WATER RESOURCE
ECONOMIC AND FISCAL ANALYSIS
JUNE 2019 | WORKING DRAFT | SUBJECT TO MATERIAL REVISION

APPLIED ANALYSIS
Summary of Findings

- Identifying the Issue
- Iron County’s Economic Climate
- Iron County’s Water Demand Outlook
- Iron County’s Water Supply Outlook
- Supply-Demand Dynamics and Potential Solutions
- Economic Impacts of Investments in Infrastructure
- Fiscal Considerations
Summary of Findings

- Historical growth and other factors gave rise to the establishment of the CICWCD and a need to study and address water resource management challenges in Iron County.
- Research suggests groundwater levels have been eroding for the better part of the past half century.
- Iron County’s economic climate supports continued growth, which will place additional pressures on the region’s water supply-demand balance.
- The long-term outlook for water demand in the region is expected to exceed capacity, a condition that can have significant economic and ecological implications.
- Potential economic returns sourced to expanded water infrastructure investments are estimated to far exceed the public’s cost of developing an expanded system.
- A sound funding model has the potential to mitigate the risks of future water shortfalls.
- The cost of doing nothing exceeds the cost of investing in additional water infrastructure.
Summary of Findings

Identifying the Issue

Iron County’s Economic Climate

Iron County’s Water Demand Outlook

Iron County’s Water Supply Outlook

Supply-Demand Dynamics and Potential Solutions

Economic Impacts of Investments in Infrastructure

Fiscal Considerations
Historical Timeline of Events

- **1884**: Motion made by Councilman Jones to levy water tax of 45 lbs. of grain for residential lots and 30 lbs. of grain for non-residential lots.
- **1902**: Election to procure the first water system in Cedar City.
- **1908**: Spring water from “Big Spring” in Right Hand Canyon introduced as drinking water (approximately 2.5 times the amount needed).
- **1910**: Additional springs collected and piped into Cedar City (near Five Lakes in Right Hand Canyon).
- **1919**: Watering restrictions imposed on lawn irrigation.
- **1924**: Water meters installed for lots suspected of overuse.
- **1927**: Cluff Springs piped into Cedar City to address growing water shortage.
- **1950**: Discussion of including Iron County in the Dixie Project of neighboring Washington County due to a severe water shortage.

Source: A History of Water in Iron County, Clemont Bauer Adams, 2007 (provided by CICWCD).
Historical Timeline of Events

- **1953**: Cedar City agrees to build Kolob Reservoir and pay for approximately 40 percent of the project.
- **1959**: Quichapa well field and water line approved.
- **1966**: Cedar Valley Basin closed to further pumping due to 15 years of declining groundwater levels.
- **1984**: Agreement between WCWCD and Cedar City provides 10 years to determine economic and environmental feasibility of transbasin diversion from Crystal Creek and Kolob.

Source: A History of Water in Iron County, Clemont Bauer Adams, 2007 (provided by CICWCD).
Historical growth patterns combined with dry conditions and other factors translated into more water being used in the Iron County area than was being put back into the system.
Identifying the Issue
Nationally, Regionally and Locally

Water resource stability is a vital concern for Iron County, the state of Utah and the United States as a whole. A relatively recent report by the Government Accountability Office (GAO) of the United States concluded:

According to state water managers, experts and literature GAO reviewed, freshwater shortages are expected to continue into the future. In particular, 40 of 50 state water managers expected shortages in some portion of their states under average conditions in the next 10 years. However, uncertainty stemming from factors, such as patterns of economic growth and land use change, is likely to complicate future state water managers’ planning efforts.

The GAO report makes it clear that there are a number of factors complicating the nation’s water resource challenges, including economic, geographic, climate, conservation and commodity-pricing considerations. Also included are infrastructure-related concerns specific to the system by which water is captured, processed and delivered to the end consumer. The GAO cited the American Society of Civil Engineers rating the nation’s water resource infrastructure at a “D” or below, the U.S. Environmental Protection Agency’s estimating a cost of $384 billion to upgrade domestic drinking water infrastructure during the next 20 years, and a similar report by the American Water Works Association forecasting that it will cost more than $1 trillion over the next 25 years to replace and expand the nation’s buried water infrastructure.

Identifying the Issue
United States Drought Monitor

June 2015

Source: http://droughtmonitor.unl.edu/

Note: Seasonality, weather patterns and snow pack in any given year can impact reported drought conditions, but drought conditions remain a concern.
Identifying the Issue
United States Drought Monitor

June 2016

Source: http://droughtmonitor.unl.edu/

Note: Seasonality, weather patterns and snow pack in any given year can impact reported drought conditions, but drought conditions remain a concern.
Identifying the Issue
United States Drought Monitor

June 2017

Source: http://droughtmonitor.unl.edu/

Note: Seasonality, weather patterns and snow pack in any given year can impact reported drought conditions, but drought conditions remain a concern.
Identifying the Issue
United States Drought Monitor

June 2018

Intensity:
- D0 (Abnormally Dry)
- D1 (Moderate Drought)
- D2 (Severe Drought)
- D3 (Extreme Drought)
- D4 (Exceptional Drought)

The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.

Author(s):
Richard Timmer, NGAA/NWS/NCEP/CPC

Source: http://droughtmonitor.unl.edu/

Note: Seasonality, weather patterns and snow pack in any given year can impact reported drought conditions, but drought conditions remain a concern.
Identifying the Issue
United States Drought Monitor

June 2019

Source: http://droughtmonitor.unl.edu/
Identifying the Issue
United States Drought Monitor

June 2015

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June 2016

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United States Drought Monitor

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Intensity:
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Author(s):
Richard Tinteri, NWS/NCEP/CPC

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Identifying the Issue
United States Drought Monitor

June 2018

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Author(s):
Richard Tiroler, N0AA/NWS/NCEP/CPC

Source: http://droughtmonitor.unl.edu/

Note: Seasonality, weather patterns and snow pack in any given year can impact reported drought conditions, but drought conditions remain a concern.
Despite its location in a drought-plagued region, Iron County has grown at a compound annual growth rate of 2.4 percent each year during the past century.

Projections of future growth have raised concerns about the sustainability of safe and reliable water resources going forward.

Historical growth patterns combined with dry conditions and other factors translated into more water being used in the Iron County area than was being put back into the system.

1970s & Prior

The Central Iron County Water Conservancy District was established in 1997 to manage the water demands and plan for the future water needs of the community.

1997
Responding to the Issue

The Creation of the CICWCD District

Serves the Cedar Valley area

- Established 1997 to benefit the people and municipalities within the CICWCD boundaries
- 1,380 square miles (approximately 81 percent vacant)
- Incorporated approximately 17 existing subdivisions with water systems into a basin-wide public water supply

Existing water systems in the District

- Currently, there are about 45 residential subdivisions, cities, towns or entities with approximately 1,254 Equivalent Residential Connections (ERCs) (excluding Cedar City, Enoch City, and Kanarraville) in the Cedar Valley area
- These entities are under the jurisdiction of the District and are potential water customers of the District in the future.

Responding to the Issue

District Objectives

1. IMPORT
2. RECHARGE
3. CONSERVE

Source: CICWCD.
District Boundaries

Water district ten as shaded in teal below

District Boundaries
As shaded in blue below

Historical growth patterns combined with dry conditions and other factors translated into more water being used in the Iron County area than was being put back into the system.

The Central Iron County Water Conservancy District was established in 1997 to manage the water demands and plan for the future water needs of the community.

USGS study SIR 2005-5170 concludes that a water shortage is inevitable given expected market expansion of consumption levels.

“Cedar Valley, located in the eastern part of Iron County in southwestern Utah, is experiencing rapid population growth that needs a larger share of the available water resources.”

Ensign Engineering was retained to evaluate the outlook for water and its delivery system for CICWCD.

The Central Iron County Water Conservancy District was established in 1997 to manage the water demands and plan for the future water needs of the community.

USGS study SIR 2005-5170 concludes that a water shortage is inevitable given expected market expansion of consumption levels.
In 2014, Ensign Engineering & Land Surveying prepared a master plan update to evaluate the current water delivery system and the long-term outlook for CICWCD.

“The groundwater level in the Cedar Valley is slowly dropping annually due to increased pumping for domestic and agricultural use.”

Source: Ensign Engineering.
Ground water levels have historically trended downward and those trends are expected to continue, barring any mitigation measures.

Population is expected to continue to trend upward.
Historical Growth Patterns combined with dry conditions and other factors translated into more water being used in the Iron County area than was being put back into the system.

The Central Iron County Water Conservancy District was established in 1997 to manage the water demands and plan for the future water needs of the community.

Ensign Engineering was retained to evaluate the outlook for water and its delivery system for CICWCD.

1970s & Prior: USGS study SIR 2005-5170 concludes that a water shortage is inevitable given expected market expansion of consumption levels.

1997: The Central Iron County Water Conservancy District was established.

2005: CICWCD solicits public input and empanels a group of experts to evaluate potential water supply/delivery alternatives to ensure a safe and reliable water environment going forward.

2014: Ensign Engineering was retained to evaluate the outlook for water and its delivery system for CICWCD.

2015: Ensign Engineering was retained to evaluate the outlook for water and its delivery system for CICWCD.

2016: Utah State Engineer establishes most recent safe yield and depletion numbers.
During this meeting, the Utah State Engineer concludes:

- The established safe yield: 21,000 AF/year
- The current depletion: 28,000 AF/year
- The potential (available) depletion: 50,000 AF/year
Historical growth patterns combined with dry conditions and other factors translated into more water being used in the Iron County area than was being put back into the system.

The Central Iron County Water Conservancy District was established in 1997 to manage the water demands and plan for the future water needs of the community.

Ensign Engineering was retained to evaluate the outlook for water and its delivery system for CICWCD.

USGS study SIR 2005-5170 concludes that a water shortage is inevitable given expected market expansion of consumption levels.

CICWCD solicits public input and empanels a group of experts to evaluate potential water supply/delivery alternatives to ensure a safe and reliable water environment going forward.

Utah State Engineer establishes most recent safe yield and depletion numbers.

Utah State Engineer proposes a large reduction in water rights in the Cedar Valley as part of its groundwater management plan for the area.

Source: SIR 2005-5170.
The Utah State Engineer, in the process of implementing a Groundwater Management Plan, proposes an aggressive reduction in water rights in the Cedar Valley Basin:

- Reduce water rights starting with the most junior in 2030
- Reduce water rights every 10 years, reducing depletion by an average of approximately 6,000 acre feet each decade
- Final reduction in 2070 to bring non-regulated rights to 20,143 acre feet in the Cedar Valley Basin

Source: Utah Division of Water Rights, CICWCD.
The CICWCD Groundwater Management Plan Committee, in response to the State Engineer’s proposed plan, put forth a more measured time table:

- Reduce water rights starting with the most junior in 2035
- Reduce water rights every 15 years, reducing depletion by an average of approximately 6,000 acre feet with each reduction
- Final reduction in 2090 to bring non-regulated rights to 20,143 acre feet in the Cedar Valley Basin

Source: Utah Division of Water Rights, CICWCD.
Historical Timeline of Events

1970s & Prior
- Historical growth patterns combined with dry conditions and other factors translated into more water being used in the Iron County area than was being put back into the system

1997
- The Central Iron County Water Conservancy District was established in 1997 to manage the water demands and plan for the future water needs of the community

2005
- USGS study SIR 2005-5170 concludes that a water shortage is inevitable given expected market expansion of consumption levels

2014
- Ensign Engineering was retained to evaluate the outlook for water and its delivery system for CICWCD

2015
- CICWCD solicits public input and empanels a group of experts to evaluate potential water supply/delivery alternatives to ensure a safe and reliable water environment going forward

2016
- Utah State Engineer establishes most recent safe yield and depletion numbers

2019
- Utah State Engineer proposes a large reduction in water rights in the Cedar Valley as part of its groundwater management plan for the area

Future
- What is the expected economic outlook?
- How does future demand evolve going forward?
- What constraints in water supply exist?
- How does the balance between supply and demand unfold?
- What are the potential implications of failing to address future water challenges?

Source: SIR 2005-5170.
## Economic Overview

### Iron County

<table>
<thead>
<tr>
<th></th>
<th>Peak</th>
<th>Present</th>
<th>% Δ</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Population</strong></td>
<td>2018</td>
<td>2018</td>
<td>54,151 At Peak</td>
</tr>
<tr>
<td><strong>Labor Force Employment</strong></td>
<td>Apr-19</td>
<td>Apr-19</td>
<td>22,924 At Peak</td>
</tr>
<tr>
<td><strong>Unemployment Rate</strong></td>
<td>Nov-06</td>
<td>Apr-19</td>
<td>3.0% 0.9%</td>
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<tr>
<td><strong>Personal Income (Billions)</strong></td>
<td>2017</td>
<td>2017</td>
<td>$1.53 At Peak</td>
</tr>
<tr>
<td><strong>Per Capita Personal Income</strong></td>
<td>2017</td>
<td>2017</td>
<td>$30,088 At Peak</td>
</tr>
<tr>
<td><strong>Average Weekly Wage</strong></td>
<td>Q4 17</td>
<td>Q3 18</td>
<td>$610 -1.8%</td>
</tr>
<tr>
<td><strong>Establishment Count</strong></td>
<td>Q3 18</td>
<td>Q3 18</td>
<td>1,557 At Peak</td>
</tr>
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</table>

<table>
<thead>
<tr>
<th></th>
<th>Prior Year</th>
<th>Present</th>
<th>% Δ</th>
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</thead>
<tbody>
<tr>
<td><strong>Population</strong></td>
<td>2017</td>
<td>2018</td>
<td>52,278 3.6%</td>
</tr>
<tr>
<td><strong>Labor Force Employment</strong></td>
<td>Mar-19</td>
<td>Apr-19</td>
<td>22,752 0.8%</td>
</tr>
<tr>
<td><strong>Unemployment Rate</strong></td>
<td>Mar-19</td>
<td>Apr-19</td>
<td>3.4% 3.0%</td>
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<tr>
<td><strong>Personal Income (Billions)</strong></td>
<td>2016</td>
<td>2017</td>
<td>$1.46 5.0%</td>
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<tr>
<td><strong>Per Capita Personal Income</strong></td>
<td>2016</td>
<td>2017</td>
<td>$29,269 2.8%</td>
</tr>
<tr>
<td><strong>Average Weekly Wage</strong></td>
<td>Q3 17</td>
<td>Q3 18</td>
<td>$596 2.5%</td>
</tr>
<tr>
<td><strong>Establishment Count</strong></td>
<td>Q3 17</td>
<td>Q3 18</td>
<td>1,453 7.2%</td>
</tr>
</tbody>
</table>


Note: Population estimates in recent years have exceeded those previously forecasted by the Gardner Policy Institute. For conservatism, the Institute estimates have been utilized in the modeling efforts contained elsewhere in this presentation.
Population
Iron County

Population Growth Rankings

Utah

2000 to 2018:
Utah: 42.1%
Iron County: 59.3%

2017 to 2018:
Utah: 1.7%
Iron County: 3.6%

Labor Force Employment
Iron County

Unemployment Rate Comparison
Iron County vs. United States

Unadjusted Unemployment Rate
- Iron County
- United States

Unadjusted Unemployment Rate Variance

Average Weekly Wages
Iron County

Employment Establishments
Iron County

Educational Attainment
Iron County, Population aged 25 years or older

Iron County
- Less Than High School: 7.5%
- High School Graduate: 24.8%
- Some College or Associate's Degree: 39.0%
- Bachelor's Degree: 19.8%
- Graduate Degree: 8.9%

Utah
- Less Than High School: 8.2%
- High School Graduate: 22.8%
- Some College or Associate's Degree: 36.4%
- Bachelor's Degree: 21.5%
- Graduate Degree: 11.0%

Poverty Rate
By Educational Attainment

<table>
<thead>
<tr>
<th></th>
<th>Iron County</th>
<th>Utah</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less Than High School</td>
<td>20.1%</td>
<td>19.9%</td>
</tr>
<tr>
<td>High School Graduate</td>
<td>18.7%</td>
<td>10.5%</td>
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<tr>
<td>Some College or Associate's Degree</td>
<td>13.7%</td>
<td>7.6%</td>
</tr>
<tr>
<td>Bachelor's Degree Or Higher</td>
<td>11.6%</td>
<td>4.4%</td>
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Median Earnings
By Educational Attainment

Iron County

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<thead>
<tr>
<th>Educational Attainment</th>
<th>Median Earnings</th>
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<td>Less Than Highschool</td>
<td>$16,436</td>
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<tr>
<td>Highschool Graduate</td>
<td>$28,148</td>
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<td>Some College or Associate's Degree</td>
<td>$28,374</td>
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<td>Bachelor's Degree</td>
<td>$31,643</td>
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<tr>
<td>Graduate or Professional Degree</td>
<td>$55,461</td>
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Utah

<table>
<thead>
<tr>
<th>Educational Attainment</th>
<th>Median Earnings</th>
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</thead>
<tbody>
<tr>
<td>Less Than Highschool</td>
<td>$24,925</td>
</tr>
<tr>
<td>Highschool Graduate</td>
<td>$30,916</td>
</tr>
<tr>
<td>Some College or Associate's Degree</td>
<td>$34,043</td>
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<tr>
<td>Bachelor's Degree</td>
<td>$47,035</td>
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<tr>
<td>Graduate or Professional Degree</td>
<td>$68,331</td>
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Personal Income
Cedar City Micropolitan Statistical Area

Personal Income

<table>
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<tr>
<th>Year</th>
<th>Millions</th>
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<tbody>
<tr>
<td>'01</td>
<td>$0</td>
</tr>
<tr>
<td>'03</td>
<td>$200</td>
</tr>
<tr>
<td>'05</td>
<td>$400</td>
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<td>$800</td>
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<td>'11</td>
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<tr>
<td>'13</td>
<td>$1,200</td>
</tr>
<tr>
<td>'15</td>
<td>$1,400</td>
</tr>
<tr>
<td>'17</td>
<td>$1,535</td>
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Personal Income Per Capita

<table>
<thead>
<tr>
<th>Year</th>
<th>$0</th>
</tr>
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<tbody>
<tr>
<td>'01</td>
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<tr>
<td>'03</td>
<td>$5,000</td>
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<td>$25,000</td>
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<td>'13</td>
<td>$30,000</td>
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<tr>
<td>'15</td>
<td>$30,088</td>
</tr>
<tr>
<td>'17</td>
<td>$30,088</td>
</tr>
</tbody>
</table>

Source: US Bureau of Economic Analysis.
Personal Income
Cedar City Micropolitan Statistical Area

Source: US Bureau of Economic Analysis.
Gross Domestic Product
Utah

Gross Domestic Product

Share of GDP by Industry

- Finance/Insurance/Real Estate: 21.8%
- Government: 12.5%
- Manufacturing: 10.7%
- Professional & Bus. Services: 11.1%
- Educational Services/Health Care: 7.4%
- Retail Trade: 7.2%
- Construction: 6.1%
- Wholesale Trade: 5.3%
- Information: 5.0%
- Transportation & Warehousing: 3.7%
- Arts/Ent./Accom./Food services: 3.4%
- Other Services: 2.8%
- Mining: 1.4%
- Utilities: 1.3%
- Agriculture/Fishing/Hunting: 0.5%

Source: US Bureau of Economic Analysis.
Gross Domestic Product

Source: US Bureau of Economic Analysis (Iron County service area estimates assume consistent per-capita GDP and 92.7 percent population of Iron County).
Iron County’s Water Demand Outlook
**Groundwater Supply-Demand Balance**

Cedar Valley Basin

**Discharge (or Depletion or Use)**
- Well pumping
- Subsurface outflow
- Evapotranspiration (evaporation and plant transpiration)
- Valley springs

**Recharge**
- Precipitation
- Seepage from irrigation
- Seepage from streams and canals
- Subsurface inflow

Source: Cedar Valley Water Users public meeting concerning the process for development a groundwater management plan for Cedar Valley in Iron County (January 7, 2016).
“The majority (±95 percent) of water depletion is sourced to irrigation (agriculture) and municipal (non-agricultural) uses”

Source: Cedar Valley Water Users public meeting concerning the process for development a groundwater management plan for Cedar Valley in Iron County (January 7, 2016).
The following provides a demand projection for municipal water

Source: Cedar Valley Water Users public meeting concerning the process for development a groundwater management plan for Cedar Valley in Iron County (January 7, 2016).
Non-Agriculture Use
CICWCD Population Expectations

Cedar Valley Basin Population

“Projected population growth remains a key driver of potential water demand going forward”

Source: US Census Bureau, Kem C. Gardner Policy Institute, Applied Analysis (CICWCD population based on approximately 92.7 percent of Iron County population).
Non-Agriculture Use
Household Expectations

“The number of households are expected to generally track with population growth and reach over 40,600 in 2080, more than double the current amount”

Source: US Census Bureau, Kem C. Gardner Policy Institute, Applied Analysis (CICWCD population based on approximately 92.7 percent of Iron County population).
Non-Agriculture Use
Water Demand Estimates: No Conservation

“Assuming no additional conservation measures, non-agriculture use is expected to reach over 20,000 acre feet in 2080”

Non-Agriculture Use
Water Demand Estimates: 25% Conservation

"With additional conservation measures, water demand is expected to eclipse 15,000 acre feet in 2080"

The following provides a range of demand projection scenarios for agricultural purposes, which currently account for approximately three quarters of all uses.
“Assuming no conversion and overall use holds stable, approximately 23,000 acre feet of water will be demanded for agricultural use”
“Assuming water rights owners’ water use continues to increase to full water right utilization, demand reaches 36,500 by approximately 2038”
Assuming conversion of agricultural uses at a rate of 0.4 percent annually, demand is expected to decline at a modest rate to roughly 18,000 acre feet in 2080.

Source: Applied Analysis, Ensign Engineering
“After implementing LESA pivot irrigation over 8,000 acres of farm land, demand is expected to decline to below 15,000 acre feet in 2080”
Discharge/Depletion Sources
Cedar Valley Basin

The majority (±95 percent) of water depletion is sourced to irrigation (agriculture) and municipal (non-agricultural) uses

Source: Cedar Valley Water Users public meeting concerning the process for development a groundwater management plan for Cedar Valley in Iron County (January 7, 2016).
All Water Use

Water Demand Estimates: No Additional Municipal Conservation, Full Ag Water Right Utilization

"With no additional conservation efforts and full water right utilization, total water demand will equate to nearly 57,000 acre feet in 2080”

Source: US Census Bureau, Kem C. Gardner Policy Institute, Applied Analysis, Ensign Engineering (assumes two households per acre foot).
All Water Use

Water Demand Estimates: 25% Municipal Conservation, Full Agricultural Water Right Utilization

"With a 25 percent conservation effort from 2025 to 2050 and full water right utilization, total water demand equates to nearly 52,000 acre feet in 2080”

"With a 25 percent conservation effort from 2025 to 2050 and stable (status quo) agriculture use, total water demand equates to over 38,000 acre feet in 2080"

All Water Use

Water Demand Estimates: 25% Municipal Conservation, Conversion to Non-Agricultural Uses

“With a 25 percent conservation effort from 2025 to 2050 and the conversion of agriculture use, total water demand equates to over 33,000 acre feet in 2080”

"With a 25 percent conservation effort from 2025 to 2050, and the conversion of agriculture use combined with LESA irrigation conversion, total water demand will fall modestly to under 30,000 acre feet in 2080."

Iron County’s Water Supply Outlook
**Groundwater Supply-Demand Balance**

**Cedar Valley Basin**

**Discharge (or Depletion or Use)**
- Well pumping
- Subsurface outflow
- Evapotranspiration (evaporation and plant transpiration)
- Valley springs

**Recharge**
- Precipitation
- Seepage from irrigation
- Seepage from streams and canals
- Subsurface inflow

Source: Cedar Valley Water Users public meeting concerning the process for development a groundwater management plan for Cedar Valley in Iron County (January 7, 2016).
Supply/Recharge Sources
Cedar Valley Basin

Quantifying the amount of recharge in the region is a difficult exercise. Based on a number of scientific analyses and studies, the Utah Division of Water Rights ("UDWR") noted four estimates:

- Flow Budget: 32,000 Acre Feet
- Groundwater Model: 24,000 Acre Feet
- Chloride Mass Model: 21,000 Acre Feet
- Storage Change (15-year Analysis): 20,000 Acre Feet

UDWR concluded the amount of recharge is estimated between 20,000 and 24,000 acre feet annually.

The Utah State Engineer estimates the sustainable safe yield is approximately 21,000 acre feet.

Currently, approximately 50,000 acre feet of water rights in the Cedar Valley Basin.

Source: Cedar Valley Water Users public meeting concerning the process for development a groundwater management plan for Cedar Valley in Iron County (December 8, 2016); Ensign Engineering.
“In February 2019, the State Engineer proposed a plan to reduce water rights in the Cedar Valley Basin to match the safe yield of 21,000 acre feet. The CICWCD groundwater management plan committee submitted an alternative timeline”

Source: Applied Analysis, Ensign Engineering (assumes two households per acre foot and 25-percent conservation from 2025 to 2050).
"Considering timing of the State Engineer’s proposed water rights reduction plan for the Cedar Valley Basin, projected demand indicates a shortfall relative to supply by 2030 or 2040 under two scenarios."

Source: Applied Analysis, Ensign Engineering (assumes two households per acre foot, 25-percent conservation from 2025 to 2050, 0.4% ag conversion to municipal use, and LESA irrigation conversion).
"Considering timing of the CICWCD Committee’s proposed water rights reduction plan for the Cedar Valley Basin, projected demand indicates a shortfall relative to supply by 2035 or 2077 under two scenarios."

Source: Applied Analysis, Ensign Engineering (assumes two households per acre foot, 25-percent conservation from 2025 to 2050, 0.4% ag conversion to municipal use, and LESA irrigation conversion).
Supply-Demand Dynamics and Potential Solutions
Supply/Demand Balance
Cedar Valley Basin

Discharge (or Depletion or Use)
- Well pumping
- Subsurface outflow
- Evapotranspiration (evaporation and plant transpiration)
- Valley springs

Recharge
- Precipitation
- Seepage from irrigation
- Seepage from streams and canals
- Subsurface inflow

Source: Cedar Valley Water Users public meeting concerning the process for development a groundwater management plan for Cedar Valley in Iron County (January 7, 2016).
Supply/Demand Balance

Putting it in Perspective

Recharge: +21,000 Acre Feet
- Precipitation
- Seepage from irrigation
- Seepage from streams and canals
- Subsurface inflow

Discharge/Depletion: -28,000 Acre Feet
- Well pumping
- Subsurface outflow
- Evapotranspiration (evaporation and plant transpiration)
- Valley springs

Net Loss: -7,000 Acre Feet per Year
“The reality of the situation is that more water is being used than is being captured, and that cannot continue into perpetuity. While water may continue to pour from residents’ faucets, other potential issues are concerning, including subsidence and fissures.”
In 2009, a 2.5-mile fault line was identified in Enoch, sourced to subsidence.

A total of 8.3 miles of earth fissures have formed the southwest and northeaster portions of Cedar Valley.

The Utah Geological Survey ("UGS") concluded the following:

Source: Utah Department of Natural Resources, Special Study 150, Utah Geological Survey.
Supply/Demand Balance
Utah Geological Survey Conclusions

1. Long-term groundwater pumping in excess of recharge (groundwater mining) is the cause of the land subsidence and earth fissures in Cedar Valley.

2. The maximum amount of land subsidence and earth fissure formation in Cedar Valley coincide with areas of significant groundwater-level decline and the presence of compressible fine-grained sediment in the subsurface.

3. If groundwater levels in Cedar Valley continue to decline at a rate of approximately 2 feet per year, average basin-wide subsidence will likely continue at a rate of 0.02 to 1.2 inches per year.

4. Continued subsidence will likely cause new fissures to form in the future.

5. The inventory of earth fissures in Cedar Valley is likely incomplete because fissures lacking offset or not enlarged by erosion typically exist as hairline cracks that are rarely visible on aerial photographs and are difficult to identify in the field.

Source: Utah Department of Natural Resources, Special Study 150, Utah Geological Survey.
6. Currently unrecognized or new earth fissures may damage existing and future infrastructure in Cedar Valley.

7. Continued southward growth of either the Enochgraben-west or -east fissures may eventually impact fully developed neighborhoods in Enoch City.

8. Earth fissures could provide a direct path for contaminated surface water to reach the Cedar Valley aquifer, a principal source of potable water in Cedar Valley.

9. Managing basin-fill aquifers as a renewable resource and managing the hazards presented by land subsidence and earth-fissure formation require that subsiding areas and rates of subsidence within those areas (likely variable) be defined (technologies such as InSAR, LiDAR, and high-precision GPS/GNSS surveying are well suited to this task).

10. Site-specific hazard investigations are required for new development, and in some instances for existing development, in areas known or suspected to be subsiding.

Source: Utah Department of Natural Resources, Special Study 150, Utah Geological Survey.
Supply/Demand Balance
Utah Geological Survey Recommendations

1. Increase overall water resources by importing water from other basins
2. Increase groundwater recharge to aquifers through conjunctive management of groundwater and surface-water resources
3. Disperse high-discharge wells to reduce localized land subsidence
4. Reduce overall groundwater withdrawals from the basin

Source: Utah Department of Natural Resources, Special Study 150, Utah Geological Survey.
Supply/Demand Balance
Putting it in Perspective

What are the potential supply implications of moving forward with the Pine Valley and Wah Wah Valley water projects recommended by the review panel?
“Currently, the Cedar Valley Basin has a sustainable safe yield of 21,000 acre feet”
“Pine and Wah Wah Valleys could theoretically come online in 2025 and 2040, respectively, increasing District water supply to 47,275 acre feet when considering safe yield of 21,000 acre feet in the Cedar Valley”
Supply/Recharge Sources
Cedar Valley Basin and the West Desert Water Supply Project
State Engineer Water Rights Reduction Plan

“When considering the maximum potential of water rights and the additional sources, total capacity reaches a maximum of slightly more than 50,000 acre feet”

- New Supply - Wah Wah Valley, 11,275 Acre Feet
- New Supply - Pine Valley, 15,000 Acre Feet
- Cedar Valley Basin Safe Yield, 21,000 Acre Feet

Additional water rights reflects the initial amount up to 50,000 acre feet and the proposed reductions by the state engineer; the result is a stair step as new supply is added (Pine and Wah Wah)

Source: US Census, Kem C. Gardner Policy Institute, Applied Analysis, Ensign Engineering
Supply/Recharge Sources
Cedar Valley Basin and the West Desert Water Supply Project
State Engineer Water Rights Reduction Plan

“While new supply from the West Desert Project adds capacity in 2025 and 2040, increased supply is insufficient to meet demand unless municipal conservation, agriculture conversion and the LESA irrigation program are implemented”

"When considering the maximum potential of water rights and the additional sources, total capacity reaches in excess of 60,000 acre feet at its highest point"
"While new supply from the West Desert Project adds capacity in 2025 and 2040, increased supply is insufficient to meet demand unless municipal conservation agriculture conversion, and the LESA irrigation program are implemented."

Supply/Demand Balance
Putting it in Perspective

What are the historical and projected impacts on the aquifer’s running deficit when measured in acre feet?
Supply/Demand Balance
Running Aquifer Deficit, Cedar Valley Basin

Currently Estimated at -415,500 Acre Feet

Supply/Demand Balance
Running Aquifer Deficit, Cedar Valley Basin

Supply/Demand Balance
Running Aquifer Deficit, Cedar Valley Basin

- **Historical Running Deficit**

- **Projected Aquifer Balance**: No Water Projects. No Additional Conservation or Ag. Conversion. Agriculture increases to Proved Water Rights.


Historical Running Deficit


Supply/Demand Balance
Running Aquifer Deficit, Cedar Valley Basin

Historical Running Deficit


Projected Aquifer Balance: Including 15,000 AF from Pine Valley, 11,275 AF from Wah Wah Valley. No Additional Conservation & Ag Conversion. Agriculture increases to Proved Water Rights.

Supply/Demand Balance
Running Aquifer Deficit, Cedar Valley Basin

Historical Running Deficit


Projected Aquifer Balance: Including 15,000 AF from Pine Valley, 11,275 AF from Wah Wah Valley. No Additional Conservation & Ag Conversion. Agriculture increases to Proved Water Rights.

Aquifer Balance: Including 15,000 AF from Pine Valley, 11,275 AF from Wah Wah Valley. No Additional Conservation. Agriculture Remains at 23k Acre Feet

Historical Running Deficit


Projected Aquifer Balance: Including 15,000 AF from Pine Valley, 11,275 AF from Wah Wah Valley. No Additional Conservation & Ag Conversion. Agriculture increases to Proved Water Rights.

Aquifer Balance: Including 15,000 AF from Pine Valley, 11,275 AF from Wah Wah Valley. No Additional Conservation. Agriculture Remains at 23k Acre Feet

Aquifer Balance: Including 15,000 AF from Pine Valley, 11,275 AF from Wah Wah Valley. No Additional Conservation. Agriculture is Converted.

Supply/Demand Balance
Running Aquifer Deficit, Cedar Valley Basin

- Historical Running Deficit

- Projected Aquifer Balance: Including 15,000 AF from Pine Valley, 11,275 AF from Wah Wah Valley. No Additional Conservation & Ag Conversion. Agriculture increases to Proved Water Rights.
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- Projected Aquifer Balance: Including 15,000 AF from Pine Valley, 11,275 AF from Wah Wah Valley. Includes 25% Conservation from 2025-2050. Includes Ag Conversion. No New Ag. Is Introduced.

In addition to measuring the impact on the running deficit, what are the implications on ground water levels
Supply/Demand Balance
Running Aquifer Deficit and Population Growth

- Historical Running Deficit
- Projected Aquifer Balance: Including 15,000 AF from Pine Valley, 11,275 AF from Wah Wah Valley. No Additional Conservation & Ag Conversion. Agriculture increases to Proved Water Rights.
- Aquifer Balance: Including 15,000 AF from Pine Valley, 11,275 AF from Wah Wah Valley. No Additional Conservation. Agriculture Remains at 23k Acre Feet
- Aquifer Balance: Including 15,000 AF from Pine Valley, 11,275 AF from Wah Wah Valley. No Additional Conservation. Agriculture is Converted.
- Projected Aquifer Balance: Including 15,000 AF from Pine Valley, 11,275 AF from Wah Wah Valley. Includes 25% Conservation from 2025-2050. Includes Ag Conversion. No New Ag. Is Introduced.

Projected Population
Iron County Water Strategy

- Develop a renewable, reliable source of potable water

- **Least Aggressive Strategy:**
  - No new water projects
  - No additional conservation efforts
  - No agriculture conversion
  - Agriculture use increases to approved water right allowance
  - This will increase the deficit to 1.7 million acre feet by 2070

Summary

415,000 AF
Current Deficit

24,000 AF
Every Year
Average Additional Deficit

507,000 AF
2025 Deficit
Iron County Water Strategy

- Develop a renewable, reliable source of potable water

**Most Aggressive Strategy:**
- Bring in water from Pine and Wah Wah Valley
- Perform a Coal Creek recharge project
- Conserve an additional 25% of non-agricultural water from 2025 through 2050
- Convert agriculture use water to non-agriculture use water at a fairly aggressive rate
- Allow no new agriculture growth past 2018
- Convert all pivot irrigation to LESA
- **This will relieve the water deficit by 2065**
Economic Impacts of Investments in Infrastructure
Quantifying the Economic Impacts of the Alternatives
Two Key Considerations

Types of Economic Impacts Considered

1. POSITIVE IMPACTS
   One-time construction impacts on the local economy that are sourced to new infrastructure investments (e.g., Pine Valley and Wah Wah Valley projects)

2. NEGATIVE IMPACTS
   The recurring economic losses sourced to an insufficient water system in the event no infrastructure investments are made, limiting future growth potential
Quantifying the Economic Impacts of the Alternatives

Two Key Considerations

Types of Economic Impacts Considered

1. **POSITIVE IMPACTS**
   One-time construction impacts on the local economy that are sourced to new infrastructure investments (e.g., Pine Valley and Wah Wah Valley projects)

2. **NEGATIVE IMPACTS**
   The recurring economic losses sourced to an insufficient water system in the event no infrastructure investments are made, limiting future growth potential
In addition to the broader implications of a reliable water supply system, there are one-time economic impacts associated with the development of new infrastructure.

One-Time Economic Impact of Infrastructure Investments
Quantifying the Impacts

<table>
<thead>
<tr>
<th>Economic Output</th>
<th>Wages and Salaries</th>
<th>Employment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Impact of Total Spending within the Local Economy</td>
<td>Impact on Personal Incomes for Local Residents</td>
<td>Impact on the Number of Jobs within the Local Economy</td>
</tr>
</tbody>
</table>
One-Time Economic Impact of Infrastructure Investments

Approach, Methodology, and Assumptions

IMPLAN Model:

— 1 of 3 nationally recognized impact analysis software tools
— Developed by Minnesota IMPLAN Group, Inc. and used by more than 1,000 public and private institutions
— IMPLAN is an input-output model that utilizes complex economic equations to explain how the “outputs” of one industry become the “inputs” of others, and vice versa
— This relationship is sometimes referred to as the “multiplier effect”, illustrating how changes in one sector of the economy can affect other sectors
— See IMPLAN.com
One-Time Economic Impact of Infrastructure Investments

Approach, Methodology, and Assumptions

IMPLAN Model:

—IMPLAN data contains 546 sectors representing all private industries in the United States (anything from grain farming to surgical appliance manufacturing) as defined by the North American Industry Classification System (NAICS) codes

—Employment, employee compensation, industry expenditures, commodity demands, relationships between industries, and more are collected to form IMPLAN’s ever-growing database
One-Time Economic Impact of Infrastructure Investments

Approach, Methodology, and Assumptions

IMPLAN Model:

—Inputs: For purposes of this analysis, the inputs for the economic impact analyses were sourced to CICWCD’s estimated development costs for the Pine Valley ($253.6 million) and Wah Wah Valley ($165.7 million) infrastructure projects for a total cost of $419.3 million

—Location: IMPLAN databases specific to Iron County, Utah were acquired and utilized to develop the economic impacts of the proposed investments
One-Time Economic Impact of Infrastructure Investments

Approach, Methodology, and Assumptions

IMPLAN Model:

—Industry: In addition to the cost and location details, industry-specific metrics were utilized that most closely resemble the type of development contemplated (Industry Code 58 - Construction of other new nonresidential structures)

—Multiplier Effect: The following multipliers were generated based on the location and industry classification:

<table>
<thead>
<tr>
<th></th>
<th>Direct</th>
<th>Indirect</th>
<th>Induced</th>
<th>Total</th>
<th>Multiplier Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output (Per $1.00 of Direct Output)</td>
<td>1.00</td>
<td>0.27</td>
<td>0.17</td>
<td>1.44</td>
<td>1.44x</td>
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<tr>
<td>Labor Income (Per $1.00 of Direct Output)</td>
<td>0.23</td>
<td>0.06</td>
<td>0.04</td>
<td>0.33</td>
<td>1.46x</td>
</tr>
<tr>
<td>Employment (Per $1.0 Million of Direct Output)</td>
<td>7.82</td>
<td>2.77</td>
<td>1.69</td>
<td>12.28</td>
<td>1.57x</td>
</tr>
</tbody>
</table>
One-Time Economic Impact of Infrastructure Investments

Multiplier Effect

Total Impact
The sum of direct, indirect and induced impacts

### Direct
Generated by direct spending on the development of homes and other uses

### Indirect
Secondary impacts generated by businesses supporting the economic activities of the development activity (e.g., vendors)

### Induced
Sourced to businesses that are supported by the spending of employees supported by direct impacts (e.g., at grocery stores, in movie theaters or at doctor’s offices)

Note: Indirect and induced impacts sourced to IMPLAN.
One-Time Economic Impact of Infrastructure Investments
West Desert Supply Project

**PINE VALLEY**
15,000 ACRE FEET

- Original Cost Estimate: $150.0 Million
- Revised Cost Estimate: $253.6 Million

**WAH WAH VALLEY**
11,275 ACRE FEET

- Original Cost Estimate: $50.0 Million
- Revised Cost Estimate: $165.7 Million

**TOTAL INVESTMENT: $419.3 MILLION**

Source: CICWCD.
### One-Time Economic Impact of Infrastructure Investments

#### Economic Impact Summary

<table>
<thead>
<tr>
<th>($ in Millions)</th>
<th>Direct</th>
<th>Indirect</th>
<th>Induced</th>
<th>Total</th>
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</thead>
<tbody>
<tr>
<td>Pine Valley Only: $254 Million Investment</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Economic Output</td>
<td>$253.6</td>
<td>$69.2</td>
<td>$43.7</td>
<td>$366.4</td>
</tr>
<tr>
<td>Wages &amp; Salaries</td>
<td>$58.2</td>
<td>$16.0</td>
<td>$10.6</td>
<td>$84.9</td>
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<tr>
<td>Employment</td>
<td>1,982</td>
<td>702</td>
<td>428</td>
<td>3,113</td>
</tr>
</tbody>
</table>

| Pine and Wah Wah Valleys: $419 Million Investment |        |          |         |       |
| Economic Output                        | $419.3 | $114.4   | $72.2   | $605.9|
| Wages & Salaries                       | $96.3  | $26.5    | $17.5   | $140.3|
| Employment                             | 3,278  | 1,161    | 708     | 5,147 |

The potential economic impacts sourced to large-scale investment in infrastructure are significant with $606 million in output, supporting approximately $140 million in wages and an estimated 5,100 person-years of employment.

Note: Indirect and induced impacts sourced to IMPLAN; employment stated in person-years of employment (i.e., one person employed for an entire year).
The potential economic impacts sourced to large-scale investment in infrastructure are significant with $606 million in output, supporting approximately $140 million in wages and an estimated 5,100 person-years of employment.

Note: Indirect and induced impacts sourced to IMPLAN; employment stated in person-years of employment (i.e., one person employed for an entire year).
The potential economic impacts sourced to large-scale investment in infrastructure are significant with $606 million in output, supporting approximately $140 million in wages and an estimated 5,100 person-years of employment.
The potential economic impacts sourced to large-scale investment in infrastructure are significant with $606 million in output, supporting approximately $140 million in wages and an estimated 5,100 person-years of employment.
Quantifying the Economic Impacts of the Alternatives
Two Key Considerations

Types of Economic Impacts Considered

1. **POSITIVE IMPACTS**
   One-time construction impacts on the local economy that are sourced to new infrastructure investments (e.g., Pine Valley and Wah Wah Valley projects)

2. **NEGATIVE IMPACTS**
   The recurring economic losses sourced to an insufficient water system in the event no infrastructure investments are made, limiting future growth potential
Based on current non-agricultural (M&I) demand levels, the value of each acre foot of water equates to:

- 5.70 residents
- 2.00 households
- 2.53 employees
- 0.16 businesses
- $174,641 in personal income
- $319,636 in gross product

### Current Demand

<table>
<thead>
<tr>
<th></th>
<th>Muni. &amp; Ind.</th>
<th>Agriculture</th>
<th>Combined</th>
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<tr>
<td>Count</td>
<td>8,787 AF</td>
<td>23,000 AF</td>
<td>31,787 AF</td>
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<tr>
<td>Population</td>
<td>50,063</td>
<td>5.70</td>
<td>2.18</td>
</tr>
<tr>
<td>Households</td>
<td>17,573</td>
<td>2.00</td>
<td>0.76</td>
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<tr>
<td>Employees</td>
<td>22,227</td>
<td>2.53</td>
<td>0.97</td>
</tr>
<tr>
<td>No. of Business Establishments</td>
<td>1,435</td>
<td>0.16</td>
<td>0.06</td>
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<tr>
<td>Personal Income</td>
<td>$1,534,500,000</td>
<td>$174,641</td>
<td>$66,717</td>
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<tr>
<td>Gross Product (est.)</td>
<td>$2,808,512,402</td>
<td>$319,636</td>
<td>$122,109</td>
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</tbody>
</table>

When agricultural demand is included, the value of each acre foot of water equates to:

- 1.57 residents
- 0.55 households
- 0.70 employees
- 0.05 businesses
- $48,275 in personal income
- $88,355 in gross product

### Current Demand

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Quantifying the Potential Impacts of Water Infrastructure
Pine Valley and Wah Wah Valley: Value per Acre Foot of Water

When applying the value per acre foot to the additional capacity of new developments, local economy is expected support:

- Over 41,000 residents
- Over 14,000 households
- Over $1.26 million in additional personal income each year
- Over $2.32 million in economic activity each year

<table>
<thead>
<tr>
<th>Future Supply</th>
<th>Pine Valley</th>
<th>Wah Wah Valley</th>
<th>Combined</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>15,000 AF</td>
<td>11,275 AF</td>
<td>26,275 AF</td>
</tr>
<tr>
<td>Population</td>
<td>23,625</td>
<td>17,758</td>
<td>41,383</td>
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<tr>
<td>Households</td>
<td>8,293</td>
<td>6,233</td>
<td>14,526</td>
</tr>
<tr>
<td>Employees</td>
<td>10,489</td>
<td>7,884</td>
<td>18,373</td>
</tr>
<tr>
<td>No. of Business Establishments</td>
<td>677</td>
<td>509</td>
<td>1,186</td>
</tr>
<tr>
<td>Personal Income</td>
<td>$724,126,031</td>
<td>$544,301,400</td>
<td>$1,268,427,431</td>
</tr>
<tr>
<td>Gross Product (est.)</td>
<td>$1,325,328,731</td>
<td>$996,205,430</td>
<td>$2,321,534,161</td>
</tr>
</tbody>
</table>

Quantifying the Potential Impacts of Water Infrastructure
Pine Valley and Wah Wah Valley: Value per Acre Foot of Water

When applying the value per acre foot of municipal and industrial water to the additional capacity of new developments, local economy is expected support:

- Nearly 150,000 residents
- Over 52,000 households
- Almost $4.6 million in additional personal income each year
- Approximately $8.4 million in economic activity each year

<table>
<thead>
<tr>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pine Valley</td>
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</tr>
<tr>
<td>Population</td>
<td>85,465</td>
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<tr>
<td>Households</td>
<td>30,000</td>
</tr>
<tr>
<td>Employees</td>
<td>37,945</td>
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<tr>
<td>No. of Business Establishments</td>
<td>2,450</td>
</tr>
<tr>
<td>Personal Income</td>
<td>$2,619,615,807</td>
</tr>
<tr>
<td>Gross Product (est.)</td>
<td>$4,794,541,206</td>
</tr>
</tbody>
</table>

Quantifying the Potential Impacts of Water Infrastructure

What are the impacts on personal income to the community under potential water constraint scenarios
Quantifying the Potential Impacts of Water Infrastructure

Personal Income Impacts Over the Next 30 Years: **Constrained 2020**

- When applying the per-capita personal income estimate of $30,652 (2019 dollars) to projected District population in the Iron County area, personal income is estimated to reach $2.2 billion annually by 2050 (in 30 years).
- Assuming growth is constrained next year (2020), the remaining 30-year impact (loss) to the community is $10.9 billion.

When applying the per-capita personal income estimate of $30,652 (2019 dollars) to projected District population in the Iron County, personal income is estimated to reach $2.2 billion annually by 2050 (in 30 years).

Assuming growth is constrained in 2030, the remaining 20-year impact (loss) to the community is $4.8 billion.
When applying the per-capita personal income estimate of $30,652 (2019 dollars) to projected District population in the Iron County, personal income is estimated to reach $2.2 billion annually by 2050 (in 30 years).

Assuming growth is constrained in 2040, the remaining 10-year impact (loss) to the community is $1.0 billion.
What are the impacts on gross product (economic activity) to the community under potential water constraint scenarios?
Quantifying the Potential Impacts of Water Infrastructure
Gross Product Impacts Next 30 Years: *Constrained 2020*

- When applying the per-capita gross product estimate of $56,099 (2019 dollars) to projected District population in the Iron County, gross product is estimated to reach $4.0 billion annually by 2050 (in 30 years).

- Assuming growth is constrained next year (2020), the remaining 30-year impact (loss) to the community is $19.9 billion.

![Graph showing Gross Product Impacts Next 30 Years: Constrained 2020](source: Bureau of Economic Analysis, Kem C. Gardner Policy Institute, Applied Analysis.)

$19.9 Billion Loss in Gross Product Due to Lack of Water Supply (2020 through 2050)
Quantifying the Potential Impacts of Water Infrastructure
Gross Product Impacts Next 30 Years: **Constrained 2030**

- When applying the per-capita gross product estimate of $56,099 (2019 dollars) to projected District population in the Iron County, gross product is estimated to reach $4.0 billion annually by 2050 (in 30 years).
- Assuming growth is constrained in 2030, the remaining 20-year impact (loss) to the community is $8.4 billion.

When applying the per-capita gross product estimate of $56,099 (2019 dollars) to projected District population in the Iron County, gross product is estimated to reach $4.0 billion annually by 2050 (in 30 years).

Assuming growth is constrained in 2040, the remaining 10-year impact (loss) to the community is $1.9 billion.

$2.1 Billion Loss in Gross Product Due to Lack of Water Supply (2040 through 2050)

Quantifying the Potential Impacts of Water Infrastructure
A Range of Returns on Investment

When comparing the potential economic implications of a constrained growth environment with the investment, or cost, associated with the Pine Valley and Wah Wah Valley pipeline projects, the ratios are significant:

- **Personal Income**: Assuming water infrastructure investments of $419.3 million were able to secure an additional 10 years of community growth (2041 to 2050), the impact of an additional $1.0 billion of personal income translates into a return of $2.50 for every $1.00 invested; more near-term constraint scenarios increase that ratio significantly

- **Gross Product**: Similarly, gross product returns during the 10-year period from 2041 to 2050 are estimated to be $1.9 billion – equating to a return of 4.5-to-1.0 with larger impacts under more conservative scenarios

<table>
<thead>
<tr>
<th>Potential Impact</th>
<th>Rate of Return</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Personal Income Impacts for the Next 30 Years:</strong></td>
<td></td>
</tr>
<tr>
<td>Constrained in 2020</td>
<td>$10,877,150,359</td>
</tr>
<tr>
<td>Constrained in 2030</td>
<td>$4,863,765,891</td>
</tr>
<tr>
<td>Constrained in 2040</td>
<td>$1,041,624,985</td>
</tr>
</tbody>
</table>

| **Gross Product Impacts for the Next 30 Years:** |                |
| Constrained in 2020                      | $19,907,860,331 | 47.5 : 1.0 |
| Constrained in 2030                      | $8,041,032,598  | 19.2 : 1.0 |
| Constrained in 2040                      | $1,906,429,904  | 4.5 : 1.0 |

Source: Bureau of Economic Analysis, Kem C. Gardner Policy Institute, Applied Analysis
While there are a number of financing alternatives, this analysis assumes:
- Term: 40-Year Repayment
- Interest Rate: 4.0%
- Fixed Payments

Amortization and Debt Service:
- Pine Valley:
  - Starts: 2026
  - Annual Debt Service: $12.8 M
- Wah Wah Valley:
  - Starts: 2040
  - Annual Debt Service: $8.4 M

Potential Debt Financing Scenario of New Infrastructure

Source: CICWCD
While there are a number of financing alternatives, this analysis assumes:
- Term: 40-Year Repayment
- Interest Rate: 4.0%
- Fixed Payments

Amortization and Debt Service:
- Pine Valley:
  - Starts: 2026
  - Annual Debt Service: $12.8 M
- Wah Wah Valley:
  - Starts: 2040
  - Annual Debt Service: $8.4 M

Source: CICWCD
# Potential Funding Sources for New Infrastructure

## User Fees

(Incremental Water Usage Fees)

<table>
<thead>
<tr>
<th>Period</th>
<th>Annual per HH</th>
</tr>
</thead>
<tbody>
<tr>
<td>2017-2026</td>
<td>$0.50</td>
</tr>
<tr>
<td>2026-2030</td>
<td>$2.30</td>
</tr>
<tr>
<td>2030-2040</td>
<td>$2.50</td>
</tr>
<tr>
<td>2040-2050</td>
<td>$2.60</td>
</tr>
<tr>
<td>2050-2060</td>
<td>$2.50</td>
</tr>
<tr>
<td>2060-2080</td>
<td>$2.00</td>
</tr>
</tbody>
</table>

## Impact Fees

(Development/Investment Community)

<table>
<thead>
<tr>
<th>Period</th>
<th>Per New HH</th>
</tr>
</thead>
<tbody>
<tr>
<td>2017-2026</td>
<td>$3,500</td>
</tr>
<tr>
<td>2026</td>
<td>$5,000</td>
</tr>
<tr>
<td>2026-2030</td>
<td>+3.0%</td>
</tr>
<tr>
<td>2030-2040</td>
<td>+3.0%</td>
</tr>
<tr>
<td>2040-2050</td>
<td>+3.0%</td>
</tr>
<tr>
<td>2050-2060</td>
<td>+1.0%</td>
</tr>
<tr>
<td>2060-2080</td>
<td>0.0%</td>
</tr>
</tbody>
</table>

## Property Taxes

(Residents, Businesses, and Landowners)

<table>
<thead>
<tr>
<th>Period</th>
<th>% To Project</th>
</tr>
</thead>
<tbody>
<tr>
<td>2017-2026</td>
<td>0.0%</td>
</tr>
<tr>
<td>2026-2030</td>
<td>1.0%</td>
</tr>
<tr>
<td>2030-2040</td>
<td>1.0%</td>
</tr>
<tr>
<td>2040-2050</td>
<td>1.0%</td>
</tr>
<tr>
<td>2050-2060</td>
<td>1.0%</td>
</tr>
<tr>
<td>2060-2080</td>
<td>1.0%</td>
</tr>
</tbody>
</table>

Source: CICWCD.
# Residential Water Bills and Rates

## Current Rates

<table>
<thead>
<tr>
<th>Level</th>
<th>Description</th>
<th>Cost</th>
<th>Includes</th>
</tr>
</thead>
<tbody>
<tr>
<td>#0</td>
<td>Minimum Monthly Fee</td>
<td>$31.00</td>
<td>No Water, Minimum Monthly Fee</td>
</tr>
<tr>
<td>#1</td>
<td>Plus $0.78 per 1,000 Gallons</td>
<td>$0.78</td>
<td>0 to 12,000 Gallons/Month</td>
</tr>
<tr>
<td>#2</td>
<td>Plus $0.94 per 1,000 Gallons</td>
<td>$0.94</td>
<td>12,001 to 20,000 Gallons/Month</td>
</tr>
<tr>
<td>#3</td>
<td>Plus $1.65 per 1,000 Gallons</td>
<td>$1.65</td>
<td>20,001 to 30,000 Gallons/Month</td>
</tr>
<tr>
<td>#4</td>
<td>Plus $2.78 per 1,000 Gallons</td>
<td>$2.78</td>
<td>30,001 to 60,000 Gallons/Month</td>
</tr>
<tr>
<td>#5</td>
<td>Plus $3.09 per 1,000 Gallons</td>
<td>$3.09</td>
<td>60,001 to 100,000 Gallons/Month</td>
</tr>
<tr>
<td>#6</td>
<td>Plus $4.12 per 1,000 Gallons</td>
<td>$4.12</td>
<td>Over 100,000 Gallons/Month</td>
</tr>
</tbody>
</table>

**Average Monthly Water Bill**
- **$2.24 per 1,000 Gallons**
- **15,926 Gallons / $35.71 per month**
- **191,112 Gallons / $428.52 per year**

Source: Water Master Plan Report, 2014; Ensign Engineering & Land Surveying, CICWCD.
There are a number of potential financing scenarios for the project; this scenario reflects one alternative.
Potential Revenue and Expenditure Scenario

Source: CICWCD