# LINDON CITY

# North Union Piping Water Conservation & Measurement Project

**WaterSMART: Water & Energy Efficiency Grants for FY2017**

**BOR-DO-17-F012**

**January 18, 2017**


## APPLICANT

**Lindon City, Utah**
100 North State Street, Lindon, UT 84042

## PROJECT MANAGER

**Mark Christensen, PE**
240 West Center, Suite 200, Orem, UT 84057
(801) 226-0393
MLC@jub.com


# Contents

# Executive Summary

Date: January 18, 2017

Applicant Name: **Lindon City, Utah**

City, County, State: **Lindon, Utah, Utah**

Project Funding Request: **$258,922.00**

## Project Summary

The North Union Canal Piping Project will pipe 1,325 linear feet in two sections of deteriorating concrete-lined canal running through developed neighborhoods and commercial areas in Lindon City. According to a water loss study performed by NRCS, nearly 23.16% of water, or 602.7 acre-feet annually is lost in the canal in the failing section from 400 East to the Zone III Reservoir; 1.4%, or 33 acre-feet, is lost in a 475-foot section at 200 South. These improvements will solve several existing and future system deficiencies including water loss and risk to residents. Water seepage and overflow from the under-sized canal leaks into yards and basements of nearby houses. Water saved by this project will contribute to energy generation along the Provo River as Lindon City will divert less water from the river above a hydropower generation plant.

**This project will conserve a total of 635.7 acre-feet annually in conveyance losses.** This amount constitutes about 32% of 2,000 acre feet the City receives from the canal annually.

**By contributing more water to hydropower generation, this project will produce 95,355 kWh of energy and save $34,964 in power loss charges each year.**

## Estimated Schedule

Environmental work and design of the North Union Canal Piping will begin upon agreement with USBR in October 2017. The design will be completed and project bidding will occur July to August 2018 for construction beginning after the water is out of the canal in October 2018. Construction will be substantially complete by April 2019 and the new pipe will be in service by late April 2019.

Final completion of incidental project work and final reports will be completed in May of 2019.

### Federal Facility

Lindon City receives water through the North Union Canal which delivers water from Jordanelle and Deer Creek Reservoirs, both Reclamation projects. The City has 924 acre-feet of contract water from the Jordanelle Project, part of Reclamation's Central Utah Project. The City also owns a share in the Central Utah Project. Deer Creek Dam and Reservoir are part of Reclamation's Provo River Project.

## Background Data

Lindon City, a suburban community located 37 miles south of Salt Lake City, is home to 10,810 residents. The City extends east to the Wasatch Mountains and west to Utah Lake. Being located near major employment and education centers, Lindon has seen steady growth and changing land uses over the last decade.

The City and its leaders have worked diligently to ensure adequate water for current and future residents, businesses and institutions. To meet demands, the City constructed a pressure irrigation system which began service in 1993. The North Union Canal (NUC), fed with a diversion from the Provo River, is the primary delivery system of water into the City's pressure irrigation system. Lindon is a majority shareholder in the NUC and has worked in partnership with the irrigation company to improve water supply sustainability, conservation and management.

## Need

The NUIC system is mainly comprised of a crumbling open canal running through developed suburban communities. The open canal creates many problems for water supply, delivery, maintenance, and nuisance water in adjacent properties.

### *System Deterioration*

The North Union Canal was originally constructed between 1852 and 1864. Concrete liner was added in the 1940s and 1950s. The concrete liner in many areas is deteriorating and cracking causing water losses through seepage. In the most urgent section to be addressed by the proposed project, the liner has collapsed, creating cavities behind the liner wherein significant water losses are occurring.

### *Water Losses*

An NRCS study conducted in September 2016 (See Attachment A) determined that the loss rate over the length of the canal in Lindon was 31% or 905.5 acre-feet annually. In the two sections that will be piped as part of this project, the annual losses total 635.7 acre-feet. The major section to be piped creates 602.7 acre-feet

*The canal does not have the capacity to carry the full water right and water is lost as it spills over the bank.*

of the total 905.5 acre-feet in loses; about 66% of the canal loses are realized in this urgent section.

### *Limited Capacity*

The current capacity of the NUC is insufficient to carry the City's full flow right from the river. At only 8 feet wide, during peak flow times the canal spills over the edge in some areas. Due to slope, the current maximum capacity ranges from 13.6 cfs to 22.3 cfs depending on the section. Once the canal is piped, the capacity will increase.

### *Risk to Residents*

The canal winds through neighborhoods and along backyards. The failing liner causes seepage into adjacent yards. Because of this nuisance water, homeowners in some parts of the City must operate small pump systems to prevent their basements from flooding.

*Cracking in the concrete liner causes water to seep into adjacent yards and properties.*

### *Maintenance Concerns*

The open canals create continual maintenance issues for the City and the irrigation company. The canal runs through private yards with limited space on either side. There is no access road for irrigation company personnel. The canal is too narrow to accommodate large equipment so repairs and cleaning must be done with smaller, less efficient equipment or manual tools. The water master and his crew must walk the ditch with rakes and shovels to remove debris and weeds. Weeds, moss and debris build up and impede water flow and cause spillage. Large trees have grown on the edge of the canal lifting and pushing the concrete liner.

*Debris must be removed manually because of the limited space available to access the canal.*

### *Lack of Information*

Lindon City and the North Union Irrigation Company have concerns about the best management of the water in their system. The measurement devices that do exist have not been functional for many years. Without this data, City officials and NUIC personnel do not have sound data as to water usage and availability.

### *Solutions*

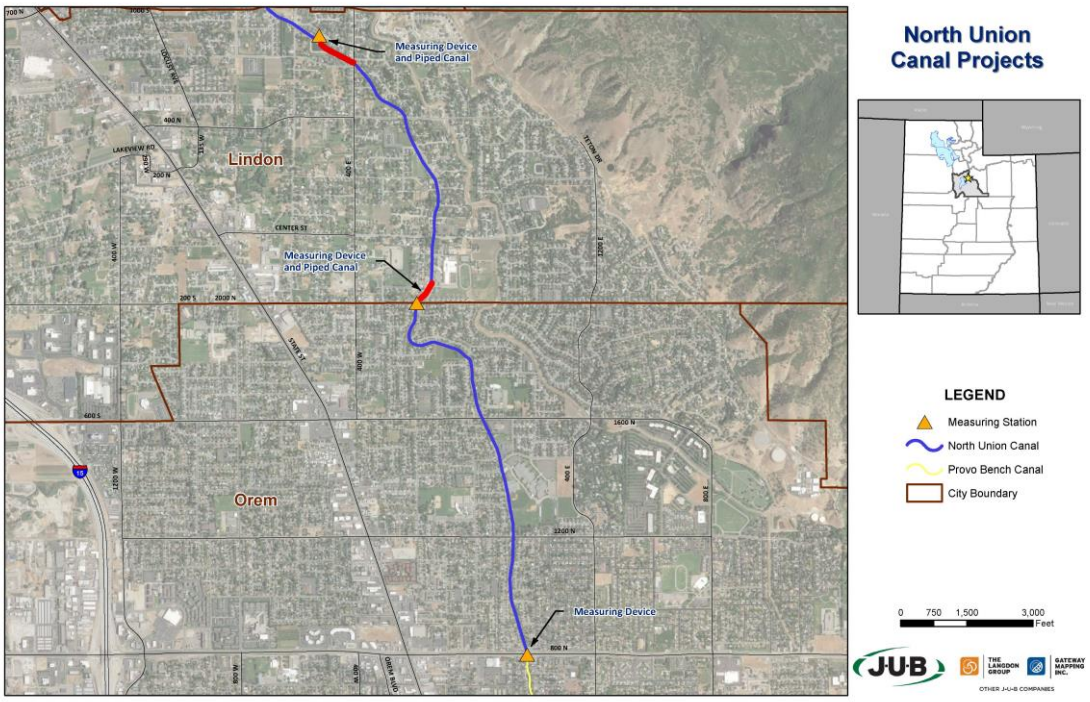
Replacing the open canal with an enclosed piped system would resolve the issues from an aging, open canal. There would no longer be massive delivery and evaporative water losses. Nearby properties would no longer be at risk of seepage and nuisance water. The irrigation company would not need to manually maintain miles of canal.

Measuring devices will give the City and Irrigation Company the ability to more efficiently manage their water to meet real-time needs.

The proposed WaterSMART project is an important step in moving toward an efficient, effective irrigation system in Lindon.

## Map

Please see Attachment B for a larger map.




## Sources of Water Supply

### *Reservoirs and Provo River*

The NUC provides primary delivery of water to Lindon City's pressure irrigation system. The NUC is fed by the Provo Bench Canal which receives a diversion from the Provo River at the mouth of Provo Canyon.

Jordanelle Reservoir → Deer Creek Reservoir → Provo River → Hydropower Generation Facility → Provo Bench Canal → North Union Canal → Lindon City Pressure Irrigation

### *Alpine Aqueduct*

Due to insufficient water supply from their river diversion, Lindon City must often take water from the Alpine Aqueduct which also receives water from the Provo River. However, the aqueduct water is diverted before a power generation plant so when the City uses aqueduct water they must pay a power loss charge.

The 21-mile long Alpine Aqueduct is also used for drinking water. It tunnels through a nearby ridge then continues in a concrete pipeline to the Utah Valley Water Treatment Plant in Orem. Treated water is then delivered from the plant to north Utah County communities by a continuation of the Alpine Aqueduct, branching reaches, and various other distribution systems.


## Water Rights Involved

Lindon City and other North Union Canal shareholders have a flow right of the Provo River by decree, but the flow right can be reduced depending on how much water is actually available in the river.

***Flow Right by Decree***

| Period | No. Days | North Union (cfs/share) | Provo Bench (cfs/share) |
|---|---|---|---|
| April 15 to May 10 | 26 | 0.02156 | 0.04074 |
| May 11 to June 20 | 41 | 0.02647 | 0.05000 |
| June 21 to July 20 | 30 | 0.02395 | 0.04525 |
| July 21 to October 15 | 87 | 0.02156 | 0.04074 |

| LINDON CITY-OWNED WATER SHARES | |
|---|---|
| Source | # of Shares |
| North Union Canal (NUC) shares | 618.832 |
| Trade with Orem City for additional NUC shares | 141.985 |
| Rent shares in NUC | 11 |
| **Total NUC shares owned by Lindon City** | **771.817 (57.6% of total NUC shares (1,340.37))** |
| Provo Bench Canal (PBC) shares | 92.18 |
| Rent PBC shares from Alpine School District | 26.050 |
| **Total PBC shares owned by Lindon City** | **118.23 (6% of total PBC shares (1,997))** |

## Current Water Uses

Lindon City's water is used primarily to water lawns and gardens. The City and its residents value green space and open space. There are some small agricultural users with orchards, fields and pastures.

## Number of Water Users Served

The table to the right identifies the number of service connections to Lindon's pressure irrigation system.

| Service Connections | |
|---|---|
| **Service Size** | **Number** |
| 1 – inch | 2,268 |
| 1 1/2 – inch | 82 |
| 2 – inch | 74 |
| 4 - inch | 1 |
| Total | 2,425 |

## Current and Projected Water Demand

In 2014, City irrigation water use totaled approximately 3,821.3 ac-ft per year, or 622 gallons of water per capita per day during the 192-day irrigation season.

The City has seen steady population growth at a rate of 7.3% between 2010 and 2015. The build-out population projection is approximately 14,000 residents by the year 2040.

If water usage continues at current levels, the City will use 8,708,000 gallons of water or 26.72 acre feet per day; 5,130.24 acre-feet during the irrigation season.

## Potential Shortfalls in Water Supply

Utah is continually subject to drought; it is the second driest state in the nation. This region of the State has been specifically impacted by drought. In 2016 Utah Lake water level was around 49% of normal. The Provo River, which supplies water to the North Union Canal, accounts for 36% of the inflow into Utah Lake.

If river flows are low, then Lindon City's flow right is reduced. For example, in 1992, a particularly low river flow year, the NUC could only take 30-50% of its right during the hottest, driest part of the irrigation season.

| TIME PERIOD | PERCENT RIVER | DAYS |
|---|---|---|
| 1992 Water Year River Flows | | |
| April 15 to April 27 | 100% | 13 |
| April 28 to April 30 | 60% | 3 |
| May 1 to May 4 | 60% | 4 |
| May 5 to May 10 | 100% | 6 |
| May 11 to June 2 | 100% | 23 |
| June 3 to June 20 | 70% | 18 |
| June 21 to June 22 | 70% | 2 |
| June 23 to July 20 | 50% | 28 |
| July 21 to August 26 | 50% | 37 |
| August 27 to Sept. 18 | 30% | 23 |
| Sept. 19 to Sept. 30 | 40% | 12 |
| October 1 to October 15 | 100% | 15 |

If Lindon City and the North Union Irrigation Company do not make improvements to conserve water, the system will not be able to meet future demands.

### Delivery System Description

| | Full North Union Canal (Orem and Lindon) | North Union Canal (in Lindon City) |
|---|---|---|
| Miles of Canals | 19,085 feet | 9,800 feet |
| Turnouts and Diversions to Municipalities | 7 (6 turnouts and 1 diversion to Lindon's Reservoir 3) | 3 (2 turnouts and 1 diversion to Lindon's Reservoir 3) |
| Municipal Connections | | 2,425 |

### Current Energy Sources and Uses

Each acre-foot of water that is delivered through the North Union Canal passes through the hydropower generation plant on the Provo River and generates about 300 kWh per acre foot. Some of the water must then must be pumped to build pressure which uses about 150 kWh per acre foot at a net gain of 150 kWh.

When water demand is greater than Lindon City's flow right or the amount that the NUC can deliver, the City takes water from the Alpine Aqueduct. Because the aqueduct diversion is above the power plant, the water cannot be used to generate power. Lindon City must then pay a power loss charge for using aqueduct water. The cost to deliver water via the Alpine Aqueduct is $55 per acre-foot and a loss of a potential 150 kWh per acre-foot.

**By more efficiently using the City's flow right, this project will save the City $34,964 and create 95,355 kWh of energy.**

### Relationship with Reclamation

The North Union Canal (NUC) receives water from Jordanelle and Deer Creek Reservoirs, both part of Reclamation's Provo River Project.

# Project Description

The proposed project will pipe 1,325 linear feet of deteriorating concrete-lined canal and with 48-inch concrete pipe (see Attachment B for a map of the project location). Any conflicting existing utilities in the proposed pipe alignment will be relocated. Access points for cleaning and general

maintenance will be located every 300 feet. The piped alignment will be reseeded after installation to beautify the area and create an aesthetically pleasing finished product. Measuring devices and telemetry will be installed at three locations to provide information to better manage the water in the system. Two of these units will be solar-powered.

This project will solve several existing and future system deficiencies including water loss and risk to downgrade residents. According to a water loss study performed by NRCS approximately 23.16% of water is lost in this section of the canal to be piped. This water flows through cracks in the concrete lining and later appears downhill in power boxes, utility boxes, residents' basements, and streets. Piping the canal would lower risk in areas like these and those where the lining has deteriorated to a point where a collapse occurred. The risk of similar collapses is high and the damage could be much more significant.

Piped sections would also increase flow capacity by up to four times the canal's current capacity. The canal is undersized to accept the full flow right during higher flows. It would also eliminate maintenance problems such as vegetation growth, significant silting, or the chance of large debris entering the flow. This significant increase in the canal's delivery capacity, reliability, and flexibility will help mitigate the variability of the canal's supply.

## Project Milestones

1. **Environmental Assessment.** An environmental document will be prepared in compliance with NEPA.
2. **Engineering Design.** Lindon City will contract with a professional engineer to provide piping design and design of turnouts and access points.
3. **Permitting.**
4. **Bidding.** The City will seek bids from qualified bidders in a competitive bidding process.
5. **Construction.** A Contractor will complete the removal and disposal of the concrete canal; install the new pipe, turnouts, and access points. The area will then be reseeded.
6. **Operation.** When construction is complete the new pipe will be put into operation for the irrigation season.

# Evaluation Criteria

## Evaluation Criterion A: Quantifiable Water Savings

### *Amount of Water Saved*

Estimated amount of water saved in acre-feet per year: **635.7 acre feet**

In September 2016, the Utah NRCS State Hydraulic Engineering performed a Water Loss Study on the North Union Canal. Flowrate measurements were taken over two days to determine water losses on the canal. An Acoustic Doppler Current Profiler (ADCP) Streampro was used to measure flowrates in the canal.

This report determined that overall the canal loss rate in Lindon is 31%. In the two sections that will be piped the losses are 23.16% and 1.14% respectively. The water savings calculation is based on the assumptions that (1) Lindon receives 2,000 acre-feet at the reservoir annually and (2) the losses measured by NRCS are constant during the entire irrigation season.

### *Conserved Water*

The conserved water will remain in Jordanelle and Deer Creek Reservoirs to contribute to instream flows in the Provo River. If Lindon City can use its river flow right more efficiently, it will not need to take additional water from the Alpine Aqueduct, leaving more water in the Provo River.

The Provo River empties into Utah Lake. The conserved water would support the Provo River Delta Restoration Project which involves the U.S. Fish and Wildlife Service, the U.S. Army Corps of Engineers, the U.S. Bureau of Reclamation, the Federal Aviation Administration (FAA), the State of Utah, Provo City, and Utah County.

Protection of instream flows is also identified in the June Sucker Recovery Plan by the U.S. Fish and Wildlife Service. The June Sucker is a federally listed endangered species with critical habitat in Utah Lake and the Provo River. This project will allow water to stay in the reservoirs and river to improve the June Sucker habitat.

### *Post-Project Seepage/Leakage Loses*

Leakage and seepage loses will be eliminated along this section of canal.

### *Anticipated Annual Transit Loss Reductions*

When these canal sections are piped, there will be a reduction of transit losses of 635.7 acre-feet annually.

### *Materials Used*

To pipe the canal 48-inch Class III reinforced concrete pipe will be used. Three measuring devices and telemetry will be installed. This equipment will be chosen based on proven technologies and cost efficiency.

## Evaluation Criterion B: Water Sustainability Benefits

### *Instream Benefits to Endangered Species*

The April 2015 Provo River Delta Restoration Project Environmental Impact Statement identifies three federally-listed endangered species in the Provo River Watershed.

- June sucker fish
- Ute-ladies'-tresses orchid
- Yellow-billed Cuckoo

The EIS describes actions needed to facilitate the recovery of June sucker in Utah Lake such as "restoring habitat conditions essential for spawning, hatching, larval transport, survival, rearing, and recruitment of June sucker on a self-sustaining basis." One action identified is to "adopt flow regime targets for the lower Provo River and provide delivery of supplemental water to the lower Provo River, including additional conserved water."

This project will allow Lindon City to use water more efficiently. The City commits to allowing the water that is currently lost from 400 East to the Reservoir to stay instream during the times of the year when the flow allows. Water no longer used by the City will remain in the Provo River to contribute to flows needed to sustain the June Sucker and provide water to Utah Lake which provides June Sucker habitat.

The June Sucker habitat is also threatened by sediment accumulation. Piping canals reduces nutrient and sediment loads often caused by open canals.

### *Water Supply Sustainability*

Water supply sustainability is always a concern in the Utah Lake Basin. Utah is the fastest growing state in the nation and this growth puts a strain on already limited water supplies. Drought conditions exacerbate water supply concerns. In 2016 Utah Lake's water level was around 49% of normal. The Provo River, which supplies water to the North Union Canal, accounts for 36% of the inflow into Utah Lake. Longstanding drought conditions made the lake levels low and stagnant. During the hot summer of 2016, Utah Lake had severe blue-green algae blooms covering about 90% of the lake. The algae blooms pose a serious health risk to people and wildlife. Utah Lake is used by other communities as a source of secondary water, but was unavailable for much of the summer. This put a strain on the entire watershed as additional water was needed from reservoirs and the Provo River.

*Utah Lake Algae Bloom, 2016. (Image Source: The Salt Lake Tribune)*

The proposed project will result in less water diverted from the River into the Alpine Aqueduct and the North Union Canal, therefore more water can remain in Jordanelle or Deer Creek for use during shortages due to drought and climate change. Piping the canal will also eliminate a capacity bottleneck in the North Union system which will allow Lindon City to take its full flow right to meet increasing demands.

## Evaluation Criterion C: Energy-Water Nexus

### *Subcriterion C.1: Implementing Renewable Energy Projects Related to Water Management and Delivery*

**Hydropower Generation**

Each acre-foot of water that is delivered through the North Union Canal passes through Central Utah Water Conservancy District's hydropower generation plant on the Provo River and generates about 300 kWh per acre foot. Some of it must then be pumped to build pressure which uses about 150 kWh per acre foot at a net gain of 150 kWh.

When water demand is greater than Lindon City's flow right or is greater than the capacity of the canal, the City takes water from the Alpine Aqueduct. Because the aqueduct diversion is above the power plant, the water can no longer be used to generate power. Lindon City must then pay a power loss charge for using aqueduct water. The cost to deliver water via the Alpine Aqueduct is $55 per acre-foot and a loss of a potential 150 kWh per acre-foot.

**$55 * 635.7 acre-feet saved = $34,964 per year**

**150 kWh * 635.7 acre feet saved = 95,355 kWh per year**

*Power usage estimates from North Union Irrigation Company power bill.*

*Power generation estimates from Rich Tullis, Central Utah Water Conservancy District's hydropower generation plant.*

### *Subcriterion No. C.2: Increasing Energy Efficiency in Water Management*

**Expected Energy Efficiencies**

Lindon City will be installing measuring devices at three locations along the canal. Two of these units will be in locations where it is feasible to install solar-powered meters. Using these energy-efficient devices will help Lindon City better manage water without additional energy consumption.

## Evaluation Criterion D: Addressing Adaptation Strategies in a WaterSMART Basin Study

In the 2013 *Colorado River Basin; Water Supply and Demand Study* there are 27 options submitted that related to municipal and industrial (M&I) conservation to reduce demand in areas receiving Colorado River supply. Many of these options were related to specific M&I conservation programs (e.g., metering, water accounting and loss control, public education, leak detection, irrigation efficiency, etc.) or targeted specific M&I water use sectors (e.g., golf courses, industrial use) that might provide additional opportunities for conservation in the Colorado River Basin as a whole. This project would contribute to the irrigation efficiency goals identified in the Colorado River Basin Study. Lindon City service area has not yet been specifically addressed in a WaterSMART Basin Study.

## Evaluation Criterion E: Expediting Future On-Farm Irrigation Improvements

Within Lindon City there are only very small agricultural users with orchards, alfalfa fields or gardens. The focus of this project with be improving the efficiency of water usage for Municipal and Industrial (M&I) purposes.

### *NRCS Relationship*

In September 2016 NRCS conducted a water loss study of the North Union Canal at the request of Lindon City. The results of the study highlighted the dire need for system improvements and prompted this funding request to the USBR.

## Evaluation Criterion F: Implementation and Results

### *Subcriterion F.1: Project Planning*

The City completed a Water Conservation Plan in 2015 (See Attachment C for relevant sections of the plan) which identifies water conservation practices and strategies, including leak detection to improve the efficiency of the water system.

This specific project was prioritized because the NRCS Water Loss Study identified this section of the canal as having the highest water losses. The nuisance water entering the yards and basements of nearby residents also makes this a priority project for the City and Irrigation Company. This section is also a capacity-limiting bottleneck for the system. It is anticipated that once piped this section will give the system the capacity to carry its full flow right during much of the irrigation season.

Lindon City is located within Central Utah Water Conservancy District's (CUWCD) service area. In 2013 CUWCD participated in the effort to develop "Prepare 60: Statewide Water Infrastructure Plan". The plan identifies the need for $730.5M in infrastructure spending between 2011 and 2020 and recommends conservation and watershed protection as needed actions in the Utah Lake Basin. This project will forward conservation areas in this water-short basin.

### *Subcriterion No. F.2: Support and Collaboration*

The proposed project has the support of a variety of stakeholders. There is widespread support for the project as it also has widespread benefits beyond Lindon City. It will benefit water users and environmental recovery efforts throughout the Utah Lake Basin. The City has received letters of support or commitment from North Union Irrigation Company and Central Utah Water Conservancy District.

The North Union Canal runs through three cities: Orem, Lindon and Pleasant Grove. It is imperative that these cities work together and coordinate water conservation efforts for the region. As Orem and Pleasant Grove and other surrounding communities see the benefits of piping the canal, they will have an example of water conservation and increased energy production and may be prompted to sponsor improvements in their cities.

In 2009, neighboring Orem City completed a concept report evaluating the possibility of creating a regional, multi-use trail system in the North Union Canal easement if the canal were to be piped and covered. The concept received positive feedback from the canal owners, city officials and transportation officials.

## Evaluation Criterion G: Additional Non-Federal Funding

Non-Federal Funding: $315,000

Total Project Cost: $573,922

**Percentage of Non-Federal Funding: 54.8%**

## Evaluation Criterion H: Connection to Reclamation Project Activities

1. How is the proposed project connected to Reclamation project activities?
   Lindon City receives water through the North Union Canal which delivers water from Jordanelle and Deer Creek Reservoirs, both Reclamation projects. The City has 924 acre-feet of contract water from the Jordanelle Project, part of Reclamation's Central Utah Project. The City also owns a share in the Central Utah Project. Deer Creek Dam and Reservoir are part of Reclamation's Provo River Project.

2. Does the applicant receive Reclamation project water?
   Yes. The applicant receives water from Jordanelle and Deer Creek Reservoirs, both Reclamation projects.

3. Is the project on Reclamation project lands or involving Reclamation facilities?
   The project is not located on Reclamation project lands but water saved will contribute to Reclamation facilities.

4. Is the project in the same basin as a Reclamation project or activity?
   Yes. This project is located in the same basin as the Provo River Project and Central Utah Project.

5. Will the proposed work contribute water to a basin where a Reclamation project is located?

Yes. This will contribute water to the water-short and environmentally-sensitive Utah Lake Basin.

6. Will the project help Reclamation meet trust responsibilities to Tribes?
Lindon City is unaware of any tribal lands near the project area.

# Performance Measures

In September 2016, the Utah NRCS State Hydraulic Engineering performed a Water Loss Study on the North Union Canal. Flowrate measurements were taken over two days to determine water losses on the canal. An Acoustic Doppler Current Profiler (ADCP) Streampro was used to measure flowrates in the canal.

To determine the effectiveness of the project, a study similar to that conducted by NRCS will be conducted to identify water loss amounts post-project. It is anticipated that piping the canal and enclosing the water will eliminate seepage and overflow in the improved areas, thus saving the water identified as losses in the NRCS study.

# Environmental and Cultural Resources Compliance

- *Will the proposed project impact the surrounding environment (e.g., soil [dust], air, water [quality and quantity], animal habitat)? Please briefly describe all earth-disturbing work and any work that will affect the air, water, or animal habitat in the project area. Please also explain the impacts of such work on the surrounding environment and any steps that could be taken to minimize the impacts.*

  The work includes the installation of pipe which will be along the existing canal alignment in developed areas. Construction will take place after the irrigation season so there will not be water in the ditch.

  Best practices will be employed for dust control and noxious weed management. Reseeding will restore vegetation upon completion of the pipe installation.

- *Are you aware of any species listed or proposed to be listed as a Federal threatened or endangered species, or designated critical habitat in the project area? If so, would they be affected by any activities associated with the proposed project?*

  There are no known threatened or endangered species in the direct project area. An assessment of threatened or endangered species will be conducted as part of the environmental document. There are federally-listed endangered species that will benefit from the improved water quality and additional water available.

- *Are there wetlands or other surface waters inside the project boundaries that potentially fall under Clean Water Act (CWA) jurisdiction as "Waters of the United States?" If so, please describe and estimate any impacts the proposed project may have.*

  Lindon City is not aware of any wetlands or Water of the United States in the direct project area. However, the environmental document will include an assessment of wetlands and biology.

- *When was the water delivery system constructed?*

  The system was originally constructed between 1852 and 1864.

- Will the proposed project result in any modification of or effects to, individual features of an irrigation system (e.g., headgates, canals, or flumes)? If so, state when those

features were constructed and describe the nature and timing of any extensive alterations or modifications to those features completed previously.

This project will pipe and enclose the existing open canal. The canal was concrete-lined in the 1940s and 1950s. There have been portions of the lining replaced and the canal has been piped in select areas.

- *Are any buildings, structures, or features in the irrigation district listed or eligible for listing on the National Register of Historic Places? A cultural resources specialist at your local Reclamation office or the State Historic Preservation Office can assist in answering this question.*

  Lindon City is not aware of any buildings, structures or features that would be eligible for listing on the National Register of Historic Place. A cultural resource inventory will be conducted as part of the environmental document.

- *Are there any known archeological sites in the proposed project area?*

  The City is unaware of any archeological sites in the project area. The environmental document will include an archeological inventory.

- *Will the proposed project have a disproportionately high and adverse effect on low income or minority populations?*

  No, this project will not have an adverse effect on low income or minority populations.

- *Will the proposed project limit access to and ceremonial use of Indian sacred sites or result in other impacts on tribal lands?*

  There are no known tribal lands or sacred sites in the project area. The environmental document will include a cultural and archaeological inventory.

- *Will the proposed project contribute to the introduction, continued existence, or spread of noxious weeds or non-native invasive species known to occur in the area?*

  No. A closed irrigation system will help control noxious weeks and invasive trees. Best practices will be employed during construction to prevent the spread of noxious weeds

## Letters of Project Support

There is widespread support for this project as the water and energy savings will benefit many municipalities, irrigation companies and environmental efforts. Lindon City has received letters of support from North Union Canal Company and Central Utah Water Conservancy District.

## Letters of Commitment

Lindon City received a commitment from the North Union Canal Company to contribute $15,000 which is 5% of the project cost.

Please see Attachment D for Letters of Support and Commitment

# Official Resolution

Lindon City will submit a signed Official Resolution within 30 days of the application deadline.

# Funding Plan

Lindon City commits $300,000.00 from its general fund as a cost-share to the Reclamation funding. North Union Irrigation Company has committed $15,000.

| FUNDING SOURCES | % of Project Cost | Total Cost by Source |
|---|---|---|
| Recipient Funding | 55% | $315,000 |
| Reclamation Funding | 45% | $258,922 |
| ***TOTAL*** | **100%** | **$573,922** |

| FUNDING SOURCES | FUNDING AMOUNT |
|---|---|
| **Non-Federal Entities** | |
| 1. Lindon City | $300,000 |
| 2. North Union Irrigation Company | $15,000 |
| **Non-Federal Subtotal** | **$315,000** |
| | |
| **Requested Reclamation Funding** | $258,922 |
| | |
| **Total Project Funding** | **$573,922** |

# Budget Proposal

| Budget Item Description | Computation | | Quantity Type | TOTAL COST |
|---|---|---|---|---|
| | $/Unit | Quantity | | |
| CONSTRUCTION | | | | |
| Mobilization (5%) | $21,023 | 1 | LS | $21,023.00 |
| Furnish, place and compact imported pipe foundation material | $13.00 | 150 | TON | $1,950.00 |
| Furnish, place and compact imported pipe bedding and initial backfill material | $14.00 | 2170 | TON | $30,380.00 |
| Remove and dispose of concrete canal | $25.00 | 1325 | LF | $33,125.00 |
| Excavate for, furnish, install, backfill, and compact 48-inch Class III RCP pipe | $150.00 | 1325 | LF | $198,750.00 |
| Turnout structure | $15,000.00 | 1 | LS | $15,000.00 |
| Manholes/boxes | $5,000.00 | 6 | EA | $30,000.00 |
| Measuring devices and telemetry | $15,000.00 | 3 | EA | $45,000.00 |
| Restoration (construction easements, landscaping, fencing, private improvements, etc.) | $50.00 | 1325 | LF | $66,250.00 |
| | | | Construction Subtotal | $441,478.00 |
| Environmental (5%) | | | | $22,074.00 |
| Engineering Design (10%) | | | | $44,148.00 |
| Construction Engineering (10%) | | | | $44,148.00 |
| Project Administration & Legal (5%) | | | | $22,074.00 |
| | | | TOTAL ESTIMATED PROJECT COSTS | $573,922.00 |

# Budget Narrative

### *Salaries & Wages*

No applicant salaries or wages are included in the project budget.

### *Fringe Benefits*

No applicant fringe benefits are included in the project budget.

### *Travel*

No travel will be required for this project.

### *Equipment*

No Lindon City equipment will be used for this project. The equipment costs are included in the contractual amount.

### *Materials and Supplies*

The cost of materials and supplies is outlined in the contractual breakdown.

# Water loss study on the North Union Canal and Provo Bench Canal,

*By Nathaniel Todea, Utah NRCS State Hydraulic Engineer*
*9/19/2016*

## Introduction / Methodology

Flowrate Measurements were taken over two different days to determine water losses in the Provo Bench Canal and North Union Canal in both Lindon and Orem Utah. This is a continuous in series system starting in the Provo Bench Canal then the North Union Canal. On July 6th measurements were only taken at the upper portion of the Provo Bench Canal. That is below the Provo Bench Canal turnout to the just below the Palisades diversion. On July 14th measurements were taken below the Palisades diversion to the just below the Lindon Reservoir turnout. An Acoustic Doppler Currant Profiler (ADCP) Streampro was used to measure flowrates in the canals. During the filtering of measurements predominately outliers in flowrate, width, total area and Q/Area were eliminated. In one case flows at the lowest flowrate, below Lindon Reservoir, cross sectional and velocity measurements were taken.

Located in Table 1 is the descriptive location and latitude and longitude. And located towards the end of report a location map of measurements. Located in table 2 and 3 are the measured flowrate that either occurred on July 6th or 14th.

Table 1. Location of flow measurements

| Location | Longitude / Latitude |
|---|---|
| At diversion (Orem) | -111.6575 / 40.3124 |
| Pre Diversion at Palisades (Orem) | -111.67 / 40.2931 |
| Palisades (Orem) | -111.6707 / 40.2929 |
| 800 N (Orem) | -111.692 / 40.3127 |
| 203 S (Lindon) | -111.7002 / 40.3341 |
| Center - Canal Dr (Lindon) | -111.6993 / 40.3381 |
| 200 N - Canal Dr (Lindon) | -111.6996 / 40.3419 |
| 400 E (Lindon) | -111.7063 / 40.3489 |
| Above Pond 400 E (Lindon) | -111.7084 / 40.3498 |
| Downstream of Pond | -111.7091 / 40.3502 |

Table 2. Flowrate measurements, July 14, 2016 (Q – Cubic feet per second, width and area in feet and square feet)

| Location | Total Q | Top Q | Meas. Q | Bottom Q | Left Q | Right Q | Width | Total Area | Q/ Area |
|---|---|---|---|---|---|---|---|---|---|
| Palisades | 15.72 | 8.43 | 2.78 | 3.81 | 0.32 | 0.37 | 12.60 | 9.91 | 1.59 |
| 800 N (Orem) | 10.54 | 5.34 | 2.25 | 2.50 | 0.29 | 0.15 | 9.90 | 8.26 | 1.28 |
| 203 S (Lindon) | 9.69 | 4.60 | 2.10 | 2.33 | 0.33 | 0.33 | 6.26 | 4.84 | 2.01 |
| Center - Canal Dr (Lindon) | 9.58 | 3.34 | 3.49 | 2.25 | 0.25 | 0.26 | 5.75 | 6.10 | 1.57 |
| 200 N - Canal Dr (Lindon) | 8.84 | 3.43 | 2.91 | 2.19 | 0.15 | 0.15 | 5.17 | 4.69 | 1.89 |
| 400 E (Lindon) | 8.68 | 3.05 | 3.44 | 2.19 | 0.00 | 0.00 | 5.00 | 4.93 | 1.76 |
| Above Pond 400 E (Lindon) | 6.67 | 2.90 | 2.07 | 1.70 | 0.00 | 0.00 | 4.56 | 3.40 | 1.96 |
| Downstream of Pond | 1.20 | | | | | | | | |

Table 3. Flowrate measurements, July 6, 2016 (Q – cubic feet per second)

| Location | Total Q | Top Q | Meas. Q | Bottom Q | Left Q | Right Q | Width | Total Area | Q/ Area |
|---|---|---|---|---|---|---|---|---|---|
| At diversion (Orem) | 24.72 | 5.08 | 14.66 | 4.04 | 0.69 | 0.26 | 16.95 | 37.72 | 0.66 |
| Pre Diversion at Palisades | 26.11 | 8.23 | 12.63 | 4.42 | 0.54 | 0.28 | 14.71 | 20.37 | 1.28 |
| Palisades | 18.27 | 9.71 | 3.48 | 4.32 | 0.35 | 0.40 | 13.46 | 10.78 | 1.70 |

## Summary

In all measurements except one a maximum of 8% loss differences were observed from ADCP measurements, see table 3. The Palisades and the 800 N have a 33% difference. The system was not necessarily measured from an upstream to downstream order. The July 14 order started at the Palisades, 203 S, Center, 200 N, 400 E, above Pond, 800 N then downstream of Lindon Pond. The measurements were followed by 800 N then downstream of Lindon Pond. The 82% difference occurred between the upstream section and stream section of the Lindon Pond. A 30% difference occurred just above and below the Palisades diversion in the Provo Bench Canal. Note that a splitter occurs in this area. Where a three splitter occurs it appears that most of the flows continues down the Provo Bench Canal. Finally just below the turnout into Provo Bench Canal and above the Palisades an increase in flow is observed. It should be noted that flows are no measured at concurrent times or flow travel times are not accounted for. This 6% difference seems reasonable and this may not represent potential losses in the system.

Table 3. Measurements and percent difference between locations.

| Location | Measurement Order | Measured Flowrate (cfs) | Percent Differences (losses)[1] |
|---|---|---|---|
| Measurements on 7/14/2016 | | | |
| Palisades | 1 | 15.72 | -33% |
| 800 N (Orem) | 7 | 10.54 | -8% |
| 203 S (Lindon) | 2 | 9.69 | -1% |
| Center - Canal Dr (Lindon) | 3 | 9.58 | -8% |
| 200 N - Canal Dr (Lindon) | 4 | 8.84 | -2% |
| 400 E (Lindon) | 5 | 8.68 | -23% |
| Above Pond 400 E (Lindon) | 6 | 6.67 | -82%[2] |
| Downstream of Pond (Lindon) | 8 | 1.20 | |
| Measurements on 7/6/2016 | | | |
| At diversion (Orem) | 1 | 24.72 | 6% |
| Pre Diversion at Palisades | 3 | 26.11 | -30%[2] |
| Palisades | 2 | 18.27 | |

[1] *Example Palisades (15.72 cfs) and 800 N (10.54 cfs) → (10.54 – 15.72)/15.72 * 100 = percent difference*

[2] *Turnout of diversions downstream*

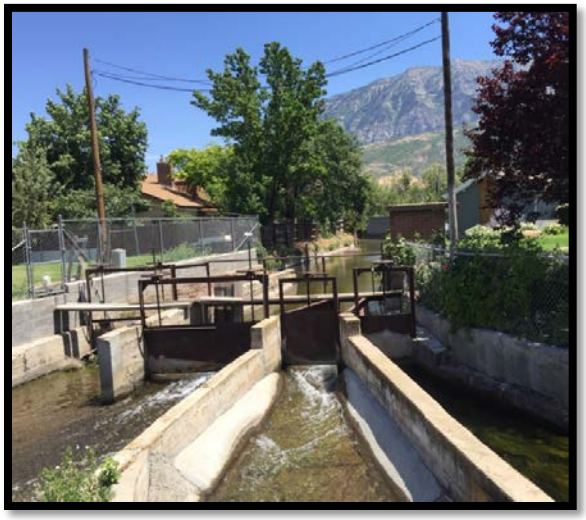
## Calculations

| Velocity Readings (fps) | Distance (ft.) | FS (ft.) | BS (ft.) | Velocity (fps) | Incremental width (ft.) | Depth (ft.) | Area (ft^2) | Flowrate (CFS) |
|---|---|---|---|---|---|---|---|---|
| | 0.7 | 5.97 | 1.3 | | | | | |
| WS | 2.5 | 6.56 | 0.71 | | | | | |
| 3.2 | 3.2 | 7.11 | 0.16 | 0.79 | 0.75 | 0.59 | 0.44 | 0.350 |
| 4 | 4 | 7.27 | 0 | 0.68 | 0.65 | 0.75 | 0.49 | 0.332 |
| 4.5 | 4.5 | 7.25 | 0.02 | 0.655 | 0.50 | 0.73 | 0.37 | 0.239 |
| 5 | 5 | 7.23 | 0.04 | 0.63 | 0.75 | 0.71 | 0.53 | 0.335 |
| WS | 6 | 6.56 | 0.71 | 0.74 | 0.93 | 0.04 | 0.04 | 0.027 |
| | | | | | | | | |
| | | | Total | | | | 1.86 | 1.28 |
| [3]area (measured) ft^2 | 1.722 | | average | 0.699 | | | Q = VA | 1.20 |

[3] *HEC RAS area measurement*

## Photos

*Palisade Diversion*



*Below Palisades Diversion*

*800 N Orem*

*200 S Orem*

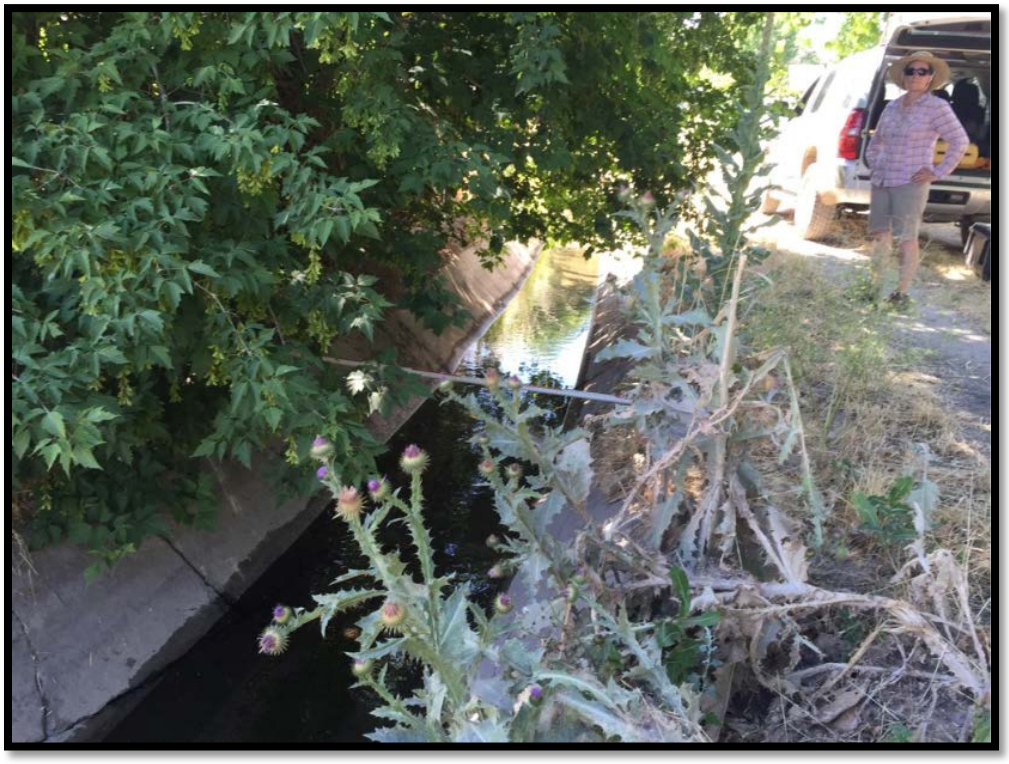
*Center St Lindon*

*200 N (Lindon)*

*400 E*

*400 E above Lindon Pond*

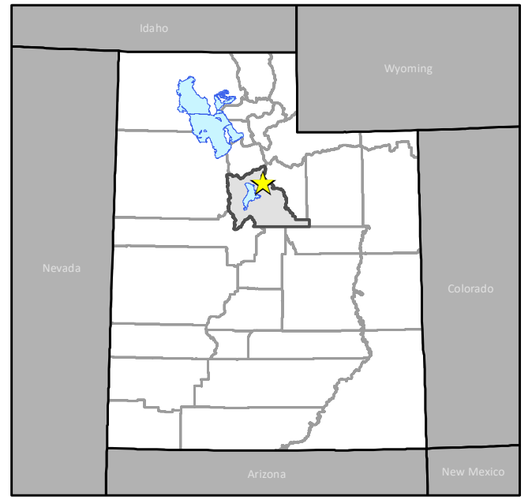
*400 E below Lindon Pond*



## Location Map of Measurements


North Union and Provo Bench Canals
North Union Canal
Provo Bench Canal
After Lindon Reservoir
High Priority Measurement
Lindon City Pressure Irrigation Reservoir #3
Before Lindon Reservoir
High Priority Measurement
At 400 E
Ditch 4, 594 E 400 N
Near end of open ditch near 260 N
High Priority Measurement
Ditch 4 (Wayne Ercanbrack or Sadie Kanno?) The turnout might be south of Center Street
North side of Center Street
Lindon 200 S/Orem 2000 N
High Priority Measurement
Ditch 4 (Hill & Lott)
Ditch 4 (1760 N Main)
Ditch 3 (1600 N Night Hawk Dr.)
1380 N 900 E
Church Ditch 2
800 North
High Priority Measurement
One of these is Church Ditch 1. Not sure if there are still users at the other turnout
400 North
Loveridge & Stratton Ditches
Below the Knight Ditch turnout
High Priority Measurement
Knight Ditch
Single User
Palisades Drive Splitter
All 3 ditches below the splitter
High Priority Measurement
At turnout into the Provo Bench Canal
High Priority Measurement
According to water turn schedules, on Wednesday July 6, 2016, the only places water should be turned out is into two other ditches from the splitter at Palisades Drive, at the Knight Ditch, and at the Lindon Reservoir. There should be no changes during the entire day.
Measurement Location
Ditch Turnout
(Planned)
Water measurement location
Map modified to include measured location and updated legend
JUB

# North Union Canal Projects




Measuring Device and Piped Canal

Measuring Device and Piped Canal

Measuring Device

Lindon

Orem

700 N
1000 S
LOCUST AVE
400 N
LAKEVIEW RD
290 W
135 W
200 N
400 E
CENTER ST
TETON DR
1200 E
200 S
2000 N
STATE ST
400 W
600 S
1600 N
1200 W
15
800 E
1200 N
800 N
800 W
OREM BLVD

## LEGEND

- Measuring Station
- North Union Canal
- Provo Bench Canal
- City Boundary

0 750 1,500 3,000 Feet

J-U-B

THE LANGDON GROUP

GATEWAY MAPPING INC.

OTHER J-U-B COMPANIES

# Lindon City Corporation

# WATER CONSERVATION PLAN

**March 2015**

## Prepared by Lindon City Public Works

**With Assistance From**
**J-U-B Engineers, Inc.**

# TABLE OF CONTENTS

## INTRODUCTION

Lindon City and its leaders have worked diligently, for many years, to insure adequate water for current and future residents, businesses, and institutions, and will continue to do so. The City owns and operates both a culinary water system and a pressure irrigation system. The culinary water system provides for all domestic water demands requiring a high quality of water and has limited use for outside watering in commercial and industrial areas. It also provides for fire protection. The pressure irrigation system provides for all other outside watering demands using raw water surface sources heretofore used for flood irrigation within the City. The culinary system has evolved over many years since the incorporation of Lindon in 1924. Construction of the pressure irrigation system occurred in 1992-93 and service began in late June of 1993.

Because we are in the second driest state in the nation, water conservation and the wise use of water has been a focal point on both a local and state level. The state legislature in 1998 passed the Utah Water Conservation Plan Act (House Bill 153), revised in the 1999 legislative session (Section 73-10-32 Utah Code Annotated.) This water conservation plan addresses the concerns of leaders and citizens of both Lindon and the State of Utah. The Act relates to water and irrigation, requesting cities to implement and update every 5 years, a water conservation plan.

## DESCRIPTION OF OUR CITY AND ITS WATER SYSTEMS

Lindon City is located in northern Utah County approximately 37 miles south of Salt Lake City. The city extends east to the Wasatch Mountains and west to Utah Lake. Lindon City is bounded on the north by Pleasant Grove City and on the South by Orem City and is 1 to 1 1/2 miles wide. The incorporated area of the city is 5,452 acres or approximately 8.5 square miles. In the past 10 years Lindon has grown from a census population of 8,363 in 2000, to 10,070 in 2010, to an estimated current population of about 10,431 (2014). Meeting the future needs of a growing population remains an important concern.

Providing water to meet the needs of its citizens has always been a top priority of city leaders and planners. As a result, well maintained and operated culinary and pressure irrigation water systems provide the citizens of our City with water where and when needed. Growth in number of connections since 2009 is shown in Table 1.

**Table 1**
**User Type**

| Year | Residential | Commercial | Industrial | Institutional | Total |
|---|---|---|---|---|---|
| 2009 | 2,475 | 227 | 82 | 23 | 2,807 |
| 2010 | 2,641 | 266 | 88 | 25 | 3,020 |
| 2011 | 2,550 | 235 | 80 | 25 | 2,890 |
| 2012 | 2,512 | 222 | 73 | 24 | 2,831 |
| 2013 | 2,589 | 181 | 85 | 23 | 2,878 |
| 2014 | 2,714 | 184 | 112 | 29 | 3,039 |

Open space and preservation of a “Little Bit Of Country” is of high value to our leaders and citizens. Consequently, open space preservation has been a high priority. Lindon City Park is the largest and oldest park centrally located in the city and includes the Lindon City Offices and new Aquatics Center. There is a Public Works Complex, eleven developed parks (containing 50.5 acres), seven future parks (containing 59.13 acres) planned, and a cemetery (currently 3.00 acres with option to expand to 7.0 acres. Of the existing and planned parks, three parks (containing 35.34 acres) will require little or no water. There are two elementary schools and a junior high school with their accompanying athletic fields, playgrounds, and other landscaped areas. Alpine School District operates and maintains these schools and their Water Conservation Plan is included in the appendix.

Lindon City's potable water sources are Dry Canyon springs, east of the city and four deep wells located between State Street and 400 East and Center Street and 700 North. Lindon City installed a pressure irrigation system to accommodate the growing need for outside watering and to preserve the use of surface waters historically used to flood irrigate the land that is being developed. The water supply for the pressure irrigation system comes primarily from the Provo River delivered through the Provo Bench Canal Company/North Union Irrigation Company canal and through the Alpine Aqueduct. This water is available because of the shares owned by Lindon City in the various irrigation/canal companies and in the Deer Creek project. The City also has 924 acre-feet of Contract Water from the Jordanelle Project of the Central Utah Project. This lesser quality surface water, that does not require treatment, conserves the higher quality water for the culinary water system.

## Inventory of Water Resources

Lindon City supplied 1,618 acre-feet of water to their culinary water system in calendar year 2010, 1,973 acre-feet in 2011, 1,838 acre-feet in 2012, and 1,778 in 2013, and 1,601 acre-feet in 2014. Wells will supply potable water for future growth. We presently have developed well capacity that will supply up to 6,215 acre-feet, 3.15 times the maximum yearly volume of potable water supplied between 2010 and 2014 (1973.21 acre-feet; see Table 4). Table 2 shows the City-Owned Culinary Water Rights.

**Table 2**
**City-Owned Water Rights**

| Source Name/No. | Water Right # | CFS | Total CFS | Present Yield, AF |
|---|---|---|---|---|
| DRY CANYON SPRINGS | 55-6908 | 1.34 | 1.34 | 592.45 |
| WELL NO. 1 | 55-416 | 1.104 | 1.104 | 806.559 |
| WELL NO. 2 | 55-742 | 0.713 | 0.713 | 493.614 |
| WELL NO. 3 | 55-4478 | 4.61 | 4.61 | 1,419.54 |
| WELL NO. 4 | 55-4107 | 6.677 | 6.677 | 2,903.61 |
| WELL | 55-2298 | 2.228 | 2.228 | 0 |
| WELL | 55-2527 | 0.75 | 0.75 | 0 |
| ALL WELLS | 55-1670 | 0.668 | 0.668 | 135.97 |
| ALL WELLS | 55-1039 | 0.155 | 0.155 | 30.8 |
| ALL WELLS | 55-1040 | 0.52 | 0.52 | 77.72 |
| ALL WELLS | 55-9400 | | | 14 |
| ALL WELLS | 55-7873 & 2520 | | | 90.38 |
| ALL WELLS | 55-12048 | | | 5.6 |
| ALL WELLS | 55-12066 | | | 12.92 |
| ALL WELLS | 55-3206 | | | 50.4 |
| ALL WELLS | 55-8998 | | | 30 |
| ALL WELLS | 55-286 | | | 92.092 |
| ALL WELLS | 55-3533 | | | 9.57 |
| ALL WELLS | 55-3534 | | | 2.57 |
| ALL WELLS | 55-12164 | | | 21.11 |
| ALL WELLS | 55-12052 | | | 1 |
| TOTAL | | | | 6,789.91 |

Under current water rights, the City is entitled to withdraw more than 13,165 acre-feet annually from the wells shown in Table 2. We have rights that would yield about twice the present developed capacity. We

anticipate that the amount of water needed for future growth will be well within the safe yield for the aquifer supplying the wells. The City no longer seeks nor accepts underground rights (with rare exceptions).

We require that new development turn in water shares from the various irrigation companies that have historically supplied water to land in Lindon. Diversion of this water historically is from streams, springs, shallow wells (artesian) and subsurface drains.

The City owns shares of stock in several local irrigation/canal companies. Water provided under these shares is, and will continue to be, used for irrigation of lawns, gardens, school athletic fields, playgrounds and other landscaped areas, church landscaped and recreation areas, city-owned parks, and other open spaces. Table 3 shows the City owned shares by Irrigation Company.

**Table 3**
**City-Owned Stock in Local Irrigation Companies**

| Irrigation Company | Shares | Yield per Share (100% water year) | Acre-Feet |
|---|---|---|---|
| North Union Irrigation Company | 612.957 | 7 | 4,172.14 |
| Provo Reservoir Canal | | | |
| Orem District | 29.23 | 6 | 169.38 |
| Alpine District | 69.985 | 6 | 860.91 |
| Provo River Water Users Assoc. | 200 | 1 | 200 |
| Central Utah Project | 1 | 1 | 925 |
| Hollow Water Users | | | |
| Whole Stream Shares | 325.02 | 2.87 | 815.25 |
| Half Stream Shares | 0.5 | 2.87 | 84.98 |
| Pleasant Grove Irrigation | 44.88 | 1.666 | 74.77 |
| Cobbley Ditch Company | 210.5 | 1.84 | 372.6 |
| Provo Bench Canal | 84.25 | 14 | 630.392 |
| Spring Ditch & Southfield | 26.8 | | |

## Water Budgets

Table 4 shows the amount of water delivered into the culinary water system and the metered outflows to end-users for the years 2003 to 2014. The numbers shown for years between 2003 and 2009 are for the fiscal year, while the 2010 through 2014 numbers are for the calendar year.

## Table 4
## Culinary Water Budget

| | | INFLOW (AF) | | | METERED SALES (AF) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Year | Wells | Springs | Total | Residential | Commercial | Industrial | Institutional | Total | %Diff. |
| Fiscal | 2003 | 1310.52 | 75.22 | 1385.74 | 672.35 | 187.21 | 189.70 | 17.07 | 1,066.33 | 23.05% |
| | 2004 | 1570.50 | 68.26 | 1638.76 | 633.64 | 184.49 | 170.84 | 16.06 | 1,005.03 | 38.67% |
| | 2005 | 1271.38 | 122.82 | 1394.20 | 682.00 | 199.15 | 192.68 | 17.31 | 1,091.14 | 21.74% |
| | 2006 | 1351.74 | 351.33 | 1703.07 | 697.60 | 296.16 | 166.59 | 18.41 | 1,178.76 | 30.79% |
| | 2007 | 1510.22 | 274.66 | 1784.88 | 861.33 | 296.08 | 201.27 | 22.67 | 1,381.35 | 22.61% |
| | 2008 | 1702.55 | 133.89 | 1836.44 | 839.93 | 242.09 | 177.77 | 17.70 | 1,277.49 | 30.44% |
| | 2009 | 1834.58 | 115.80 | 1950.38 | 821.72 | 394.02 | 152.64 | 25.73 | 1,394.11 | 33.90% |
| Calendar | 2010 | 1479.21 | 138.89 | 1618.10 | 728.53 | 266.27 | 125.96 | 18.93 | 1,139.69 | 41.98% |
| | 2011 | 1686.53 | 286.68 | 1973.21 | 756.27 | 376.59 | 127.95 | 18.06 | 1,278.88 | 54.29% |
| | 2012 | 1636.85 | 200.88 | 1837.74 | 825.64 | 261.11 | 152.43 | 14.00 | 1,253.18 | 46.65% |
| | 2013 | 1665.11 | 112.62 | 1777.74 | 852.43 | 252.99 | 149.10 | 17.64 | 1,272.16 | 39.74% |
| | 2014 | 1529.82 | 70.96 | 1600.79 | 744.70 | 173.15 | 112.04 | 17.15 | 1,047.04 | 52.89% |

The pressure irrigation water supply is metered from each of the water sources delivering water to the system. The services have no meters and so no comparison for a water budget can be made. Table 5 shows the amount of water delivered to the pressure irrigation system for the years 1999 through 2014.

## Table 5
## Pressure Irrigation Source

| | From North Union Canal | | Salt Lake | | North Union | |
|---|---|---|---|---|---|---|
| Year | Gravity (AF) | Pumped (AF) | Aqueduct (AF) | Alpine 3 (AF) | Pump (AF) | Total (AF) |
| 1999 | | | | | | 2,913.46 |
| 2000 | 672.33 | 1,173.80 | 114.00 | | 1,219.00 | 3,179.13 |
| 2001 | 842.14 | 1,275.00 | 201.00 | | 1,529.00 | 3,847.14 |
| 2002 | 728.21 | 1,874.00 | | 919.00 | | 3,521.21 |
| 2003 | 807.72 | 1,932.00 | | 1,093.00 | | 3,832.72 |
| 2004 | 759.67 | 1,933.00 | | 1,153.00 | | 3,845.67 |
| 2005 | 751.17 | 1,344.00 | | 1,262.00 | | 3,357.17 |
| 2006 | 640.05 | 1,364.91 | | 1,509.00 | | 3,513.96 |
| 2007 | 1,008.91 | 1,691.72 | | 1,787.00 | | 4,487.62 |
| 2008 | 1,008.91 | 1,329.84 | | 1,707.00 | | 4,045.74 |
| 2009 | 908.02 | 1,187.01 | | 1,526.00 | | 3,621.03 |
| 2010 | 1,008.91 | 1,179.60 | | 1,574.00 | | 3,762.51 |
| 2011 | 1,008.91 | 1,099.16 | | 1,396.00 | | 3,504.06 |
| 2012 | 1,008.91 | 1,289.87 | | 2,079.00 | | 4,377.78 |
| 2013 | 1,008.91 | 899.70 | | 1,862.00 | | 3,770.61 |
| 2014 | 1,008.91 | 781.39 | | 2,031.00 | | 3,821.30 |

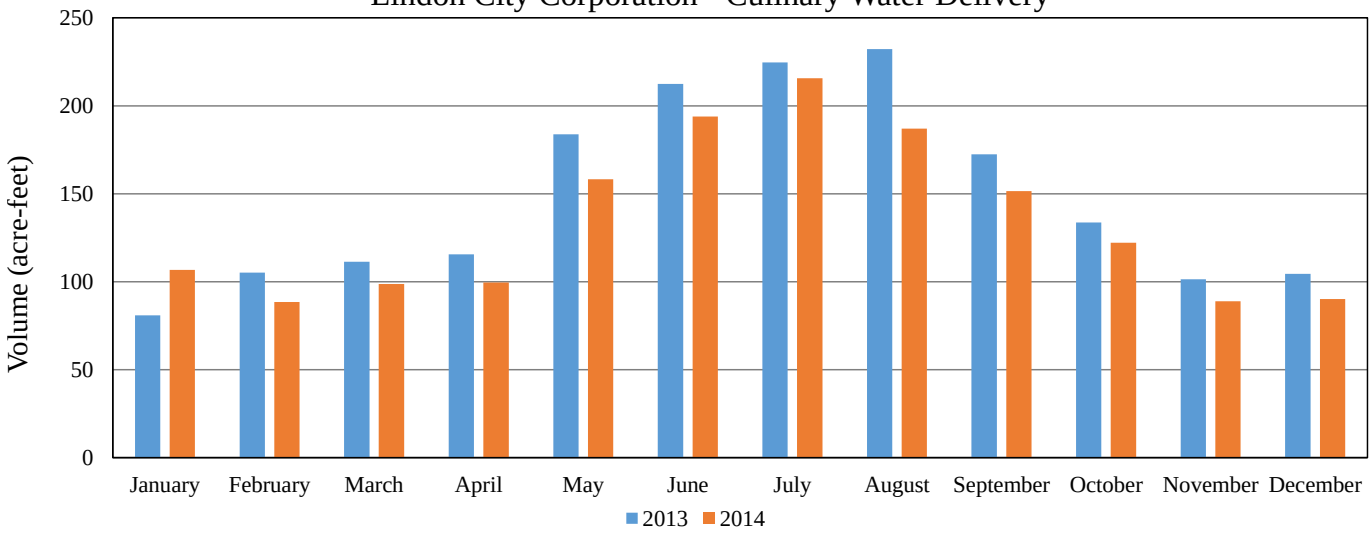
## Present Water Use and Future Water Needs

All uses (residential, commercial, industrial, and institutional) of culinary grade water (approximately 1,601 ac-ft) divided by the number of people living in Lindon in 2014 (approximately 10,431 people) makes the average daily use approximately 137 gallons of water per capita per day (gpcd). All uses of irrigation grade water in 2014 (approximately 3,821.3 ac-ft) divided by the number of people living in Lindon in 2014 makes the average daily use approximately 622 gallons of water per capita per day (gpcd) during the 2014 irrigation season of 192 days, which equates to an annual average irrigation use of 327 gpcd. The total average daily water use is 464 gallons of water per capita per day (gpcd). The statewide average is 293 gpcd and 184 gpcd nationally. The statewide and national numbers do not consider all uses, and so a direct comparison cannot be made. Our per capita use is likely higher because of the large amount of green space discussed earlier and the size of residential lots (the typical lot is 20,000 to 24,000 square feet.)

Total monthly water use in the culinary system for 2013 and 2014 is shown in Figure 1.

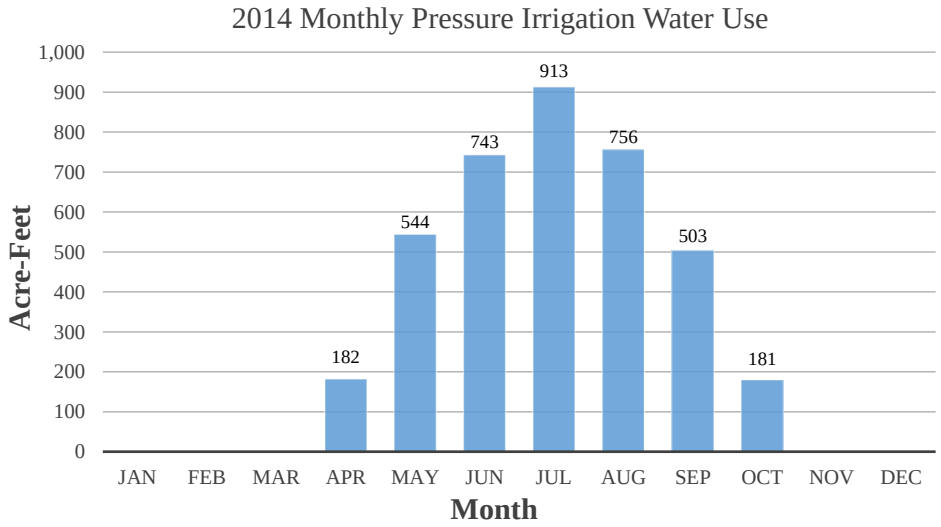
**Figure 1**

Lindon City Corporation - Culinary Water Delivery



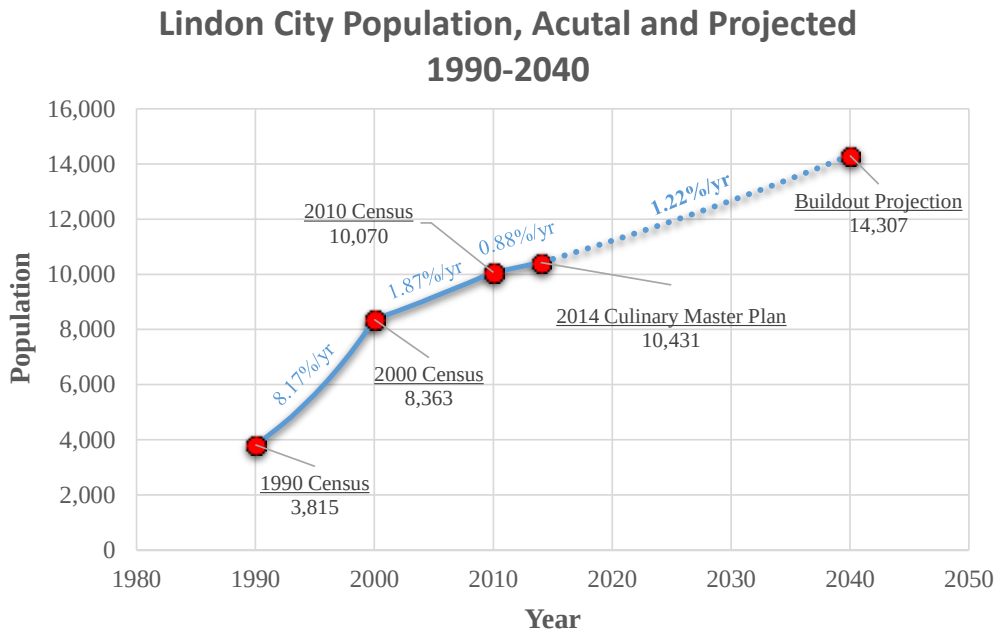

The total monthly water use in the pressure irrigation system is shown in Figure 2. The system is "charged" around April 15 and drained between October 15 and October 30 each year.

**Figure 2**




During the 1990's, especially the last half of that decade, Lindon had an annual growth rate of about 8 percent. That has slowed during the years of 2001 to 2005 to about 3 percent. Using a 2 percent annual growth rate resulted in the population projected to the year 2020. Figure 3 shows the population history and projections.

**Figure 3**




## WATER PROBLEMS, CONSERVATION MEASURES AND GOALS

### Problems Identified

The City Staff in conjunction with their City Engineering Consultant identified and prioritized several problems during the investigative phase of preparing this Water Conservation Plan.

- Water not metered, accounted for, and/or billed, such as city owned facilities, water used for flushing sanitary sewer and storm drain lines, and water used for street sweeping. This is evident by the inflow and metered sales shown in Table 4, Culinary Water Budget.

- Contractor authorized use or unauthorized use of water for construction purposes. Authorized use is metered by a hydrant meter provided by the City, reported and billed separately. However, the usage is not included in the metered water sales. Unauthorized use is contractors obtaining water from hydrants without having notified the city.

- Citizens lack understanding and fail to implement landscape water requirements and efficient water-use habits and practices. Few residences know how much water is required to maintain healthy landscaped areas and how to consistently use water efficiently indoors. Many citizens' irrigation and indoor practices are based on convenience rather than plant needs and water supply considerations.

- Our families have landscapes with large areas of grass and other water intensive landscaping. Over watering of lawns, shrubs, and landscaped areas from the pressure irrigation system occurs, partly due to water being un-metered to the user and poor watering practices.

- The current culinary water pricing and billing system lacks incentives and sufficient information for residents and businesses to use water more efficiently. The current structure may not be adequate to cover expenses in the water enterprise fund. This will not be known until the water budget discrepancies are resolved.

Each problem represents an opportunity. The opportunity exists to solve the above problems through a combination of education, reduction in high water-use landscaping, accounting for all water delivered from the culinary and pressure irrigation systems, and a well-thought-out water-pricing program.

The opportunity exists to prepare a new generation of wise-water users. This can be assisted with a strong sustained water education program in the public and private schools.

Additional opportunities can be found in two of the remaining problems. Implement increased enforcement, with appropriate fines, for unauthorized use of water by contractors and others. Promoting guidelines for water thrifty plants, shrubs, and landscaping concepts. Planter areas along existing and future roads could be more easily maintained if low water-use shrubs, mulches, and decorative rock were used instead of Kentucky blue grass.

Installation of meters on the remaining unmetered culinary services to city owned facilities and "billing" the appropriate fund for the water used rather than having the water fund carry the burden. Bill the appropriate funds for irrigation for parks and open space.

## Water Conservation Goals

In pursuit of solutions to the problems identified previously, and in light of the variety of conservation measures available to solve these problems, the following goals have been identified:

- **GOAL #1**
  **Continue to install water meters on all City owned facilities that use culinary water.**
  Metering these facilities will allow billing the appropriate fund for water use payable to the

water fund. Meters have been installed at existing City owned facilities except Creekside Park restrooms, and the Geneva Road landscaping from 200 South to Center Street.

- **GOAL #2**
  **Continue to bill for water supplied from the pressure irrigation system to city parks and public properties.** The operation and maintenance cost for parks, public properties are paid for from general funds, and that fund should pay the water fund for services rendered.

- **GOAL #3**
  **Maintain financially viable water systems.** The water pricing system should encourage customers to reduce use without creating a revenue shortfall. City facilities and irrigation needs supplied by the culinary system be billed for water used.

- **GOAL #4**
  **Continue education of water conservation practices.** Continue the ongoing education program with emphasis on elementary grades 4 & 5. Continue to provide information on an annual basis regarding efficient use of water to all users of both systems.

## CURRENT CONSERVATION PRACTICES

In order to solve the problems identified above and take advantage of the many associated opportunities, specific water conservation measures must be identified and evaluated. Our City has already implemented several water conservation measures; these, along with additional measures that will effectively help us manage Our City's water systems, are discussed below.

Having both culinary and pressure irrigation systems provides greater flexibility in dealing with water conservation. Our City's current water conservation program is directed at managing water shortages in the culinary system in emergency events, such as loosing a well and providing useful material to assist residents to use water more efficiently indoors. We go into elementary classrooms with a prepared presentation to teach students fundamentals of water conservation. We have begun a water meter-testing program to identify inaccurate and obsolete meters and replace them. We continue to monitor our water rate structure with the goal of maintaining financially viable water systems while promoting conservation.

Our rates are automatically adjustment annually based the April Consumer Price Index (CPI).
Water conservation for the pressure irrigation system is directed at education and information sharing regarding the water available for a given water year. Through recent drought years, we have not had to eliminate outside watering.

Current measures include a water conservation contingency plan, water education program for outdoor and indoor water use, and consideration of a conservation oriented water rate structure.

### 1. Water Conservation Contingency Plan

The city has a "Water Conservation Contingency Plan" that spells out climate and political realities related to water use during drought or other water supply shortages. Also addressed are the conservation measures that may be implemented during times of emergency. They are as follows:

### Level 1 – Normal Supply

- Eliminate outside watering on all property from 10 a.m. to 6 p.m.

- Promote voluntary public conservation measures.
- Issue information to all customers on conservation procedures each can accomplish around their own property and within their own homes.

**Level 2 – 75% of Normal Supply**

- Educate the public on the water supply decreases.
- Initiate mandatory public conservation measures.
- Enforce outside watering restrictions including watering times and quantities.

**Level 3 – 50% of Normal Supply**

- Strictly enforce all conservation policies with significant fines for non-compliance.
- Physically restrict water supplies to (in order of priority):
  - All outside irrigation systems
  - Park properties and other non-essential support facilities
  - Commercial businesses, restricting largest users first
  - Residential areas
  - Any other "non-life support" areas, insuring water supplies to hospitals, hospices, and all other heath care facilities, and controlled designated area water facilities.

Additional non-emergency water conservation measures are listed below.

## 2. Water Education Program

The following information on efficient outdoor and indoor water use is available to the citizens of Lindon through the City Center, Public Works, Elementary School Programs, Lindon Fair and is occasionally distributed with the water bill.

**<u>Outdoor Water Use</u>**:

- Use pressure irrigation system for landscaping, if available. Most residential and some commercial areas have the pressure irrigation system in Lindon.
- Water landscape only as much as required by the type of landscape, and the specific weather patterns of your area, including cutting back on watering times in the spring and fall.
- Do not water on windy days and/or rainy days.
- Do not water during the hours of 10:00 AM and 6:00 PM.

- Sweep sidewalks and driveways instead of using the hose to clean them.

- Wash your car from a bucket of soapy (biodegradable) water and rinse while parked on or near the grass or landscape so that all the water running off goes to beneficial use instead of running down the gutter to waste.

- Check for and repair leaks in all pipes, valves etc. for secondary, faucets, hoses etc. on culinary. Verify there are no leaks by turning everything off and checking your water meter to see if it is still running. Some underground leaks may not be visible due to draining off into storm drains, ditches, or traveling outside your property. Periodic checks by city on their secondary boxes for leaks.

- Adjust and repair sprinkler heads to maintain proper spray patterns and eliminate waste.

- Periodically check and adjust timers on sprinkling systems.

- Use mulch around trees and shrubs, as well as in your garden to retain as much moisture as possible. Areas with drip systems will use much less water, particularly during hot, dry and windy conditions.

- Keep your lawn well trimmed and all other landscaped areas free of weeds to reduce overall water needs of your yard. Discourage water fountains. Encourage low water landscaping at interchanges, planting strips, etc in the city.

**Indoor Water Use**:

About two-thirds of the total water used in a household is used in the bathroom. Concentrate on reducing your bathroom use. Following are suggestions for this specific area:

- Do not use your toilet as a wastebasket. Put all tissues, wrappers, diapers, cigarette butts, etc. in the trashcan.

- Check the toilet for leaks. Is the water level too high? Put a few drops of food coloring in the tank. If the bowl water becomes colored without flushing, there is a leak.

- If you do not have a low volume flush toilet, put a plastic bottle full of sand and water to reduce the amount of water used per flush. However, be careful not to over conserve to the point of having to flush twice to make the toilet work. Also, be sure the containers used do not interfere with the flushing mechanism.

- Take short showers with the water turned up only as much as necessary. Turn the shower off while soaping up or shampooing. Install low flow showerheads and/or other flow restriction devices.

- Do not let the water run while shaving or brushing your teeth. Fill the sink or a glass instead.

- When doing laundry, make sure you always wash a full load or adjust the water level appropriately if your machine will do that. Most machines use 40 gallons or more for each load, whether it is two socks or a week's worth of clothes.

- Repair any leak within the household. Even a minor slow drip can waste up to 15 to 20 gallons of water a day.

- Know where your main shutoff valve is and make sure that it works. Shutting the water off yourself when a pipe breaks or a leak occurs will not only save water, but also eliminate or minimize damage to your personal property.

- Keep a jar of water in the refrigerator for a cold drink instead of running water from the tap until it gets cold. You are putting several glasses of water down the drain for one cold drink.

- Plug the sink when rinsing vegetables, dishes, or anything else; use only a sink full of water instead of continually running water down the drain.

## 3. Water Rates

Designing an appropriate rate structure is a complex task. Rate design is a process of matching the costs of operating the water system to the unique economic, political, and social environments in which the city provides its service. The cost of delivering the service must be evaluated and understood. Each water system has unique assets and constraints. Based on the characteristics of the system, and past capital and operating costs, revenue requirements can be estimated. Tables 6 and 7 show the current rate structure for culinary and pressure irrigation.

**Table 6**
**Current Monthly Culinary Water Rates**

| Meter Size | 1-inch | 1 1/2-inch | 2-inch | 3-inch | 4-inch | 6-inch |
|---|---|---|---|---|---|---|
| **Zone 2 & 3** | | | | | | |
| Base Rate | $ 16.17 | $ 29.11 | $ 46.89 | $ 177.87 | $ 323.40 | $ 599.91 |
| Base Allocation | 0 gal | 0 gal | 0 gal | 0 gal | 0 gal | 0 gal |
| Volume Charge (per 1Kgal) | $ 1.33 | $ 1.33 | $ 1.33 | $ 1.33 | $ 1.33 | $ 1.33 |
| **Zone 1** | | | | | | |
| Base Rate | $ 17.51 | $ 31.52 | $ 50.78 | $ 192.61 | $ 350.20 | $ 649.62 |
| Base Allocation | 0 gal | 0 gal | 0 gal | 0 gal | 0 gal | 0 gal |
| Volume Charge (per 1Kgal) | $ 1.40 | $ 1.40 | $ 1.40 | $ 1.40 | $ 1.40 | $ 1.40 |
| **Zone 0** | | | | | | |
| Base Rate | $ 26.24 | $ 47.23 | $ 76.10 | $ 288.64 | $ 524.80 | $ 973.50 |
| Base Allocation | 0 gal | 0 gal | 0 gal | 0 gal | 0 gal | 0 gal |
| Volume Charge (per 1Kgal) | $ 1.63 | $ 1.63 | $ 1.63 | $ 1.63 | $ 1.63 | $ 1.63 |

The reason for the different rates for different zones is pumping costs to boost the water up to higher developed areas of the city. The City does a Water Systems Rate Analysis about every 3 to 5 years. Based the results of the analysis the City Council may make changes. Also, in an effort to increase the accuracy of water billing, the water meters are read every month.

## Table 7
## Current Pressure Irrigation Service Size and Water Rates

**Service Size Based on Lot Area**

| Service Size | Service Area |
|---|---|
| 1-inch | 1 acre or less |
| 1 1/2-inch | 1 to 2 acres |
| 2-inch | 2+ acres |

**Water Rate Based on Lot Area**

***- Non-Agricultural -***

| Lot Area (SF) | Monthly Rate |
|---|---|
| 0 to 11,000 | $8.00 |
| 11,001 to 21,000 | $10.00 |
| 21,001 to 28,000 | $15.00 |
| 28,001 to 40,000 | $20.00 |
| 40,001 to 60,000 | $30.00 |
| 60,001 to 80,000 | $40.00 |
| 80,001 to 87,120 | $50.00 |
| 2 acres or more | $50.00 + $3.00 per each 1/4 acre |

***- Agricultural -***

| | |
|---|---|
| Base Rate | $10.00 |
| Each Additional Acre | $3.00 per acre |

## POSSIBLE ADDITIONAL CONSERVATION MEASURES

In order to effectively meet our City's future water needs and solve all the water problems identified, additional and more specific water conservation measures will be required. These include water rates that are more stringent; meter replacement and leak repair improved efficiency of irrigation at city parks and other open spaces, education, and plumbing fixture replacement.

### 1. More Stringent Water Rate Structure

The current culinary water rates may need to be increased following implementation of the recommendations in Water Rates above. As part of the investigation, a different rate schedule designed to provide additional price incentives for efficient water use to show the customer how much water is needed each month and provide funding for water conservation assistance and education. This rate schedule is called "Target Billing".

This rate schedule is designed to meet revenue requirements while creating funding for the water conservation program from fees paid by those who waste water. Water users, who use water indiscriminately and fall into the most expensive tier, will experience a volume charge of $6.00/Kgal for the last block.

**Table 8**

**Possible Water Rate Structure**

| Type: | Target Billing |
|---|---|
| Base Charge | $16.17 |
| Base Allocation | 0 Kgal/month |
| | |
| **% of Target** | **Rate** |
| 0 - 50% | $1.33/Kgal |
| 51 - 100% | $1.46/Kgal |
| 101 - 150% | $2.00/Kgal |
| 151 - 200% | $3.00/Kgal |
| 201% + | $6.00/Kgal |

### 2. Meter Replacement and Leak Detection Program

Over time, all meters become less accurate in recording actual flows. This leads to lost revenue to the city and inaccurate data to citizens. For example, if a survey of sufficient randomly chosen meters revealed that nearly 10 percent of the water delivered is not being registered on the meters. City income from metered water is more than $1,060,000. The 10% not registering represents $106,000. When sewer revenues, which are calculated based on metered usage, are accounted for, total revenue lost dependent on metered deliveries is greater.

### 3. Education

Education of residents and businesses as to efficient use of water indoors and for irrigation will continue. Education will continue at the local schools. This process will result in a generation of responsible efficient water users.

### 4. Plumbing Fixture Replacement

Incentives to exchange old high water-use toilets and shower heads for new ones that are more efficient can be provided through city cost sharing using revenues generated by penalty tiers in the rate schedule. While it is difficult to calculate meaningful estimates of the benefits and costs of such programs on the water-use rate, there is ample evidence in the literature that such programs are effective. The Division of Water Resources estimated in 1995 that such programs could reduce residential indoor water use by 33 percent.
Many of the city's homes and businesses have been built since 1992 when plumbing codes were revised to require low water-use toilets and low flow showerheads in new construction.

## COST ANALYSIS

Our City reached the previous plan Goal #1 (Install water meters at the Lindon City Center, Public Works Complex, and City Park complexes that use culinary water) by June 30, 2005.

January 11, 2016

Adam Cowie
Lindon City
100 North State Street
Lindon, Utah 84042

Dear Mr. Cowie,

Alex Lott is writing to acknowledge the North Union Irrigation Company's commitment to the North Union Piping Water Conservation & Measurement Project and to the grant application Lindon City is submitting to the Bureau of Reclamation for a WaterSMART grant.

As the President of the North Union Irrigation Company, I realize what a great benefit this project will provide in water conservation and to provide a means of measuring the water that is supplied to users of the canal. This project will also prevent future damage to those living alongside the deteriorating portions of the canal.

As part of this grant, the North Union Irrigation Company will commit $15,000 to this project.

Sincerely,

Alex D Lott

Alex Lott
President
North Union Irrigation Company

CENTRAL UTAH WATER
CONSERVANCY DISTRICT

355 W. University Parkway
Orem, UT 84058-7303
801.226.7100
www.cuwcd.com



January 12, 2017

Bureau of Reclamation: Water Resources and Planning
Attn: Mr. Josh German
Mail Code: 84-51000
P.O. Box 25007
Denver, CO 80225

Subject: WaterSMART grant application for the improvements to the North Union Canal Project

Dear Mr. German:

Central Utah Water Conservancy District (District) is pleased to write this letter in support of Lindon City's application to the WaterSMART: Water and Energy Efficiency grant program to make improvements to the North Union Canal. The District understands that the proposed project includes piping a deteriorated sections of the North Union Canal which currently has large water losses and damage to nearby residential properties. In addition, the proposed project will improve the sustainability of the water supply in our area and contribute to hydropower generation using the conserved water.

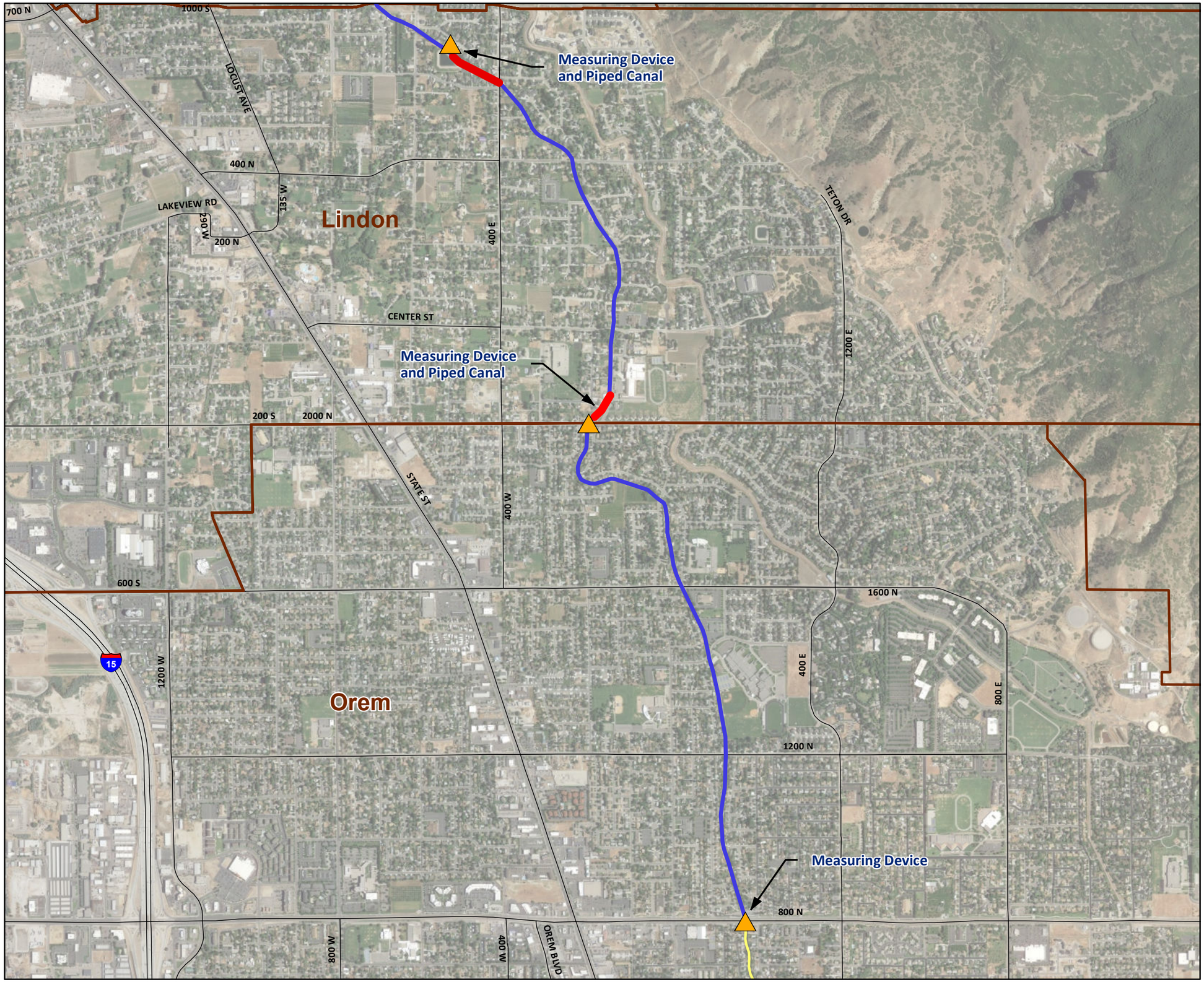
The District supports the proposed project because of the water-saving aspect from piping a section of the North Union Canal. The conserved water will be used in a beneficial manner by the canal company and its users.

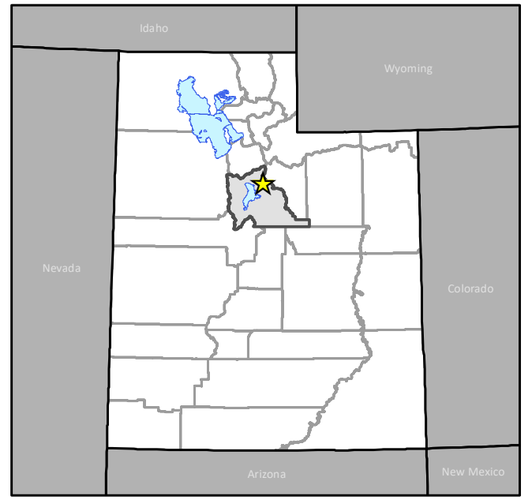
The proposed project will help Lindon City to be more resilient to drought or shortages and better manage the water in their system. The District supports Lindon City in their dedication to address the water needs of our area. If you have any questions feel free to contact me.

Sincerely,

Chris Elison, PE
Project Manager – Water Rights

# North Union Canal Projects




## LEGEND

- Measuring Station
- North Union Canal
- Provo Bench Canal
- City Boundary

0 750 1,500 3,000 Feet

J-U-B

THE LANGDON GROUP

GATEWAY MAPPING INC.

OTHER J-U-B COMPANIES