp. Water	1,180	391	114	505	381	225	48	273	-231
Wellsville City Corp.	8,365	3,634	49	3,684	392	5,730	20	5,750	2,066
Cache County summary for 2060	**268,041**	**63,965**	**17,254**	**81,219**	**270**	**54,586**	**7,056**	**61,642**	**-19,577**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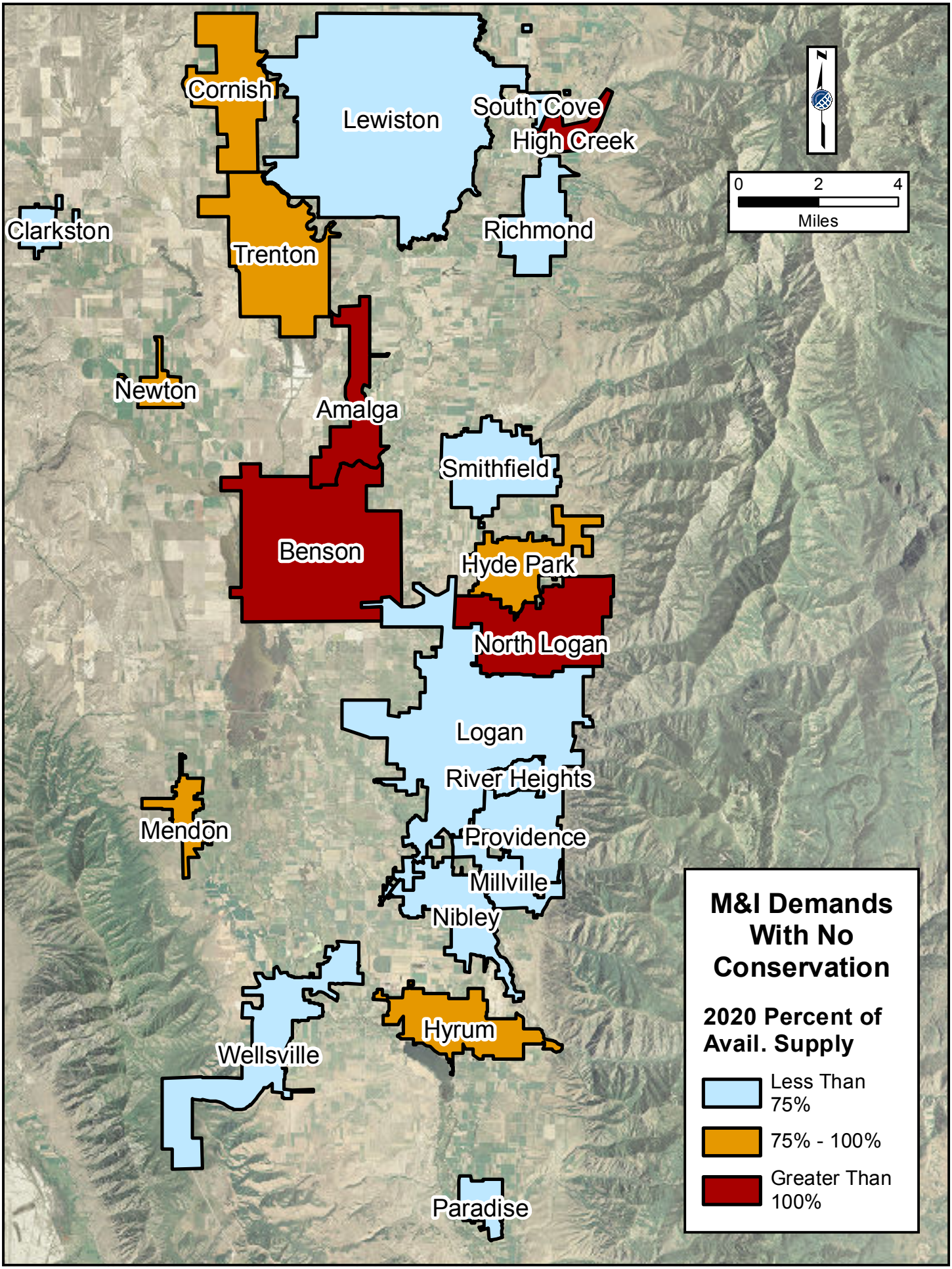
M&I Demands With No Conservation
2010 Percent of Avail. Supply
Less Than 75%
75% - 100%
Greater Than 100%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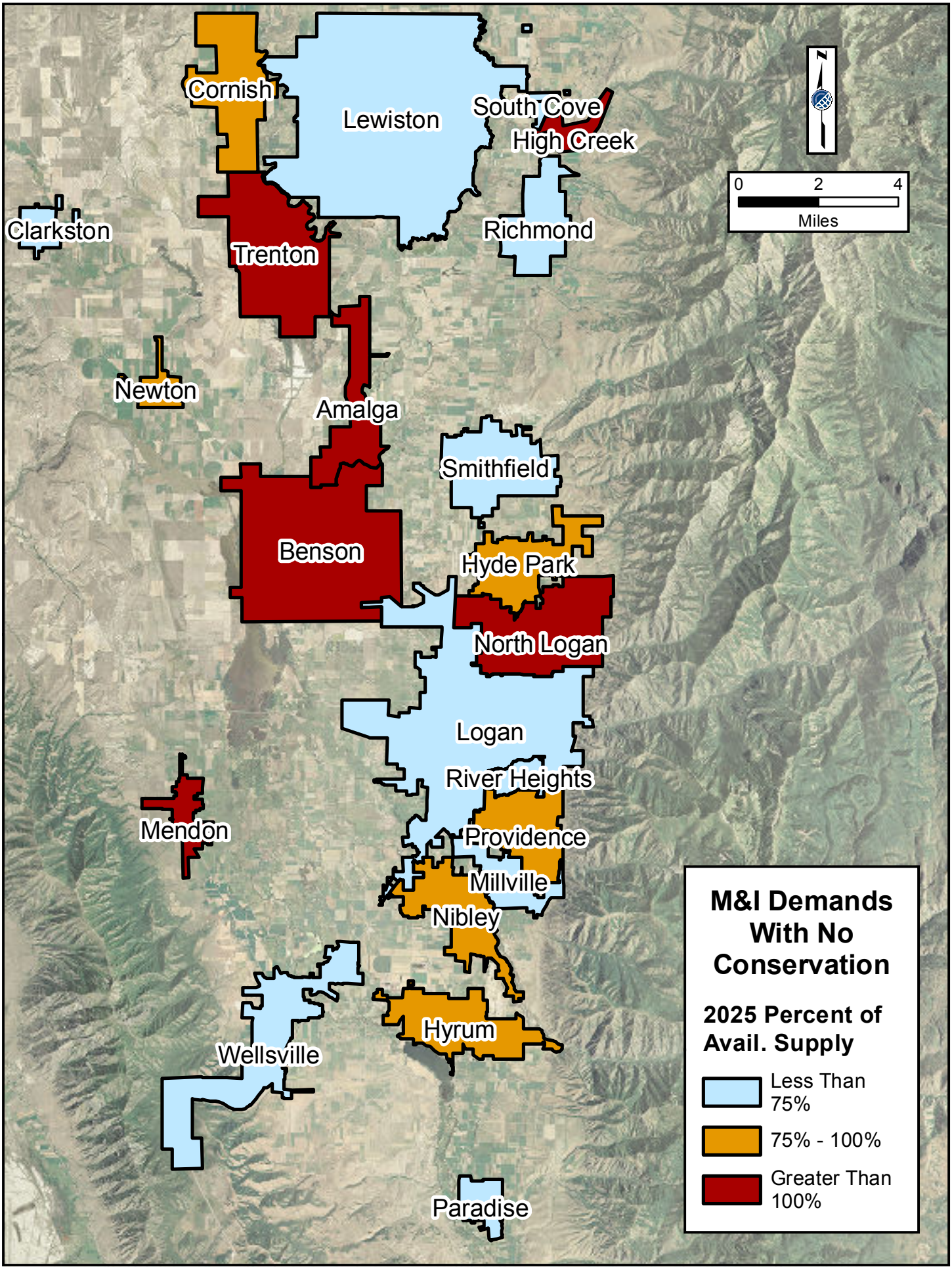
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2025 Percent of Avail. Supply
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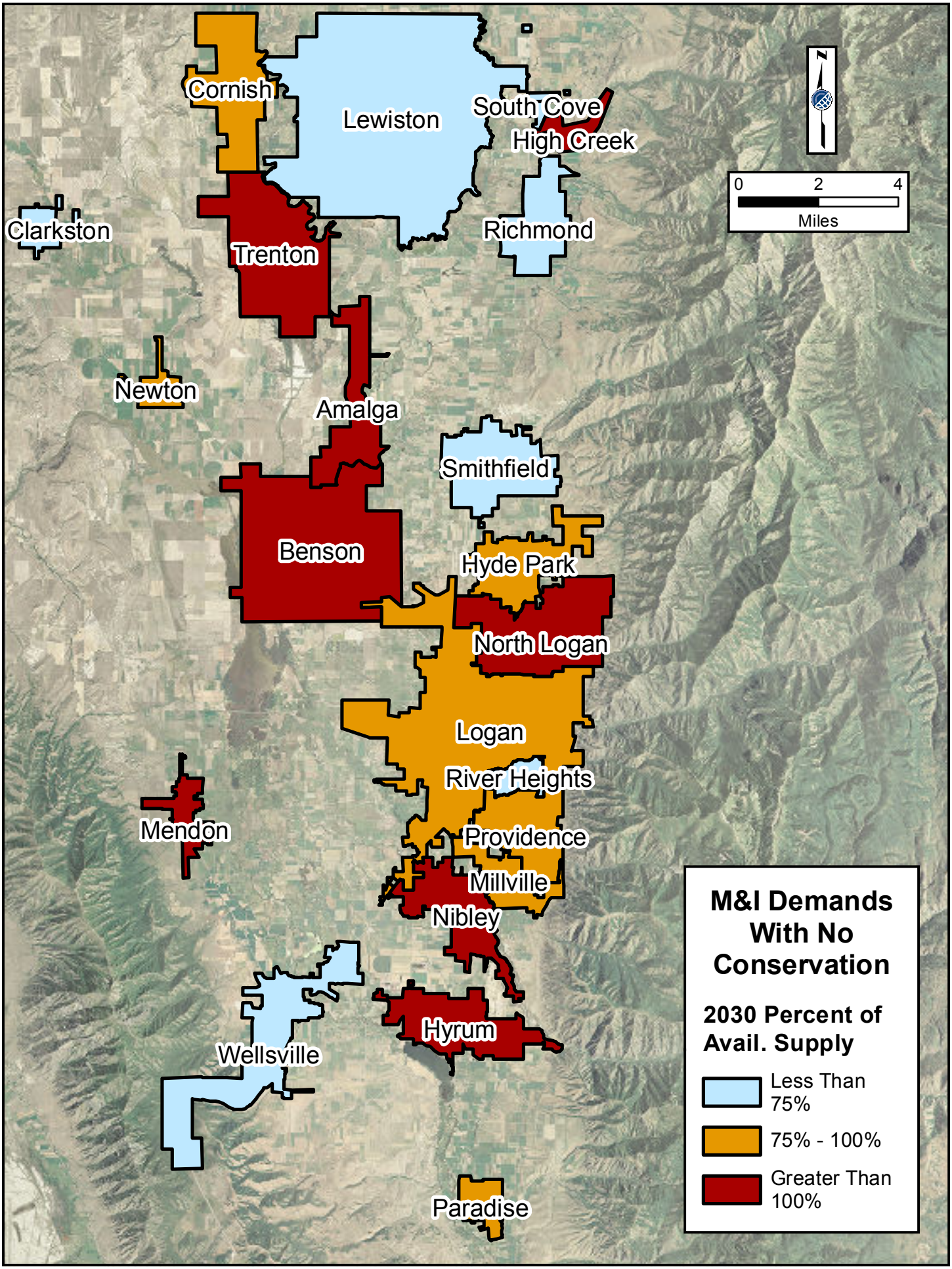
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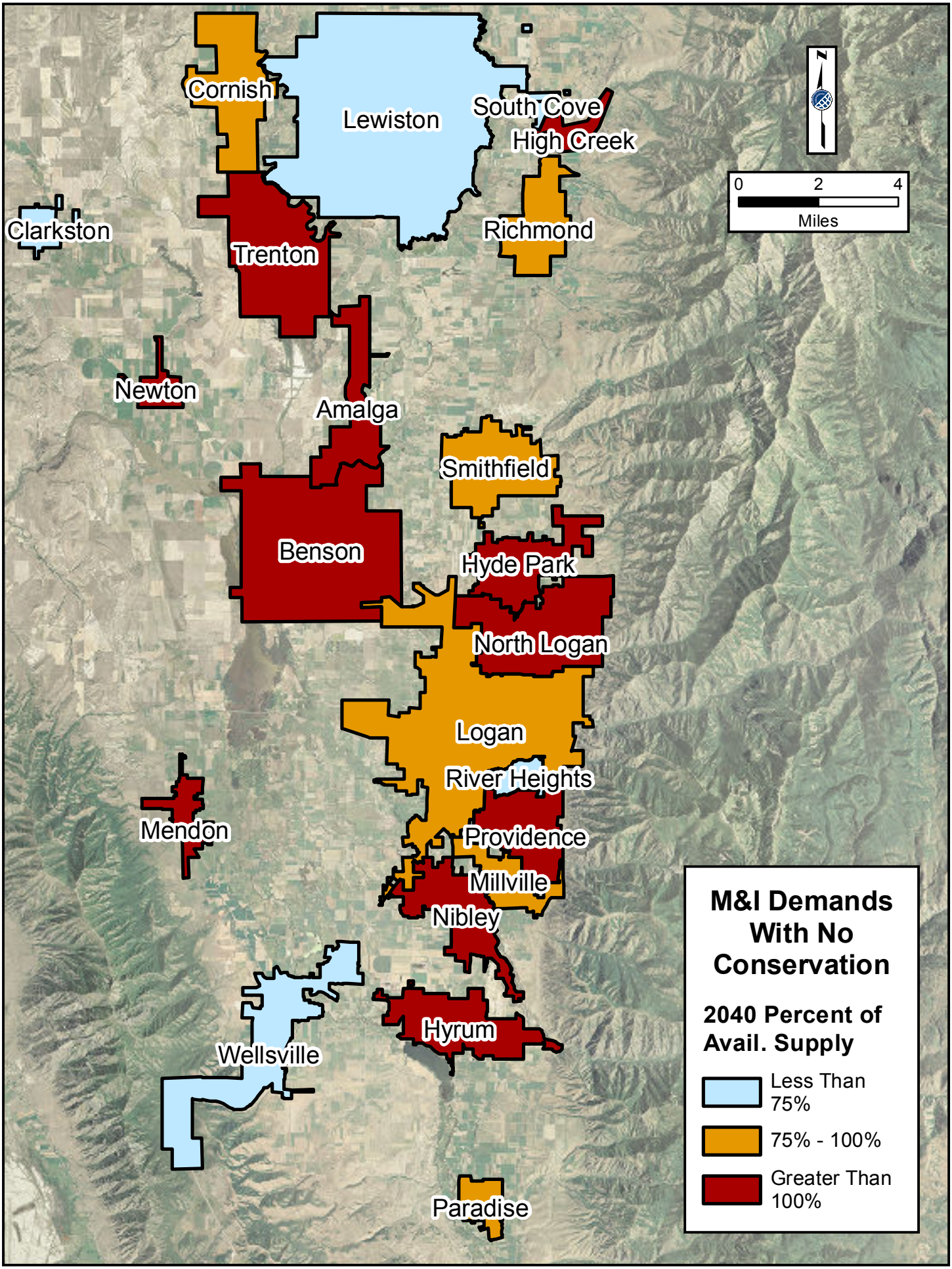
75% - 100%
Greater Than 100%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2040 Percent of Avail. Supply
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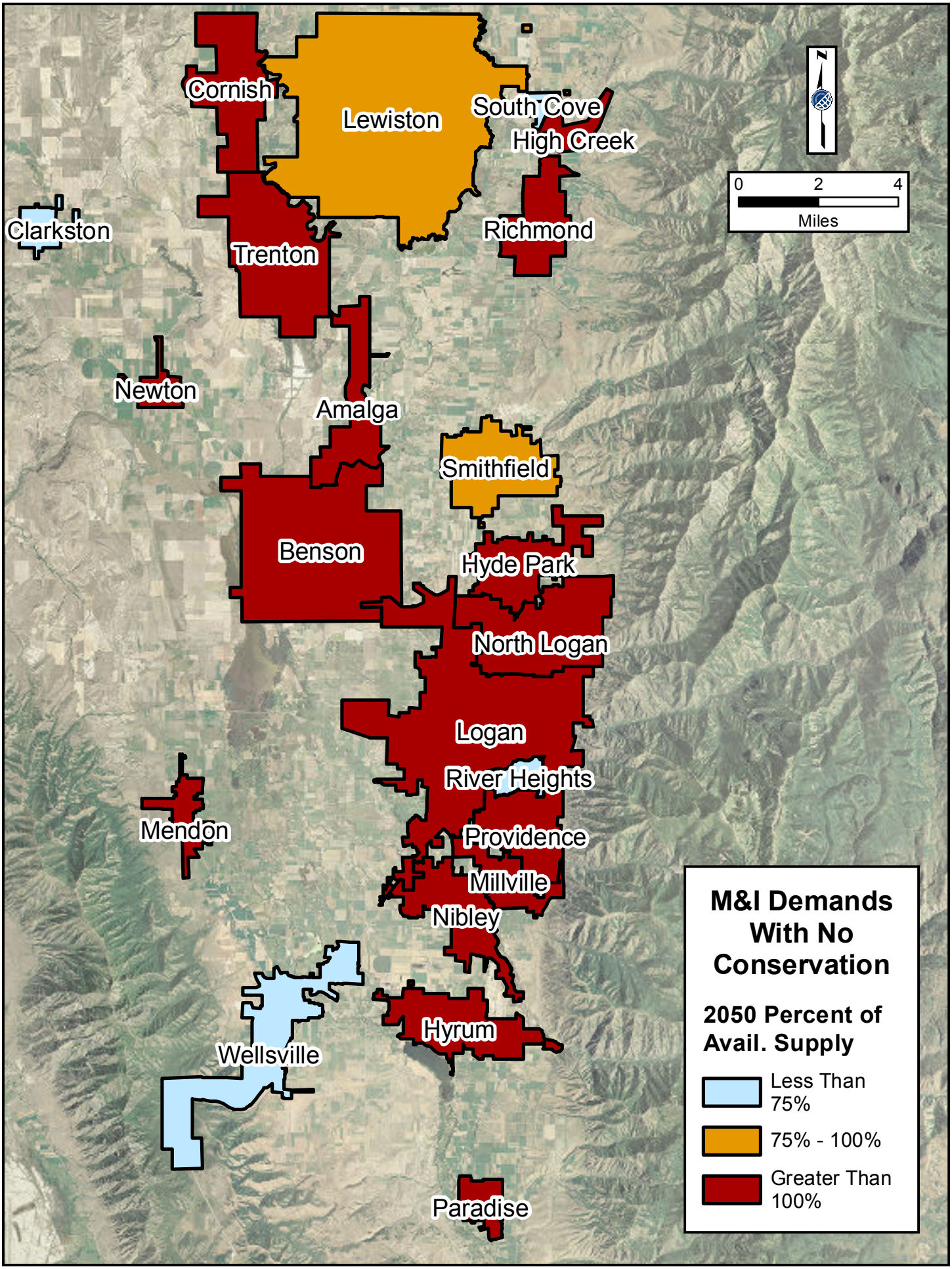
75% - 100%
Greater Than 100%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M&I Demands With No Conservation
2050 Percent of Avail. Supply
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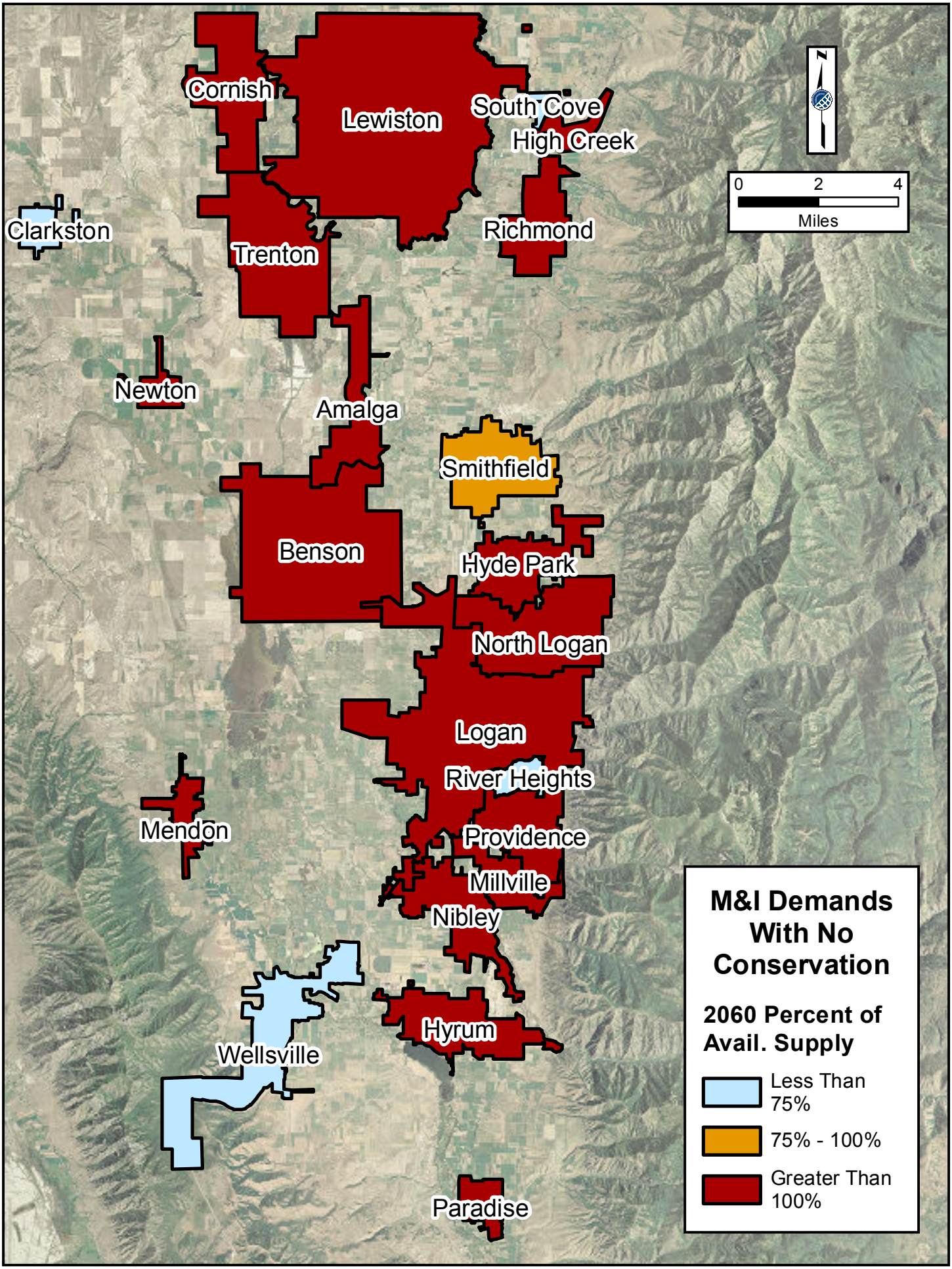
75% - 100%
Greater Than 100%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Miles
M&I Demands With No Conservation
2060 Percent of Avail. Supply
Less Than 75%
75% - 100%
Greater Than 100%

Bear River Basin conserve 25% from 2000 to 2025

Base Year Year 2010	Population	Potable Total	Secondary Total	M I Total	Total GPCD	Reliable Potable Supply	Secondary Supply	Total Supply	Total Supply Surplus
Cache County									
Amalga Town Culinary Water System	530	661	5	666	1,122	686	5	691	25
Benson Water Culinary District	747	169	50	219	262	348	50	398	178
Clarkston Town Culinary Water	800	211	82	293	327	1,049	82	1,132	838
Cornish Town Water	290	92	44	136	420	142	44	186	50
Goaslind Spring Water Works Co.	60	6	12	18	269	394	12	406	388
High Creek Culinary Water System	129	49	2	51	352	66	2	68	17
Hyde Park City	3,830	712	340	1,051	245	1,417	340	1,757	706
Hyrum City	7,550	4,278	1,400	5,678	671	6,382	1,400	7,782	2,104
Lewiston City	1,770	711	96	807	407	1,612	96	1,708	900
Logan City	48,000	8,957	1,820	10,777	200	16,652	1,820	18,472	7,695
Mendon City Culinary Water System	1,400	171	190	361	230	356	190	546	184
Millville City Water	1,900	443	54	497	234	825	54	879	382
Newton Town Water	800	219	187	406	453	246	187	433	27
Nibley City	5,400	836	300	1,136	188	2,499	300	2,799	1,663
North Logan Water	8,250	1,435	235	1,670	181	1,727	235	1,962	292
Paradise Town	900	111	290	401	397	497	290	787	386
Providence Town Water System	7,000	2,069	100	2,169	277	4,076	100	4,176	2,006
Richmond City Corp.	2,470	700	300	1,000	361	1,388	300	1,688	688
River Heights City	1,930	516	34	550	254	2,099	34	2,133	1,582
Smithfield City	9,600	1,685	1,405	3,090	287	5,976	1,405	7,381	4,291
South Cove Water Works Co., Inc.	70	7	22	29	369	197	22	219	190
Trenton Town Corp. Water	500	165	48	213	381	225	48	273	60
Wellsville City Corp.	3,400	1,473	20	1,493	392	5,730	20	5,750	4,257
Cache County summary for Base Year 2010	**107,326**	**25,677**	**7,037**	**32,713**	**272**	**54,586**	**7,037**	**61,623**	**28,909**

Bear River Basin conserve 25% from 2000 to 2025

Conserve 20%	Population	Potable Total	Secondary Total	M I Total	Total GPCD	Reliable Potable Supply	Secondary Supply	Total Supply	Total Supply Surplus
Year 2020									
Cache County									
Amalga Town Culinary Water System	587	683	5	688	1,044	686	5	692	3
Benson Water Culinary District	1,358	287	85	372	244	348	85	439	67
Clarkston Town Culinary Water	836	205	80	286	304	1,049	80	1,135	850
Cornish Town Water	334	99	47	146	390	142	47	193	46
Goaslind Spring Water Works Co.	60	6	11	17	251	394	11	406	389
High Creek Culinary Water System	235	83	3	86	328	66	3	70	-17
Hyde Park City	4,926	854	408	1,261	228	1,417	408	1,855	594
Hyrum City	9,255	4,892	1,601	6,493	625	6,382	1,601	8,103	1,610
Lewiston City	1,781	668	90	758	379	1,612	90	1,708	951
Logan City	56,851	9,896	2,011	11,906	186	16,652	2,011	18,814	6,907
Mendon City Culinary Water System	1,844	210	233	444	214	356	233	606	163
Millville City Water	2,281	497	60	557	217	825	60	890	333
Newton Town Water	847	216	185	401	421	246	185	445	44
Nibley City	8,734	1,261	453	1,713	175	2,499	453	2,986	1,272
North Logan Water	11,614	1,884	309	2,193	168	1,727	309	2,059	-134
Paradise Town	1,118	128	336	464	370	497	336	858	393
Providence Town Water System	8,954	2,469	119	2,588	257	4,076	119	4,204	1,616
Richmond City Corp.	2,785	736	316	1,051	336	1,388	316	1,727	676
River Heights City	2,324	580	38	618	237	2,099	38	2,140	1,522
Smithfield City	12,184	1,995	1,663	3,658	267	5,976	1,663	7,764	4,106
South Cove Water Works Co., Inc.	70	6	21	27	343	197	21	219	192
Trenton Town Corp. Water	600	185	54	239	354	225	54	283	44
Wellsville City Corp.	4,121	1,666	23	1,688	365	5,730	23	5,754	4,066
Cache County summary for 2020	**133,699**	**29,505**	**8,151**	**37,655**	**251**	**54,586**	**8,151**	**63,348**	**25,693**

Bear River Basin conserve 25% from 2000 to 2025

Conserve 25% Year 2025	Population	Potable Total	Secondary Total	M I Total	Total GPCD	Reliable Potable Supply	Secondary Supply	Total Supply	Total Supply Surplus
Cache County									
Amalga Town Culinary Water System	612	666	5	671	978	686	5	692	21
Benson Water Culinary District	1,915	379	112	491	229	348	112	476	-15
Clarkston Town Culinary Water	923	212	83	295	285	1,049	83	1,144	849
Cornish Town Water	349	97	46	143	366	142	46	195	52
Goaslind Spring Water Works Co.	60	5	10	16	235	394	10	406	390
High Creek Culinary Water System	332	110	4	114	307	66	4	71	-43
Hyde Park City	5,568	902	431	1,333	214	1,417	431	1,911	578
Hyrum City	10,124	5,003	1,637	6,640	586	6,382	1,637	8,259	1,619
Lewiston City	1,986	696	94	790	355	1,612	94	1,719	929
Logan City	60,281	9,810	1,993	11,803	175	16,652	1,993	18,938	7,134
Mendon City Culinary Water System	2,145	229	254	483	201	356	254	647	164
Millville City Water	2,487	506	62	568	204	825	62	896	328
Newton Town Water	850	203	173	376	395	246	173	445	69
Nibley City	11,386	1,537	552	2,088	164	2,499	552	3,132	1,043
North Logan Water	13,272	2,013	330	2,343	158	1,727	330	2,105	-238
Paradise Town	1,223	131	344	475	347	497	344	891	416
Providence Town Water System	10,299	2,655	128	2,783	241	4,076	128	4,223	1,439
Richmond City Corp.	2,906	718	308	1,026	315	1,388	308	1,741	715
River Heights City	2,360	550	36	587	222	2,099	36	2,140	1,553
Smithfield City	13,761	2,107	1,756	3,863	251	5,976	1,756	7,990	4,127
South Cove Water Works Co., Inc.	70	6	19	25	321	197	19	219	194
Trenton Town Corp. Water	662	191	55	246	332	225	55	289	42
Wellsville City Corp.	4,555	1,721	23	1,745	342	5,730	23	5,757	4,012
Cache County summary for 2025	**148,126**	**30,446**	**8,457**	**38,903**	**234**	**54,586**	**8,457**	**64,283**	**25,381**

Bear River Basin conserve 25% from 2000 to 2025

Conserve 25% Year 2030	Population	Potable Total	Secondary Total	M I Total	Total GPCD	Reliable Potable Supply	Secondary Supply	Total Supply	Total Supply Surplus
Cache County									
Amalga Town Culinary Water System	637	693	5	698	978	686	5	692	-6
Benson Water Culinary District	2,472	489	144	633	229	348	144	513	-120
Clarkston Town Culinary Water	1,010	232	91	323	285	1,049	91	1,153	830
Cornish Town Water	364	101	48	149	366	142	48	197	48
Goaslind Spring Water Works Co.	60	5	10	16	235	394	10	406	390
High Creek Culinary Water System	429	142	6	148	307	66	6	73	-75
Hyde Park City	6,209	1,006	481	1,487	214	1,417	481	1,968	482
Hyrum City	10,993	5,432	1,778	7,210	586	6,382	1,778	8,420	1,210
Lewiston City	2,191	768	104	871	355	1,612	104	1,730	859
Logan City	63,712	10,368	2,107	12,475	175	16,652	2,107	19,068	6,593
Mendon City Culinary Water System	2,445	261	289	550	201	356	289	687	137
Millville City Water	2,694	548	67	615	204	825	67	902	286
Newton Town Water	852	203	174	377	395	246	174	445	68
Nibley City	14,038	1,894	680	2,575	164	2,499	680	3,279	704
North Logan Water	14,930	2,264	371	2,635	158	1,727	371	2,152	-483
Paradise Town	1,328	142	373	516	347	497	373	924	409
Providence Town Water System	11,645	3,002	145	3,147	241	4,076	145	4,242	1,095
Richmond City Corp.	3,026	747	321	1,068	315	1,388	321	1,756	688
River Heights City	2,395	559	37	595	222	2,099	37	2,141	1,545
Smithfield City	15,338	2,348	1,958	4,306	251	5,976	1,958	8,221	3,915
South Cove Water Works Co., Inc.	70	6	19	25	321	197	19	219	194
Trenton Town Corp. Water	725	209	61	270	332	225	61	295	25
Wellsville City Corp.	4,989	1,885	26	1,911	342	5,730	26	5,759	3,849
Cache County summary for 2030	**162,552**	**33,306**	**9,293**	**42,599**	**234**	**54,586**	**9,293**	**65,242**	**22,643**

Bear River Basin conserve 25% from 2000 to 2025

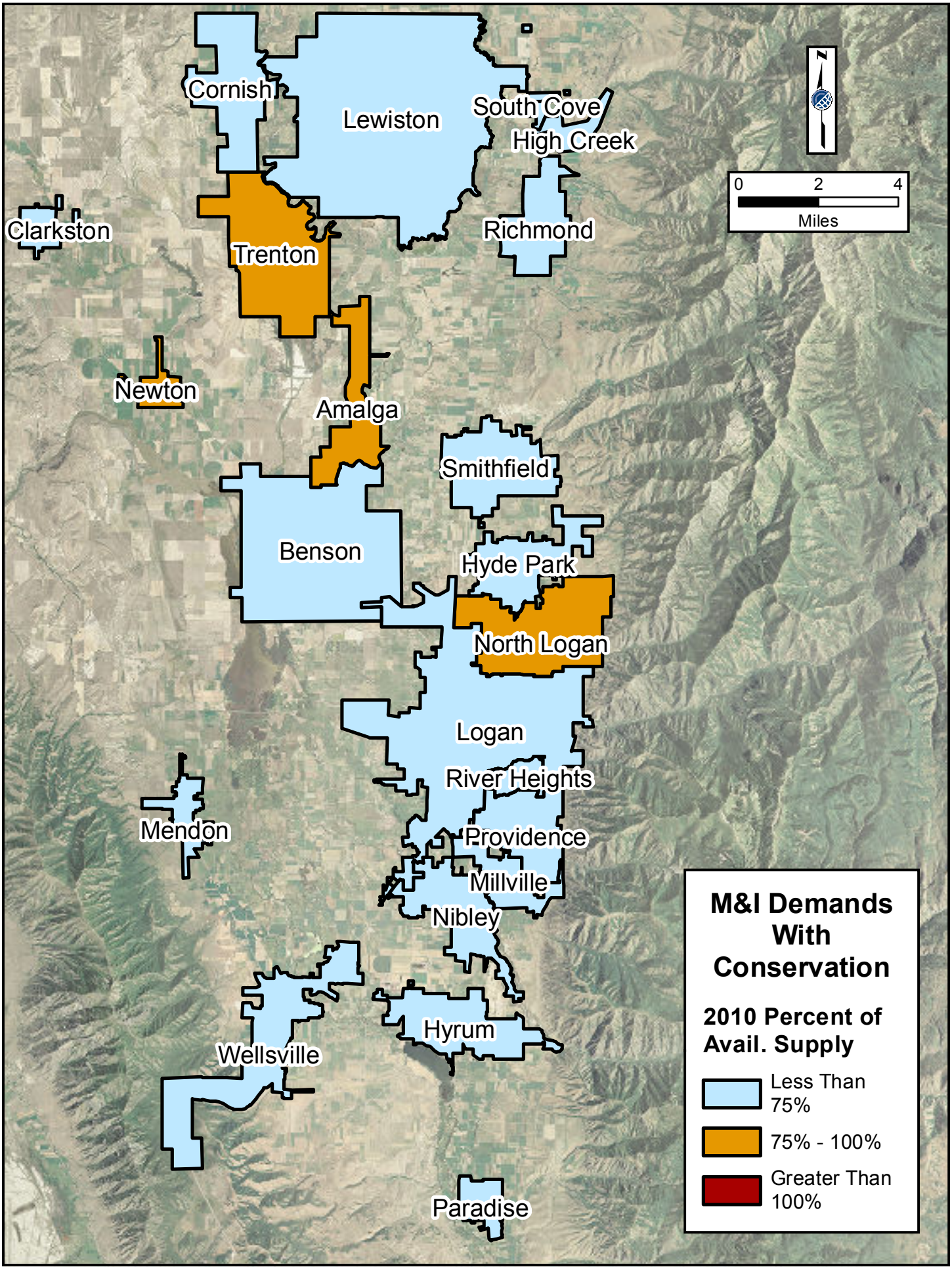
Conserve 25% Year 2040	Population	Potable Total	Secondary Total	M I Total	Total GPCD	Reliable Potable Supply	Secondary Supply	Total Supply	Total Supply Surplus
Cache County									
Amalga Town Culinary Water System	655	714	5	720	978	686	5	692	-28
Benson Water Culinary District	3,505	695	205	900	229	348	205	583	-317
Clarkston Town Culinary Water	1,181	272	107	379	285	1,049	107	1,171	793
Cornish Town Water	387	108	51	159	366	142	51	201	42
Goaslind Spring Water Works Co.	60	5	10	16	235	394	10	406	390
High Creek Culinary Water System	607	201	8	209	307	66	8	75	-134
Hyde Park City	7,546	1,226	586	1,812	214	1,417	586	2,089	277
Hyrum City	12,695	6,291	2,059	8,349	586	6,382	2,059	8,742	393
Lewiston City	2,561	900	121	1,021	355	1,612	121	1,751	729
Logan City	76,381	12,464	2,533	14,997	175	16,652	2,533	19,556	4,559
Mendon City Culinary Water System	2,790	298	331	629	201	356	331	735	106
Millville City Water	3,065	626	76	702	204	825	76	912	211
Newton Town Water	996	238	204	442	395	246	204	479	38
Nibley City	15,615	2,113	759	2,872	164	2,499	759	3,369	497
North Logan Water	16,669	2,535	415	2,950	158	1,727	415	2,203	-747
Paradise Town	1,545	166	435	602	347	497	435	996	394
Providence Town Water System	13,613	3,519	170	3,689	241	4,076	170	4,271	582
Richmond City Corp.	3,342	828	355	1,183	315	1,388	355	1,795	612
River Heights City	2,514	588	39	627	222	2,099	39	2,143	1,516
Smithfield City	18,509	2,841	2,369	5,210	251	5,976	2,369	8,692	3,482
South Cove Water Works Co., Inc.	70	6	19	25	321	197	19	219	194
Trenton Town Corp. Water	847	245	71	316	332	225	71	307	-9
Wellsville City Corp.	5,776	2,189	30	2,218	342	5,730	30	5,764	3,546
Cache County summary for 2040	**190,929**	**39,068**	**10,958**	**50,026**	**233**	**54,586**	**10,958**	**67,152**	**17,125**

Bear River Basin conserve 25% from 2000 to 2025

Conserve 25% Year 2050	Population	Potable Total	Secondary Total	M I Total	Total GPCD	Reliable Potable Supply	Secondary Supply	Total Supply	Total Supply Surplus
Cache County									
Amalga Town Culinary Water System	1,010	1,099	8	1,107	978	686	8	696	-411
Benson Water Culinary District	5,698	1,127	333	1,459	229	348	333	729	-731
Clarkston Town Culinary Water	1,396	321	126	446	285	1,049	126	1,193	747
Cornish Town Water	468	130	62	192	366	142	62	213	21
Goaslind Spring Water Works Co.	60	5	10	16	235	394	10	406	390
High Creek Culinary Water System	988	327	13	340	307	66	13	81	-259
Hyde Park City	7,667	1,242	594	1,836	214	1,417	594	2,098	262
Hyrum City	15,729	7,773	2,544	10,316	586	6,382	2,544	9,299	-1,018
Lewiston City	3,495	1,225	165	1,390	355	1,612	165	1,801	411
Logan City	92,651	15,078	3,064	18,142	175	16,652	3,064	20,165	2,023
Mendon City Culinary Water System	3,046	325	361	685	201	356	361	769	84
Millville City Water	3,983	811	99	910	204	825	99	938	29
Newton Town Water	1,179	281	240	521	395	246	240	522	0
Nibley City	18,467	2,492	895	3,387	164	2,499	895	3,525	138
North Logan Water	18,555	2,814	461	3,275	158	1,727	461	2,256	-1,020
Paradise Town	1,871	201	526	726	347	497	526	1,099	373
Providence Town Water System	16,100	4,150	201	4,351	241	4,076	201	4,306	-46
Richmond City Corp.	4,184	1,033	443	1,477	315	1,388	443	1,896	420
River Heights City	2,846	664	44	707	222	2,099	44	2,149	1,441
Smithfield City	19,280	2,952	2,461	5,412	251	5,976	2,461	8,798	3,385
South Cove Water Works Co., Inc.	70	6	19	25	321	197	19	219	194
Trenton Town Corp. Water	1,002	289	84	373	332	225	84	321	-51
Wellsville City Corp.	7,032	2,657	36	2,693	342	5,730	36	5,771	3,078
Cache County summary for 2050	**226,777**	**47,001**	**12,787**	**59,787**	**235**	**54,586**	**12,787**	**69,248**	**9,461**

Bear River Basin conserve 25% from 2000 to 2025

Conserve 25% Year 2060	Population	Potable Total	Secondary Total	M I Total	Total GPCD	Reliable Potable Supply	Secondary Supply	Total Supply	Total Supply Surplus
Cache County									
Amalga Town Culinary Water System	1,190	1,298	10	1,308	978	686	10	697	-611
Benson Water Culinary District	6,690	1,327	392	1,718	229	348	392	797	-922
Clarkston Town Culinary Water	1,645	379	148	527	285	1,049	148	1,219	692
Cornish Town Water	551	153	73	226	366	142	73	226	-1
Goaslind Spring Water Works Co.	60	5	10	16	235	394	10	406	390
High Creek Culinary Water System	1,160	385	16	400	307	66	16	84	-316
Hyde Park City	8,448	1,372	656	2,028	214	1,417	656	2,169	141
Hyrum City	18,864	9,347	3,059	12,406	586	6,382	3,059	9,890	-2,517
Lewiston City	3,842	1,350	182	1,532	355	1,612	182	1,820	288
Logan City	111,314	18,165	3,691	21,856	175	16,652	3,691	20,884	-972
Mendon City Culinary Water System	3,588	384	426	810	201	356	426	844	34
Millville City Water	4,854	991	121	1,111	204	825	121	963	-148
Newton Town Water	1,388	332	284	616	395	246	284	571	-44
Nibley City	21,752	2,943	1,057	4,000	164	2,499	1,057	3,711	-289
North Logan Water	21,855	3,324	544	3,868	158	1,727	544	2,351	-1,517
Paradise Town	2,226	239	627	867	347	497	627	1,216	349
Providence Town Water System	18,964	4,902	237	5,139	241	4,076	237	4,347	-792
Richmond City Corp.	5,203	1,289	553	1,841	315	1,388	553	2,022	180
River Heights City	3,352	784	52	835	222	2,099	52	2,158	1,322
Smithfield City	21,480	3,297	2,749	6,046	251	5,976	2,749	9,128	3,082
South Cove Water Works Co., Inc.	70	6	19	25	321	197	19	219	194
Trenton Town Corp. Water	1,180	341	99	440	332	225	99	339	-101
Wellsville City Corp.	8,365	3,170	43	3,213	342	5,730	43	5,779	2,567
Cache County summary for 2060	**268,041**	**55,783**	**15,047**	**70,830**	**235**	**54,586**	**15,047**	**71,840**	**1,010**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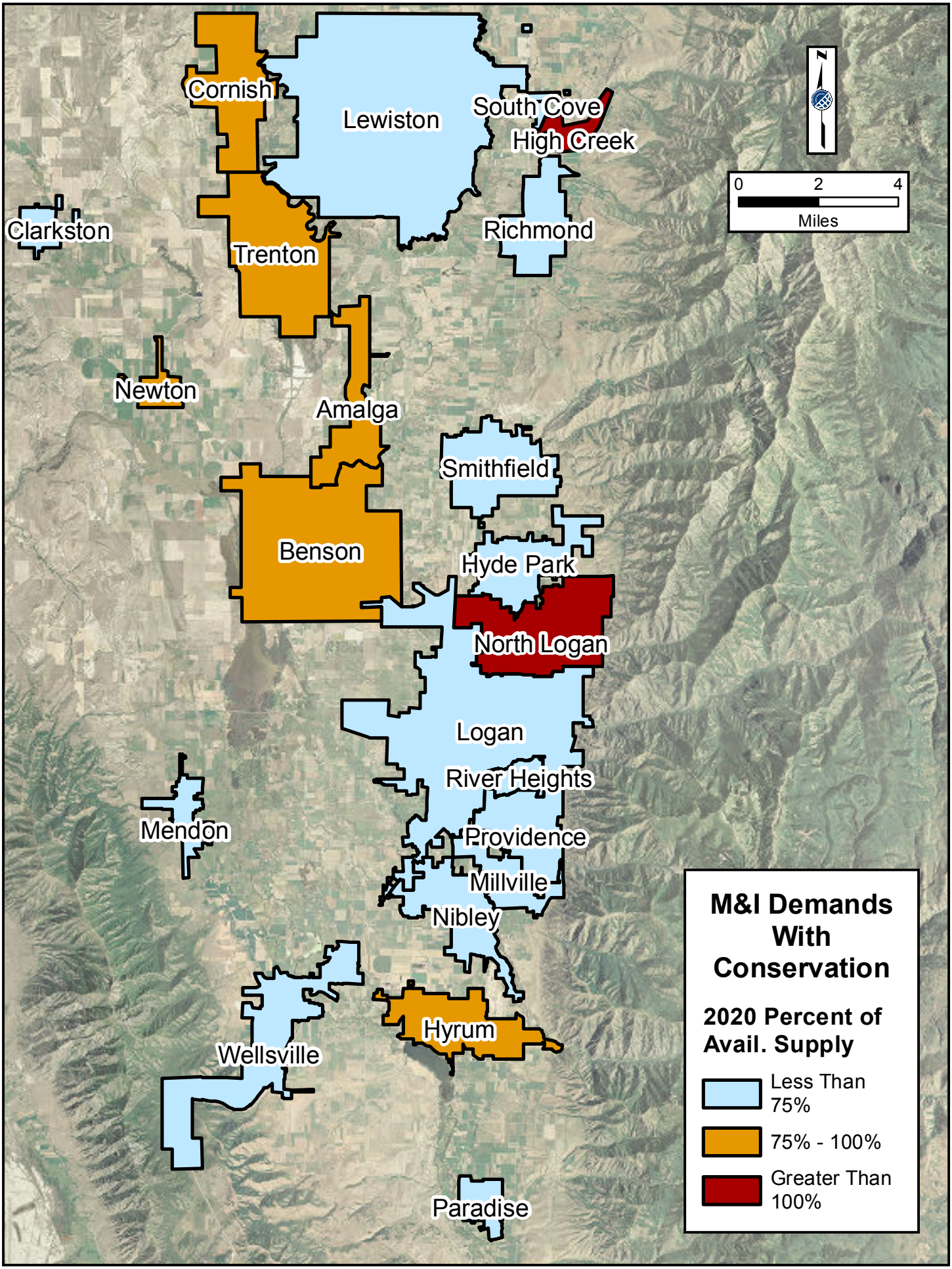
M&I Demands With Conservation
2010 Percent of Avail. Supply
Less Than 75%
75% - 100%
Greater Than 100%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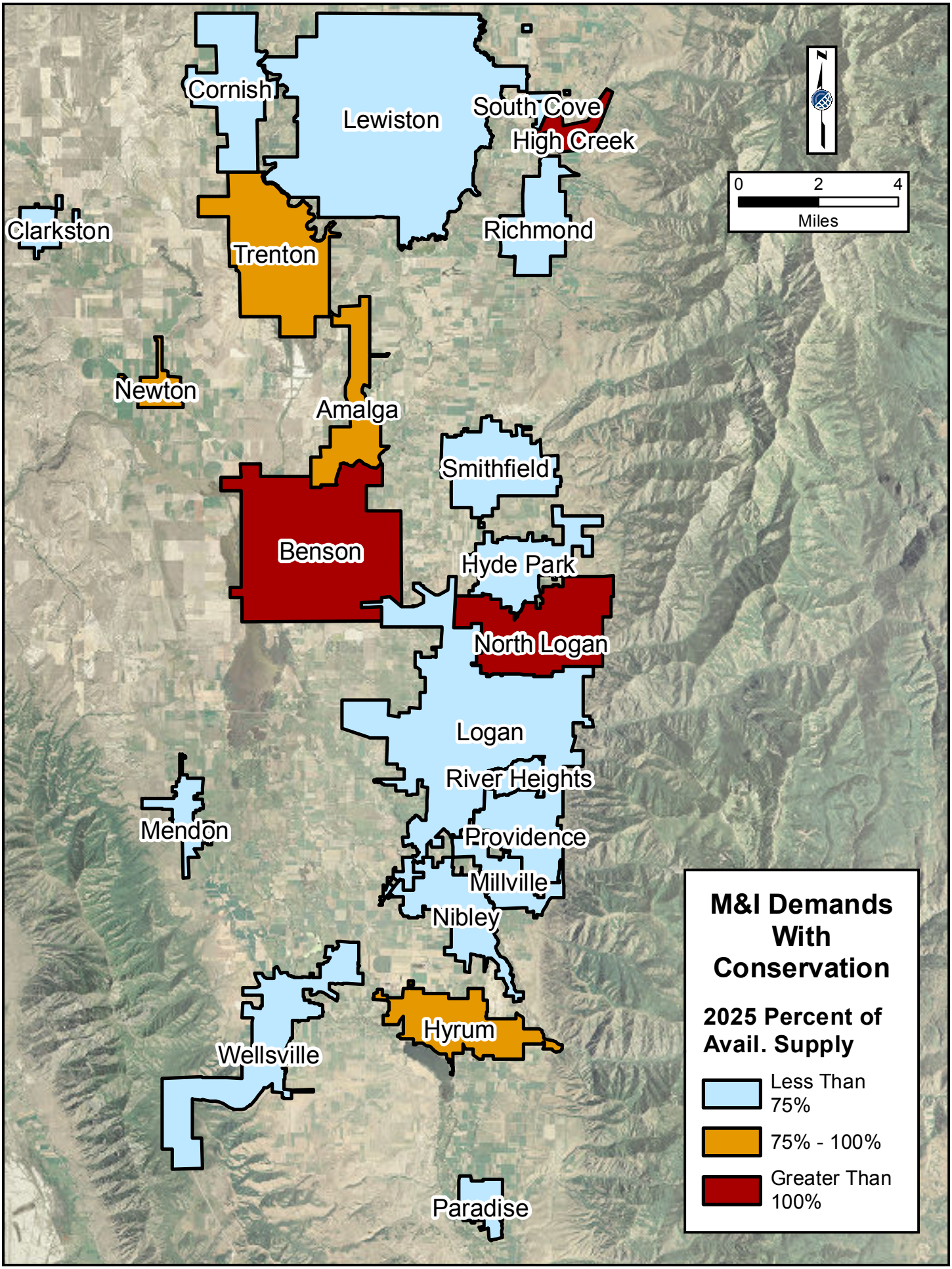
M&I Demands With Conservation
2020 Percent of Avail. Supply
Less Than 75%
75% - 100%
Greater Than 100%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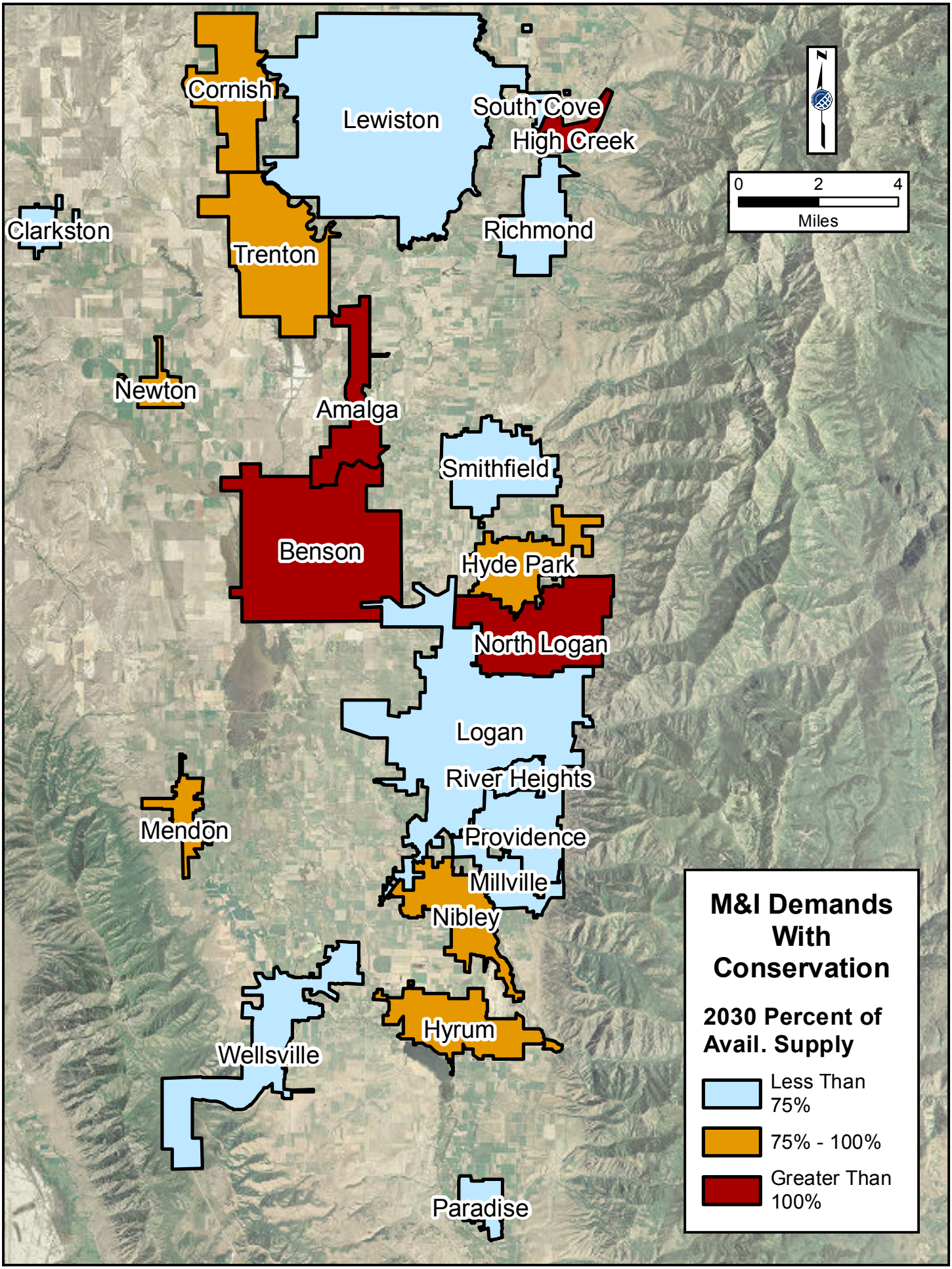
M&I Demands With Conservation
2025 Percent of Avail. Supply
Less Than 75%
75% - 100%
Greater Than 100%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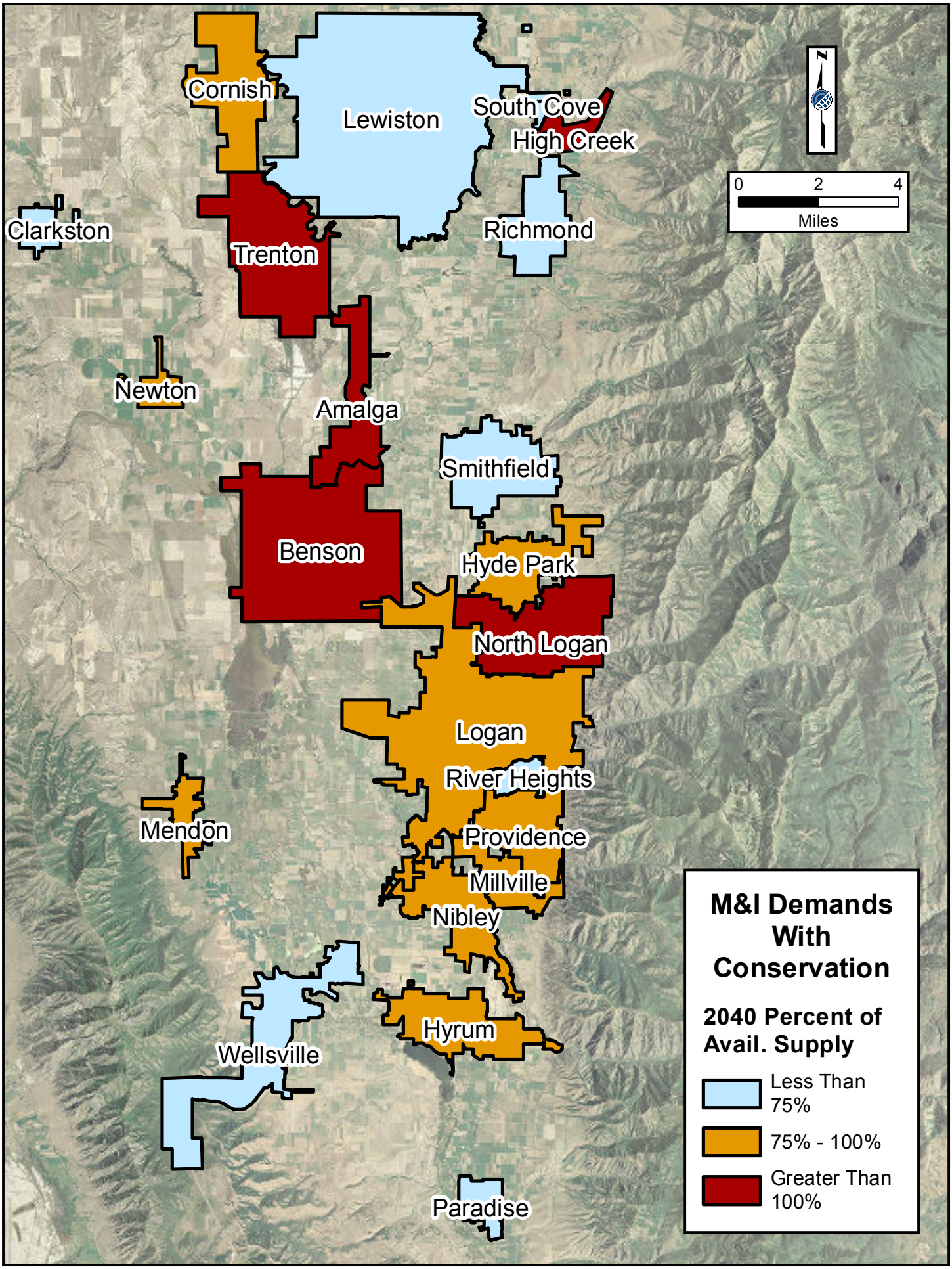
M&I Demands With Conservation
2030 Percent of Avail. Supply
Less Than 75%
75% - 100%
Greater Than 100%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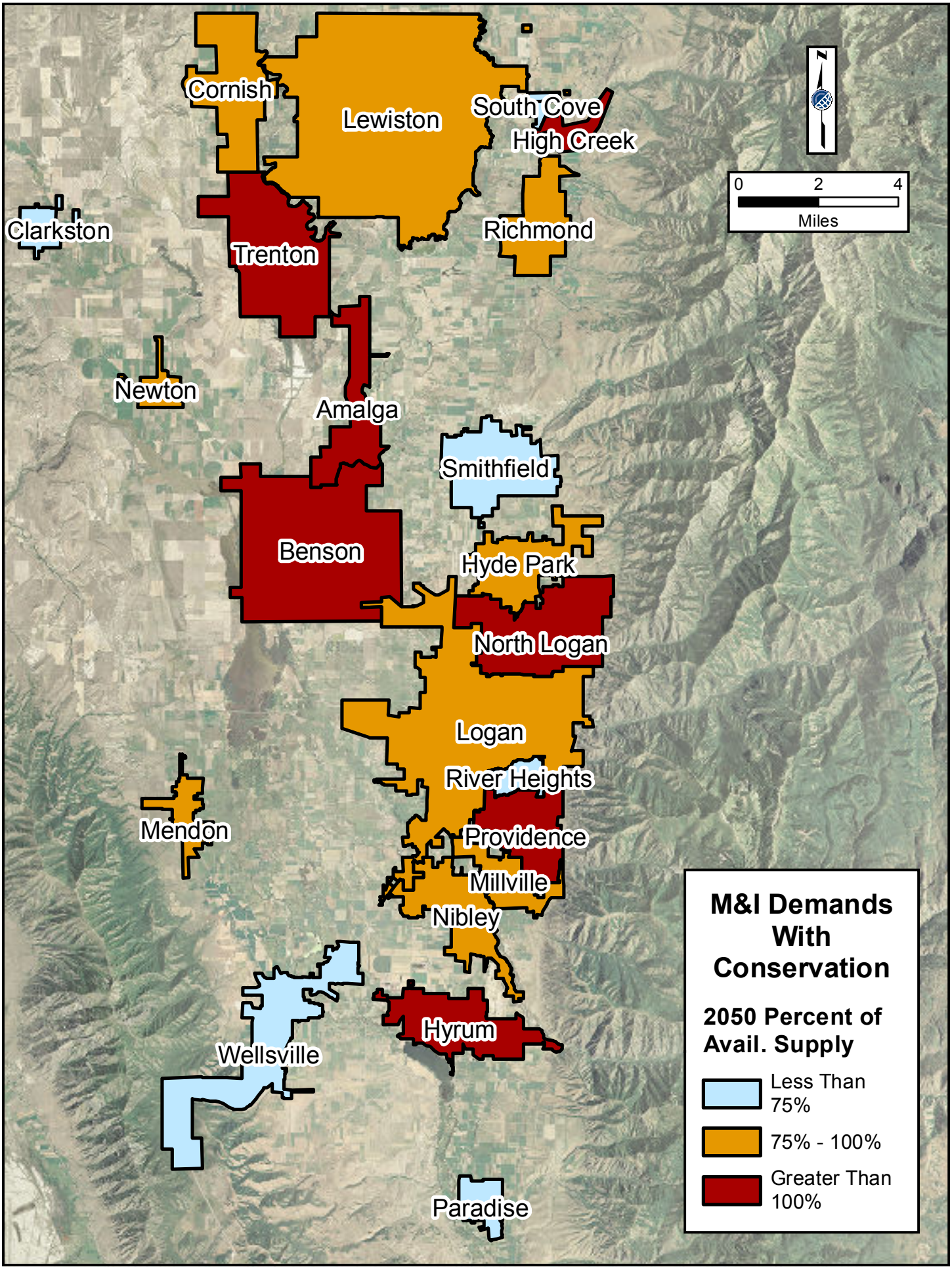
M&I Demands With Conservation
2040 Percent of Avail. Supply
Less Than 75%
75% - 100%
Greater Than 100%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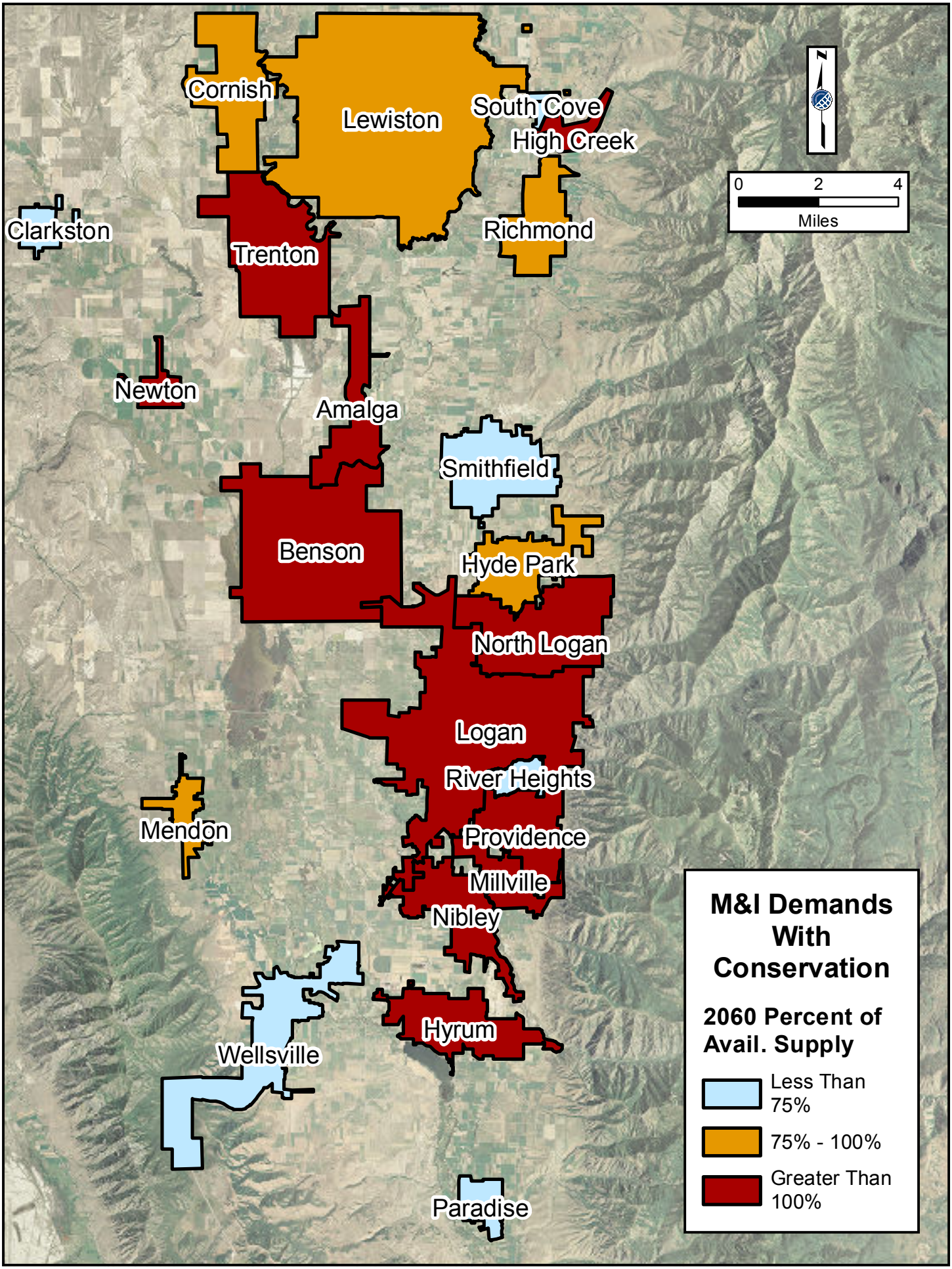
M&I Demands With Conservation
2050 Percent of Avail. Supply
Less Than 75%
75% - 100%
Greater Than 100%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Miles
M&I Demands With Conservation
2060 Percent of Avail. Supply
Less Than 75%
75% - 100%
Greater Than 100%

Appendix 4-B

Cache Valley Groundwater Management Plan

Guidelines followed by the Division of Water Rights in managing the groundwater resources in Cache Valley.

CACHE COUNTY
WATER MASTER PLAN

State of Utah
DEPARTMENT OF NATURAL RESOURCES
DIVISION OF WATER RIGHTS

Michael O. Leavitt
Governor
Ted Stewart
Executive Director
Robert L. Morgan
State Engineer

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Box 146300
Salt Lake City, Utah 84114-6300
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INTERIM CACHE VALLEY GROUND-WATER MANAGEMENT PLAN

INTRODUCTION

The purpose of this plan is to set forth the framework for future management of ground-water resources in Cache Valley and the State Engineer's guidelines regarding ground-water appropriations and change applications. The State Engineer believes there exists a close regional hydrologic connection between ground-water aquifers, springs and streams, and thus surface and ground water must be jointly managed. In adopting this plan, the State Engineer's primary objective is to protect prior water rights while putting to beneficial use the greatest amount of available water.

In evaluating the ground-water resources of Cache Valley, the State Engineer has used, among other information, the U.S. Geological Survey (USGS) report entitled *Hydrology of Cache Valley, Cache County, Utah, and Adjacent part of Idaho, with Emphasis on Simulation of Ground-Water Flow* (Kariya, et al., 1994).

BACKGROUND

The State Engineer believes that there is unappropriated water available in Cache Valley, Utah, during certain times of the year. According to the *Utah State Water Plan, Bear River Basin*, there is 196,000 acre-feet of depletable water available each year on the Bear River system for development in Utah. Much of this water is available during the winter and spring runoff period. During peak demand periods of most years, principal water sources are fully appropriated and there is not sufficient flow in surface sources to meet the demand of all existing surface water rights. In 1992 the basin experienced severe drought conditions and many early priority surface rights experienced shortages.

The USGS study shows, through measured data and model simulations, that surface and ground water within Cache Valley are hydrologically connected. Although the ground-water flow model (model) developed by the USGS is a simplified representation of the physical system, if used within the limitations of the model, it is a useful tool to evaluate the effects of ground-water withdrawals. Flows from the ground-water system to surface water sources are sensitive to both well withdrawals and changes in recharge to the ground-water system. The model (Kariya, et al., 1994) indicates that on an annual basis, the effect of additional ground-water withdrawal and consumption, is a reduction in surface water flows. Increased ground-water depletions cause 1) less water to be discharged from the aquifer to

surface water sources in discharge areas and, to a lesser degree, 2) more water to enter the aquifer system from surface water sources in recharge areas. In assessing the impact on the hydrologic system of existing and future ground-water withdrawals, it is important to consider that a portion of the withdrawn water may be returned to the system.

Physically, there are significant quantities of water within the basin fill aquifers. However, because ground water and surface water within Cache Valley are interrelated, it is anticipated that additional development and depletion of ground water will affect surface water flows. The ground-water system discharges water to the surface streams, springs, and reservoirs; and this water constitutes part of the flow in the tributaries and main stem of the Bear River. The limiting factor regarding ground-water development in Cache Valley is not the amount of water which is physically available within the aquifers, but rather the amount of ground water which can be withdrawn without impairing prior rights. Because of their interrelationship, ground-water and surface water systems need to be jointly managed as one system.

Ground-water withdrawals in Cache Valley represent about 12% of the annual recharge. The ground-water system is not currently experiencing any significant, regional, long-term problems. Locally, water levels fluctuate seasonally due to well withdrawals and climatic conditions; however, long-term, regional water levels appear to be stable. Estimated average annual recharge and discharge to the ground-water system in the Utah portion of Cache Valley for 1982 through 1990 are shown in table 1.

	Acre-Feet
Recharge	
Infiltration of precipitation and unconsumed irrigation water	90,000
Seepage from streams	1,000
Seepage from canals	86,000
Other forms of recharge (bedrock)	46,000
Total	223,000
Discharge	
Seepage to streams	70,000
Spring discharge	58,000
Evapotranspiration	36,000
Seepage to reservoirs	31,000
Withdrawals from wells	28,000
Total	223,000

Table 1 - Estimated water budget for the ground-water flow system in Cache Valley, Utah, 1982-90.

Table 1 shows a mass balance of the recharge and discharge components of the ground-water system and its relationship to surface water sources. Changes in one component will generally cause changes in other components. The table also shows that about 25 percent of the total discharge from the ground-water system is to springs.

Springs supplied from the valley fill aquifers generally occur in those areas where either the water level in a water table aquifer intersects the land surface or the water level in a confined aquifer is above the land surface and issues forth through an opening in the confining layer. Therefore, to maintain the discharge of springs at current levels, no significant change in the ground-water level should occur.

The issue is whether ground-water development should be curtailed in order to maintain current water levels. The State Engineer's water management objectives for the valley are to protect prior rights while putting to beneficial use the greatest amount of available water. The challenge is to institute criteria to guide development in a reasonable and equitable manner. The State Engineer recognizes the prior rights of spring users; however, he does not believe at this time it is reasonable or wise water management to close ground-water to further appropriations.

The affects of additional ground-water withdrawals are difficult to predict because they are dependent on several factors, such as, location, rate of withdrawal, geologic conditions, aquifer permeability and other related parameters. However, it is anticipated that as additional ground-water is withdrawn in Cache Valley, generally, water levels will change, with the greatest changes in the vicinity of large production wells. These general water level changes may result in a corresponding decrease in certain spring flows.

In the case where the discharge of a spring decreases to a point where the flow is insufficient to supply their beneficial uses, the spring user should be allowed to drill a well to replace that water no longer supplied from the spring. The well should be used only within the limitations of the water right and would carry the same priority date as the spring.

Surface water rights are supplied from many different sources, such as, runoff, ground-water inflow and irrigation return flow. Senior water rights are entitled to rely on upstream sources to make up their water supply. Since the ground-water system is hydrologically connected to some surface sources, the State Engineer believes that both surface and ground-water rights should be managed conjunctively. If surface flows are not sufficient to supply all rights, both surface and ground-water rights should be distributed according to priority.

Municipal and industrial water demand has been projected for Cache Valley through 2020 (Hughes, 1996). Based on population projections and historical water use practices, it is estimated that water diversion will increase by 15,000 AF from 1990 usage. Other uses and demands on the system may account for an additional 10,000 AF over the next 20 years. The State Engineer believes that potential withdrawals of 25,000 AF is a reasonable quantity of additional water to be developed to meet future demands for water over the next 20 years.

MANAGEMENT GUIDELINES

After considering at length the total situation of the Cache Valley hydrologic system as briefly summarized above, the State Engineer has formulated a plan which seeks to reasonably and wisely manage the water resources of Cache Valley. The plan strives to balance the protection of existing water rights in a reasonable manner, with the objective of encouraging that the greatest amount of available water be put to beneficial use. The State Engineer will use the following guidelines in reviewing applications and managing the ground-water resources of Cache Valley.

1) Cache Valley is open to new appropriations of ground water for individual family domestic purposes. Such applications are limited to a maximum diversion of 1.73 acre-feet per year for the domestic purposes of one family, up to 0.25 acres of irrigation of lawn and garden and incidental stock watering of 10 livestock. Applications considered under this paragraph may not be approved if water can be supplied by a public water system or the land is in a subdivision. The State Engineer may approve no more than one application to appropriate ground water under the provisions of this paragraph on any parcel of land which exists as of the effective date of this plan.

2) Applications to appropriate ground water, larger than the limitations set forth in paragraph 1, above, will be considered for approval, if the applicant can show that, (a) There is reason to believe that prior water rights will not be impaired, or (b)That impacts to prior water rights will be compensated or adequate replacement water provided. It is the responsibility of the applicant to make an evidentiary showing to the State Engineer at the time the application is filed, pursuant to (a) or (b)above. The evidentiary showing should address local, regional, and downstream effects on springs, streams, and the ground-water system. Appropriations considered under this paragraph will be subject to the annual withdrawal limitations set forth in paragraph 5, below. All applications are also subject to the statutory criteria of Section 73-3-8, Utah Code Annotated.

3) Change applications that propose to move surface water rights to ground water and/or move within the ground-water system will be considered on their own individual merits subject to the statutory criteria set forth in sections 73-3-3 and 73-3-8, Utah Code Annotated. Applications will be reviewed to ensure there is no enlargement of the underlying right and intervening rights are not impaired. Changes under this paragraph will be subject to the annual withdrawal limitations set forth in paragraph 5, below.

4) Extension of time requests on approved applications will be critically reviewed and if the applicant is not diligently pursuing the development of the water, the extension request may be denied, the quantity of water reduced, or the priority date reduced.

5) The State Engineer will allow an additional 25,000 acre-feet/year of potential ground-water withdrawals. As this water is fully developed and used, the effect of such development on the hydrologic system will be evaluated to determine if additional withdrawals can be allowed. The State Engineer will continue to monitor ground-water withdrawals, water levels in selected wells, and, as necessary, discharge at various springs in Cache Valley. As ground water is developed and provisions for replacement water implemented, or at the request of water users, the State Engineer will investigate the need to appoint a water commissioner to ensure the proper distribution of both surface and ground water.

6) Owners of existing water rights, whose source of supply is from springs, will be allowed to drill a well(s) if the flow of their spring is reduced by new ground-water development to a point where the flow is insufficient to supply their beneficial uses. A water user would need to file a change application, and set forth their claim of reduced spring flow.

7) Local water administration practices which exist within Cache Valley will supplement this plan and will remain in effect and are not overridden by this plan. These areas include Cove, Paradise and Petersboro, among others.

8) The effective date of this management plan is September 1, 1999.

REFERENCES

Hughes, Trevor C., Cache County Water Demand/Supply Model. Final Report to Utah Division of Water Resources, U.S. Bureau of Reclamation and Cache County, Utah State University, December 1996.

Kariya, K.A., Roark, M.D., Hanson, K.M., Hydrology of Cache Valley, Cache County, Utah and Adjacent Part of Idaho, with Emphasis on Simulation of Ground-Water Flow, United States Geological Survey in cooperation with Utah Department of Natural Resources and Utah Division of Water Rights, 1994.

Utah Code Annotated, 1953, as Amended, Title 73.

Utah State Water Plan, Bear River Basin, Utah Board of Water Resources, January 1992.

Appendix 5-A

Evaluation of Project Alternatives

Explanation of the evaluation completed to determine what water projects need to be completed in Cache County to meet current and future water needs. The actual evaluation table is included after the explanation.

CACHE COUNTY
WATER MASTER PLAN

Overview of Project Evaluation Table Parts

The evaluation table is broken into the following parts:

Project Alternatives

The alternatives that were evaluated are listed down the left hand side of the table and are sorted by the type of project.

Objectives

The goals or objectives that have been identified as important by the steering committee and project team are listed across the top of the table. These objectives are split into the following three categories:

- Water Supply (shown in blue)
- Implementation (shown in purple)
- Environment (shown in green)

Metrics

The metrics for each objective are listed across the top of the table just below the objectives. The metrics provide the units and the method used to measure how well a given alternative meets the corresponding objective. In the future, as more specifics are gathered for a given alternative, more solid data can be added to the analysis.

Color Key

A color key is shown just below the metrics and gives four ranges of values for each metric. The alternatives were evaluated at a conceptual level. Therefore, there is a level of uncertainty in the values calculated for the evaluation. The four color levels indicate how well the objectives or goals are attained by a given alternative, with the darker colors indicating a higher level of attainment than the lighter colors.

Evaluation

In the rows to the right of each alternative, numbers are given in cells to indicate the estimated value that each alternative has for each of the metrics. For metrics that could not be exactly quantified, without further evaluation, an assignment of “None”, “Low”, “Medium”, or “High” was given. Any cell that is labeled with “N/A” indicates that the metric in that column does not apply to the alternative listed on that row.

The strength of a given alternative can be determined by looking across a row for the given alternative and comparing how dark the cells are for that alternative with the cells for other alternatives. Alternatives that have darker cells are stronger than alternatives with lighter cells.

EVALUATION OF PROJECT ALTERNATIVES

PROJECT ALTERNATIVES	OBJECTIVES																		
	Water Supply								Implementation						Environment				
	Protect Bear River water allocated to County		Provide adequate reliable future culinary supply	Provide adequate reliable irrigation supply now and in the future	Maintain existing irrigation delivery systems	Keep rights to water that are converted from Ag to M&I uses in Cache County	Match use of water to the water quality	Conserve water	Promote collaboration and focus on regional projects	Minimize costs			Educate public about Bear River development	Educate public about current water situation and future anticipated problems	Maintain or improve environmental quality			Protect water quality and drinking water sources	Minimize power consumption to operate water systems
	METRICS (methods of measurement)																		
	Water put to beneficial use or in approved non-use status (acre-feet)	Bear River water developed (acre-feet)	Additional communities with adequate culinary supply to year 2060 (number)	Reliable late season irrigation supply added (acre-feet)	Canals dredged, lined, or reconstructed (linear feet)	Amount of converted water that is banked (acre-feet)	Residential units with secondary water (number)	Volume of water conserved (acre-feet / year	Entities that benefit (number)	*Capital Costs ($)	*Debt service and operation and maintenance costs for 50 year life cycle ($ per acre-feet per year)	Potential grant money available (yes/no)	Additional County residents that understand act (number)	Residents that understand how long water supplies will last (number)	Water developed to maintain or improve wildlife habitat (acre-feet)	Water developed to maintain or improve fish flows in natural streams (acre-feet)	Water related recreational opportunities added (yes/no)	Enhances water source protection (yes/no)	Change in power consumption (increase or decrease)
	COLOR KEY																		
	Less than 1000	Less than 1000	0	Less than 1000	0	Less than 500	Less than 500	Less than 50	less than 3	more than $150,000,000	More than $500	None	None	None	None	None	None	No	Large increase
	1000 to 10,000	1000 to 10,000	1 to 5	1000 to 10,000	1 to 5000	1 to 5,000	501 to 1,000	50 to 3000	3 to 7	$75,000,000 to $150,000,000	276 to 450	Grants in past	Low	Low	Low	Low	Low		Some increase
	10,001 to 20,000	10,001 to 20,000	6 to 10	10,001 to 20,000	5001 to 20,000	5,000 to 10,000	1,001 to 1,500	3001 to 6,000	8 to 15	$4,000,001 to $75,000,000	101 to 275	50%	Medium	Medium	Medium	Medium	Medium		No change
	More than 20,000	More than 20,000	11 to 15	More than 20,000	More than 20,000	More than 10,000	More than 1,500	More than 6,000	More than 15	Less than $4,000,000	Less than 100	75%	High	High	High	High	High	Yes	Some decrease
Aquifer Storage and Recovery Projects																			
Aquifer Storage and Recovery (ASR)at mouth of Green Canyon	2,000	2,000	3	Low	0	0	0	0	More than 15	$600,000	$20	50% Grant	None	None	None	Low	None	No	Some Decrease
ASR using River Park Well	5,000	5,000	3	Low	0	0	0	0	More than 15	$3,000,000	$30	50% Grant	None	None	None	Low	None	No	Some Decrease
Reservoir Projects																			
Logan Canyon Reservoir - add 0.5 feet of irrigation water each year to irrigators (approx. 35,000 acres served)	30,000	30,000	15**	30,000	0	0	Low	0	More than 15	$138,000,000	$240	75% funding for irrigation reservoir	None	None	Low	Low	High	No	No Change
Reservoir in Logan Canyon - Irrigate 8000 new acres in Petersboro area (Pump from Cutler)	30,000	30,000	15**	30,000	0	0	Low	0	More than 15	$173,000,000	$330	75% funding for irrigation reservoir	None	None	Med	Low	High	No	Large Increase
Reservoir on Cub River, adds one foot more summer water for small pumpers and West Cache Irrigation	15,000	15,000	15**	15,000	0	0	Low	0	More than 15	$95,000,000	$340	75% funding for irrigation reservoir	None	None	Low	Low	High	No	Some Increase
Construct Multiple Small (less than 10,000 acre feet) Reservoirs to provide more secure irrigation water supply	60,000	60,000	15**	60,000	0	0	Low	0	More than 15	$315,000,000	$370	75% funding for irrigation reservoir	None	None	None	None	Low	No	No Change
Enlarge Hyrum reservoir to provide more irrigation to South Cache Irrigators	16,000	16,000	15**	16,000	0	0	Low	0	More than 15	$84,000,000	$280	75% funding for irrigation reservoir	None	None	Low	Low	Low	No	Some Decrease

*Low values are preferred and are shown in a darker color than higher values.

**Would require surface water treatment plant or exchange for ground water along with drilling a well or making spring improvements

PROJECT ALTERNATIVES	OBJECTIVES																		
	Water Supply								Implementation						Environment				
	Protect Bear River water allocated to County		Provide adequate reliable future culinary supply	Provide adequate reliable irrigation supply now and in the future	Maintain existing irrigation delivery systems	Keep rights to water that are converted from Ag to M&I uses in Cache County	Match use of water to the water quality	Conserve water	Promote collaboration and focus on regional projects	Minimize costs			Educate public about Bear River development	Educate public about current water situation and future anticipated problems	Maintain or improve environmental quality			Protect water quality and drinking water sources	Minimize power consumption to operate water systems
	METRICS (methods of measurement)																		
	Water put to beneficial use or in approved non-use status (acre-feet)	Bear River water developed (acre-feet)	Additional communities with adequate culinary supply to year 2060 (number)	Reliable late season irrigation supply added (acre-feet)	Canals dredged, lined, or reconstructed (linear feet)	Amount of converted water that is banked (acre-feet)	Residential units with secondary water (number)	Volume of water conserved (acre-feet / year	Entities that benefit (number)	*Capital Costs ($)	*Debt service and operation and maintenance costs for 50 year life cycle ($ per acre-feet per year)	Potential grant money available (yes/no)	Additional County residents that understand act (number)	Residents that understand how long water supplies will last (number)	Water developed to maintain or improve wildlife habitat (acre-feet)	Water developed to maintain or improve fish flows in natural streams (acre-feet)	Water related recreational opportunities added (yes/no)	Enhances water source protection (yes/no)	Change in power consumption (increase or decrease)
	COLOR KEY																		
	Less than 1000	Less than 1000	0	Less than 1000	0	Less than 500	Less than 500	Less than 50	less than 3	more than $150,000,000	More than $500	None	None	None	None	None	None	No	Large increase
	1000 to 10,000	1000 to 10,000	1 to 5	1000 to 10,000	1 to 5000	1 to 5,000	501 to 1,000	50 to 3000	3 to 7	$75,000,000 to $150,000,000	276 to 450	Grants in past	Low	Low	Low	Low	Low		Some increase
	10,001 to 20,000	10,001 to 20,000	6 to 10	10,001 to 20,000	5001 to 20,000	5,000 to 10,000	1,001 to 1,500	3001 to 6,000	8 to 15	$4,000,001 to $75,000,000	101 to 275	50%	Medium	Medium	Medium	Medium	Medium		No change
	More than 20,000	More than 20,000	11 to 15	More than 20,000	More than 20,000	More than 10,000	More than 1,500	More than 6,000	More than 15	Less than $4,000,000	Less than 100	75%	High	High	High	High	High	Yes	Some decrease
Reservoir near Avon - Irrigate Mt. Sterling Area (pump from Hyrum reservoir)	12,000	12,000	15**	12,000	0	0	Low	0	More than 15	$118,000,000	$550	75% funding for irrigation reservoir	None	None	Low	Low	Med	No	Large Increase
Logan Canyon Reservoir- Irrigate Petersboro area (Pipe from Logan Canyon)	30,000	30,000	15**	30,000	0	0	Low	0	More than 15	$286,000,000	$480	75% funding for irrigation reservoir	None	None	None	None	Med	No	No Change
Reservoir near Avon - Irrigate Mt. Sterling Area (Pipe from Avon)	12,000	12,000	15**	12,000	0	0	Low	0	More than 15	$199,000,000	$830	75% funding for irrigation reservoir	None	None	None	None	Med	No	No Change
Participate in a Box Elder Reservoir, pump back to cutler, pump to west bench areas	30,000	30,000	15**	30,000	0	0	0	0	1 to 5	$170,000,000	$470	75% funding for irrigation reservoir	None	None	None	None	None	No	Large Increase
Construct Millcreek Reservoir	10,000	10,000	15**	10,000	0	0	Low	0	More than 15	$79,000,000	$420	75% funding for irrigation reservoir	None	None	Med	Med	Med	No	No Change
Water Banking Projects																			
Bank water that is made available during conversion from Ag to Municipal & Through Bear River Development	60,000	0	13	0	0	12,000	0	0	More than 15	Depends on organizational structure used (less than $4Million)	Depends on organizational structure used	50% Grant	None	None	Low	Low	Low	No	No Change
Secondary Water Projects																			
Construct secondary water system in North Logan below L&N canal	0	0	1	0	0	0	1,800	50	3 or 4	$6,800,000	$230	50% Grant	None	None	None	None	None	No	Some Decrease
Construct secondary water system in Logan	0	0	1	0	0	0	3,000	100	3 or 4	$6,500,000	$230	50% Grant	None	None	None	None	None	No	Some Decrease

*Low values are preferred and are shown in a darker color than higher values.

**Would require surface water treatment plant or exchange for ground water along with drilling a well or making spring improvements

PROJECT ALTERNATIVES	OBJECTIVES																		
	Water Supply								Implementation						Environment				
	Protect Bear River water allocated to County		Provide adequate reliable future culinary supply	Provide adequate reliable irrigation supply now and in the future	Maintain existing irrigation delivery systems	Keep rights to water that are converted from Ag to M&I uses in Cache County	Match use of water to the water quality	Conserve water	Promote collaboration and focus on regional projects	Minimize costs			Educate public about Bear River development	Educate public about current water situation and future anticipated problems	Maintain or improve environmental quality			Protect water quality and drinking water sources	Minimize power consumption to operate water systems
	METRICS (methods of measurement)																		
	Water put to beneficial use or in approved non-use status (acre-feet)	Bear River water developed (acre-feet)	Additional communities with adequate culinary supply to year 2060 (number)	Reliable late season irrigation supply added (acre-feet)	Canals dredged, lined, or reconstructed (linear feet)	Amount of converted water that is banked (acre-feet)	Residential units with secondary water (number)	Volume of water conserved (acre-feet / year	Entities that benefit (number)	*Capital Costs ($)	*Debt service and operation and maintenance costs for 50 year life cycle ($ per acre-feet per year)	Potential grant money available (yes/no)	Additional County residents that understand act (number)	Residents that understand how long water supplies will last (number)	Water developed to maintain or improve wildlife habitat (acre-feet)	Water developed to maintain or improve fish flows in natural streams (acre-feet)	Water related recreational opportunities added (yes/no)	Enhances water source protection (yes/no)	Change in power consumption (increase or decrease)
	COLOR KEY																		
	Less than 1000	Less than 1000	0	Less than 1000	0	Less than 500	Less than 500	Less than 50	less than 3	more than $150,000,000	More than $500	None	None	None	None	None	None	No	Large increase
	1000 to 10,000	1000 to 10,000	1 to 5	1000 to 10,000	1 to 5000	1 to 5,000	501 to 1,000	50 to 3000	3 to 7	$75,000,000 to $150,000,000	276 to 450	Grants in past	Low	Low	Low	Low	Low		Some increase
	10,001 to 20,000	10,001 to 20,000	6 to 10	10,001 to 20,000	5001 to 20,000	5,000 to 10,000	1,001 to 1,500	3001 to 6,000	8 to 15	$4,000,001 to $75,000,000	101 to 275	50%	Medium	Medium	Medium	Medium	Medium		No change
	More than 20,000	More than 20,000	11 to 15	More than 20,000	More than 20,000	More than 10,000	More than 1,500	More than 6,000	More than 15	Less than $4,000,000	Less than 100	75%	High	High	High	High	High	Yes	Some decrease
Irrigation Delivery Projects																			
Reduce seepage from canals and use saved water to create more habitat for wildlife (1200 feet per year)	0	0	0	0	60,000	0	0	5,000	More than 15	$30,000,000	$270	50% Grant	None	None	Med	Med	Low	No	No Change
Program to rebuild or improve major canals in Cache County (1200 ft per year)	0	0	0	5,000	60000	0	Low	5,000	More Than 15	$30,000,000	$270	50% Grant	None	None	None	None	None	No	No Change
Enclose Crockett Canal east of Logan Center Street	0	0	0	Low	2450	0	0	440	12	$2,600,000	$17,000	50% Grant	None	None	None	None	Low	No	No Change
Create access along major canals in Logan, North Logan Hyde Park, Providence, River Heights	0	0	0	0	0	0	0	0	12	$400/lineal foot. Does not develop water	N/A	Low	None	None	None	None	Low	No	No Change
Culinary Water Distribution Projects																			
Culinary water pipe between Mendon and Wellsville	1,300	0	2	0	0	0	0	0	2	$2,200,000	$80	Low	None	None	None	None	None	No	No Change
Culinary water pipe Between Lewiston and Cornish	1,300	0	1	0	0	0	0	0	2	$600,000	$20	Low	None	None	None	None	None	No	No Change
Culinary water pipe between Trenton and Lewiston	1,300	0	1	0	0	0	0	0	2	$2,100,000	$80	Low	None	None	None	None	None	No	No Change
Culinary water pipe between Trenton and Cornish	1,300	0	1	0	0	0	0	0	2	$2,100,000	$70	Low	None	None	None	None	None	No	No Change
12" Culinary water pipe between Logan and Cache Junction, 8" lines to Mendon and Newton	2600	0	2	0	0	0	0	0	4	$14,000,000	$260	Low	None	None	None	None	None	No	No Change

*Low values are preferred and are shown in a darker color than higher values.
**Would require surface water treatment plant or exchange for ground water along with drilling a well or making spring improvements

PROJECT ALTERNATIVES	OBJECTIVES																		
	Water Supply								Implementation						Environment				
	Protect Bear River water allocated to County		Provide adequate reliable future culinary supply	Provide adequate reliable irrigation supply now and in the future	Maintain existing irrigation delivery systems	Keep rights to water that are converted from Ag to M&I uses in Cache County	Match use of water to the water quality	Conserve water	Promote collaboration and focus on regional projects	Minimize costs			Educate public about Bear River development	Educate public about current water situation and future anticipated problems	Maintain or improve environmental quality			Protect water quality and drinking water sources	Minimize power consumption to operate water systems
	METRICS (methods of measurement)																		
	Water put to beneficial use or in approved non-use status (acre-feet)	Bear River water developed (acre-feet)	Additional communities with adequate culinary supply to year 2060 (number)	Reliable late season irrigation supply added (acre-feet)	Canals dredged, lined, or reconstructed (linear feet)	Amount of converted water that is banked (acre-feet)	Residential units with secondary water (number)	Volume of water conserved (acre-feet / year	Entities that benefit (number)	*Capital Costs ($)	*Debt service and operation and maintenance costs for 50 year life cycle ($ per acre-feet per year)	Potential grant money available (yes/no)	Additional County residents that understand act (number)	Residents that understand how long water supplies will last (number)	Water developed to maintain or improve wildlife habitat (acre-feet)	Water developed to maintain or improve fish flows in natural streams (acre-feet)	Water related recreational opportunities added (yes/no)	Enhances water source protection (yes/no)	Change in power consumption (increase or decrease)
	COLOR KEY																		
	Less than 1000	Less than 1000	0	Less than 1000	0	Less than 500	Less than 500	Less than 50	less than 3	more than $150,000,000	More than $500	None	None	None	None	None	None	No	Large increase
	1000 to 10,000	1000 to 10,000	1 to 5	1000 to 10,000	1 to 5000	1 to 5,000	501 to 1,000	50 to 3000	3 to 7	$75,000,000 to $150,000,000	276 to 450	Grants in past	Low	Low	Low	Low	Low		Some increase
	10,001 to 20,000	10,001 to 20,000	6 to 10	10,001 to 20,000	5001 to 20,000	5,000 to 10,000	1,001 to 1,500	3001 to 6,000	8 to 15	$4,000,001 to $75,000,000	101 to 275	50%	Medium	Medium	Medium	Medium	Medium		No change
	More than 20,000	More than 20,000	11 to 15	More than 20,000	More than 20,000	More than 10,000	More than 1,500	More than 6,000	More than 15	Less than $4,000,000	Less than 100	75%	High	High	High	High	High	Yes	Some decrease
Public Education Projects																			
Visit each city council/ culinary water board to discuss results of master plan	0	0	Low	Low	0	0	0	0	More than 15	$40,000	0	Low	350	350	None	None	None	Yes	No Change
Water Conservation Projects																			
Water Conservation Campaign to reduce water usage by 25% by year 2050	0	0	8	0	0	0	0	21,000	More than 15	$28,000,000	$60	50% Grant	None	10,000	None	None	None	No	Some Decrease
Water Wise landscaping classes	0	0	Low	0	0	0	0	5,000	More than 15	?	?	50% Grant	None	2,000	None	None	None	Low	Some Decrease
Large water user workshops to help promote conservation	0	0	Low	0	0	0	0	5,000	More than 15	?	?	50% Grant	None	2,000	None	None	None	No	Some Decrease
Water conservation demonstration garden	0	0	Low	0	0	0	0	2,000	More than 15	?	?	50% Grant	None	2,000	None	None	None	No	Some Decrease
Water Quality Projects																			
Public Education campaign in Cache County to help public understand how to protect our aquifers	0	0	0	0	0	0	0	0	More than 15	$100,000	N/A	Low	None	None	None	None	None	Yes	No Change
Water Study Projects																			
Study to quantify environmental water needs in Cache County (min stream flows etc.)	0	0	0	0	0	0	0	0	More than 15	$250,000	N/A	Low	None	None	High	High	Med	Yes	No Change
Climate change study	0	0	0	0	0	0	0	0	More than 15		N/A	Low	None	None	None	None	None	No	No Change
Other Projects																			
Construct riparian Meadows	less than 1000	0	0	0	0	0	0	0	10 to 12	?	?	50% Grant	None	None	Med	Med	No	Yes	No Change
500 Beaver Dams	500	500	0	500	0	0	0	0	2 or 3	Small	small	50% Grant	None	None	500	500	No	No	No Change

*Low values are preferred and are shown in a darker color than higher values.

**Would require surface water treatment plant or exchange for ground water along with drilling a well or making spring improvements

Appendix 5-B

Summary of Major Cost Assumptions

A summary of the major assumptions that were used to create the conceptual cost estimates for the evaluated projects.

CACHE COUNTY
WATER MASTER PLAN

PROJECT COST ASSUMPTIONS

The following types of projects were evaluated.

- Aquifer Storage and Recovery (ASR)
- Reservoirs
- Water Banking
- Secondary Water
- Irrigation Delivery (Canal improvements)
- Culinary Water Interconnects
- Water Quality Projects
- Water Study Projects

Multiple specific project examples were evaluated for some of the above listed project types.

One of the objectives used in the evaluation of projects was to minimize costs. Three metrics were used to measure how well a given project met the cost objective:

- Capital Costs
- Cost to pay back a loan on a project (Debt Service), and to operate a given project for a period of 50 years
- Potential for grant money to help fund a project

The following general cost assumptions were made for all of the projects evaluated:

- All estimates of yearly cost per acre foot (debt service and operation and maintenance) for a given project are based on a 50 year loan with a 4% interest rate.
- All capital cost estimates include a 50% contingency to account for engineering, studies, and uncertainty in construction costs.

The cost assumptions that are specific for projects evaluated are listed below.

ASR PROJECTS

Capital Costs:

River Park Well: Based on the cost to develop the Brigham City ASR project which was $165,000 in 1998. The project developed approximately 525 acre feet of water per year based on a withdrawal capacity of 3.5 feet acre feet per day (DWRe Bear River Basin Planning for the Future 2004 report) and assuming 5 months of withdrawal per year. The costs were inflated to 2013 dollars using the Engineering News Record Cost Index and adjusted to include engineering fees. This gave a cost of

$600/acre foot and a total project cost of $3,000,000. It was assumed that water would be injected utilizing the existing well.

Green Canyon: The costs for the Green Canyon site are based on some input from UGS as to what general items will need to be done to develop the site. The construction of the Green Canyon site will be less cost prohibitive then River park well site. The Green Canyon project will utilize surface infiltration instead of injection through a well. The following table shows the assumptions made for the Green Canyon costs.

Description	Unit	Quantity	Unit Cost	Opinion of Probable Cost
Hydrology/ Geology Studies	LS	1	$ 30,000	$30,000
Earthwork	CY	25000	$ 10	$250,000
Monitoring well with 2 piezometers (150-170' deep)	LS	1	$ 30,000	$30,000
Measure amount of water entering basin (2 flumes)	LS	1	$ 18,000	$18,000
Deliver Water to infiltration Basin (piping/canal)	LS	1	$ 50,000.00	$50,000
		Total Construction Cost		$378,000
	Construction Contingency (35%)			$ 132,300
		Engineering (15%)		$ 76,545
			TOTAL	**$ 586,845**
		Cost per acre foot		**$ 293.42**

The cost for the Green Canyon site is significantly less than the cost for the River Park Well. The 2004 Bear River Basin Report prepared by DWRe states that ASR facilities cost an average of about $360 per acre-foot per year for construction.

Storage Volumes: Estimates of anticipated storage volumes are based on conversations with UGS.

RESERVOIR ASSUMPTIONS

Capital Costs:

- **Construction Capital Costs for New Reservoirs:** $2,300 per acre foot based on average costs of selected reservoirs studied in the past and an inflation factor given from the Bureau of Reclamation (BOR) cost index for the construction of reservoirs with earthen dams.
- **Construction Capital Costs to expand Existing Reservoirs:** $2000 per acre foot based on past studies to enlarge Hyrum reservoir and BOR cost index mark up.
- **Construction Capital Costs for Reservoirs smaller than 10,000 Acre Feet in Capacity:** $4,000 per acre foot based on costs for reservoirs of similar size studied by the BOR in a Southeast Oregon 2010 Study. No pumping or piping included in costs for small reservoirs. Reservoir location unknown.

The total costs to construct the reservoirs are based on the total storage volume and not solely by the estimated yield volume.

The cost per acre foot per year is based on the estimated reliable yield that was estimated based on past reservoir studies where available.

Delivery : Costs to Deliver Irrigation Water to the areas served by the Reservoir

Pipe Costs: $10 per lineal foot per inch diameter of pipe size

Property along pipe alignment (estimated 40' easements with purchase cost of $30,000/acre)

Irrigation Distribution Piping Throughout the Area Served:

Major distribution lines =$2,100 per acre served. On-farm piping and sprinklers not included. (Assumptions are based on past large irrigation distribution construction projects)

Pump Stations: costs to pump water to areas that can't be served by gravity out of the reservoir

Elevation Lift: Assumed 300 feet of lift for all lift stations. Assumed two pump stations for Box Elder Reservoir

Cost per horsepower: $1,300.

Operation and Maintenance Costs**:** 1% of pump station construction

WATER BANKING

Costs depend on the type of management structure implemented. Assumed to be less than $400,000 per year and are categorized as such in the evaluation table.

SECONDARY WATER PROJECTS

Service Areas

North Logan Project: Assumed serving area between 1400 East and HWY 91 and 1700 North and 2500 North.

Logan Project: Assumed serving area between 800 East and Main Street and 1400 North and Canyon Road

Costs: Based on the recent costs to build a secondary water system in Santaquin City. Cost per acre foot = $3,034 plus contingencies.

Assumed that system will be fed from existing canals and will not require pumping.

IRRIGATION DELIVERY PROJECTS

Construction Costs: Average cost of $325 per lineal foot to improve a canal.

Crockett Canal: Cost based on feasibility 2010 report completed by JUB Engineers for canal enclosure.

CULINARY WATER INTERCONNECT PROJECTS

Construction Costs: Assumed cost of $12 per inch diameter foot of pipe**.**

Assumes pipes are sized to keep maximum flow velocity below 5 ft per second.

WATER QUALITY PROJECTS

Public Education campaign in Cache County to help public understand how to protect our aquifers

Capital cost of $100,000 assumed for an education campaign for water quality improvement.

WATER STUDY PROJECTS

Study to quantify environmental water needs in Cache County (min stream flows etc.)

Assumed $250,000 based on conceptual scope of work from Utah State University given in Appendix 3-D.

Appendix 5-C

Reservoir Cost Summary

Summary table that lists the different reservoirs that were evaluated along with conceptual cost estimates. Specific conceptual reservoir sites were evaluated with different methods of water delivery to determine how well they meet the objectives. The reservoir sites evaluated are at locations that have been evaluated in previous studies.

CACHE COUNTY
WATER MASTER PLAN

		Logan Canyon Reservoir -add 0.5 feet of irrigation water each year to irrigators (approx. 35,000 acres served)			Reservoir in Logan Canyon - Irrigate 8000 new acres in Petersboro area (Pump from Cutler)			Reservoir on Cub River, adds one foot more summer water for small pumpers and West Cache Irrigation		
		approx yield (acre-feet)		30,000	approx yield (acre-feet)		30,000	approx yield (acre-feet)		15,000
ITEM	**UNIT**	**QUANTITY**	**UNIT COST**	**TOTAL COST**	**QUANTITY**	**UNIT COST**	**TOTAL COST**	**QUANTITY**	**UNIT COST**	**TOTAL COST**
Construction of Reservoir	AC-FT	40,000	$ 2,300	$ 92,000,000	40,000	$ 2,300	$ 92,000,000	27,000	$ 2,300	$ 62,100,000
Conveyance Pipe ($12/in. dia./ft)	LF	0		$ -	0		$ -	0		$ -
Property for Easements for Pipes	ACRES	0	$ 20,000	$ -	0	$ 20,000	$ -	0	$ 20,000	$ -
Major Distribution Pipes	ACRES SERVED	0	$ 2,100	$ -	8,000	$ 2,100	$ 16,800,000	600	$ 2,100	$ 1,260,000
Pump Station Construction	EA	0		$ -	1	$ 6,825,000	$ 6,825,000	0	$ -	$ -
Cost				$ 92,000,000			$ 115,625,000			$ 63,360,000
Construction Contingency	35%			$ 32,200,000			$ 40,468,750			$ 22,176,000
Total Construction Cost				$ 124,200,000			$ 156,093,750			$ 85,536,000
Engineering	15%			$ 13,800,000			$ 17,343,750			$ 9,504,000
Total				**$ 138,000,000**			**$ 173,437,500**			**$ 95,040,000**
O&M (yearly Costs)										
Reservoir Maintenance (1% of Reservoir Constuction)				$ 920,000			$ 920,000			$ 621,000
Conveyance Pipe Maintenance (.05% of Conveyance Pipe)				$ -			$ -			$ -
Pump Station Maintenance (1% of Pump Station Construction)				$ -			$ 68,250			$ -
Yearly Power Costs							$ 950,670			$ -
Total yearly O&M Costs				$ 920,000			$ 1,938,920			$ 621,000
Present Value Costs										
Loan Term (years)	50									
Interest rate	4%									
O&M Costs (Present Value)				$19,800,000			$41,700,000			$13,300,000
Total Present Value Cost of Project				$ 157,800,000			$ 215,137,500			$ 108,340,000
Total Present Value Cost /acre- foot (including operation and maintainence				$ 5,260			$ 7,171			$ 7,223
Yearly Loan Payments										
Yearly payment including O&M				$7,345,622			$10,014,694			$5,043,249
Yearly payment per acre foot of reliable storage including O&M				$244.85			$333.82			$336.22

		Construct Multiple Small (less than 10,000 acre feet) Reservoirs to provide more secure irrigation water supply			Enlarge Hyrum reservoir to provide more irrigation to South Cache Irrigators			Reservoir near Avon - Irrigate Mt. Sterling Area (pump from Hyrum reservoir)		
		approx yield (acre-feet)		45,000	approx yield (acre-feet)		16,000	approx yield (acre-feet)		12,000
ITEM	**UNIT**	**QUANTITY**	**UNIT COST**	**TOTAL COST**	**QUANTITY**	**UNIT COST**	**TOTAL COST**	**QUANTITY**	**UNIT COST**	**TOTAL COST**
Construction of Reservoir	AC-FT	60,000	$ 3,500	$ 210,000,000	28,000	$ 2,000	$ 56,000,000	30,000	$ 2,300	$ 69,000,000
Conveyance Pipe ($12/in. dia./ft)	LF	0		$ -	0		$ -	0		$ -
Property for Easements for Pipes	ACRES	0	$ 20,000	$ -	0	$ 20,000	$ -	0	$ 20,000	$ -
Major Distribution Pipes	ACRES SERVED	0	$ 2,100	$ -	0	$ 2,100	$ -	3,200	$ 2,100	$ 6,720,000
Pump Station Construction	EA	0	$ -	$ -	0	$ -	$ -	1	$ 2,730,000	$ 2,730,000
Cost				$ 210,000,000			$ 56,000,000			$ 78,450,000
Construction Contingency	35%			$ 73,500,000			$ 19,600,000			$ 27,457,500
Total Construction Cost				$ 283,500,000			$ 75,600,000			$ 105,907,500
Engineering	15%			$ 31,500,000			$ 8,400,000			$ 11,767,500
Total				**$ 315,000,000**			**$ 84,000,000**			**$ 117,675,000**
O&M (yearly Costs)										
Reservoir Maintenance (1% of Reservoir Constuction)				$ 2,100,000			$ 560,000			$ 690,000
Conveyance Pipe Maintenance (.05% of Conveyance Pipe)				$ -			$ -			$ -
Pump Station Maintenance (1% of Pump Station Construction)				$ -			$ -			$ 27,300
Yearly Power Costs				$ -			$ -			$ 360,514
Total yearly O&M Costs				$ 2,100,000			$ 560,000			$ 1,077,814
Present Value Costs										
Loan Term (years)	50									
Interest rate	4%									
O&M Costs (Present Value)				$45,100,000			$12,000,000			$23,200,000
Total Present Value Cost of Project				$ 360,100,000			$ 96,000,000			$ 140,875,000
Total Present Value Cost /acre- foot (including operation and maintainence				$ 8,002			$ 6,000			$ 11,740
Yearly Loan Payments										
Yearly payment including O&M				$16,762,727			$4,468,819			$6,557,759
Yearly payment per acre foot of reliable storage including O&M				$372.51			$279.30			$546.48

		Logan Canyon Reservoir- Irrigate Petersboro area (Pipe from Logan Canyon)			Reservoir near Avon - Irrigate Mt. Sterling Area (Pipe from Avon)			Participate in a Box Elder Reservoir, pump back to cutler, pump to west bench areas		
		approx yield (acre-feet)		30,000	approx yield (acre-feet)		12,000	approx yield (acre-feet)		21,500
ITEM	**UNIT**	**QUANTITY**	**UNIT COST**	**TOTAL COST**	**QUANTITY**	**UNIT COST**	**TOTAL COST**	**QUANTITY**	**UNIT COST**	**TOTAL COST**
Construction of Reservoir	AC-FT	40,000	$ 2,300	$ 92,000,000	30,000	$ 2,300	$ 69,000,000	30,000	$ 2,300	$ 69,000,000
Conveyance Pipe ($12/in. dia./ft)	LF	132,000	$ 600	$ 79,200,000	114,500	$ 480	$ 54,960,000	50,000	$ 360	$ 18,000,000
Property for Easements for Pipes	ACRES	121	$ 20,000	$ 2,424,242	105	$ 20,000	$ 2,102,847	46	$ 20,000	$ 918,274
Major Distribution Pipes	ACRES SERVED	8,000	$ 2,100	$ 16,800,000	3,200	$ 2,100	$ 6,720,000	5,733	$ 2,100	$ 12,040,000
Pump Station Construction	EA	0	$ -	$ -	0	$ -	$ -	2	$ 6,825,000	$ 13,650,000
Cost				$ 190,424,242			$ 132,782,847			$ 113,608,274
Construction Contingency	35%			$ 66,648,485			$ 46,473,996			$ 39,762,896
Total Construction Cost				$ 257,072,727			$ 179,256,843			$ 153,371,169
Engineering	15%			$ 28,563,636			$ 19,917,427			$ 17,041,241
Total				**$ 285,636,364**			**$ 199,174,270**			**$ 170,412,410**
O&M (yearly Costs)										
Reservoir Maintenance (1% of Reservoir Constuction)				$ 920,000			$ 690,000			$ 690,000
Conveyance Pipe Maintenance (.05% of Conveyance Pipe)				$ 39,600			$ 27,480			$ 9,000
Pump Station Maintenance (1% of Pump Station Construction)				$ -			$ -			$ 136,500
Yearly Power Costs										$ 1,259,329
Total yearly O&M Costs				$ 959,600			$ 717,480			$ 2,094,829
Present Value Costs										
Loan Term (years)	50									
Interest rate	4%									
O&M Costs (Present Value)				$20,600,000			$15,400,000			$45,000,000
Total Present Value Cost of Project				$ 306,236,364			$ 214,574,270			$ 215,412,410
Total Present Value Cost /acre- foot (including operation and maintainence				$ 10,208			$ 17,881			$ 10,019
Yearly Loan Payments										
Yearly payment including O&M				$14,255,364			$9,988,475			$10,027,491
Yearly payment per acre foot of reliable storage including O&M				$475.18			$832.37			$466.39

		Construct Millcreek Reservoir			General reservoir cost		
		approx yield (acre-feet)		10,000	approx yield (acre-feet)		50,000
ITEM	**UNIT**	**QUANTITY**	**UNIT COST**	**TOTAL COST**	**QUANTITY**	**UNIT COST**	**TOTAL COST**
Construction of Reservoir	AC-FT	23,000	$ 2,300	$ 52,900,000	66,667	$ 2,300	$ 153,334,100
Conveyance Pipe ($12/in. dia./ft)	LF	0	$ -	$ -	0		$ -
Property for Easements for Pipes	ACRES	0	$ 20,000	$ -	0	$ 20,000	$ -
Major Distribution Pipes	ACRES SERVED	0	$ 2,100	$ -	0	$ 2,100	$ -
Pump Station Construction	EA	0	$ -	$ -	0		$ -
Cost				$ 52,900,000			$ 153,334,100
Construction Contingency	35%			$ 18,515,000			$ 53,666,935
Total Construction Cost				$ 71,415,000			$ 207,001,035
Engineering	15%			$ 7,935,000			$ 23,000,115
Total				**$ 79,350,000**			**$ 230,001,150**
O&M (yearly Costs)							
Reservoir Maintenance (1% of Reservoir Constuction)				$ 529,000			$ 1,533,341
Conveyance Pipe Maintenance (.05% of Conveyance Pipe)				$ -			$ -
Pump Station Maintenance (1% of Pump Station Construction)				$ -			$ -
Yearly Power Costs							
Total yearly O&M Costs				$ 529,000			$ 1,533,341
Present Value Costs							
Loan Term (years)	50						
Interest rate	4%						
O&M Costs (Present Value)				$11,400,000			$32,900,000
Total Present Value Cost of Project				$ 90,750,000			$ 262,901,150
Total Present Value Cost /acre- foot (including operation and maintainence				$ 9,075			$ 5,258
Yearly Loan Payments							
Yearly payment including O&M				$4,224,431			$12,238,101
Yearly payment per acre foot of reliable storage including O&M				$422.44			$244.76

Appendix 5-D

Comparison of District Types

A summary of the differences between district types is given in a table. There are four types of local districts included in the table with one of those being a conservancy district. Conservancy districts were the only type of local districts included in the final evaluation of management alternatives because the other types do not fit as well to manage both irrigation and drinking water. The table can be used as a guide to locate sections of the state code that cover specific topics related to districts. The table is not comprehensive and should be used accordingly. Two of the alternatives evaluated in the master plan are forms of districts, special service and water conservancy. Information about these two types of districts is given in Utah Code Annotated Section 17B and 17D.

CACHE COUNTY
WATER MASTER PLAN

	Local Districts (17B-1)				
	Water Improvement District (17B-2a-400)	**Irrigation District (17B-2a-500)**	**Metropolitan Water District (17B-2a-600)**	**Water Conservancy District (17B-2a-1000)**	**Special Service District (17D)**
Purpose	**17B-2a-403** Own and operate all or any part of a system or systems for the supply, treatment, and distribution of water	Obtain and distribute water for irrigation of lands	Provide services to meet municipal water needs	**17B-2a-1002** - Conservation and development of water and land resources - Provide for greatest beneficial use of water - Make use of unappropriated waters for beneficial uses including domestic, manufacturing, irrigation, and power - Obtain the highest duty for domestic uses and irrigation of lands	
Status and Powers (All Local Districts)	**17B-1-103** Political subdivision of the state that may: - Acquire or lease property, or a groundwater right, - Acquire, construct, operate, use and maintain works and facilities - Borrow money - Issue Bonds - Levy and collect property taxes (Not Irrigation Districts) - Invest money - Impose fees for services provided by the district - Contract with another political subdivision of state to allow them to use district's surplus water				**17D-1-103** A body corporate and politic with perpetual succession, separate and distinct from the county or municipality that creates it; a quasi-municipal corporation; that may: - Exercise the power of eminent domain - Enter into contracts to carry out district functions - Acquire or construct facilities - Acquire real or personal property, or an interest in real or personal property, including water and water rights, by purchase, lease, gift, devise, bequest, or otherwise - Own, hold, improve, use, finance, or deal in and with the property or property right - Sell, convey, lease, exchange, transfer property or assets, including water and water rights - Mortgage, pledge, or encumber property or assets, including water and water rights - Contract for the use, operation, or maintenance of all or any part of district's property or assets, including water and water rights - Accept a government grant or loan - Use an officer, employee, property, equipment, office, or facility of the county or municipality that created the special service district, subject to reimbursement - Employ one or more officers, employees, or agents, including one or more engineers, accountants, attorneys, or financial consultants, and establish their compensation; - Must reimburse the county or municipality for what the special service district uses. - Designate an assessment area and levy an assessment - Borrow money and incur indebtedness; - Issue bonds - Impose fees for commodities, services, or facilities - Provide service to an area outside the district's boundary, if the governing body finds that there is a public benefit - Provide other services that the governing body determines will more effectively carry out the purposes of the district
Additional Powers	**17B-2-403** - Acquire / operate a water system - Appropriate or acquire water and water rights inside or outside boundaries - Sell water or services outside of boundaries	**17B-2a-503** - Purchase irrigation stock - Access lands to survey and locate and construct a canal - Lease water in the neighborhood of the district (5 year max lease period) - Acquire water from in or out of state - Lease, rent or sell water not needed by the owners of land in district to a municipality, corporation, association, or individual inside or outside of district	**17B-2a-603** - Acquire or lease property in or out of district - Encumber district property - Acquire or construct improvements in and out of the district and state - Acquire water, works, water rights, and sources of water in and out of the district and state and encumber, transfer an interest in, or dispose of water, works, water rights, and water sources - Develop, store, and transport water - Provide, sell, lease, and deliver water in or out of district - Subscribe for, purchase, lease, or otherwise acquire stock in a canal company, irrigation company, water company, or water users association	**17B-2a-1004** - Acquire water, works, water rights, and water sources needed in and out of district - Encumber, sell, lease, transfer an interest in, or dispose of water, works, water rights, and sources - Levy assessments against lands where water is allotted - Promote water conservation and development - Appropriate and acquire water and water rights - Develop, store, treat, and transport water - Acquire stock in canal companies, water companies, and water users associations - Acquire, construct, maintain irrigation works - Sell services to individual customers - Own property for district purposes - Coordinate water planning among public entities - Contract with public entities or private persons for joint operation or use of works, or the sale, purchase, lease, exchange, or loan of water, water rights, works - Contract with entities out of state for the joint construction, operation, or ownership of a facility - May not sell water to a customer in a municipality for culinary use without consent of the municipality **17B-2a-1007** - Contract with municipalities, irrigation companies, and private entities to sell water	
Service Area	**17B-1-202-5** May include all or part of the unincorporated area of one or more counties and all or part of one or more municipalities				**17D-1-202-2-d** A county may not create a district that includes some or all of the area within a municipality unless the legislative body of that municipality adopts a resolution or ordinance consenting to the inclusion.

	Local Districts (17B-1)				Special Service District (17D)	
	Water Improvement District (17B-2a-400)	**Irrigation District (17B-2a-500)**	**Metropolitan Water District (17B-2a-600)**	**Water Conservancy District (17B-2a-1000)**	**PETITION**	**RESOLUTION**
Process to Create (by Petition or by Resolution)	**17B-1-203** **PETITION:(Each municipality and county must do steps 1 through 3)** 1 - File a request for services signed by owners of 10% of the private land area and cover 7% of private land value and 10% of the registered voters (17B-1-204) 2 - Hold a public hearing on the request for services (17B-1-210) 3 - Adopt a resolution to provide or not provide the proposed services (17B-1-212) 4 - Petition must be signed by property owners who's property covers at least 33% of private land, and is equaling value to at least 25% of the total private property in the area and covers 33% of the registered voters in the proposed area (17B-1-203) 5 -Election 6 - Signature from Lieutenant Governor (17B-1-215)			**RESOLUTION:(Each municipality and county must do steps 1 through 3)** 1 - Adopt a signed resolution by the legislative body proposing the creation of a district (17B-1-203) 2 - Hold a public hearing on the resolution (17B-1-210) 3 - 60 day protest period (17B-1-213) 4 - Election 5 - Signature from Lieutenant governor (17B-1-215)	1 - Petition signed by owners of at least 10% of value of taxable property or 10% of registered voters (17D-1-203) 2 - Give public notice of petition and public hearing (17D-1-205) 3 - Hold a public hearing (17D-1-207) 4- Period for public protest (17D-1-206) 5 - Adopt a resolution or ordinance approving the creation of district (17D-1-208) 6 - Signature from Lieutenant Governor (17D-1-209)	1- Adopt a resolution stating need to create a district (17D-1-203) 2- Give written notices of resolution to create a district(17D-1-205) 3 -Hold a public hearing (17D-1-207) 4- Period for public protest (17D-1-206) 5 -Adopt a resolution approving the creation of a district (17D-1-208) 6 -Signature from Lieutenant Governor (17D-1-209)
Election to form District	**17B-1-214** - Held by the responsible clerk in the county if the district will be located completely within the county - Not required if a petition is completed that covers at least 67% of private land area and is equal to at least 50% of the values of private property or if the petition has signatures from at least 67% of registered voters				No Election Required to Form	
How Opposed				**17B-1-213** **Protest of Resolution Process** 1- 60 day protest period after public hearing 2- Protest must be signed by property owners that own 25% of private land by area and at least 15% of value of private property 3- If protest is successful, governing body can not take any further action for 2 year period	**17-D-206** - Submit written protest t no later than 15 days after the public hearing - The legislative body may not adopt a resolution or ordinance creating a district if adequate protests are filed **17D-1-207** -At the public hearing the legislative body will give full consideration to each written protest that has been filed. **17D-1-212** -May file an action in district court within 30 days of adoption of resolution or of ordinance to create district	
Governing Body	**17B-1-302** - Board of Trustees - Each board member must live in district boundaries and if district has divisions, within the appropriate division boundaries - odd number of board members - At least 3 board members **17B-1-308** - Board can be made up of county or municipal legislative bodies but must hold separate meetings, and each board member represents the district at large				**17D-1-301** - Legislative body of the county or municipality that creates the district - The legislative body may create an administrative control board for the special service district and delegate to the administrative control board the exercise of any right, power, or authority that the legislative body possesses with respect to the governance of the district.	
Board of Trustees (or Administrative Board)	**Board of Trustees**				**Administrative Control Board**	
	Term of Service (17B-1-303 and 17D-1-304) Elected or appointed to four year term of service, except that approximately half the members of the initial board of trustees, chosen by lot, serve a two-year term. There is no limit on number of terms served.					
	17B-1-308 County Council could serve as board but must meet at different times than council meetings. May use municipal facilities with proper compensation. Each board member represents the district at large				**17D-1-301** - The administrative control board must allow the legislative body to act on some items that the board does not have authority to do, such as levy a tax or issue bonds, or hold an election **17D-1-303** - Some board members could be appointed and some could be elected. - A municipality may appoint one member to represent it on an administrative control board created by a special service district - An institution of higher education for which a special service district provides services, may appoint members to an administrative control board	
	17B-2a-404 - Legislative body of county may elect at time of creation to be the board and adopt at any time a resolution providing for the election of board members, or the appointment of board members - Legislative body of each included municipality each elects or appoints one member of the board - The legislative body of the county elects or appoints all other board members	**17B-2a-504** - One member elected from each division established in the district -Each landowner casts one vote per acre foot or fraction of an care foot of water allotted to the owned land	**17B-2a-604** Board members appointed or elected	**17B-2a-1005** Board members appointed or elected		
Number of Board Members	**17-B-2a-404 (6)** - Number of included municipalities plus one if the number of municipalities is even - Number of included municipalities plus two, if the number of municipalities is odd - Board members do not have to come specifically from each of the municipalities -allows for a board member from the unincorporated (remaining) area	**17B-2a-504** Equal to number of divisions in the district	**17B-2a-604** - Municipalities each appoint or elect a board member - At least one board member shall be appointed by each municipality	**17B-2a-1005** Not more than 11 persons who are residents of the district	**17D-1-302** Equal to the number of council members of the legislative body or at least 3 members of an administrative control board	

	Local Districts (17B-1)				
	Water Improvement District (17B-2a-400)	**Irrigation District (17B-2a-500)**	**Metropolitan Water District (17B-2a-600)**	**Water Conservancy District (17B-2a-1000)**	**Special Service District (17D)**
District Divisions	**17B-1-306.5** Board may split district into divisions so that board members may be elected by division rather than at large	**17B-2a-505** - Must split the district into divisions - The number of divisions is the same as the number of board members	***?***	**17B-2a-505** - Board of trustees divides district into equal sized divisions, - Number of divisions is equal to number of board members	No divisions
Procedure to Appoint Board Members	**17B-1-304** -Prepare a notice of vacancy -Advertise the notice -Allow all interested persons to be heard -After 2 months, select a person from the applicants who meet the qualifications -Adopt a resolution appointing a person	**17B-2a-504** Board members are elected	**17B-2a-604** - If district contains some or all of the retail water service area of more than one municipality, the legislative body of each municipality shall appoint board members from that municipality - One member from each municipality is a officer that is responsible for the municipality's water system -The number of members appointed by each municipality shall be determined by agreement between the district and the municipalities	**17B-2a-1005** -For a district located entirely within the boundaries of a single county, the county legislative body of that county appoints each trustee - In a division composed solely of municipalities, the legislative body of each municipality within the division shall submit two nominees per trustee - In all other divisions, the county legislative body submits three nominees per trustee. - In districts where substantial water is allocated for irrigated agriculture, one trustee appointed in that district is a person who owns irrigation rights and uses those rights as part of that person's livelihood	**17B-1-304** -Prepare a notice of vacancy -Advertise the notice -Allow all interested persons to be heard -After 2 months, select a person from the applicants who meet the qualifications -Adopt a resolution appointing a person
Procedure to Elect Board Members	**17B-1-306** - Give notice of positions to be filled at next municipal general election with instructions for how to file for candidacy - Prospective board members that are qualified are allowed to file for candidacy - If no person files for candidacy, a person is appointed by following the requirements for appointment	**17B-2a-504** Each landowner casts one vote per acre foot or fraction of an acre foot of water allotted to the owned land	**17B-2a-604** Members of the board can be elected if three-fourths of all board members vote in favor of changing to an elected board; and the legislative body of each municipality that appoints a member to the board adopts a resolution approving the change to an elected board **17B-1-306** - Give notice of positions to be filled at next municipal general election with instructions for how to file for candidacy - Prospective board members that are qualified are allowed to file for candidacy - If no person files for candidacy, a person is appointed by following the requirements for appointment	**17B-2a-1005** - Elected in accordance with the petition or resolution to create district, or are appointed. - Members of an existing appointed board can be elected if three-fourths of all board members vote in favor of changing to an elected board; and the legislative body of each municipality that appoints a member to the board adopts a resolution approving the change to an elected board. **17B-1-306** - Give notice of positions to be filled at next municipal general election with instructions for how to file for candidacy - Prospective board members that are qualified are allowed to file for candidacy - If no person files for candidacy, a person is appointed by following the requirements for appointment	**17B-1-306** - Give notice of positions to be filled at next municipal general election with instructions for how to file for candidacy - Prospective board members that are qualified are allowed to file for candidacy - If no person files for candidacy, a person is appointed by following the requirements for appointment
Compensation of Board Members	**17B-1-307 and 17D-1-305** Can be compensated up to $5,000 as determined by board of trustees, but not in addition to compensation they receive as members of a county or municipal legislative body				

	Local Districts (17B-1)				
	Water Improvement District (17B-2a-400)	**Irrigation District (17B-2a-500)**	**Metropolitan Water District (17B-2a-600)**	**Water Conservancy District (17B-2a-1000)**	**Special Service District (17D)**
Debt Limit	**17B-1-613** The board of trustees of a local district may not make any appropriation in the final budget of any fund in excess of the estimated expendable revenue for the budget year of the fund				
Bonds	**17B-1-1102 General Obligation Bonds** - Must first obtain the approval of district voters for issuance of general obligation bonds at an election - May issue refunding general obligation bonds, without obtaining voter approval - May not issue general obligation bonds that cause the outstanding principal amount of all general obligation bonds to exceed a specified percentage of the vale of taxable property in the district **17B-1-1103** -May make an annual levy of ad valorem property taxes to pay bond debts, but for a conservancy district may not exceed total tax levy limits **17B-1-1104** Bonds may be payable from the revenues to be derived by the district from providing its services, taxes, federal, state, or local grants, in the case of special assessment bonds, the special assessments pledged to repay the special assessment bonds; and other money legally available to the district. **17B-1-1105 Revenue Bonds** -District may, but is not required to, submit to district voters for their approval the issuance of the revenue bonds at an election held for that purpose -Impose rates and charges for the services or commodities it provides, along with other sources of district revenues, to carry out all undertakings of the district with respect to its revenue bonds				**17D-1-502** -If a special service district intends to issue general obligation bonds, it must first obtain the approval of district voters, but it may issue refunding general obligation bonds without obtaining voter approval -May not issue general obligation bonds if the issuance of the bonds will cause the outstanding principal amount of all of the district's general obligation bonds to exceed the amount that results from multiplying the fair market value of the taxable property within the special service district by 0.12 - May not be considered to be a municipal corporation for purposes of the debt limitation **17D-1-505** - May issue revenue bonds with or without a vote, but shall impose rates and charges sufficient to pay back the debt **17D-1-507** Before bonding, must obtain a report prepared by a qualified person, that outlines the project and how it will be financed **17D-1-508** District obligations are not obligation of any other entity
Water Banking	**17B-1-202-1c** - May bank ground water rights in a critical management area following adoption of groundwater management plan by the state engineer or **17B-1-103-2a** - May acquire or lease groundwater rights necessary or convenient to the full exercise of the district's powers				
Maximum savings	**17B-1-612** - The accumulation of a fund balance in the general fund may not exceed the greater of: 100% of the current year's property tax; or 25% of the total general fund revenues for a district with an annual general fund budget greater than $100,000; or 50% of the total general fund revenues for a district with an annual general fund budget equal to or less than $100,000.				
Annexing an Area	**17B-1-402** - An area outside the boundaries of a local district may be annexed **17B-1-403** The following steps must be followed: 1- Petition signed by owners of land that covers at least 10% of the proposed private land area to be annexed and is equal to at least 10% of the property to be annexed or represents at least 10% of the registered voter in the area to be annexed (17B-1-403) 2 - A resolution adopted by the legislative body each municipality whose boundaries include any of the area proposed to be annexed; or a resolution adopted by the board of trustees of the proposed annexing local district if, for at least 12 consecutive months immediately preceding adoption of the resolution, the local district has provided retail service to the area; or a wholesale service to a provider of the same service that has provided that service on a retail basis to the area (17B-1-403) 3- Public hearing held for each body that has petitioned to join the district (17B-1-409) 4 - Adopt a resolution to provide or not provide the proposed services (17B-1-408) 5 - Hold an election if protests are filed from landowners that own 10% of the total private land in the proposed area to be annexed, and that is equal to at least 10% of the vale of private property in the proposed area, or it is filed by at least 10% of the registered voters that live in the proposed area. 6- If voters vote in favor of annexation, board adopts resolution approving the annexation (17B-1-412) **17B-1-412** - An owner of private real property located within or a registered voter residing within an area proposed to be annexed may protest an annexation by filing a written protest with the board of trustees **17B-1-413** - The public hearing and protest provisions do not apply if the petition covers 75% of the private land area and is equal to at least 75% of the property value of the proposed annexation area or is signed by 75% or registered voters in the area				**17D-1-401** - Must follow same steps as are needed to create a special service district **17D-1-402** - Could annex an area with only a petition if all the owners of the taxable property within the proposed annexation area sign the petition
Fees	**17B-1-643(1)** Before imposing a new fee or increasing an existing fee for a service provided by a local district, the board must first hold a public hearing at which any interested person may speak for or against the proposal to impose a fee or to increase an existing fee **17B-1-1106** Board may fix the rate or rates for services or commodities provided by the district that will, in conjunction with the proceeds of any maintenance and operation tax and other district revenues: (1) pay the district's operating expenses (2) provide for repairs and depreciation of works owned or operated by the district (3) pay the interest on any bonds issued by the district (4) provide, as much as practicable, a sinking or other fund to pay the principal of the bonds as they become due				17D-1-105 - A county or municipality that has created a special service district may levy a tax on the taxable property in the special service district. - Each levy is subject to the prior approval of a majority of the registered voters of the special service district voting in an election held for that purpose 17D-1-506 - District must set taxes to cover district expenses and pay back any bonds
		17B-2a-506 May divide the district into units and apply different use charges to the different units based on amount of water the district provides the area served, or any other reasonable basis	**17B-2a-606** The rates, charges, and assessments may be established by agreement between the district and the municipalities serviced by the district.		

	Local Districts (17B-1)				
	Water Improvement District (17B-2a-400)	**Irrigation District (17B-2a-500)**	**Metropolitan Water District (17B-2a-600)**	**Water Conservancy District (17B-2a-1000)**	**Special Service District (17D)**
Tax Levy Limits	**17B-1-616** - Tax set based on planned budget **17B-1-1002** - Maximum property tax of .0008	**17B-2a-503** Cannot levy a property tax	**17B-1-1002** - Maximum Tax of .0005	**17B-2a-1006** **-** May not exceed .0001 before the planning or design of works; the acquisition of the site or right-of-way on which the works will be constructed; or the commencement of construction of the works - May not exceed .0002 until after the earliest of the events listed above	**17D-1-105** - Subject to the prior approval of a majority of the registered voters of the special service district voting in an election held for that purpose **17D-1-503** - If a district has issued general obligation bonds, or expects to have debt service payments due on general obligation bonds during the current year, the legislative body of the county or municipality that created the district may make an annual levy of ad valorem property taxes -The levy is without limitation as to rate or amount; and subject to the prior approval of a majority of registered voters of the special service district voting in an election held for that purpose.
Preferential Right to Purchase Water			**17B-2a-605** Each city that is in the district and provides water on a retail level in the district has a preferential right to purchase a portion of the water served by the district.		
Costs and Expenses of Creation	**17B-1-216** -Each county whose unincorporated area includes and each municipality whose boundaries include some or all of the proposed local district shall bear their respective costs and expenses for creating a local district. - Within a year after its creation, each local district shall reimburse the costs and expenses associated with the preparation, certification, and recording				

Appendix 5-E

Evaluation of Management Alternatives

Explanation of the evaluation completed to determine what water management system should be implemented in Cache County to complete needed water projects and to meet future water needs. The actual evaluation table is included after the explanation.

CACHE COUNTY
WATER MASTER PLAN

Overview of Management Structure Evaluation Table Parts

The evaluation table is broken into the following parts:

Project Alternatives

The alternatives that were evaluated are listed down the left hand side of the table and are sorted by the type of project.

Objectives

The goals or objectives that have been identified as important by the steering committee and project team are listed across the top of the table. These objectives are split into the following three categories:

- Water Supply (shown in blue)
- Governance (shown in red)
- Implementation (shown in purple)
- Environment (shown in green)

Metrics

The metrics for each objective are listed across the top of the table just below the objectives. The metrics provide the units and the method used to measure how well a given alternative meets the corresponding objective. In the future, as more specifics are gathered for a given alternative, more solid data can be added to the analysis.

Color Key

A color key is shown just below the metrics and gives four ranges of values for each metric. The alternatives were evaluated at a conceptual level. Therefore, there is a level of uncertainty in the values calculated for the evaluation. The four color levels indicate how well the objectives or goals are attained by a given alternative, with the darker colors indicating a higher level of attainment than the lighter colors.

Evaluation

In the rows to the right of each alternative, numbers are given in cells to indicate the estimated value that each alternative has for each of the metrics. For metrics that could not be exactly quantified, without further evaluation, an assignment of “None”, “Low”, “Medium”, or “High” was given. Any cell that is labeled with “N/A” indicates that the metric in that column does not apply to the alternative listed on that row.

The strength of a given alternative can be determined by looking across a row for the given alternative and comparing how dark the cells are for that alternative with the cells for other alternatives. Alternatives that have darker cells are stronger than alternatives with lighter cells.

EVALUATION OF MANAGEMENT ALTERNATIVES

MANAGMENT ALTERNATIVES	OBJECTIVES																	
	Water Supply	Governance							Implementation									Environment
	Protect Bear River Allocation	Represent Cache County on water legislation issues	Represent all County water users	Operate and maintain water systems on a local level	*Minimize management costs	Fund needed regional water studies and projects	Ease of creation	Focus on water issues	Complete water management projects							Promote collaboration		Maintain or improve environmental quality
	METRICS (methods of measurement)																	
	Water put to beneficial use or in an approved none use status (acre feet)	Influence with state water coalition and executive task force (Scale)	Entities represented on water board for regional water decisions (number)	Culinary water systems that make own source, storage, distribution and other local system improvements (number)	*Cost to manage each year ($)	Funding available each year for studies/ projects ($/year)	Election required (yes/no)	Board members that are focused on water issues (number)	Study and develop ASR sites (yes/no)	Evaluate environmental water demands (yes/no)	Study and develop above ground storage sites (yes/no)	Implement water conservation program to achieve 25% water conservation (yes/no)	Water banking (yes/no)	Implement canal rehabilitation program (yes/no)	Secondary water studies and installation (yes/no)	Facilitates cooperation between municipalities and irrigation companies (complete contracts for projects) (yes/no)	Steering committee members that support organization (percent)	Water developed to improve wildlife habitat and fish flows (acre-feet)
	COLOR KEY																	
	None	None	None	None	$400,001 to $500,000	None	Yes	None	None	None	None	None	None	None	None	None	less than 15%	None
	1 to 5000	Low	No Board	1 to 10	$300,001 to $400,000	$30,000		Low	Low	Low	Low	Low	Low	Low	Low	Low	16% to 30%	Low
	5,001 to 20,000	Medium	Culinary water users	11 to 20	$200,000 to $300,000	$30,000 to $150,000		Medium	Medium	Medium	Medium	Medium	Medium	Medium	Medium	Medium	30% to 65 %	Medium
	More than 20,000	High	Culinary and irrigation water users	More than 20	less than $200,000	$150,000 to $700,000	No	High	High	High	High	High	High	High	High	High	More than 65%	High
MANAGEMENT STRUCTURES																		
Water Manager with more Resources (additional $120,000 for projects)	15,000	Low	No water board	23	$185,000	$30,000 to $150,000	No	Low	Med	Med	Low	Low	None	Low	Low	Med	6%	Med
Special Service District	5,001 to 20,000	Med	Culinary Water Users	23	$350,000	$150,000 to $700,000	Yes	Med	High	High	High	Medium	High	High	High	High	18%	High
Water Conservancy District	60,000	High	Irrigation and Culinary	23	350,000	$150,000 to $700,000	Yes	High	High	High	High	High	High	High	High	High	70%	High
Continue with Current System (Water Manager)	5,000	Low	No water Board	23	$185,000	$30,000	No	Low	Low	Low	None	None	None	None	None	Low	6%	Low

*Low values are preferred and are shown in a darker color than higher values.

Appendix 6-A

Next Steps

i: Five Year Action Plan Summary Table

Table that outlines projects to complete in the next 5 years. The table lists actions that should be completed for each objective each year, the expected results of those actions and the estimated costs.

ii: Three Year Public Education Campaign

Detailed list of tasks for the three year public education campaign to complete in years 2014 - 2016.

CACHE COUNTY
WATER MASTER PLAN

5 YEAR ACTION PLAN					
Stage (Year)		Task-(Objective)	Actions	Results	Estimated Cost
2014	Public Education	Water Conservation	Public Education Campaign: • Conduct a poll to understand public opinion of conservation • Identify desired conservation strategies with steering committee • Prepare conservation promotion tips for cities • Meet with individual city water policy leaders about importance of conservation • Give conservation presentations to councils • Meet with irrigators	• Increase in water conservation in County to meet state conservation averages • Water policy makers understand the current and future water needs in the County.	$50,000
	Public Education	District Formation	Public Education Campaign: • Conduct a poll to understand public opinion of districts • Review poll outcomes with steering committee • Prepare list of answers to common questions about districts • Review master plan recommendations with city leaders • Give presentation to councils about organizational structures • Interviews with key stake holders • Meet with irrigators	• Improved consensus and unified direction for future water management	$50,000
	ASR (Bear River Dev.)		• Complete Millville ASR Water Storage and Nitrate Remediation Study	• Develops and protects a portion of the Bear River water allocation • Provides greater understanding of how much Bear River water can be developed in County through ASR projects • Improves ground water quality • Adds water supply for communities and irrigators	$30,000
	Environmental Demand Studies/Storage (Bear River Development)		• Quantify and prioritize environmental water demands (Year 1) • Monitor and coordinate planning efforts with the Wasatch Front	• Preserves and prioritizes critical environmental areas • Maintains or improves wildlife habitat • Quantifies environmental water demands for studied areas • Gives Cache County voice on Bear River development decisions • Protects Bear River allocation • Improves plans for future storage site development	$100,000
	Bank Water Rights		• Organize water bank	• Protects Bear River allocation rights • Keeps existing water rights for use in Cache County • Maintains future supply of water rights for Cache County Residents	$65,000
				Year Total	**$295,000**

5 YEAR ACTION PLAN					
Stage (Year)		**Task-(Objective)**	**Actions**	**Results**	**Estimated Cost**
2015	Public Education	Water Conservation	Public Education Campaign: • Hold a steering committee meeting to develop strategies to improve water conservation • Follow up with steering committee members on conservation progress • Continue polls to evaluate the effectiveness of the public education process	• Increase in water conservation in County to meet state conservation averages • Water policy makers understand the current and future water needs in the County	$50,000
	Public Education	District Formation	Public Education Campaign: • Prepare a handout that outlines ways conservancy district can be structured • Hold steering committee meetings to evaluate potential conservancy district structures • Disseminate information about the district formation through open houses and committee members • Continue polls to evaluate the effectiveness of the public education process • Interviews with key stake holders • Meet with irrigators	• Improves consensus and unified direction for future water management	$50,000
	ASR (Bear River Dev.)		• Construct Millville ASR project	• Develops and protects a portion of the Bear River water allocation • Provides greater understanding of how much Bear River water can be developed in County through ASR projects • Improves ground water quality • Adds water supply for communities and irrigators	$100,000
	Environmental Demand Studies/Storage (Bear River Development)		• Quantify and prioritize environmental water demands (Year 2) • Monitor and coordinate planning efforts with the Wasatch Front	• Preserves and prioritizes critical environmental areas • Maintains or improves wildlife habitat • Quantifies environmental water demands for studied areas • Gives Cache County voice on Bear River development decisions • Protects Bear River allocation • Improves plans for future storage site development	$100,000
	Bank Water Rights		• Execute lease agreements	• Protects Bear River allocation rights • Keeps existing water rights for use in Cache County • Maintains future supply of water rights for Cache County Residents	$65,000
				Year Total	**$365,000**

5 YEAR ACTION PLAN					
Stage (Year)		Task-(Objective)	Actions	Results	Estimated Cost
2016	Public Education	Water Conservation	Public Education Campaign: • Progress update with city councils • Track water conservation effort progress with committee • Information dissemination through open houses to educate about conservation • Meet with irrigators	• Increase in water conservation in County to meet state conservation averages	$50,000
	Public Education	District Formation	• Progress update with city councils • District information dissemination through steering committee and open houses • Interviews with key stake holders • Meet with irrigators • Prepare Legal Documents • Hold Election	• Implementation of a water management organization (conservancy district) to continue conservation efforts and to protect Cache Valley's water interests	$80,000
	ASR (Bear River Dev.)		• Construct Millville ASR Project	• Develops and protects a portion of the Bear River water allocation • Provides greater understanding of how much Bear River water can be developed in County through ASR projects • Improves ground water quality • Adds water supply for communities and irrigators	$100,000
	Environmental Demand Studies/Storage (Bear River Dev.)		• Quantify and prioritize environmental demands (Year 3) • Monitor and coordinate planning efforts with the Wasatch Front • Storage site investigation for potential small dams	• Preserves and prioritizes critical environmental areas • Maintains or improves wildlife habitat • Quantifies environmental water demands for studied areas • Gives Cache County voice on Bear River development decisions • Protects Bear River allocation • Improves plans for future storage site development	$100,000
	Bank Water Rights		• Execute lease agreements	• Protects Bear River allocation rights • Keeps existing water rights for use in Cache County • Maintains future supply of water rights for Cache County Residents	$65,000
				Year Total	**$395,000**
2017	Water Conservation		• Increase resources to promote conservation • Implement programs identified through 2014 and 2015 steering committee meetings	• 25% Reduction in per capita Water use by year 2025	$120,000
	District Formation				Done
	ASR (Bear River Dev.)		• Finish Millville Project, Study River Park Well ASR Site	• Develops and protects a portion of the Bear River water allocation • Provides greater understanding of how much Bear River water can be developed in County through ASR projects • Improves ground water quality • Adds water supply for communities and irrigators	$150,000
	Environmental Demand Studies/Storage (Bear River Dev.)		• Monitor and coordinate planning efforts with the Wasatch Front • Storage site investigation for potential small dams	• Gives Cache County voice on Bear River development decisions • Protects Bear River allocation • Improves plans for future storage site development	$100,000
	Bank Water Rights		• Execute lease agreements	• Protects Bear River allocation rights • Keeps existing water rights for use in Cache County • Maintains future supply of water rights for Cache County Residents	$65,000
				Year Total	**$435,000**

5 YEAR ACTION PLAN				
Stage (Year)	**Task-(Objective)**	**Actions**	**Results**	**Estimated Cost**
2018	Water Conservation	• Increase resources to promote conservation • Implement programs identified through 2014 and 2015 steering committee meetings	• 25% Reduction in per capita Water use by year 2025	$120,000
	District Formation			Done
	ASR (Bear River Dev.)	• Green Canyon ASR Development	• Develops and protects a portion of the Bear River water allocation • Provides greater understanding of how much Bear River water can be developed in County through ASR projects • Adds water supply for communities and irrigators	$200,000
	Environmental Demand Studies/Storage (Bear River Dev.)	• Monitor and coordinate planning efforts with the Wasatch Front • Storage site investigation for potential small dams	• Gives Cache County voice on Bear River development decisions • Protects Bear River allocation • Improves plans for future storage site development	$100,000
	Bank Water Rights	• Execute lease agreements	• Protects Bear River allocation rights • Keeps existing water rights for use in Cache County • Maintains future supply of water rights for Cache County Residents	$65,000
			Year Total	**$485,000**

PUBLIC EDUCATION CAMPAIGN TO PROMOTE WATER CONSERVATION AND DISTRICT FORMATION (2014-2016)

The following is given as a recommendation for the public education campaign and includes:

- Objectives to accomplish through the campaign
- Actions to take to meet the objectives
- Results expected from actions

OBJECTIVES

1. Begin water conservation efforts now in order to enhance awareness amongst the community and further secure the potential for state funding on future water projects.
2. Educate public with regard to the water needs of Cache Valley and the need for an organization (conservancy district) to represent those needs and protect water allocated for use in Cache Valley.
3. Create a water conservancy district

Strategies

1. Use the momentum and organization from the CC Water Master Plan to meet the goals. This includes continued input from the CCWMP Steering Committee.
2. Share the knowledge of the Master Plan Team and Steering Committee gained from the master planning process to leaders in each community to create consensus and buy-in.
3. Invite community leaders to educate their constituents with regard to the goals and promote efforts to attain those goals.
4. Reinforce efforts by community leaders to reach the goals through County support of educational information and countywide programs to reach the goals.
5. Promote conservation and education/organizational goals together to take advantage of time and expense.

Water Conservation Ideas – The Low Hanging Fruit

1. Establish a link to the state water conservation website from the County website and encourage communities to do the same.
2. Utilize the USU extension office as an education resource for conservation.
3. Create water conservation tips that communities can place in their utility billings.
4. Place a booth at the County Fair to educate people about the water master plan and water conservation practices.
5. Run advertisements that promote water conservation on local radio stations.
6. Expand the 4th grade water fair program to include elements on water conservation.
7. Implement a rebate program for water conservation practices (after management organization is in place).

ACTIONS
Year 2014

- **Conduct Public Poll –** Develop a public poll to gage current feelings about water conservation and the level of current support for water conservancy district. Coordinate with the county council for the poll strategy and approval of the poll questions. Execute the poll, analyze and

draft the findings of the poll. Report on the poll findings and develop an education strategy. The poll will help evaluate understanding of current water issues and effectiveness of the public education process and will promote interest and research by citizens. (January 2014 - March 2014)

- **Steering Committee Kickoff Meeting** - Meet with the master plan steering committee to review the planned public education process and gather input on the process. Identify key stakeholders that should be interviewed, informed on the master plan process and invited to future committee meetings. Include two county council members in all steering committee meetings. The steering committee will be used as a tool to help identify water conservation strategies to implement along with other Tasks in the 5 Year Action Plan. (April 2014)

- **Conservation and Conservancy District Information** - Prepare initial information that gives water conservation promotion tips for cities. Prepare answers to commonly asked questions about conservancy districts, and summarize how conservancy districts have changed since the last time a district was proposed in Cache County. (April 2014 - October 2014)

- **Meetings with Individual City Water Policy Leaders -** Identify and meet with the key water policy maker of each City. Review results of master plan, importance of water conservation and reasons for master plan recommendations. Set time to meet with each City Council. (March 2014 - September 2014)

- **Steering Committee Meeting** - Hold a steering committee meeting to provide an update and report on the meetings with water policy leaders and overview of input gathered from stakeholder interviews. Include water policy leaders in the meeting. Report any water conservation strategies and input about the formation of a district, gathered from the meetings. (October 2014)

- **Presentations to City Councils** - Visit each city council to explain the need to conserve water by showing results of the master plan, explain the master plan findings and recommendations and identify additional key stakeholders to meet with. Ask for a designated council person to attend all future steering committee meetings. (October 2014 - April 2015)

Year 2015

- **District Organization Handout** - Prepare a handout that outlines how a conservancy district can be formed and ways the board can be structured. (January 2015 – February 2015)

- **Winter Steering Committee Meeting** - Hold a steering committee meeting to develop strategies for a water conservation campaign. Ideas to discuss include the use of mailers, open houses, media interviews etc. (January 2015)

- **2015 Steering Committee Meetings** - Hold two additional steering committee meetings in 2015. The meetings will be used to track the water conservation effort progress and strategies, and to learn more about water districts. More specifically, these meeting will provide information about how districts can be organized, governed, and potential powers of districts. Input gathered at these meetings will be used as a guide for the formation of the district. These meetings will also be used to organize a greater outreach effort that will occur between meetings. (April 2015 and October 2015)

- **District Information Dissemination** - Carry out an information dissemination campaign through open houses around the valley with help from steering committee members to educate the public about districts. (Assume 1 open house in 2015)

- **Conduct Public Poll –** Complete a public poll to evaluate understanding of current water issues and effectiveness of the public education process. A comparison to results from earlier efforts will be made to guide changes to the public education process. (November 2015 - December 2015

Year 2016

- **Presentations to City Councils** - Visit each city council to request the adoption of a resolution proposing the creation of a district. (January 2016 - May 2016)

- **2016 Steering Committee Meetings** - Hold two steering committee meetings in 2016 prior to the general election. The meetings will be used determine how to disseminate accurate district information to the public leading up to the district election. Steering committee members will be utilized to distribute information. These meetings will also be used to implement and track the water conservation effort progress and strategies. (April 2016 and August 2016)

- **District Information Dissemination** – Continue the information dissemination campaign through open houses around the valley and with help from steering committee members, to educate the public about district and conservation. (Assume 2 open houses in 2016)

- **Prepare District Legal Documents -** Prepare legal documents for formation of a district. (May 2016 - July 2016)

- **District Election -** Place vote for district formation on the ballot. (November 2016)

Items to Complete Throughout the 3 Project Years

- **Interview Key Stakeholders** (**45**) - Hold individual interviews with key stakeholders as identified through the steering committee and other interviews. Discuss outcomes of master plan and recommendations moving forward. Discuss conservation efforts and resolve concerns and provide answers to questions. (January2014 - November 2016)

- **Meet with USU Staff** – Hold meetings every six months with key USU staff members identified through input from the steering committee and through the additional stakeholder interviews. These meetings will be used to update the USU Staff on the progress of the public education campaign. Invite USU staff to all steering committee meetings. Only one meeting will be held in 2014. (April and October each year)

- **Irrigation Meetings –** Attend irrigation meetings to provide updates, answer questions and receive feedback on the process. Anticipated meetings to attend annually are the Mini Water Conference, Bear River Small Pumpers Board meeting and North Cache and Blacksmith Fork Conservation District board meetings. (January2014 - November 2016)

- **Other Meetings -** Attend annual mayor's meeting and also the city manager's meeting to provide updates and receive feedback on the process. (January2014 - November 2016)

- **Quarterly updates to the County Council** - Throughout the three year process, give quarterly progress updates to the County Council on water conservation and the district organization efforts. (January2014 - November 2016)

RESULTS

1. Increase in water conservation in Cache Valley to meet state conservation averages (catch up).
2. Water Policy makers understand the current and future water needs in the County.
3. Implementation of a water management organization (conservancy district) to continue conservation efforts and to protect Cache Valley's water interests.