CULINARY AND PI WATER MASTER PLAN

WATERPRO INC.
A Draper Irrigation Company

APRIL 2020

BOWEN COLLINS & ASSOCIATES

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Prepared for:

WATERPRO INC.
A Draper Irrigation Company

Prepared by:

BOWEN COLLINS
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TABLE OF CONTENTS

Page No.

TABLE OF CONTENTS
(continued)

Page No.

TABLE OF CONTENTS
(continued)

Page No.

TABLE OF CONTENTS
(continued)

LIST OF TABLES

No. Title **Page No.**

TABLE OF CONTENTS
(continued)

LIST OF TABLES

No. Title **Page No.**

TABLE OF CONTENTS
(continued)

LIST OF FIGURES

No. Title **Page No.**

EXECUTIVE SUMMARY

INTRODUCTION

Draper Irrigation Company (Company or DIC) has retained Bowen Collins & Associates (BC&A) to complete a water master plan study for its culinary and pressure irrigation (PI) water systems. The purpose of this document is to update both those master plans. The chapters include a comprehensive review of:

- **Supply and Demand** – An examination of water demands expected in the Company and the existing and future supplies available to meet these demands.
- **Conveyance and Storage** – An evaluation of the Company's existing conveyance and distribution system and its ability to deliver water when and where it is needed.
- **Implementation and Capital Facility Plan** – A plan for completing the necessary improvements identified in this master plan.

ACKNOWLEDGEMENTS

We recognize the significant effort and ongoing professional management, operation, and planning that continues to make DIC/WaterPro a successful non-profit, shareholder owned company. This masterplan development process has shown that the culinary and PI systems are well managed. This report provides culinary and PI system recommendations for continued success in the future. The BC&A team wishes to thank the following individuals from the Company for their cooperation and assistance in working with us in preparing this master plan:

Executive Staff:

CEO/General Manager – Darrin Jensen-Peterson
Assistant General Manager – David A. Gardner
CAO/GIS Specialist – Steve Cunningham
Operations Manager – Nolan Wootton
Plant Manager – Jerry Nielson

DEMAND AND SUPPLY REQUIREMENT PROJECTIONS

BC&A developed projections of the Company's culinary and PI water demand and supply requirements through build-out in 2050 as discussed in Chapters 2 and 3. The requirements were evaluated under various scenarios to provide conservative planning recommendations. For planning purposes, we assume 100% future use of the PI system by customers within the PI service boundaries. This will shift significant demands from the culinary system to the PI system in the future.

Annual Culinary Water: Existing sources are historically adequate to meet the existing demands but are considered approximately 536 acre-ft/yr short for planning purposes when reliable source yield is considered. This has not been an actual source shortage in the past but could occur in a dry year using conservative planning numbers in this report. This theoretical shortage is expected to decrease and become a surplus in the future as more customers utilize the PI system instead of the culinary system for irrigation purposes. The Company should continue to encourage more use of the PI system for irrigation through advertising, rate structure, and incentives.

Annual Pressure Irrigation Water: For conservative planning purposes the Utah Lake source was considered 50% reliable/available to account for algal blooms or drought years that may make the water undesirable or unavailable. This produces a planning deficit of reliable source yield compared to the required production of approximately 3,929 ac-ft/year. This deficit increases to approximately 3,934 ac-ft/year at build-out if the PI use rate increases to 100% within the area where the culinary and PI systems overlap. The Company's planned shallow well and reuse project would shore up the yield of the existing Utah Lake water rights and result in a system able to meet existing and projected PI demands in the future.

Peak Day Culinary Water: The culinary system has a peak day production surplus under existing demands. This surplus is expected to increase in the future as outdoor watering within the PI service boundaries that is currently met by the culinary system shifts to the PI system.

Peak Day Pressure Irrigation Water: The PI system has an approximately 2,334 gpm existing deficit of peak day capacity compared to the required production at the current PI use rate. This planning deficit is historically met using available PI storage and surplus peak culinary water. Future build-out deficit is estimated to be 1,936 gpm if the PI use rate within the area where the culinary and PI systems overlap increases to 100% in the overlapped area. Available PI storage and surplus peak culinary water flow will be able to satisfy the projected future peak PI deficit.

EXISTING WATER STORAGE

BC&A used the Company's flow data to determine the diurnal flow patterns of both the culinary and PI systems to evaluate the peak day demand storage requirements. The required culinary equalization storage (100% of average day demand), fire flow storage, and recommend emergency storage (25% of peak day demand, were determined to be a total of approximately 12.55 million gallons during existing conditions for the entire system. Each storage tank service area was then evaluated individually on its ability to meet storage requirements. The culinary system has adequate storage for all tank service areas to meet equalization and fire flow requirements. Cove at Bear Canyon is an isolated zone that has a booster station and tank servicing a single pressure zone. The zone does meet state minimum requirements of fire flow and equalization (15% of peak day demands), but when WaterPro targeted emergency (25% of peak day demands) storage and additional equalization (38% of peak day demands to be conservative) storage is added, the zone is slightly deficient. As the available storage in this zone meets all regulatory requirements, no storage related projects are recommended or desired by the Company at this time.

The State of Utah does not have any requirements for PI storage sizing. However, BC&A typically recommends that similar requirements for equalization storage would apply to sizing of PI facilities. DIC has a small (0.3 MG) PI storage deficiency using 2018 planning numbers and is unable to meet 48% (equalization and emergency storage) of peak day demand using the criteria described above. Surplus storage becomes available in 2028 and 2050 as usage becomes more efficient with the implementation of meters on all PI connections. Based on discussions with Company personnel and due to the small size of the current storage deficit and the conservative nature of the storage evaluation, no new storage for the PI system is recommended at this time.

EXISTING BOOSTING CAPACITY

Most of the Company's culinary water sources are delivered into the water treatment plant and then gravity fed throughout the system with a few pressure zones using booster pumps to move water to higher elevations. Pump stations are to be capable of supplying the peak day demand of the zones they service.

Current boosting facilities for the culinary system are adequate to supply the State of Utah recommended peak day demand for all zones supplied by the boosting station.

The PI system has an existing and build-out deficit under the 100% PI use immediately scenario. However, the storage available in the PI system has the capacity to cover the peak day boosting deficit. No future boosting projections or expansions are recommended at this time except those included in the current shallow groundwater and reuse project for the PI system. The Company's PI water system does not have booster stations feeding from one pressure zone into another. All pump stations pumping into the pressure irrigation system are considered sources. The source capacity to supply peak day demands was evaluated instead of PI boosting system capabilities.

DISTRIBUTION SYSTEM EVALUATION

Water Models

BC&A developed a new culinary water model in InfoWater software using the Company's GIS files to create a spatially accurate model. Water meter data, pump curves, system set points, and other updated information provided by Company personnel were used to create a more accurate model.

BC&A updated the existing PI system model in InfoWater software by comparing GIS data to the existing model and identifying areas of significant differences to make corrections. Company's up-to-date GIS data was used to compare pipe size and verify connectivity generally represented in the model. PRV settings were also verified with Company personnel and updated.

Updated water demands based on recent flow data and peaking factors were also entered into both models

System Evaluation

The culinary water system performance was evaluated under the four operating conditions specified by the Division of Drinking Water (DDW): static, peak day, peak day with fire flow, and peak instantaneous demands.

A summary of key results of the culinary modeling is below:

Static and Peak Day demand modeling efforts indicate the system is in general compliance with all DDW criteria.

1. Peak Day Demands with Fire Flows.
    a. There are a few areas with 4-inch and 6-inch pipes that cannot meet current fire flow demand requirements of 1,500 gpm at the target flow velocity of 10 ft/sec. These lines were installed previously when fire flow requirements were approximately 500 gpm with 4-inch minimum line size and later with 1,000 gpm and 6-inch minimum line size. The lines are grandfathered under the previous fire flow requirements. DIC has plans to replace and/or eliminate these lines in future projects identified in this report.

2. 2018 Peak Instantaneous Demand Scenario
    a. Two sections of pipe near the intersection of 13200 South and 1100 East have velocities of approximately 13 ft/sec. One other section of pipe in the southwest corner of the system along Rocky Knoll Lane have velocities of approximately 13.5

ft/sec. These locations exceed the 10 ft/sec maximum and are included in the list of recommended projects in this report.

The hydraulic computer model was used to simulate peak day demands on the PI system. The following conclusions are from the PI system evaluation of peak day demands:

1. The system can provide the targeted minimum 50 psi pressure at connections with a few exceptions due to elevation relative to the irrigation pond. No projects are recommended to address these low-pressure issues because they would require significant system modifications and booster pumps and/or storage for a few connections.
2. Future projects to develop shallow groundwater wells and reuse water as sources will positively impact flows in the system in the near future by providing pumped flows into the lower zone.
3. All pipes in the system are under the target of 10 ft/sec during the peak day simulation.
4. DIC has experienced large (approximately 40 psi) pressure fluctuations in the lower zone during peak day flows. Those fluctuations are not able to be replicated in the model. It is recommended that:
    a. Data monitoring of pressure fluctuations with portable pressure data loggers and flow meters continue to isolate specific locations and impacted areas
    b. DIC continue to install PI meters on all PI connections to collect spatially accurate water use data
    c. PI water model be updated with future GIS data and flow data from (a) and (b)
    d. Field tests/evaluations be completed on valves, meters, and impacted connections
    e. DIC plans to install PI meters with integrated pressure sensors at various strategic locations throughout the system. This will help further identify the locations and potential causes of these pressure fluctuations.

10-YEAR CAPITAL IMPROVEMENT SCHEDULE

In coordination with Company personnel, a capital facilities plan has been developed to serve as a guideline for the budgeting and implementation of recommended system improvements over the next 10 years. BC&A has assembled 10-year culinary and PI capital improvement plans as summarized in Chapters 10 and 11, including targeted years for funding and estimated costs. The projects were prioritized through coordination with Company personnel to address the most important needs of the system while balancing available budget amounts.

A 10-year capital improvement plan includes determining how much funding should be set aside each year for capital improvements. One way to identify a recommended level of funding is to consider system service life. Each component of a water system has a finite service life. If adequate funds are not set aside for regular system renewal, the collection system will fall into a state of disrepair and be incapable of providing the level of service that Company customers expect.

Assuming that most water system components have an average service life of about 50 years, the Company should plan to spend about 2% of the total system value per year in order to prevent utilities from falling into disrepair. Future budgeting efforts should continue to carefully consider phasing in gradual replacement costs of existing system components. This will reduce the potential for having major unexpected projects and associated costs due to system failure.

CHAPTER 1
INTRODUCTION

INTRODUCTION

Draper Irrigation Company (DIC or Company) desires to develop an updated master plan for its culinary and pressure irrigation (PI) water systems. The purpose of this document is to update both those master plans. Each of the following chapters of this report will address both water systems individually. The chapters include a comprehensive review of:

- **Supply and Demand** – An examination of water demands expected in the Company and the existing and future supplies available to meet these demands.
- **Conveyance and Storage** – An evaluation of the Company's existing conveyance and distribution system and its ability to deliver water when and where it is needed.
- **Implementation and Capital Facility Plan** – A plan for completing the necessary improvements identified in this master plan.

BACKGROUND

The most recent previous master planning documents are:

- Culinary Water Master Plan Update: Water Rate and Fee Determination – Prepared by Epic Engineering in August 2017
- Water Rights Master Plan & 40 Year Supply Plan – Prepared by Bowen Collins & Associates in April 2018
- Reuse and Shallow Groundwater Cost Feasibility Study – Prepared by Bowen Collins & Associates in October 2018
- Water Rates Study – Prepared by Bowen Collins & Associates in October 2019

System growth, conservation, drought and climate change were covered in those previous studies. Since the completion of those previous studies, a number of changes have occurred. Changes that need to be evaluated and addressed for the Company to meet its future water supply, storage and conveyance commitments include:

- **Updated Flow Production Data** – Previously reported flow production data was inconsistent between reporting documents. The Company has defined the preferred data for current and future planning studies and documents.
- **Build-Out Timeframe** – Future population and growth projections have been updated and should be considered in new planning documents.
- **Updated Population and ERC projections** – Population projections were updated to reflect the most accurate data available for the culinary service area (including an updated distribution of population growth). Equivalent Residential Connection (ERC) projections were then updated based on historical residential and non-residential usage and future population projections.

To consider these and other issues relative to the Company's future water supply, storage and conveyance commitments, the Company has retained Bowen, Collins & Associates (BC&A) to evaluate its culinary and PI water systems.

SCOPE OF SERVICES

The scope of the work documented in this report includes six major tasks:

Task 1 – Water Requirement Projections

This report used the Wasatch Front Regional Council (WFRC) population projections to project future residential and employment populations in the DIC service area thru 2050. Available GIS data from the Company and other sources were used to examine the geographic distribution of existing and future water requirements. Additional specific issues were considered as part of the demand analysis:

- Determining historic water production requirements, ERCs, flow per ERC, irrigated acreage, and flow per irrigated acre to project future production requirements.
- Projected annual production requirements were converted to peak day and peak instantaneous demands based on peaking ratios obtained from historic data.
- Conservation goals and their impact on projected demands were considered.

Task 2 – Evaluate Available Water Supply

The report examined all identified existing and future water sources for DIC including groundwater wells, JVWCD supply, mountain streams, other culinary sources, Utah Lake/Jordan River/Canal, shallow groundwater wells, and wastewater treatment plant reuse. This included consideration of how the supplies will be impacted in drought scenarios and climate change.

Task 3 - Evaluate the adequacy of the projected supply of the Company to meet projected demands

With updated system demands and an understanding of available supply, we evaluated the adequacy of existing supplies and master plan future supply development as follows:

- The adequacy of Company sources to meet projected demands on an annual volumetric basis.
- The adequacy of Company sources to meet projected peak demands.
- The effects of conservation and the Company's plans for source development.

Task 4 – Updated the Company's Culinary and PI Hydraulic Models

A new culinary water model was created based on the Company's GIS data including all major system features. The Company already had an existing PI water model setup. The existing PI model was updated to include the latest water system peak day demands and pipe construction. Existing facilities included in the hydraulic models were documented as part of this report.

Task 5 –Storage Evaluation

Existing and future storage requirements were evaluated based on existing and potential future demand patterns within the Company. Storage needs to accommodate mixing requirements were considered for the PI system.

Task 6 –Major Conveyance Evaluation

Existing and future hydraulic deficiencies were identified within the culinary and PI water systems. Improvements to address deficiencies were recommended along with cost estimates for the recommended improvements.

Subsequent chapters of this report document the execution of these tasks along with the corresponding results.

REPORT ASSUMPTIONS

As a long-term planning document, this report is based on a number of assumptions relative to future growth patterns, service area expansion, and source availability. Of special significance to the Company are a number of assumptions relative to conservation throughout the Company and water demands associated with irrigated acres. If any variables are significantly different than what has been assumed, the results of this report will need to be adjusted accordingly. Because of these uncertainties, this report and the associated recommendations should be updated every five years or sooner if significant changes occur such as irrigation metering, increased pressure irrigation usage or changes in development patterns.

ACKNOWLEDGEMENTS

We recognize the significant effort and ongoing professional management, operation, and planning that continues to make DIC/WaterPro a successful non-profit, shareholder owned company. This masterplan development process has shown that the culinary and PI systems are well managed. This report provides culinary and PI system recommendations for continued success in the future. The BC&A team wishes to thank the following individuals from the Company for their cooperation and assistance in working with us in preparing this master plan:

<u>Executive Staff:</u>

CEO/General Manager – Darrin Jensen-Peterson
Assistant General Manager – David A. Gardner
CAO/GIS Specialist – Steve Cunningham
Operations Manager – Nolan Wootton
Plant Manager – Jerry Nielson

We also express appreciation to the Board of Directors for their vision, leadership and support for these planning efforts:

<u>The Board of Directors:</u>

President – Ryan Daw
Vice President – George Greenwood
Secretary – Dale Smith
Director – Kent S. Ware
Director – Greg J. Matis
Director – Tom Ward
Director – Stephen L. Tripp

The project work was performed by the BC&A team members listed below. Team member's roles on the project are also listed. The project was completed in BC&A's Draper, Utah office. Questions may be addressed to Jon Oldham, Project Manager at (801) 495-2224.

Jon Oldham – Project Manager
Josh Bean – Project Engineer
Derek Shriner – Staff Engineer
Keith Larson – QA/QC
Roland Rocha – Hydraulic Model Development
Andrew McKinnon – Hydraulic Model Development

CHAPTER 2
DEMAND PROJECTIONS

There are several methods that can be used to estimate future water demand. This study developed demand projections using equivalent residential connections (ERCs) and irrigated acres. The methodology of this approach can be summarized as follows:

CULINARY SYSTEM:

1. Define the service area
2. Project residential populations for the culinary service area based on existing and projected patterns of development from WFRC data
3. Project equivalent residential connections (including non-residential growth) for the culinary service area based on existing and projected population and historic water production including a breakdown of indoor and outdoor use
4. Determine the existing and projected irrigated acreage being served by the culinary system
5. Determine the projected irrigated acreage to be transitioned to the pressure irrigation system at build-out
6. Convert projections of equivalent residential connections and irrigated acreage to water demands based on their historic contributions
7. Adjust projected demands as necessary to account for conservation trends and goals.

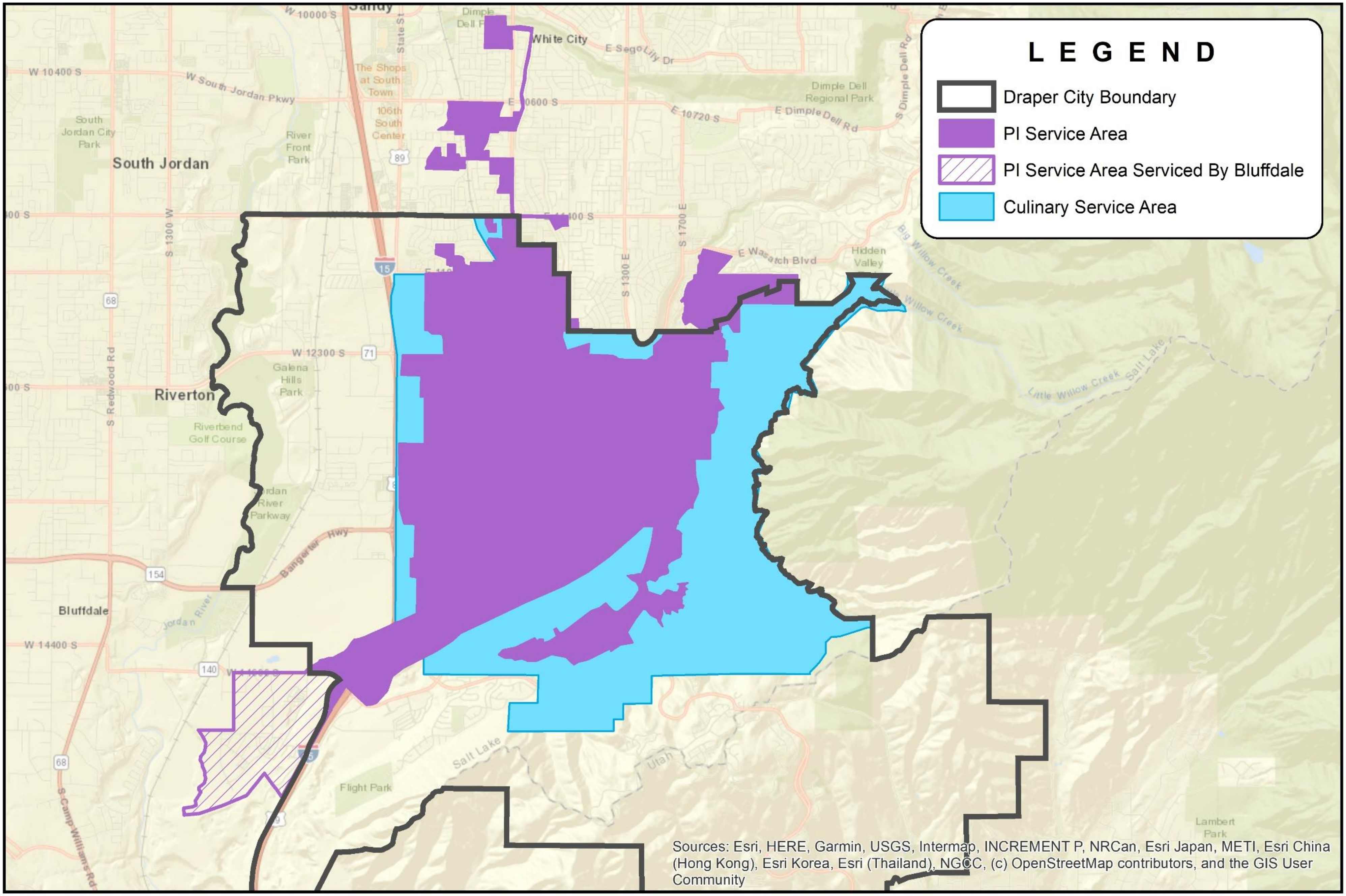
PRESSURE IRRIGATION SYSTEM:

1. Define the service area
2. Project irrigated acreage of the PI service area based on existing aerial imagery, developed area, and developable area
3. Determine the existing and projected irrigated acreage being served by metered and unmetered connections
4. Determine the projected irrigated acreage to be transitioned from the culinary system at build-out
5. Convert projections of irrigated acreage to water demands based on Wasatch Front irrigation application rates for metered and unmetered connections
6. Adjust projected demands as necessary to account for conservation trends and goals.

Each step of this process is summarized in the sections below.

SERVICE AREA

The service areas of the culinary and pressure irrigation (PI) systems were determined primarily from GIS data provided by the Company (see Figure 2-1). Based on discussions with Company personnel, the build-out service area boundaries are not anticipated to change from the current boundaries shown in Figure 2-1.



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PROJECT
2019 WATER MASTER PLAN

CULINARY AND PI SERVICE BOUNDARIES

NORTH:

SCALE: 1 inch = 6,000 feet

FIGURE NO. 2-1

P:\Water Pro\093-19-05 Culinary Master Plan\GIS\Figures\Figure 2-1 Service Area Boundary.mxd dschriner 3/2/2020

The PI service area has been updated since the 2018 Water Rights Master Plan (2018 WRMP). Approximately 731 acres have been removed from the south western most part of the service area to account for an agreement with Bluffdale City. Under this agreement, DIC will instead provide up to a contracted 2,230 gpm flow to Bluffdale City.

RATES OF GROWTH

Rates of growth were estimated for the culinary and outdoor irrigation systems separately due to different service area boundaries and available data. The culinary system growth was projected based on population growth and estimated irrigated acres within the culinary service area boundary. PI system growth was projected based on aerial imagery evaluation and estimated irrigated acres from historic production data.

Culinary System Growth

The planning agencies that produce population growth estimates for the culinary area include: the State of Utah Governor's Office of Management and Budget (GOMB), the Kem C. Gardner Policy Institute, and the Wasatch Front Regional Council (WFRC). The first two listed agencies generally develop growth estimates at a county or state level. The WFRC does planning on a smaller scale (as a result of needing to conduct traffic modeling of future conditions). The WFRC develops traffic analysis zones (TAZs) that include sub-areas which comprise residential and employment projections divided into relatively small areas representative of collector roads. BC&A used WFRC projections in this master plan to allow us to project different growth rates throughout the system.

BC&A reviewed the WFRC TAZ projections and used the existing population estimates and growth rate for each TAZ within the Company's culinary service area to help define the rate of growth for the culinary system population through the year 2050. Build-out conditions were assumed to be 2050 based on evaluation of the population growth and development data.

Table 2-1 and Figure 2-2 identify the overall population projections for the culinary service area based on WFRC data.

Table 2-1
Population Projections for the Culinary Service Area

Year	Culinary Service Area Population	Avg. Annual Rate of Growth
2018	30,000	
2020	30,058	0.10%
2025	30,293	0.16%
2028	30,487	0.21%
2030	30,565	0.13%
2035	30,771	0.13%
2040	31,114	0.22%
2045	31,450	0.22%
2050	32,188	0.47%

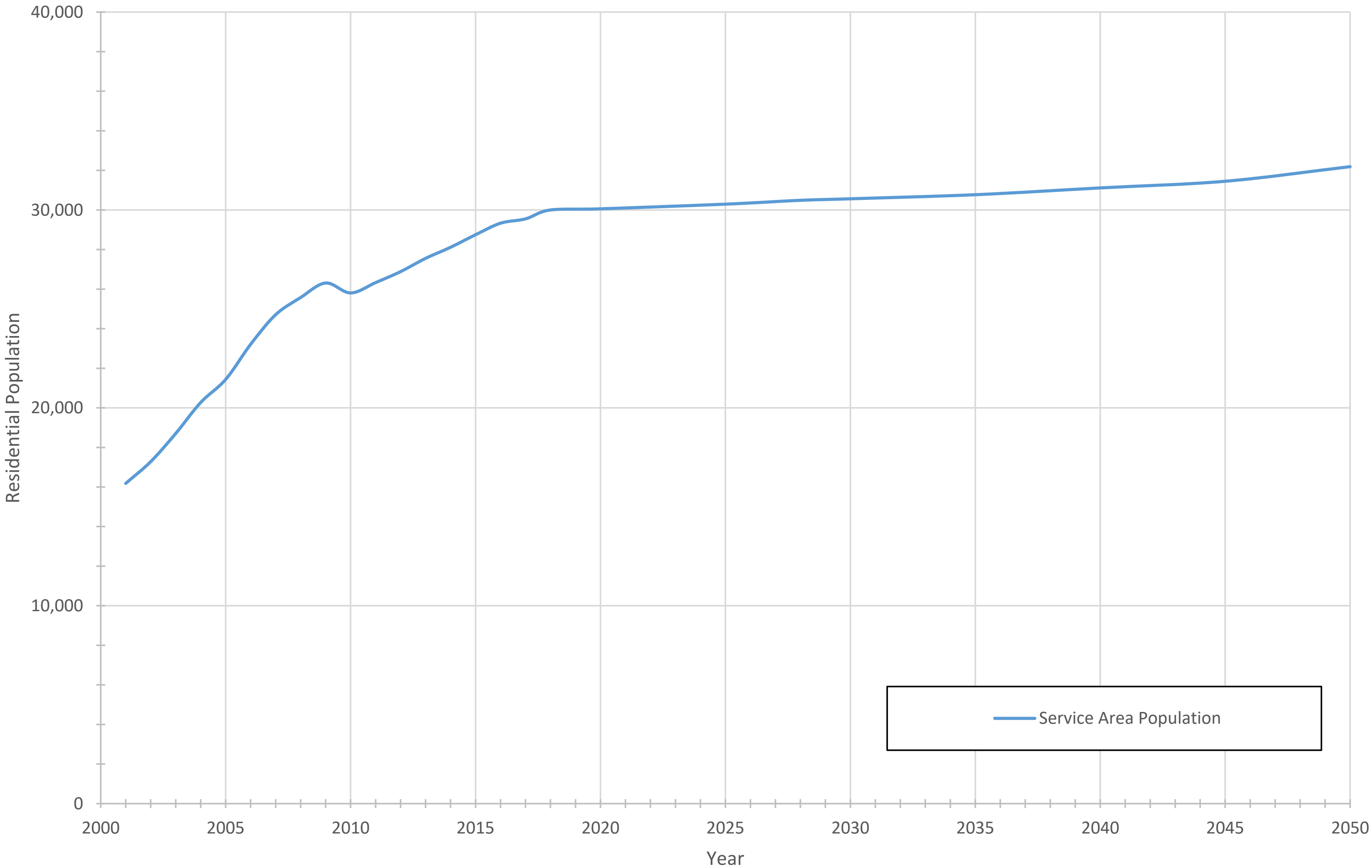


Figure 2-2
Residential Population in Culinary Service Area

As shown in Table 2-1 and Figure 2-2, the population growth rates have basically plateaued in 2018. Growth rates from 2018 to 2050 range from 0.10% to 0.47%.

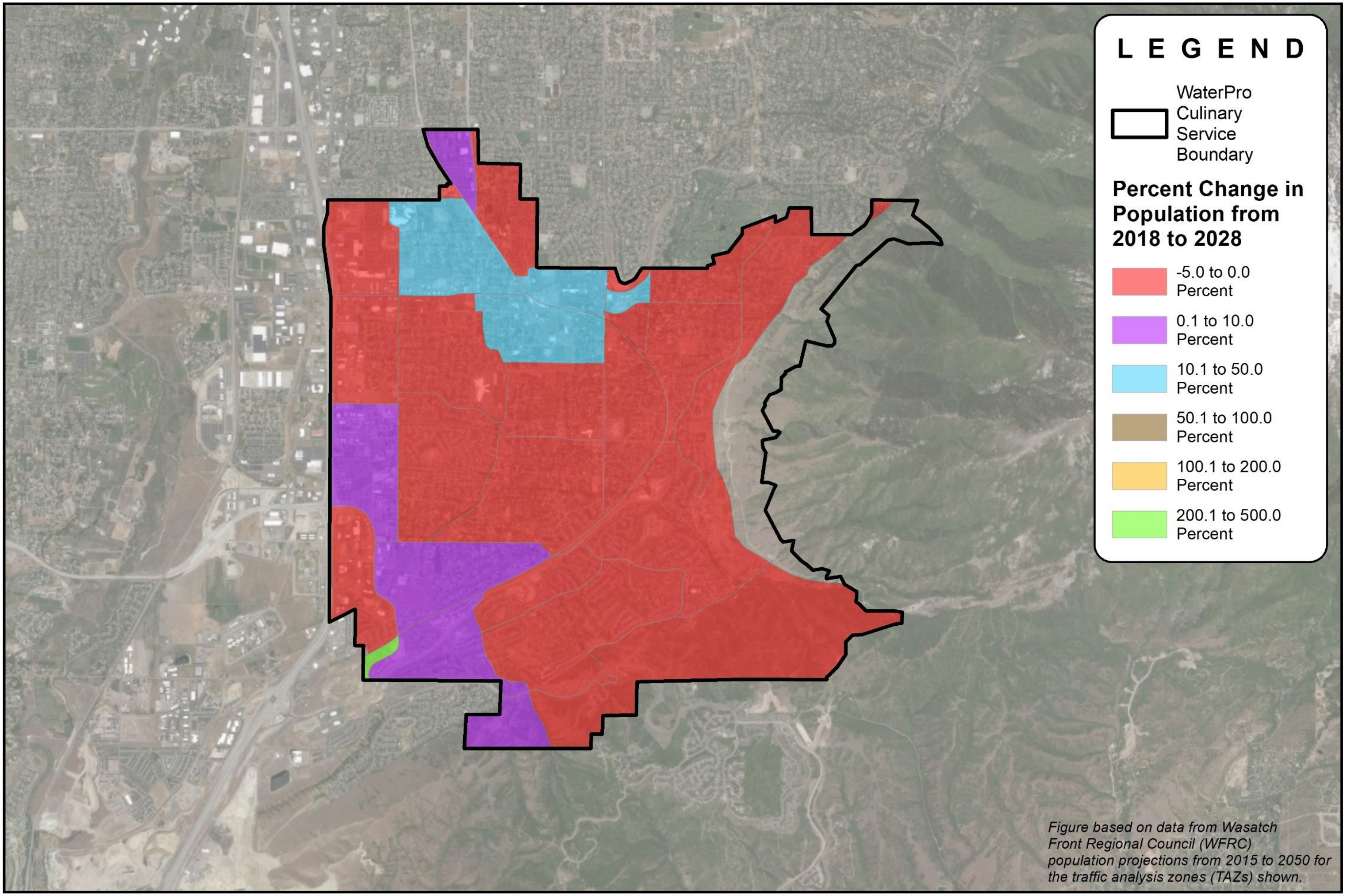
Population Growth Projections

The rates of growth from the WFRC are useful for generally projecting how fast and where localized growth will occur within the Company. The area within the current service boundary is relatively dense with minimal space for new development. For this reason, the location of population growth within each TAZ was used to allocate growth areas for future development. Figures 2-3 and 2-4 show the expected distribution of growth for the next 10 years and at build out. These expected growth rates were used to adjust demands for the 10-year and build-out culinary hydraulic models.

Equivalent Residential Connections

Equivalent residential connections (ERCs) were used to project future culinary system production requirements. All culinary water production (residential, commercial, institutional, etc.) was converted to ERCs using the 2018 average flow per residential connection. 2018 was used to determine the starting point of the existing ERCs for two reasons:

1. 2018 had the most recent complete year of data available. Data used included culinary water sales, production, connections and service area population.
2. Metering and reporting information within the Company has become more accurate in the recent past due to improved meters and SCADA information. Therefore, historic reporting totals are likely to have unknown inaccuracies when compared with the newest data.



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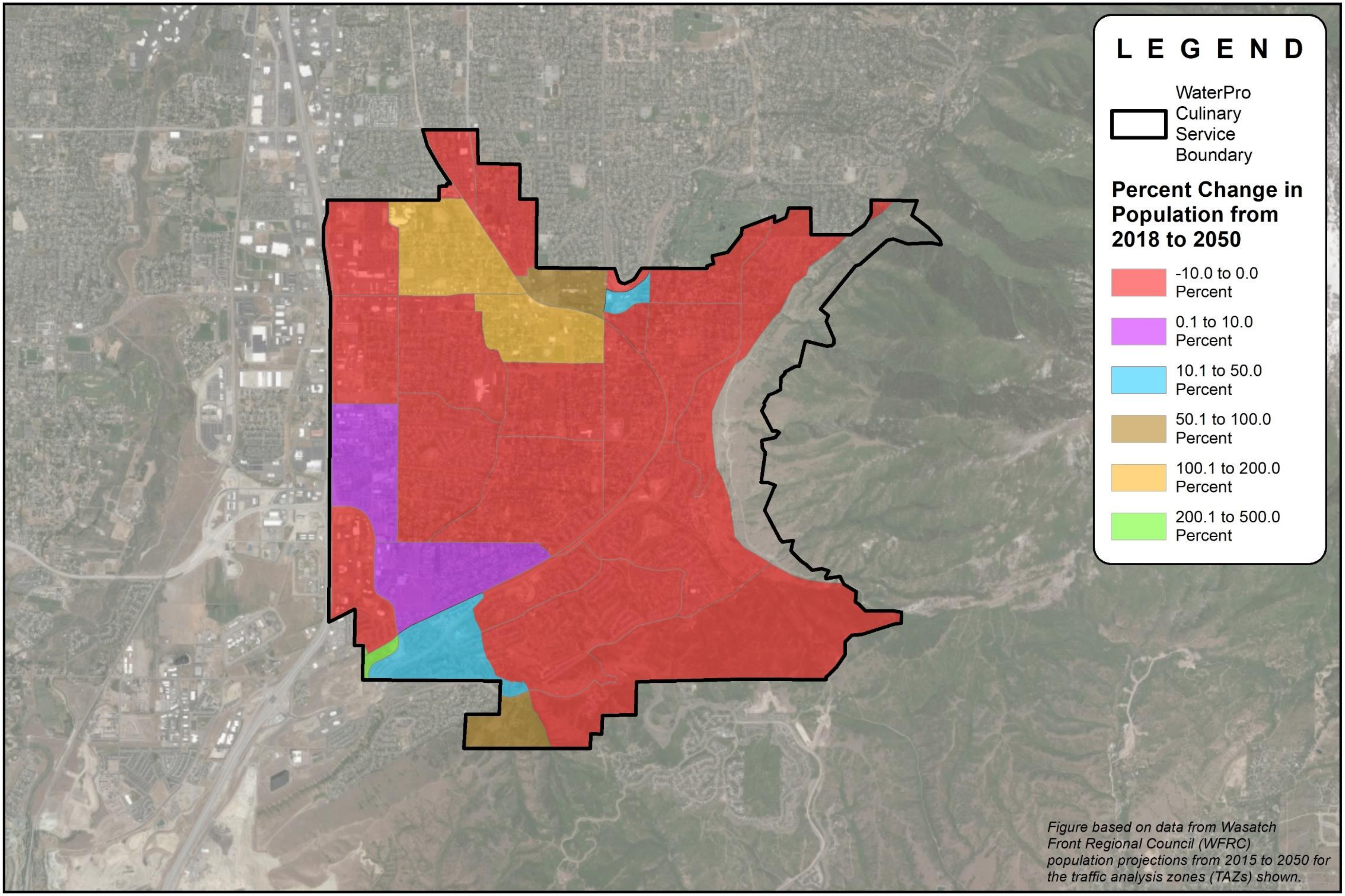
PROJECTED POPULATION CHANGE FROM 2018 TO 2028

NORTH:

SCALE: 1 inch = 5,000 feet

FIGURE NO. 2-3

P:\Water Pro\093-19-05 Culinary Master Plan\GIS\Figures\Figure 2-3 2018-2028 Growth Areas.mxd dschriner 3/6/2020



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PROJECTED POPULATION CHANGE FROM 2018 TO 2050

NORTH:

SCALE: 1 inch = 5,000 feet

FIGURE NO. 2-4

P:\Water Pro\093-19-05 Culinary Master Plan\GIS\Figures\Figure 2-4 2018-2050 Growth Areas.mxd dschriner 3/6/2020

Multiple data sources (JVWCD, DWRi and DIC meter data) were available to determine the total system production and sales water volumes for the culinary system. Reporting requirements vary between agencies and therefore do not provide the same value. The available data and reporting requirements were reviewed with DIC to determine the most appropriate data source for each data need. Detailed information regarding calculations and data for ERC calculations can be found in Appendix A. A summary of existing ERC information for the culinary system is shown in Table 2-2.

Table 2-2
2018 Culinary Equivalent Residential Connections

Connection Information	Year 2018
Residential Population[1]	30,000
Residential Connections[2]	7,413
Residential Production (acre-ft)[3]	5,279
Non-Residential Production (acre-ft)[3]	1,627
Non-Residential ERCs	2,285
Total Production (acre-ft)[4]	6,906
Total ERCs	9,698
Total Production per ERC (acre-ft/ERC)	0.71

[1]From WFRC data; [2]From WFRC DWRi data; [3]From JVWCD data but split based on percentage determine from DWRi data; [4]From JVWCD data

Although there were only 7,413 residential connections in the culinary system in 2018, there were 9,696 ERCs. One way to visualize the difference between those numbers is that all the 2018 non-residential water use in the Company was the same as if there were 2,285 (9,698-7,413 = 2,285) additional residential homes. Utilizing ERCs to characterize system growth is generally easier to conceptualize the quantity of the growth.

Historic ERCs within the culinary system were defined using the same procedure described for 2018 with the corresponding year's data. This was done to establish a baseline for comparison with growth projections. ERCs for selected years are shown in Table 2-3.

The projections of residential and non-residential growth for the culinary system were distributed based on new population growth areas determined using the TAZ data as previously discussed. Total culinary system ERCs were projected through build-out based on population growth percentages determined using the TAZ data (see Table 2-1). Table 2-3 summarizes the growth of ERCs within the Company.

Table 2-3
Total Culinary System Equivalent Residential Connection Summary

Year	Total Culinary System ERCs
2001	5,134
2005	7,025
2010	8,065
2015	9,050
2018	9,698
2020	9,708
2025	9,723
2028	9,744
2030	9,756
2035	9,769
2040	9,791
2045	9,812
2050	9,858

Indoor Water Demand Growth

The historic production of the culinary system during the winter months of January, February, March, November, and December was used to estimate indoor only culinary water production requirements. Winter production in the last 10 years of data (2008-2018) had an average of approximately 265 gpd/ERC. Figure 2-5 shows somewhat regular intervals of peaking indoor water use. To be conservative in planning, a trend line of the peak use data was developed to ensure usage assumptions accounted for potential future peaks. That peak trend line nearly intersects with the 10-year average in 2018 due to the trend of less water use per ERC. Using the available historic peak values and recent trends in population and water use, we selected 265 gpd/ERC as a conservative approximation of indoor water demand.

Through water conservation goals, this rate may decrease in the future; however, our experience would suggest that the vast majority of water conservation will be realized through changes associated with outdoor water use. The 265 gpd/ERC use rate was assumed to be constant through build-out (i.e. no reduction in indoor water use rate) and was applied to the number of ERCs in Table 2-3 to project the culinary water indoor use shown in Table 2-4.

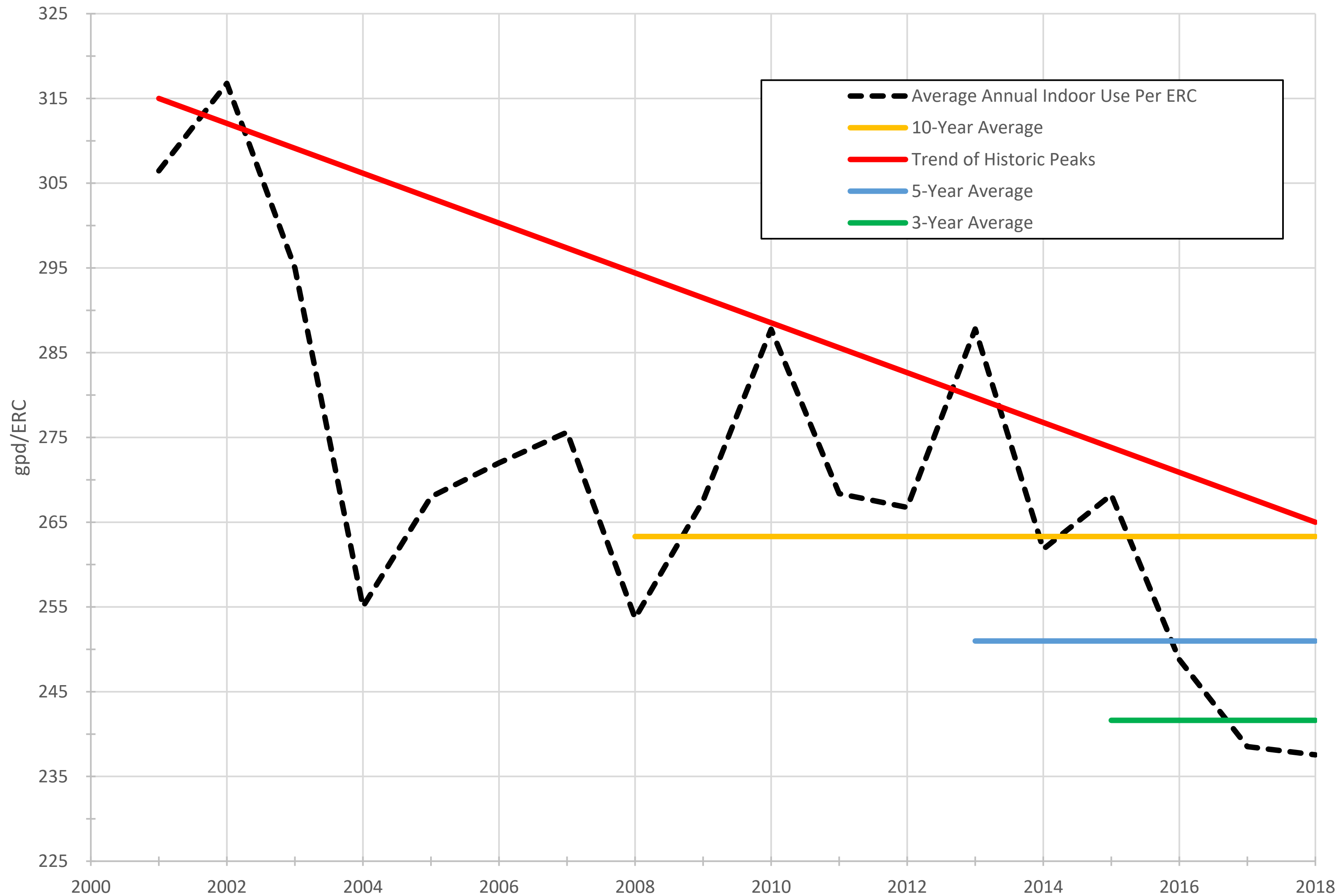


Figure 2-5
Average Annual Historical Indoor Water Use

Table 2-4
Projected Culinary Indoor Water Use

Year	Total Culinary System ERCs	Culinary Indoor Water Use (acre-ft/year)
2018	9,698	2,839
2020	9,708	2,879
2025	9,723	2,882
2028	9,744	2,886
2030	9,756	2,892
2035	9,769	2,896
2040	9,791	2,900
2045	9,812	2,906
2050	9,858	2,913

Projected Irrigated Acres

As described in the 2018 WRMP, there is a portion of potential PI system users that have refused PI service and instead use culinary water for outdoor use where the two water systems overlap. The Company is taking measures to encourage all users to use PI water for outdoor irrigation if it is available, including potential implementation of a reuse water blending project to improve PI water quality in the next few years. To account for the transition period of converting to PI for outdoor use, three scenarios were developed. Those three scenarios are to maintain current PI use rate, 100% conversion to the PI system at build-out, and 100% conversion to the PI system immediately in 2018. These scenarios were used to determine boundaries for conversion to the PI system and therefore bracket the high and low bounds for production requirements for both systems. These scenarios will also be useful for determining impact fees for projects when impact fees are updated in the near future. Figure 2-6 shows the current distribution of irrigated acres between systems, and Figure 2-7 shows the proposed scenario where all overlapped area is irrigated using the PI system. Appendix B presents detailed estimates of irrigated acreage for each scenario.

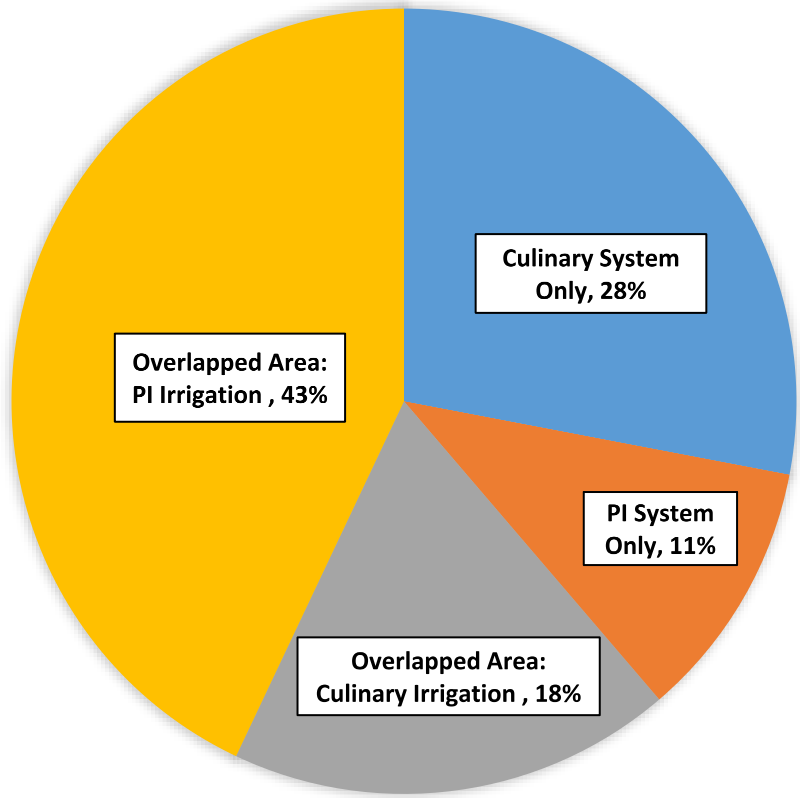


Figure 2-6
Current Irrigation Use by System

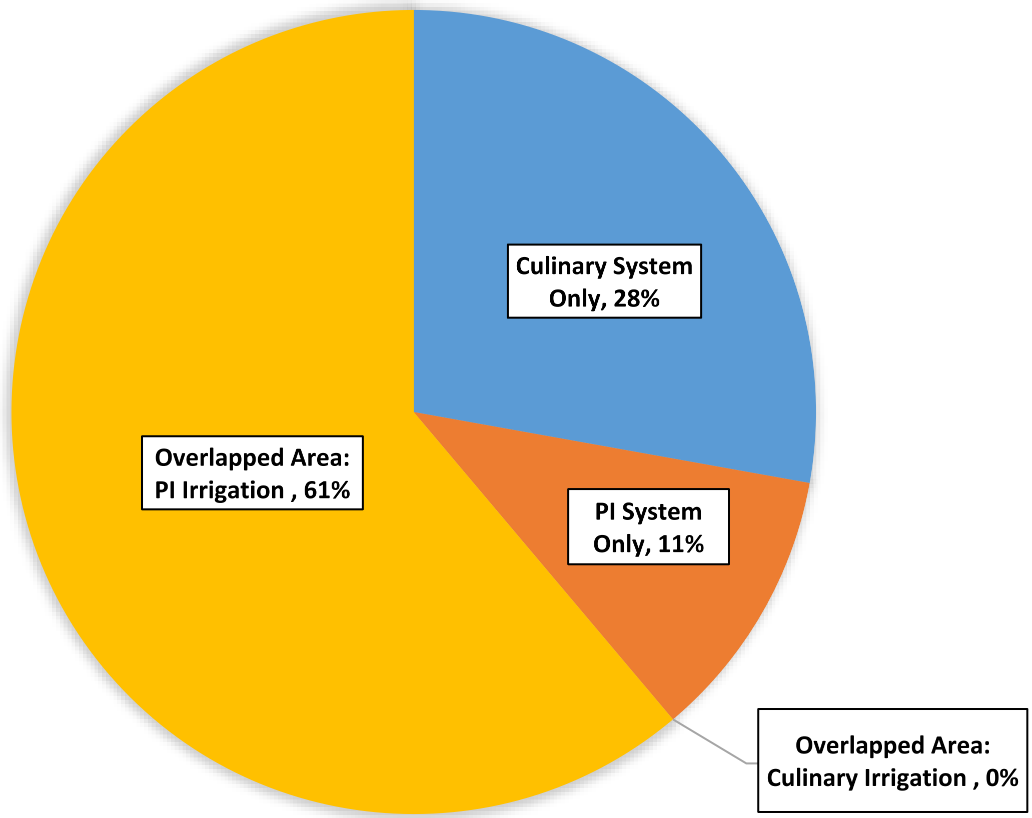


Figure 2-7
100% PI Use at Build-Out Irrigation Use by System

Culinary Outdoor Peaking in Areas with Access to Pressure Irrigation

As discussed in the 2018 WRMP, a summer peak is shown in culinary water use for customers with access to the pressure irrigation system (for the remainder of this report, this will be referred to as the culinary peak). While a very small amount of this peak might be associated with increased summer indoor use, the vast majority of this culinary peak is likely used for outdoor irrigation.

If a customer has access to the pressure irrigation system, we would normally assume the customer would utilize it for all outdoor use to save money on water rates. This would also support Company efforts to reduce the burden on the culinary water system. The data show a summer culinary peak that is approximately three times the observed indoor use in the winter, indicating this is not the case. It appears that a significant number of WaterPro customers are not using the pressure irrigation system at all or are watering more sensitive areas of their landscaping with culinary water. While there are several reasons this could be occurring, the most likely appears to be pressure irrigation water quality issues perceived by some customers.

Data regarding outdoor acreage that is currently being irrigated was not available from any source and needed to be developed specifically for this study. Acreage irrigated by the culinary peak was estimated following the same methodology used in the 2018 WRMP that included: separating indoor and outdoor culinary use, identifying total irrigated acreage, and estimating water application rates for irrigation.

Pressure Irrigation (PI) System and Culinary Outdoor Irrigation Growth

PI system and culinary outdoor irrigation growth was projected based on aerial imagery evaluation and estimated irrigated acres. The addition of new PI meters to existing connections and transition of more customers from culinary irrigation to the PI system was also accounted for in the growth scenarios of the culinary and PI systems.

Irrigated acres within the culinary and PI service boundaries were updated using the same methodology as described in the 2018 WRMP and aerial imagery as described in the 2018 WRMP by BC&A with updates made for historical production of each system based on the trend of the last 10 years of production data reported to JVWCD, ERC projections, indoor water use, and the reduction in PI service area to not include the PI service area now within Bluffdale as previously described. In summary:

- 20% of Company service areas (existing and future) will never be irrigated due to roads, sidewalks, canals, etc.
- 8% of the existing Company service area is not currently developed, but may be in the future.
- 50% of the remaining existing service area (72%) is currently irrigated.
- Build-out conditions assume the undeveloped 8% becomes developed with the same 50% irrigated area.

Irrigation Application Rate

The water application rate per irrigated acre was determined based on a study that BC&A completed with others for the State of Utah Division of Water Resources in January 2018. As part of that study, the water application rates per irrigated acre were investigated for multiple geographic areas of Utah based on temperatures, precipitation, soil and other considerations under average conditions. The study concluded that the estimated application rate per irrigated acre in the Salt Lake County Area is 3.4 ac-ft/year for metered systems and 5.1 ac-ft/year for unmetered systems.

Company data in 2017 showed that the connections in the PI system were 43.8% metered and 56.2% unmetered. It was assumed that all connections would be metered at build-out. To be conservative, it was assumed that the metering transition rate would occur at a uniform rate until build-out. However, it is likely that the entire PI system will be fully metered within the next ten years.

Culinary Outdoor Irrigation Transition to PI System

The observed culinary peak is important to identify and understand because it will affect projections of both culinary and PI water use. As shown in Figures 2-6 and 2-7, 18% of irrigated acres are currently being irrigated using the culinary system at connections with access to the PI system. That 18% represents approximately 448 irrigated acres in 2018 and 592 irrigated acres at build-out. Therefore, the increased production requirement for the PI system with 100% PI use for irrigation in overlapped areas was determined using a 3.4 acre-ft/irrigated acre application rate for 448 and 592 irrigated acres in their respective years. Production requirements for each system and scenario are described in the following section.

ANNUAL PRODUCTION REQUIREMENT

The final step in developing annual water production requirement projections is to convert the projections of each use component (indoor ERCs and irrigated acreage as described previously) into the actual water production requirement. This was accomplished by multiplying each projected component by its water production requirement. The production requirement is the amount of water required to be produced for each component with allowance for system losses and other system inefficiencies. In other words, the production requirement answers the question, "How much water must be produced for the demands of each component of water use?" Because production requirement factors are subject to change through conservation, several scenarios of use factors are addressed in this report below.

Historic Production Requirements

Historical water use data was used to calculate historic per capita demands. This data was then extrapolated to predict future water production requirements for Draper Irrigation Company. This step assumed that future production will be a function of historical production and assumes relatively minimal system water loss from leaking pipes, inaccurate meters, etc. The Company's average system loss (sales to production loss) has been an average of approximately 6 percent for recent years (JVWCD data from 2016 to 2018). This is well below the State average of 15 percent and indicates the Company has minimal losses within the system. A water loss audit can be useful for identifying areas where additional improvements may be made. For planning purposes and due to the small percentage of system loss, it will be assumed that most system loss is a result of metering inaccuracies and not from wide spread system leakage.

Table 2-5 and Figure 2-6 show production requirements within the Company since the year 2001 according to data from JVWCD. Both culinary and PI production has gradually increased since 2001 with annual spikes depending on other factors such as wet or dry years.

Peaking Factors

Culinary peaking factors were determined using 2018 meter data for source flows into the DIC culinary system from the WTP and 1300 East well. The meter data included flows every 15-minutes for the entire year of 2018, which allowed detailed evaluation of the peak month, week, day, hour and instant (or 15-minute period). Peak day and peak instantaneous factors were defined as 2.61 and 4.96 times the average day production requirements as shown in Table 2-6.

PI peaking factors are also included in Table 2-6. PI peaking factors were determined using 2018 meter data for source flows into the DIC PI system from the irrigation pond, north pump station and irrigation filters. The meter data included flows every 15-minutes for the entire year of 2018, which allowed detailed evaluation of the peak month, week, day, hour and instant (or 15-minute period). Peak day and peak instantaneous factors were defined as 2.06 and 3.09 times the average day production requirements. These peaking factors assume that all of the PI system flow occurs within the irrigation season of April 15th to October 15th or 184 days.

It is recommended that future flows into both the culinary and PI systems continue to be metered at one-hour or finer intervals. This data will allow future evaluations of peaking factors to be more accurate and provide a better understanding of water use in both systems.

Table 2-5
Historic Water Production Requirements

Source	Total Culinary Production (acre-ft)	Total PI Production (acre-ft)	Total Water Produced (acre-ft)
2001	4,566	6,779	11,345
2002	4,105	4,772	8,877
2003	4,652	5,302	9,954
2004	5,187	4,459	9,646
2005	4,975	4,294	9,269
2006	5,691	5,821	11,511
2007	6,408	5,959	12,368
2008	6,148	5,646	11,794
2009	5,806	5,128	10,935
2010	5,964	5,259	11,223
2011	5,825	5,963	11,787
2012	7,153	6,707	13,859
2013	6,849	5,550	12,399
2014	6,203	5,764	11,967
2015	6,500	6,806	13,306
2016	6,232	5,305	11,536
2017	6,434	5,093	11,527
2018	6,906	5,593	12,500

Table 2-6
Peaking Factor Summary

Scenario	Peaking Factor
Culinary Peak Day	2.61
Culinary Peak Instantaneous	4.96
PI Peak Day	2.06
PI Peak Instantaneous	3.09

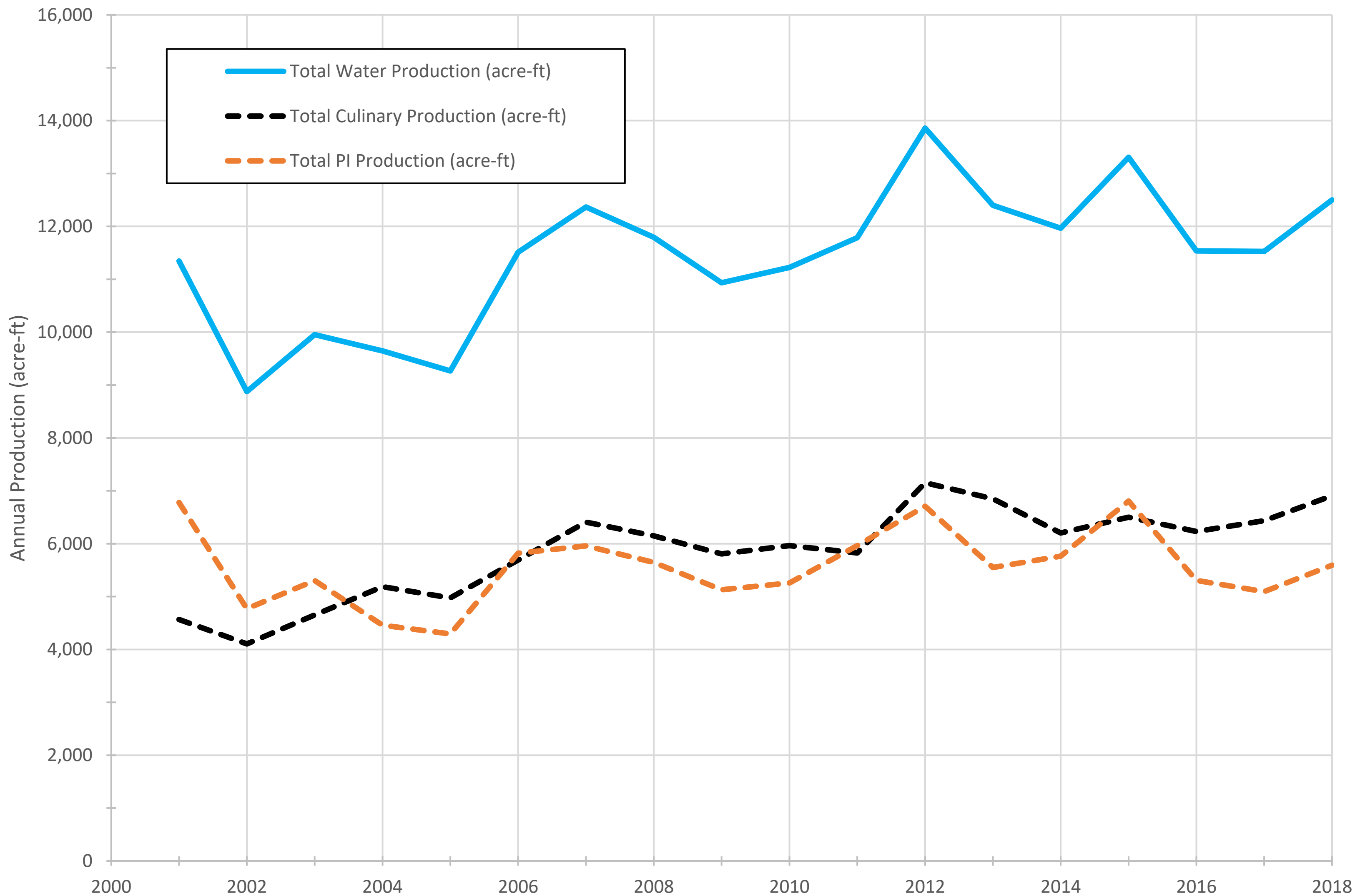


Figure 2-8
Historic Culinary and PI Production

Future Production Requirements

Culinary production projections were based on the following assumptions/process:

1. 2018 projected annual production was estimated as 7,371 acre-ft using historical trend of 0.76 acre-ft/ERC peak values (based on Company production data reported to JVWCD and connection data reported to DWRi). This value was used as a starting point for projecting future production requirements as shown in Figure 2-9.
2. Culinary indoor production was determined using historical monthly data reported by the Company to JVWCD for the months of January, February, March, November and December. An average flow per ERC was found for each year. The trend of this value was plotted and the historical peak and trend was used to determine a current peak culinary indoor value of 265 gpd/ERC as shown in Figure 2-5.
3. The outdoor use portion of the culinary system that could be immediately transferred to the PI system was estimated as 1,523 acre-ft, and the portion that could be transferred at build-out is 2,013 acre-ft. Both values were determined using the irrigated acres presented in Appendix B and an application rate of 3.4 acre-ft/irrigated acre.
4. The build-out culinary production with the current PI use rate (7,629 acre-ft) and 100% PI use at build-out (5,617 acre-ft) were determined by adding the build-out production requirement for culinary indoor production to the increase in irrigated acres required for the culinary system in each projection scenario as shown in Figure 2-9.
5. It should be noted that all planning values presented use the projected values for the 2018 starting point and 10-year historical trend numbers for build-out. A historical trend line was used to account for annual variation in reported production numbers that occur due to weather patterns (dry vs wet years) and other factors that impact production. This value was used in the determination of irrigated acres.

PI production projections were based on the following assumptions/process:

A. 2018 irrigated acres were determined using 2018 production based on a trend of the last 10 years of PI production and the Wasatch Front irrigation application rates discussed in the Irrigation Application Rates section of 3.4 acre-ft/year for metered systems and 5.1 acre-ft/year for unmetered systems. A historical trend line was used to account for annual variation in reported production numbers that occur due to weather patterns (dry vs wet years) and other factors that impact production.

B. 2018 projected production was estimated as 7,000 acre-ft using historic production peak values and the observed historical trend as shown in Figure 2-10.

C. Build-out production was determined using projected build-out irrigated acres at the state average irrigation application rates referenced above. For the 100% PI use scenario, we assumed that 100% of the overlapped culinary service area was transferred to the PI system as shown in Figure 2-7.

Based on observed historic production requirements in Table 2-7, Table 2-8 summarizes the calculated historic production rates for the Company in year 2001 and 2018. It also shows the projected future production rates for the Company based on the projected ERCs and irrigated acreage growth previously discussed. Future production requirements for both culinary and PI systems depend primarily on the conversion to, and use of, the PI system for irrigation purposes. For this reason, three scenarios were evaluated for future production requirements including current PI use rate, 100% conversion to PI system use at build-out and immediate 100% conversion to the PI system.

Table 2-8 and Figures 2-9 and 2-10 show the projection of total annual water production needs for both systems within the Company.

Table 2-7
Historic and Projected Culinary Production Requirement

Component	Year 2001	Year 2018	Year 2028	Year 2050
Population	16,182	30,000	30,487	32,188
Equivalent Residential Connection (ERC) Estimate	5,134	9,698	9,744	9,858
Annual Indoor Production (gpd/ERC)	306	238	265	265
Annual Irrigation Rate (acre-ft/irrigated acre)	--	3.40	3.40	3.40
Current PI Use Rate				
Annual Per Capita Production (gpcd)	252	219	218	212
Peak Day Demand Per Capita Production (gpcd)	657	572	570	552
100% PI Use at Build-Out				
Annual Per Capita Production (gpcd)	252	219	200	156
Peak Day Demand Per Capita Production (gpcd)	657	572	521	407
100% PI Use Immediately				
Annual Per Capita Production (gpcd)	252	219	156	156
Peak Day Demand Per Capita Production (gpcd)	657	572	408	407

Table 2-8
Total Annual Water Production

Year	Total Annual Culinary Water Production w/ Current PI Use Rate (acre-ft)	Total Annual Culinary Water Production w/ 100% PI Use Rate (acre-ft)	Total Annual Culinary Water Production w/ 100% Immediate PI Use Rate (acre-ft)	Total Annual PI Water Production w/ Current PI Use Rate (acre-ft)	Total Annual PI Water Production w/ 100% PI Use Rate (acre-ft)	Total Annual PI Water Production w/ 100% Immediate PI Use Rate (acre-ft)
2018	7,371	7,371	5,208	7,000	7,000	8,776
2020	7,387	7,261	5,234	6,875	7,000	8,615
2025	7,427	6,987	5,298	6,561	7,001	8,346
2028	7,452	6,823	5,336	6,373	7,001	8,185
2030	7,468	6,713	5,362	6,247	7,002	8,078
2035	7,508	6,439	5,426	5,933	7,002	7,809
2040	7,549	6,165	5,490	5,620	7,003	7,541
2045	7,589	5,891	5,553	5,306	7,003	7,272
2050	7,629	5,617	5,617	4,992	7,004	7,004

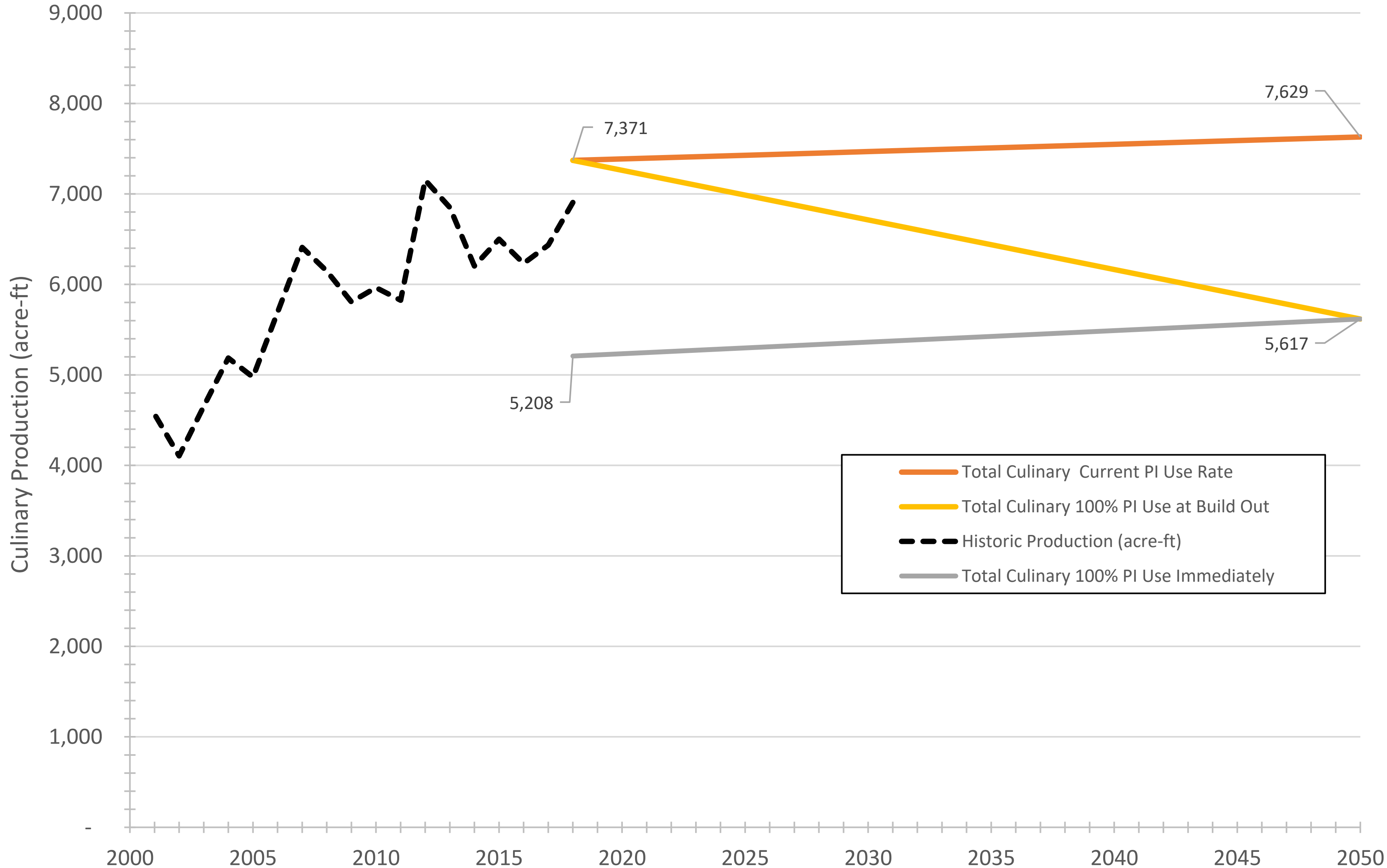


Figure 2-9
Total Annual Culinary Water Production Requirements Projections

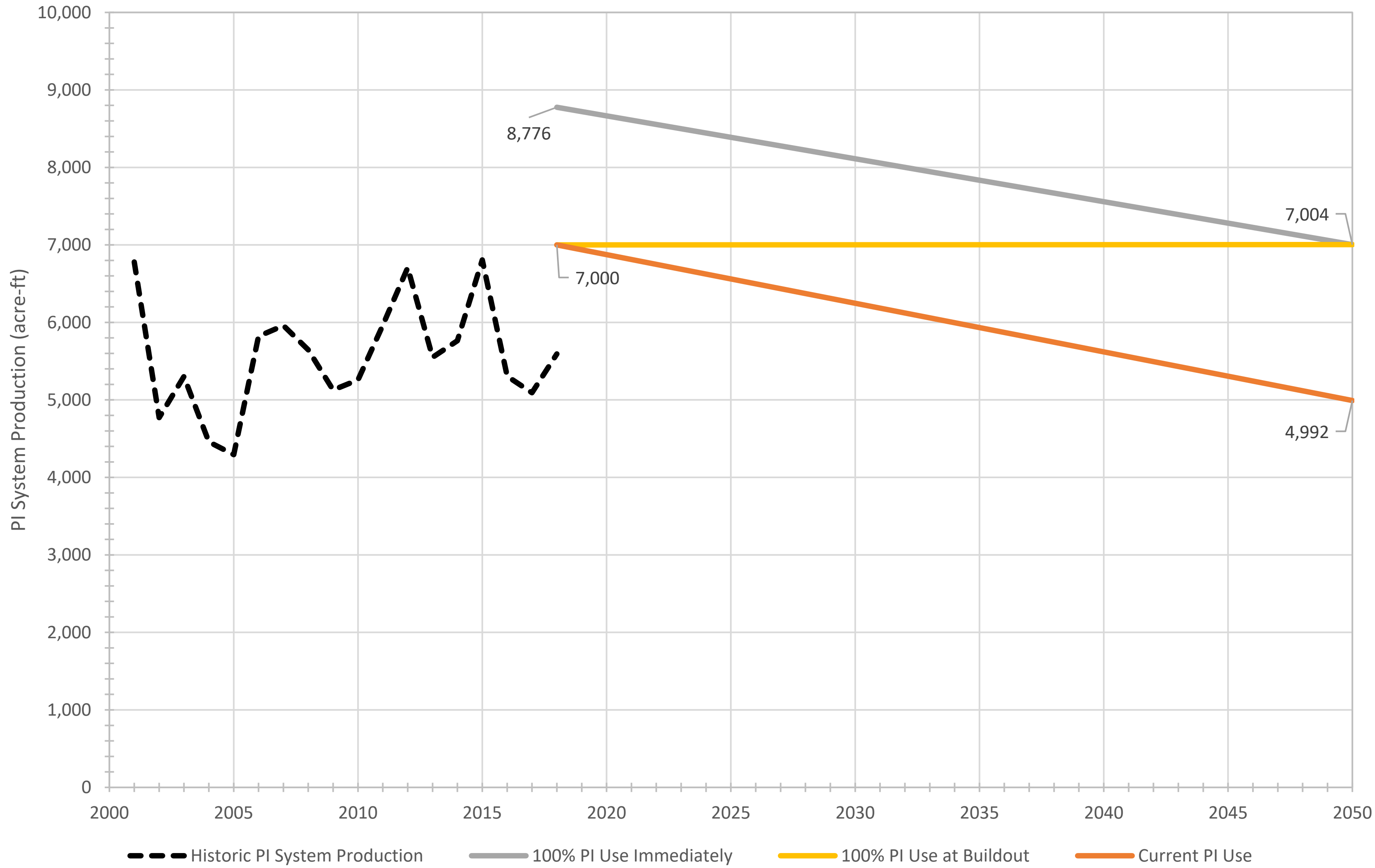


Figure 2-10
Total Annual PI Water Production Requirements Projections

As shown in the figures, projections for both systems begin above the recorded 2018 production requirement to be conservative. Figure 2-9 shows minimal system growth in the culinary system under the current PI use rate with a change of 258 acre-ft in production requirement from 2018 to 2050. In contrast, a significant drop in production is required if the PI system were to be completely utilized immediately. The actual future scenario is likely in the middle of these two and closer to the 100% PI use at build-out scenario.

The PI system in Figure 2-10 shows a steady decline in production requirements under the current PI use rate because of the implementation of metering and corresponding drop in water use. A significant burden would be placed on the system if all potential PI connections were utilized immediately for all irrigation purposes within the system. The 100% PI use at build-out scenario shows practically no change in production requirements between 2018 and 2050 because the increase in users and irrigated acres is offset with a reduction in application rates due to metering.

Tables 2-9 to 2-11 and Figures 2-11 and 2-12 show the projections of peak day demand both with and without conversion to PI usage for irrigation. The figures and tables show the same patterns as the average day production projections shown previously. These figures and tables are provided to show the magnitude of flows required to meet peak day requirements. Specifically, the PI system in Figure 2-12 has very high peak day flows because the annual totals are only distributed over the 184 day irrigation season from April 15 to October 15. Development of supply scenarios to meet future production requirements of the culinary and PI systems is discussed in Chapter 3.

Table 2-9
Total Peak Day Water Production Requirements – Current PI Use Rate

Year	Total Peak Day Culinary Demand (gpm)	Total Peak Day PI Demand (gpm)	Total Peak Day Culinary Demand (mgd)	Total Peak Day PI Demand (mgd)
2018	11,927	8,939	17.2	12.9
2020	11,953	8,780	17.2	12.6
2025	12,018	8,379	17.3	12.1
2028	12,057	8,138	17.4	11.7
2030	12,083	7,978	17.4	11.5
2035	12,149	7,577	17.5	10.9
2040	12,214	7,177	17.6	10.3
2045	12,280	6,776	17.7	9.8
2050	12,345	6,375	17.8	9.2

Table 2-10
Total Peak Day Water Production Requirements – 100% PI Use Rate at Build-Out

Year	Total Peak Day Culinary Demand (gpm)	Total Peak Day PI Demand (gpm)	Total Peak Day Culinary Demand (mgd)	Total Peak Day PI Demand (mgd)
2018	11,926	8,940	17.2	12.9
2020	11,749	8,940	16.9	12.9
2025	11,306	8,941	16.3	12.9
2028	11,040	8,941	15.9	12.9
2030	10,863	8,942	15.6	12.9
2035	10,419	8,943	15.0	12.9
2040	9,976	8,943	14.4	12.9
2045	9,533	8,944	13.7	12.9
2050	9,090	8,945	13.1	12.9

Table 2-11
Total Peak Day Water Production Requirements – 100% PI Use Immediately

Year	Total Peak Day Culinary Demand (gpm)	Total Peak Day PI Demand (gpm)	Total Peak Day Culinary Demand (mgd)	Total Peak Day PI Demand (mgd)
2018	8,428	11,208	12.1	16.1
2020	8,469	11,067	12.2	15.9
2025	8,572	10,713	12.3	15.4
2028	8,634	10,501	12.4	15.1
2030	8,676	10,359	12.5	14.9
2035	8,779	10,006	12.6	14.4
2040	8,883	9,652	12.8	13.9
2045	8,986	9,299	12.9	13.4
2050	9,090	8,945	13.1	12.9

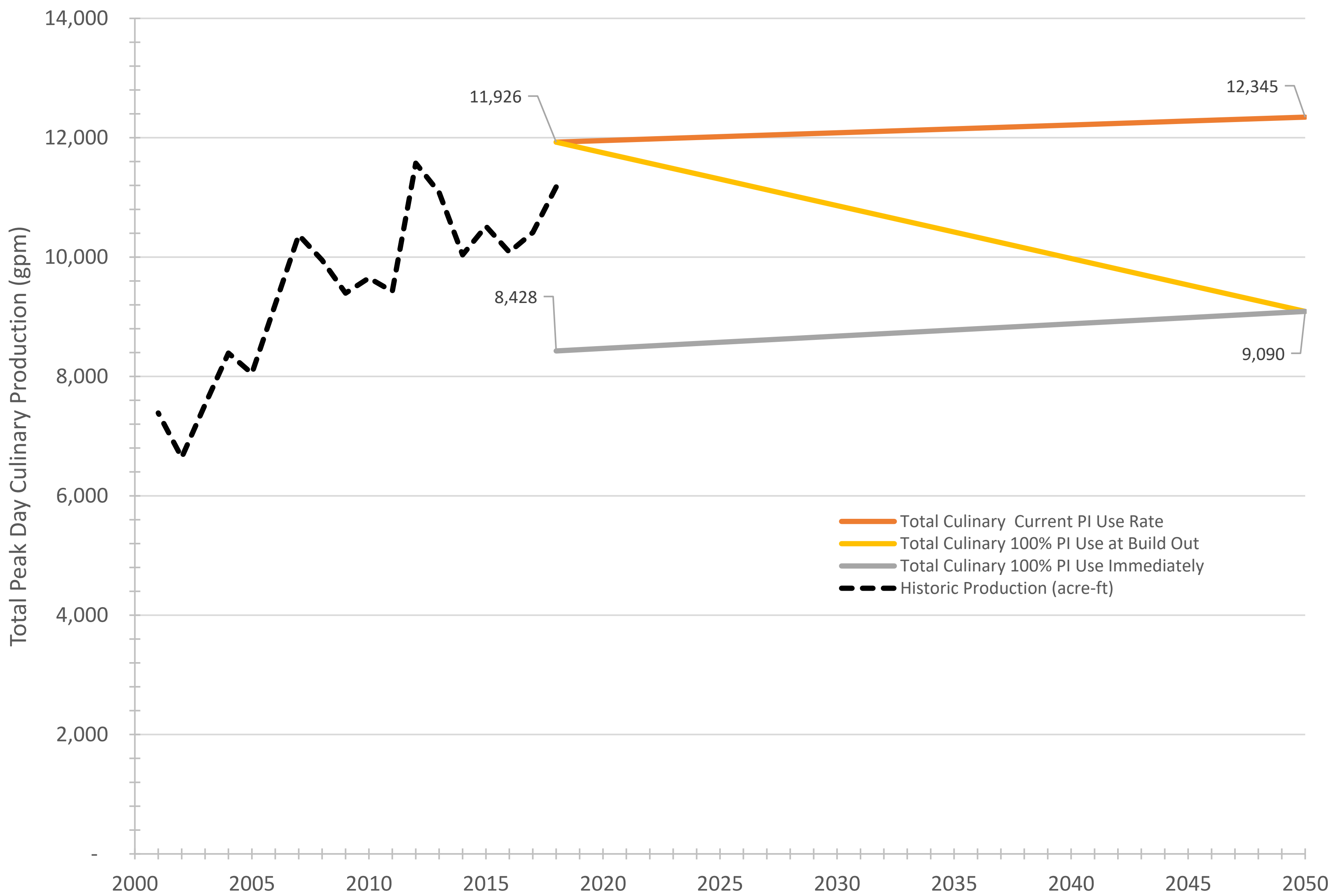


Figure 2-11
Total Culinary Water Peak Day Production Requirements Projections

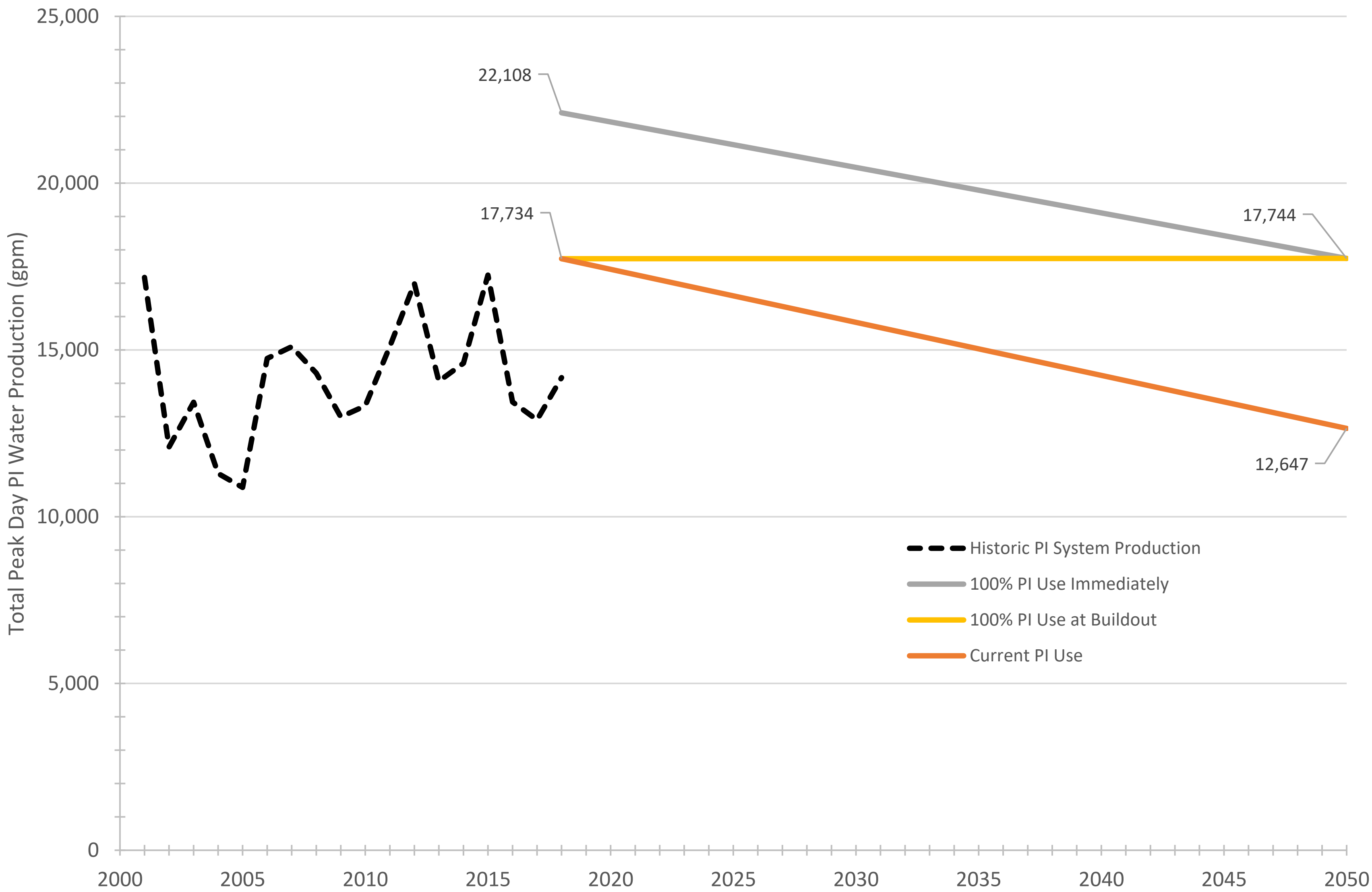


Figure 2-12
Total PI Water Peak Day Production Requirements Projections

CHAPTER 3
WATER SUPPLY PROJECTIONS

This chapter will describe the Company's sources and discuss the adequacy of existing and future supplies to meet the projected demand discussed in Chapter 2. Additional details regarding each of the Company's water sources can be found in Chapters 5 and 6 about existing facilities.

WATER SUPPLY – EXISTING SOURCES

The Company's existing water supply comes from several different sources as shown in the water system schematics (Figures 3-1 and 3-2). Based on best available data and for planning purposes, the Company's culinary sources have been grouped into five categories for production including Jordan Valley Water Conservancy District Supply, Company culinary wells, mountain/Water Treatment Plant (WTP) sources, Metropolitan Water District of Salt Lake and Sandy (MWDSLS), and emergency connections. The Company also has separate PI sources. These sources are discussed and broken down further in the following sections.

Jordan Valley Water Conservancy Company (JVWCD)

The Company has three connections to the JVWCD: one near the WTP, one at Wasatch Boulevard and one at Autumn Ridge (emergency connection), and one at 11400 South and 700 East (emergency connection). Each connection includes a flow meter, pressure reducing valve (except the WTP connection), and isolation valves.

JVWCD provides water to the Company in the form of a 950 ac-ft/year contractual obligation and returning "banked" water to the Company on an 'as needed' basis. The "banked" portion of the water is addressed in the miscellaneous mountain stream category described below. The 950 ac-ft/year obligation to the Company is considered to be the reliable production of this source. Flow from JVWCD is primarily used to help offset peak demands on the culinary system in summer months due to irrigation. Table 3-1 summarizes the Company's water contract with JVWCD.

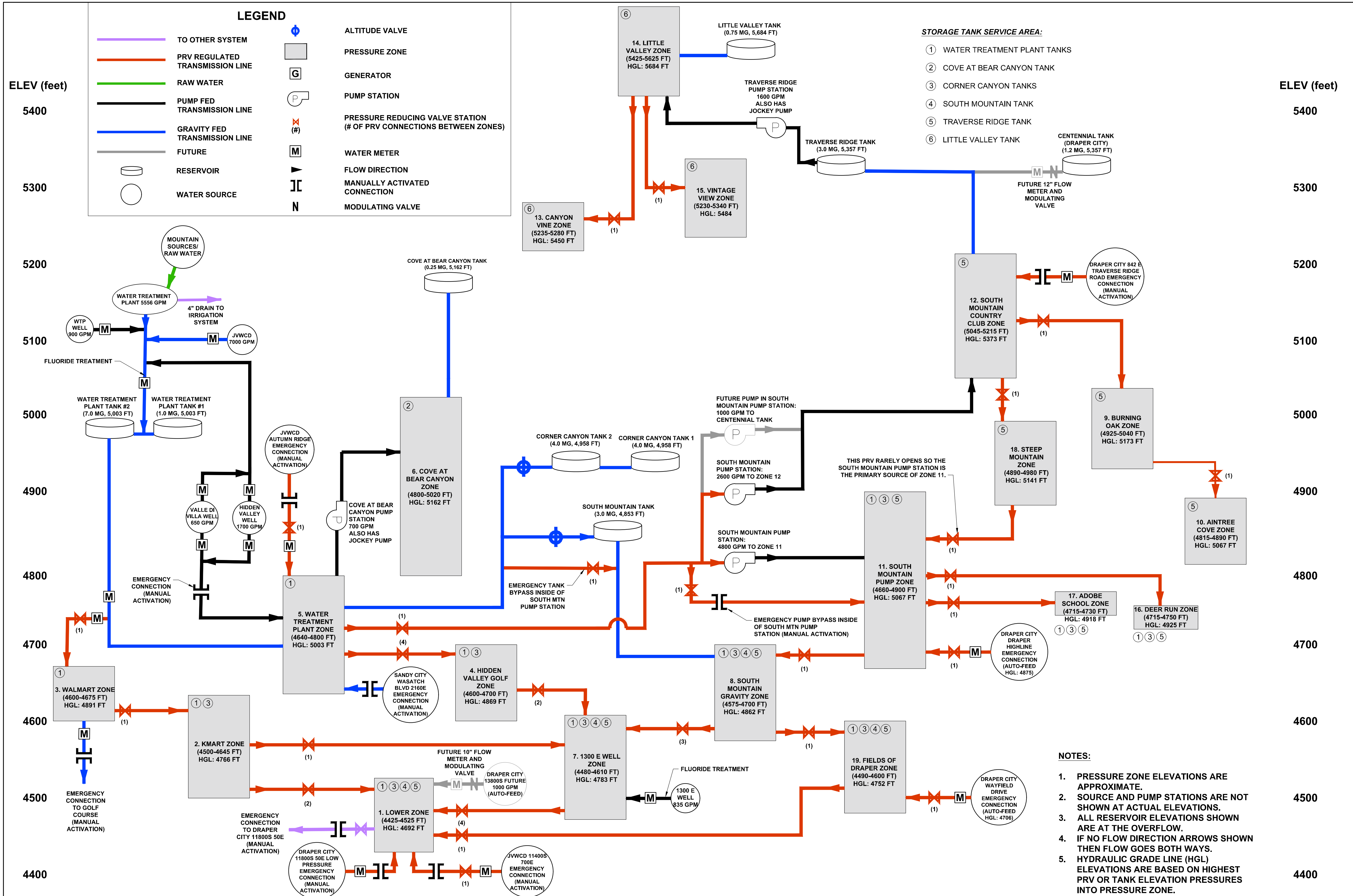
Table 3-1
JVWCD Water Contracted Supply

JVWCD Supply	Annual Volume (acre-ft)	Reliable Flow[2] (gpm)	Maximum Flow (gpm)
Contract Amount	950	589	7,000
"Banked" Amount[1]	As Needed	-	-
Total	**950**	**589**	**7,000**

[1]See 2018 Water Rights Master Plan Section 3 for details about "banked" water supply from JVWCD
[2]Reliable flow is based on a continuous flow of 950 acre-ft over the entire year

Draper Irrigation Company Culinary Groundwater Wells

DIC owns water rights for five groundwater wells: 1300 East Well, Valle Di Villa, Hidden Valley, WTP Well #1 and WTP Well #2. The Company's ability to draw on groundwater is limited not only by water rights (1,476 acre-ft/year), but also by well capacity. To be conservative, it has been assumed that 50 percent of each well's maximum production capacity (the volume that could be produced pumping 365 days per year at the maximum capacity) is available for use as reliable dry year supply.



NOTES:

1. PRESSURE ZONE ELEVATIONS ARE APPROXIMATE.
2. SOURCE AND PUMP STATIONS ARE NOT SHOWN AT ACTUAL ELEVATIONS.
3. ALL RESERVOIR ELEVATIONS SHOWN ARE AT THE OVERFLOW.
4. IF NO FLOW DIRECTION ARROWS SHOWN THEN FLOW GOES BOTH WAYS.
5. HYDRAULIC GRADE LINE (HGL) ELEVATIONS ARE BASED ON HIGHEST PRV OR TANK ELEVATION PRESSURES INTO PRESSURE ZONE.

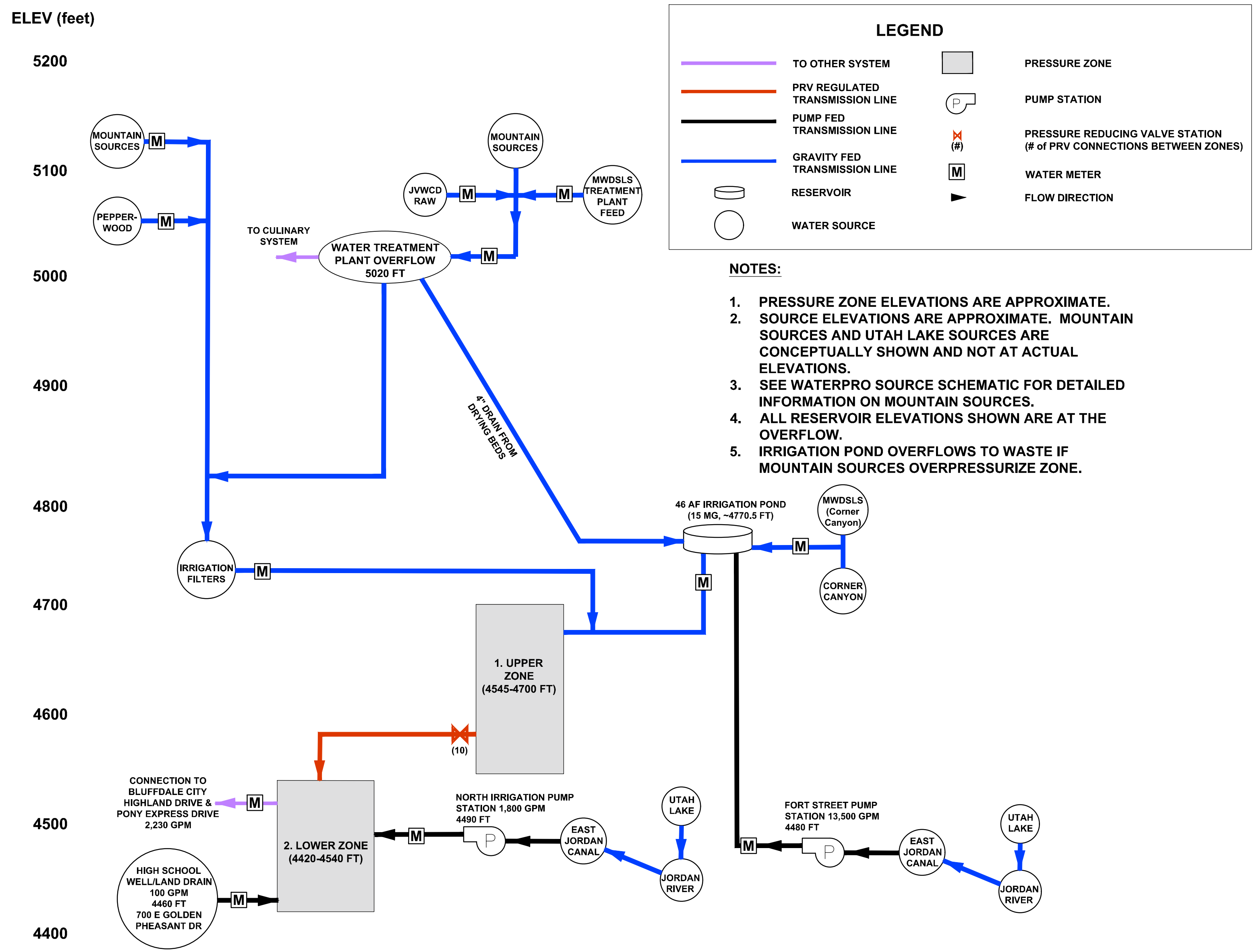
FIGURE NO. 3-1

CULINARY WATER SYSTEM SCHEMATIC

CLIENT: DRAPER IRRIGATION COMPANY

PROJECT: 2019 WATER MASTER PLAN

BOWEN COLLINS & ASSOCIATES



NOTES:

1. PRESSURE ZONE ELEVATIONS ARE APPROXIMATE.
2. SOURCE ELEVATIONS ARE APPROXIMATE. MOUNTAIN SOURCES AND UTAH LAKE SOURCES ARE CONCEPTUALLY SHOWN AND NOT AT ACTUAL ELEVATIONS.
3. SEE WATERPRO SOURCE SCHEMATIC FOR DETAILED INFORMATION ON MOUNTAIN SOURCES.
4. ALL RESERVOIR ELEVATIONS SHOWN ARE AT THE OVERFLOW.
5. IRRIGATION POND OVERFLOWS TO WASTE IF MOUNTAIN SOURCES OVERPRESSURIZE ZONE.

FIGURE NO.
3-2

SECONDARY WATER SYSTEM SCHEMATIC

CLIENT
DRAPER IRRIGATION COMPANY

PROJECT
2019 WATER MASTER PLAN

BOWEN COLLINS & ASSOCIATES

While actual water rights and physical capacity may allow for greater production, this lower yield is recommended for planning purposes to account for two limitations: potential mechanical failure at one or more wells; and low demands during the winter months when full well production is not needed in the system. Table 3-2 shows the existing Company wells and their potential reliable production volumes.

Table 3-2
Groundwater Well Capacities

Well	Maximum Flow[2] (gpm)	Maximum Volume (ac-ft/year)	Reliable Flow (gpm)	Reliable Volume (ac-ft/year)
1300 East Well	835	1,347	418	673
Valle Di Villa	650	1,048	325	524
Hidden Valley	1700	2,742	850	1371
WTP Well #1	900	1,452	450	726
WTP Well #2[1]	-	-	-	-
Total	**4,085**	**6,589**	**2,043**	**3,295**
Reliable Capacity[3]	**-**	**1,476**	**-**	**1,476**

[1]WTP Well #2 is not currently in use.
[2]Well capacities are from company personnel
[3]As total well reliable capacities exceed the total water rights, the total water rights are assumed to be the reliable capacity.

As shown in the table, the total well capacities with the 50% reduction are significantly greater than the existing well water rights of 1,476 ac-ft/year. It should be noted that the Hidden Valley Well has been experiencing significant production issues. Even if that well was permanently offline, the total reliable capacity of the remaining wells is 1,923 ac-ft/year. Therefore, the existing water rights of 1,476 ac-ft/year are considered to be the reliable volume.

Mountain/WTP Sources

The Company has three main other sources of culinary water including Bear Canyon, Corner Canyon, and miscellaneous mountain streams. The grouping of these miscellaneous mountain stream sources includes Bell Canyon, Middle Fork, Rocky Mouth, South Fork Dry, Big Willow, and Little Willow flows. The total reliable yield for the miscellaneous mountain streams also includes the banked water (as described in the 2018 Water Rights Master Plan) from JVWCD. As described in Table 3-8 of the 2018 Water Rights Master Plan, they are reliably able to produce 8,445 ac-ft/year. Per discussions with the Company, these sources can produce 5,556 gpm max flow through the Company's water treatment plant.

Metropolitan Water District of Salt Lake and Sandy (MWDSLS)

Water from MWDSLS is sold to the Company if it is available. While there is currently a significant amount of surplus water available in average water years for purchase, the availability of this water is expected to diminish over time. It is not expected that any surplus water will be available in dry years, either now or into the future. Thus, this water will not be included as a reliable source. This water is mixed with Corner Canyon and Bear Canyon water; so those two metered sources include water delivered from MWDSLS.

Emergency Connections

Several emergency connections to surrounding water systems exist within the Company's culinary system. These surrounding water systems include JVWCD, Draper City, and Sandy City. See Figure 3-1 for connection locations and operations.

Pressure Irrigation (PI) Water Sources

The Company has PI water available from two main sources: Utah Lake/Jordan River/Canal and the land drain. The main source of flows comes from Utah Lake/Jordan River/Canal with a reliable annual yield of 2,992 acre-ft as documented in 2018 WRMP. The challenge with this source is that it is heavily dependent on water in Utah Lake. Issues such as low water levels, algae blooms, etc. could reduce reliability of this source. Based on discussions with Company personnel, the Company is expecting to install a shallow well field in the near future to access water through their Jordan River/Utah Lake water rights and canal shares. Supply from the shallow well field will be blended with reuse water from Jordan Basin Water Reclamation Facility (JBWRF). The Company currently has 5,983 acre-ft/yr of secured water from this source, but only utilizes half or approximately 2,992 acre-ft/yr. The Fort Street and North Irrigation pump stations provide access to Utah Lake/Jordan River water and has a maximum pumping capacity of 15,300 gpm.

Because the land drain has only one year of historical production data, it is difficult to determine its reliable production capacity. Based on discussions with Company personnel, the land drain has a maximum pump capacity of approximately 800 ac-ft/year, but due to various issues, it is not capable of maintaining that production capacity. Company personnel indicated that 79 ac-ft/year (the value from the only data point) is a conservative estimation of its reliable capacity.

Mountain sources can provide a third source for the PI system. However, as described in the 2018 WRMP, all dual system mountain sources were assumed to be completely used for the culinary system.

CULINARY / PI SUMMARY

Table 3-3 summarizes the Company's existing culinary and PI sources.

Table 3-3
Summary of Existing Sources Annual and Peak Capacity

	Culinary			Pressure Irrigation		
Source	**Annual Reliable Capacity (acre-ft)**	**Reliable Flow (gpm)**	**Peak Capacity (gpm)**	**Annual Reliable Capacity (acre-ft)**	**Reliable Flow[3] (gpm)**	**Peak Capacity (gpm)**
JVWCD	950	589	7,000	--	--	--
Wells	1,476	2,043	4,085	--	--	--
Other Culinary Sources	4,409	2,733	5,556	--	--	--
Utah Lake/ Jordan River	--	--	--	2,992	3,680	15,300[2]
Land Drain				79	96	100[1]
Total	**6,835**	**5,365**	**16,641**	**3,071**	**3,776**	**15,400**

[1]Land drain peak pumping capacity obtained from Company personnel
[2]Fort Street and North Irrigation pump stations combined maximum flow as reported by the Company
[3]Reliable flow determined by converting reliable annual capacity to gpm assuming 184 irrigation days

ANNUAL WATER SUPPLY & PRODUCTION REQUIREMENTS

Table 3-4 compares the existing source capacity to existing production requirements.

Table 3-4
Summary of Existing Source Annual Supply vs Production Requirement

Source	Reliable Annual Capacity (acre-ft)	Annual Production Requirement (acre-ft)	Surplus (Deficit) (acre-ft)
Culinary			
JVWCD	950	--	--
Wells	1,476	--	--
Other Culinary Sources	4,409	--	--
Total Culinary: Current PI Use Rate	6,835	7,371	(536)
Total Culinary: 100% PI Use at Build-out		7,371	(536)
Total Culinary: 100% PI Use Immediately		5,208	1,627
Pressure Irrigation			
Utah Lake/Jordan River	2,992	--	--
Land Drain	79	--	--
Total PI: Current PI Use Rate	3,071	7,000	(3,929)
Total PI: 100% PI Use at Build-out		7,000	(3,929)
Total PI: 100% PI Use Immediately		8,776	(5,705)

The type of sources and timing of development needed by the Company is dependent on rate of growth of the various types of demand within the Company. Culinary water demands are primarily a function of population or employment growth within the Company service boundaries. The rate of growth of PI water demand within the Company is dependent on the utilization rate of the PI system expansion and the number of metered connections within the Company. As a result, several phasing scenarios, as described in the previous chapter were developed for evaluating the projected production requirements of both systems:

- **Existing PI Use** – This is not a realistic scenario for the Company but will provide a lower bound for future impact fee determinations. This scenario assumes that the existing amount of culinary outdoor watering in areas where the culinary and PI systems overlap remains unchanged.
- **Immediate 100% PI Use** – This is not a realistic scenario for the Company but will provide an upper bound for future impact fee determinations. This scenario assumes that all users who have access to the PI system immediately begin to use it for all outdoor watering.
- **Build-out 100% PI Use Rate** – This scenario assumes that conversion to the PI system happens gradually through build-out in 2050 and then increases production requirements for system growth as education and awareness of water conservation improves within the Company's users.

As shown in Table 3-4, nearly all scenarios being evaluated have a supply deficit for the production requirements presented in Chapter 2. New sources are required in both the culinary and PI systems to meet the needs of the existing systems and prevent deficits in the future.

WATER SUPPLY – FUTURE SOURCES

There are a variety of options to secure new water, however the Company has indicated three primary alternatives that have already been investigated by the Company. These alternatives are: new groundwater rights, development of a shallow well system, and reuse of wastewater treatment plant effluent. Any future source to be acquired should be evaluated for its capacity to supply water during the Company's summer peak usage time. Potential future sources are summarized in Table 3-5 and described in more detail below.

Table 3-5
Summary of Future Sources for Culinary and PI Systems

Source	Reliable Culinary Annual Capacity (acre-ft)	Reliable PI Annual Capacity (acre-ft)
Existing		
JVWCD	950	--
Wells	1,476	--
Other Culinary Sources	4,409	--
PI Sources	--	3071
Subtotal - Existing	**6,835**	**3,071**
Future		
New Groundwater/Well Rights	400	--
Shallow Groundwater Wells	--	2,992[1]
Wastewater Treatment Plant Reuse	--	3,000
Subtotal - Future	**400**	**5,992**
Total	**7,291**	**9,063**

[1]Development of new shallow groundwater wells will allow Utah Lake water right unreliable flow to become reliable

New Groundwater/Well Rights – The Company has been acquiring new groundwater rights and transitioning points of diversion from other rights to its existing wells for many years. As water obtained from wells is typically more reliable than surface water, continuing to acquire more groundwater rights would be recommended. The Company has discussed the potential availability of approximately 400 ac-ft/year of ground water suitable for use in the culinary system that could be acquired in the near future.

Shallow Groundwater Well System – As shown in Figure 3-4, the current PI system water from the Utah Lake/Jordan River and the East Jordan Canal are utilizing half of the full water right and canal share volumes for the reliable yield. Due to the much more reliable nature of groundwater, these existing water assets could be shown as fully available and provide an additional 2,992 acre-ft/yr if a shallow well field is constructed that would allow transferring the points of diversion of the existing secured water to the shallow well system. Appropriate sizing of the well field is critical to potentially allowing all of the secured water volume to be reliably obtained in the future.

Wastewater Treatment Plant Reuse Water – The Company is actively pursuing opportunities for wastewater reuse. Based on preliminary discussions with South Valley Sewer District and previous investigations by the Company, potential reuse of treated wastewater effluent could result in up to approximately 3,000 ac-ft/year of additional water supply. This water would be used in the existing PI system and would yield the same amount of water in both dry and average water years, potentially resulting in the full 3,000 ac-ft/year being considered the reliable supply.

Since this reuse water will be utilized for the PI system, it is anticipated to be primarily needed during the summer months. The production of the wastewater to be treated by South Valley Sewer District will be year-round at a relatively constant rate since it is produced as a function of indoor water use.

Additional infrastructure to deliver the reuse water to the Company will be needed. The Company's implementation of those infrastructure improvements will require the cooperation of other entities in the region that also could benefit from making reuse water available.

Annual Supply Conclusions

Culinary water and PI annual demands are compared to annual supplies through the year 2050 in Table 3-6, Figure 3-3 and Figure 3-4 below. Several observations can be made from these figures:

1. **Annual Culinary Water:**
   a. There is an existing reliable source yield deficit compared to the required production of approximately 536 acre-ft/yr, even if all sources that have potential to serve both the culinary and PI systems are being fully utilized by the culinary system.
   b. If the current culinary outdoor use trends continue in areas where PI is available, the Company appears to have a reliable source supply build-out deficit of approximately 394 acre-ft/yr. The Company should encourage more use of the PI system for irrigation through advertising, rate structure, and incentives.
   c. The Company's existing sources are projected to meet annual production requirements at build-out (with an approximately 1,618 acre-ft surplus) if all culinary outdoor watering needs within the PI service boundaries are satisfied by the PI system.

2. **Annual Pressure Irrigation Water:**
   a. There is an existing deficit of reliable source yield compared to the required production of approximately 3,929 ac-ft/year. This deficit increases to approximately 3,934 ac-ft/year at build-out if the PI use rate within the area where the culinary and PI systems overlap increases to 100%. This deficit is almost entirely the result of the assumed 50% reduction of 50% Utah Lake water yield in a drought year.
   b. Completing the Company's planned shallow well and reuse project would shore up the yield of the existing Utah Lake water assets and result in a system able to meet projected demands at current PI use rates and 100% conversion of overlapped areas.
   c. Historic PI annual usage has trended down for the past 5 of 6 years. The historic downward trend likely results from a combination of some users' reluctance to utilize the PI system due to perceived water quality issues, increased metering of PI water, and the general trend toward water conservation.

Table 3-6
Summary of Build-Out Source Annual Supply vs Production Requirement

Source	Reliable Annual Capacity (acre-ft)	Annual Production Requirement (acre-ft)	Surplus (Deficit) (acre-ft)
Culinary			
JVWCD	950	--	--
Wells	1,476	--	--
Other Culinary Sources	4,409	--	--
New Groundwater/Wells	400	--	--
Total Culinary: Current PI Use Rate	7,235	7,629	(394)
Total Culinary: 100% PI Use at Build-out		5,617	1,618
Total Culinary: 100% PI Use Immediately		5,617	1,618
Pressure Irrigation			
Utah Lake/Jordan River/Canal	--	--	--
Land Drain	79	--	--
Shallow Groundwater Wells	5,984	--	--
Wastewater Treatment Plant Reuse	3,000	--	--
Total PI: Current PI Use Rate	9,063	4,992	4,071
Total PI: 100% PI Use at Build-out		7,004	2,059
Total PI: 100% PI Use Immediately		7,004	2,059

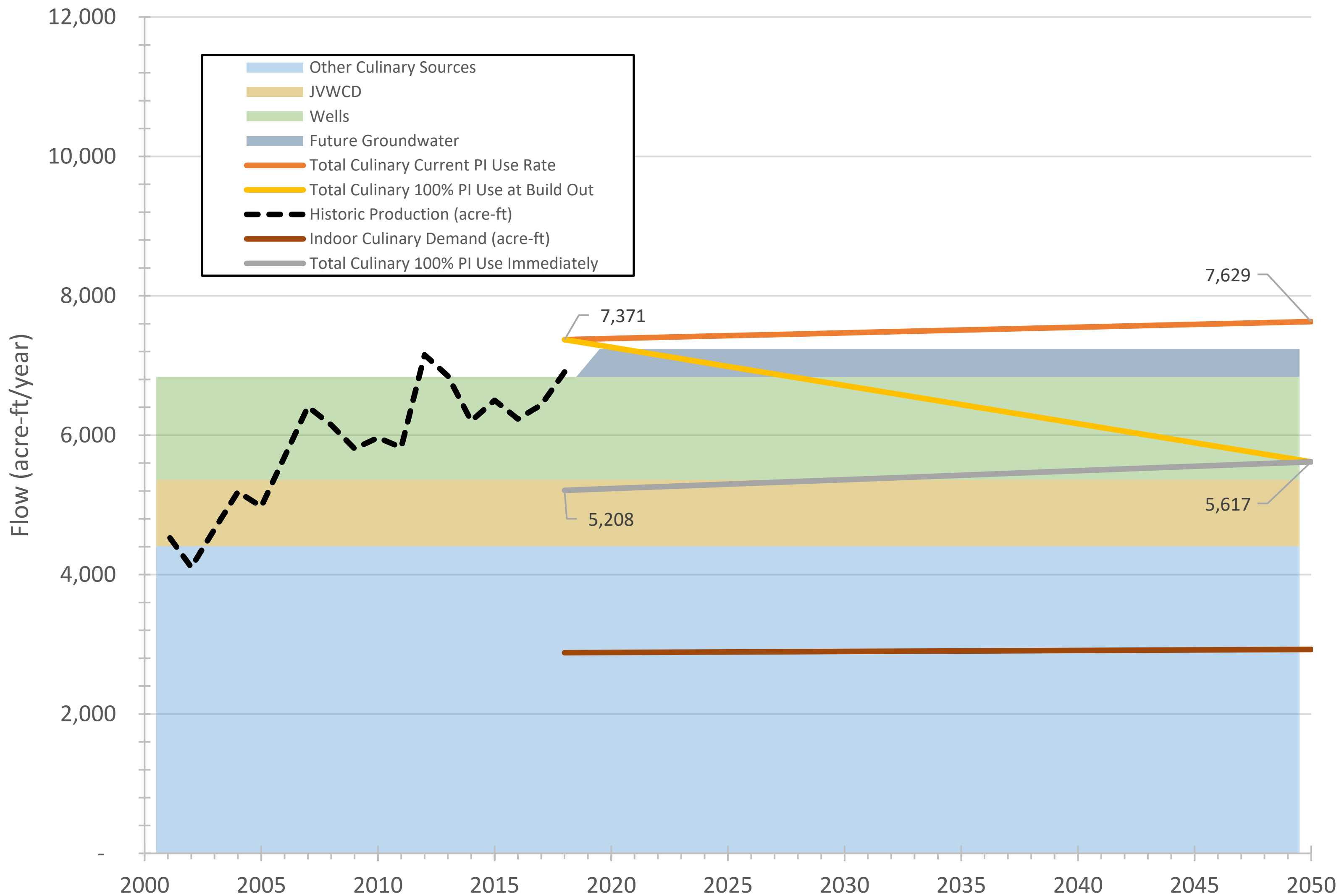


Figure 3-3
Annual Culinary Production Requirements

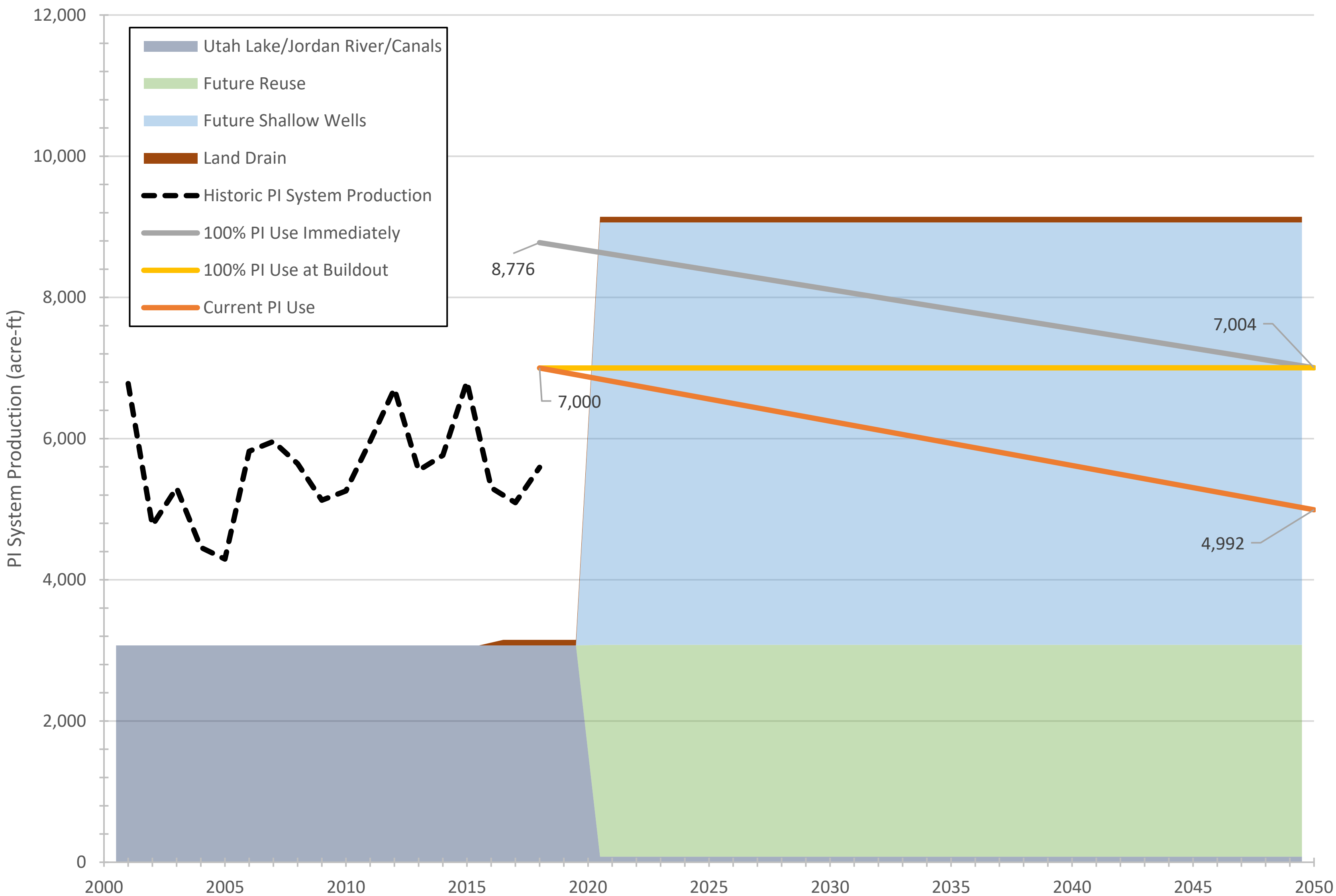


Figure 3-4
Annual PI Production Requirement

PEAK DAY WATER SUPPLY & DEMAND

Table 3-7 summarizes the existing and potential supplies that the Company may be able to use to meet its future annual demands.

Peak Day Supply Conclusions

Peak day culinary water and PI demands are compared to peak supplies through the year 2050 in Table 3-7, Figure 3-5 and Figure 3-6 below. Several observations can be made from these figures:

1. **Peak Day Culinary Water:**
    a. There is an existing peak day surplus compared to the required production of approximately 4,715 gpm.
    b. If the current culinary outdoor use trends continue in areas where PI is available, the Company peak day surplus reduces to approximately 4,544 gpm.
    c. The Company's existing sources are projected to meet peak day production requirements at build-out (with an approximately 7,799 gpm surplus) if all culinary outdoor watering needs within the PI service boundaries are satisfied by the PI system.

2. **Peak Day Pressure Irrigation Water:**
    a. There is an approximately 2,334 gpm existing deficit of peak day capacity compared to the required production at the current PI use rate. This deficit becomes a build-out surplus of 3,161 gpm if the current PI use rate is maintained in the system. Under that same scenario, the culinary system has an existing peak day demand surplus of 4,715 gpm. Thus, the WTP is capable of routing the needed surplus culinary flow into the PI system to resolve the deficit.
    b. The build-out deficit is 1,936 gpm if the PI use rate within the area where the culinary and PI systems overlap increases to 100% in the overlapped area. This surplus is a reduction to the existing deficit of 2,334 gpm because of the introduction of new PI sources. Under that same scenario, the culinary system would have a build-out peak day demand surplus of 7,799 gpm. Thus, the WTP would be capable of routing the needed surplus culinary flow into the PI system.

Table 3-7
Summary of Source Peak Day Capacity vs Production Requirement

Source	Existing Peak Day Capacity (gpm)	Existing Peak Day Production Requirement (gpm)	Existing Surplus (Deficit) (gpm)	Build-Out Peak Day Capacity (gpm)	Build-Out Peak Day Production Requirement (gpm)	Build-Out Surplus (Deficit) (gpm)
Culinary						
JVWCD	7,000	--	--	7,000	--	--
Wells	4,085	--	--	4,085	--	--
Other Culinary Sources	5,556	--	--	5,556	--	--
New Groundwater/Wells[2]	--	--	--	248	--	--
Total Culinary: Current PI Use Rate	16,641	11,926	4,715	16,889	12,345	4,544
Total Culinary: 100% PI Use at Build-out		11,926	4,715		9,090	7,799
Total Culinary: 100% PI Use Immediately		8,428	8,213		9,090	7,799
Pressure Irrigation						
Utah Lake/Jordan River[3]	15,300	--	--	--	--	--
Land Drain	100	--	--	100	--	--
Shallow Groundwater Wells[1]	--	--	--	15,708	--	--
WTP Reuse[1]	--	--	--		--	--
Total PI: Current PI Use Rate	15,400	17,734	(2,334)	15,808	12,647	3,161
Total PI: 100% PI Use at Build-out		17,734	(2,334)		17,744	(1,936)
Total PI: 100% PI Use Immediately		22,108	(6,708)		17,744	(1,936)

[1]Build-out peak day capacity determined by 35 cfs project future flow from shallow wells and reuse water as defined in 2018 Reuse and Shallow Groundwater Cost Feasibility Study
[2]Build-out peak day capacity determined by converting annual capacity to gpm assuming 365 days
[3]Includes Fort Street and North Irrigation pump stations

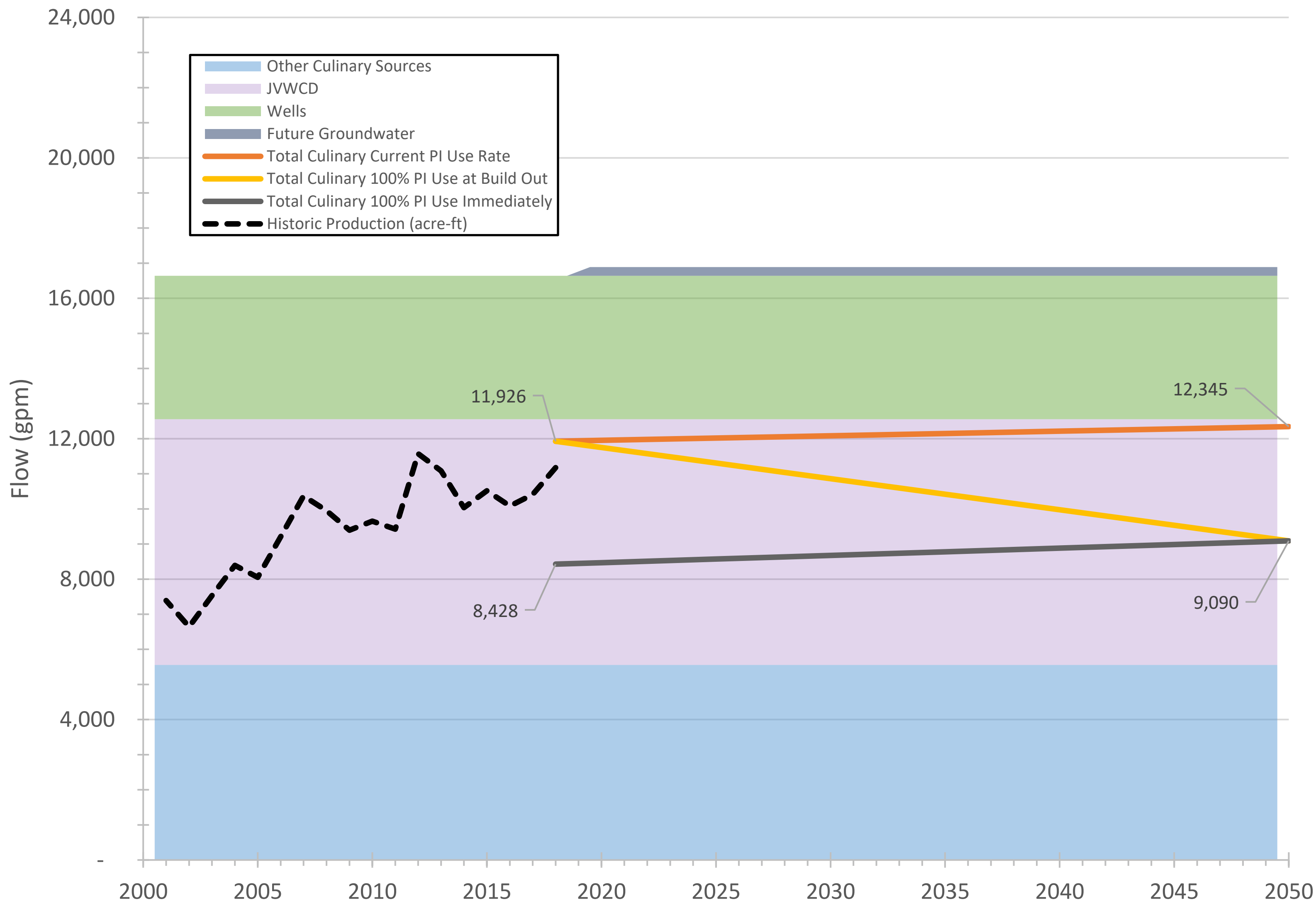


Figure 3-5
Peak Day Culinary Capacity Requirements

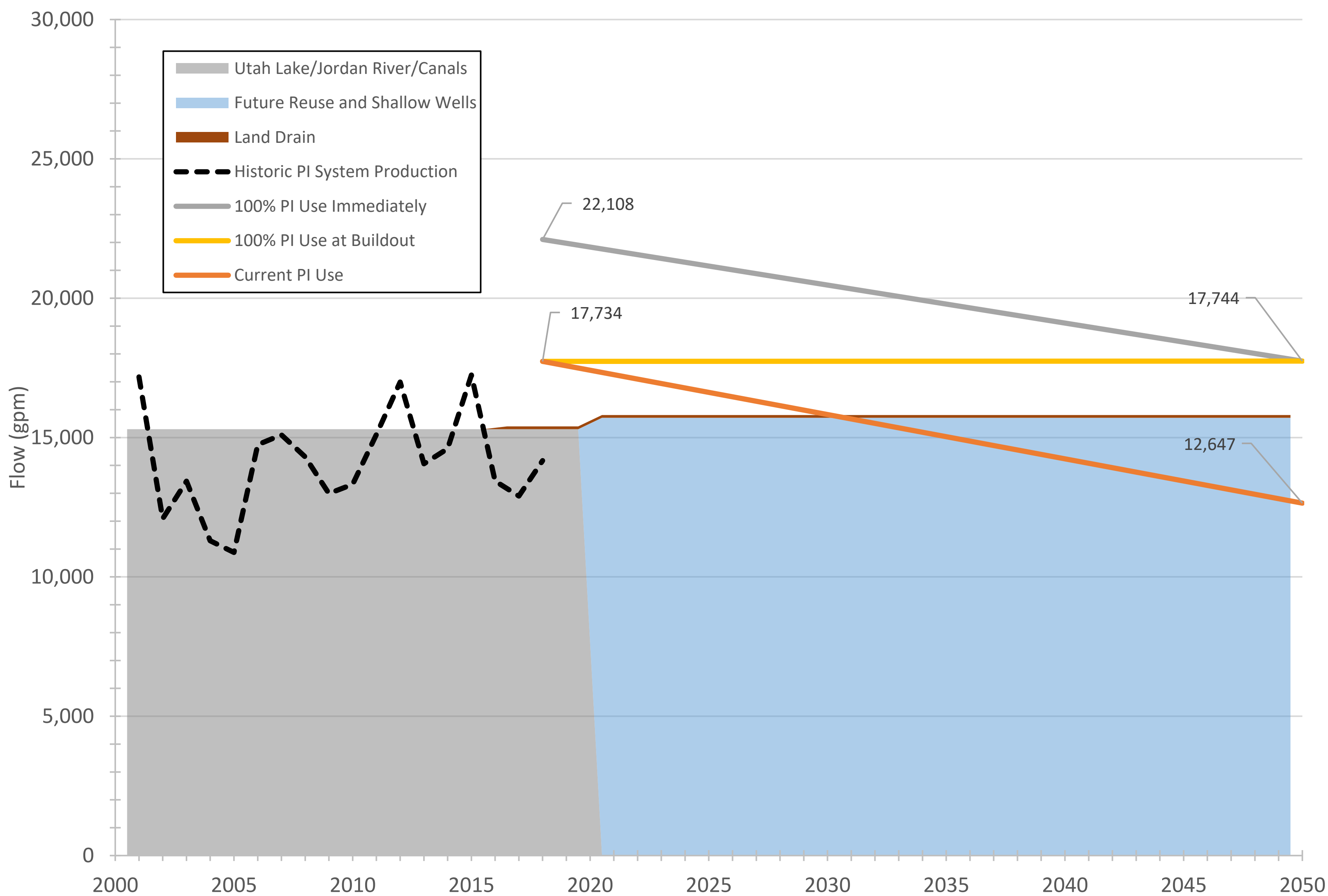


Figure 3-6
Peak Day PI Capacity Requirements

CHAPTER 4
WATER SUPPLY VARIATION – NOW AND IN THE FUTURE

The information presented in Chapters 2 and 3 of this report is based on the some of the most up-to-date data available. Intrinsic to this analysis is the assumption that sources are expected to produce well into the future in accordance with past performance. This begs questions such as:

- Is the modern historical record sufficient to account for variation in water availability to be used for planning purposes?
- Will climate change or other factors likely affect water availability or system demands and, if so, in what ways?

This chapter is dedicated to considering these types of questions to better inform the conclusions reached elsewhere in this report, and ultimately to assist the Company in understanding the long-term water supply and demand characteristics of their system inclusive of these types of considerations.

GROUNDWATER

The Company is intending to continue proactive well maintenance to protect well production and prevent well degradation. It is recommended that well production and yields be monitored closely for variations year to year. If yields decrease, a future well study and/or well replacement may be required. For now, the wells are functioning adequately and the values identified in Chapter 3 appear to be the best available information.

UTAH LAKE/CANALS

There are two potential problems with canal water delivered from Utah Lake: natural variability, and water quality concerns.

- **Natural Variability.** Natural variability may reduce the amount of volume to users per share of irrigation water. During droughts, canal companies may reduce the volume available per share. In times past, it has not been uncommon for canal companies to reduce their yield per share by up to 20 percent in drought years. In extreme events, yield has been reduced even more. Based on the 2018 WRMP, the reliable yield of the Utah Lake/Canal water sources are 50 percent of their maximum amount.
- **Water Quality.** Water quality is a main concern for water coming from Utah Lake through the canal system. Concerns include algae blooms, TDS, salts and other debris such as snails, worms, fish, etc. It is unknown if recent algae blooms in Utah Lake are primarily caused by recent isolated water quality problems, water quality problems that have accumulated over years, or if climate change is impacting temperatures to increase the frequency of algae blooms at Utah Lake. There are two potential alternatives to mitigate potential problems with canal water that comes from Utah Lake: provide treatment or provide sufficient mixing water to dilute issues with water quality. The Company is currently settling and treating all water from Utah Lake with algaecide to improve water quality for its customers. The Company is also pursuing reuse and shallow groundwater wells as described in Chapter 3 to improve reliability and water quality, in the PI system.

JVWCD

The Company's existing 950 acre-ft/yr contract with JVWCD is considered reliable for planning purposes because JVWCD has its own contingencies to account for source interruption and climate variability.

REUSE WATER

The Company is investigating the feasibility of reusing treated wastewater in their PI system as another source. Indoor water conservation has the potential to reduce available reuse water. However, demand for irrigation water would likely be reduced concurrently with indoor conservation efforts but at a greater rate. So reuse water reduction would be a negligible risk for the Company.

MOUNTAIN SOURCES

The grouping of these miscellaneous mountain stream sources includes Bell Canyon, Middle Fork, Rocky Mouth, South Fork Dry, Big Willow, and Little Willow flows. Ideally, production data over a span of many years would be desirable to estimate historically drier years and determine reliable flows. Unfortunately, only the grouping of these miscellaneous mountain stream sources includes Bell Canyon, Middle Fork, Rocky 2 to 6 years of data is available for all sources except Big Willow (which has 13 years of data available for analysis). Due to its longer period of record, it was assumed that Big Willow could be used as a gauge of the reliability of flows for the other mountain streams. See the 2018 WRMP for a more detailed evaluation of mountain source reliability and variation.

CLIMATE CHANGE

The earth is presently undergoing a warming trend. The warming appears to coincide with the results of many climate models predicting global warming. Locally, if you examine Salt Lake City Airport average temperatures in June, July, and August from 1948 to the present it shows an average temperature increase of 4.7 degrees Fahrenheit. Climate change can affect water supplies in a number of different ways. It can cause a change in overall precipitation in the watershed, less precipitation in the form of snow, earlier spring runoffs, and increases in outdoor demand because of the longer and warmer growing season.

The impact of climate change on supply has generally been discussed in the sections above, but the Company should also consider the potential impact on system demands. A study was prepared by JVWCD in 2017 titled "Preparing for Climate Change – A Management Plan". In this study, JVWCD hired Western Water Assessment to determine the impacts of climate change on demand. The results of this study showed that demand on their system could increase from between 2 and 17.4 percent. JVWCD used a number of 9.7% for climate change impacts to water demand, which was the midpoint of that range.

While the available data is limited, it appears that climate change could have a significant impact on the Company's water supply plan. The Company may desire to consider these potential impacts to the system in future studies as more data becomes available.

CHAPTER 5
EXISTING CULINARY WATER FACILITIES

EXISTING SERVICE AREA AND TOPOGRAPHY

Draper Irrigation Company provides culinary and pressure irrigation (PI) water for residents within its service boundaries as shown in Figure 2-1. The Company's existing culinary service area is approximately 12.3 square miles and is bordered by the following: the Wasatch Mountain Range to the east and south, Sandy City to the north, and Bluffdale City to the west. The Company's existing PI service area is approximately 8.05 square miles and is bordered by the same entities as the culinary system. The topography of the Company generally slopes from east to west such that most of the Company storage reservoirs are located near the eastern and southern sides of the service area along the base of the Wasatch Mountains.

In 2018, the Company's culinary service area included a population of approximately 30,000 permanent residents. In addition to permanent residents, the Company also serves many commercial, industrial, and institutional entities. The east side of the Company is largely residential and is mostly built out. The west side of the Company is mostly commercial and industrial with some residential areas. The system is mostly build-out with small areas of space available for future development throughout the entire system. Figure 3-1 shows a schematic of how the sources, storage reservoirs, and pump stations in the Company are connected.

CULINARY SOURCES

Wells

Of the 5 existing culinary wells in the Company's water system, only 4 are actively used. All except one (1300 East well) are not directly pumped into the culinary system. Most active wells are not used directly because they require water treatment/water blending before they may be used in the Company's culinary water system. Valle Di Villa and Hidden Valley wells are able to feed the culinary system directly in an emergency scenario but require blending with treated water during normal operation. The older of the two water treatment plant wells deteriorated over time and is no longer in use. All wells in the system have connection capabilities to a portable generator in case of a power outage. Table 5-1 lists the historic capacity of each of the wells along with the reliable capacity as described in Chapter 3.

Table 5-1
Existing Culinary System Wells

Name	Historic Capacity (gpm)	Reliable Capacity (gpm)
WTP Well	900	450
1300 East Well	835	418
Valle di Villa Well	650	325
Hidden Valley Well	1,700	850
Total		**2,043**

Water Treatment Plant

The Company's WTP uses an ultrafiltration membrane system originally installed in 2004 with significant upgrades and membrane replacement in 2014. The plant is completely owned and operated by DIC and is the main water supply for the culinary system. With a capacity of 8 MGD, the plant treats surface water runoff from seven canyons in the Wasatch Front and groundwater from an onsite well. Table 5-2 summarizes the main characteristics of the Company's WTP.

Table 5-2
Water Treatment Plant Overview

Water Treatment Plant Component	Quantity
First Year of Operation	2004
Wells Treated/Blended	3
Surface Water Canyons Sources Treated	7
Finished Water Tank Size (MG)	8.0
Treatment Capacity (MGD)	8.0

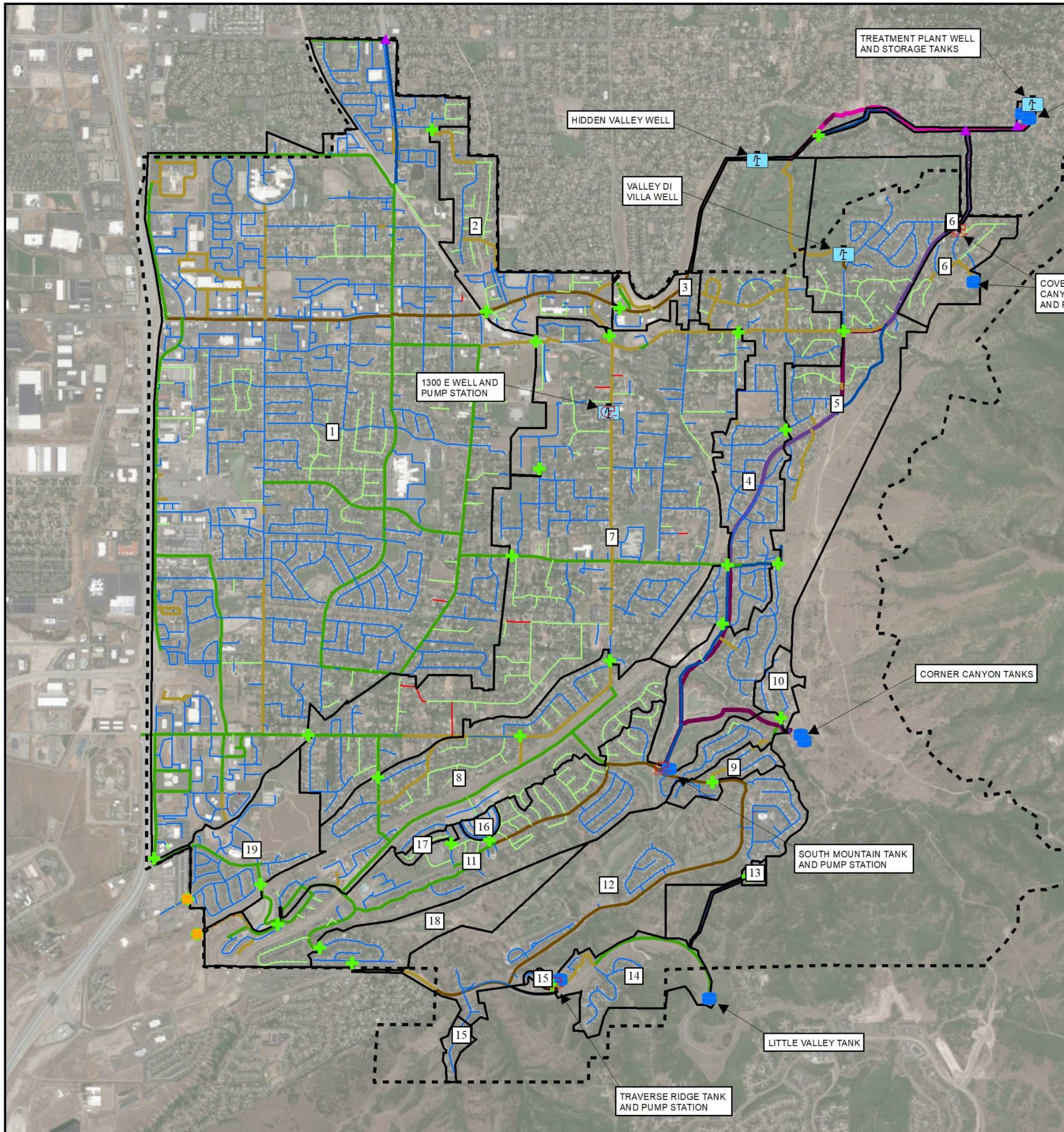
The amount of water treated varies depending on total system demands and the quantity/quality of raw water being received from the mountain sources. Flow from the plant is used throughout the Company, but first enters the Company system in the WTP Zone (at northeast end of the service area) as shown in Figure 2-7. The WTP has an on-site emergency backup generator and is able to operate during a power outage.

Jordan Valley Water Conservancy District

The Company has three physical connections to the Jordan Valley Water Conservancy District (JVWCD) as described in Chapter 3. The connections are located near 700 East and 11400 South, Autumn Ridge Drive and Wasatch Boulevard, and the Water Treatment Plant. The Water Treatment Plant connection is the Company's primary connection for supply, but all three connections are equipped with flow meters. The 700 East and 11400 South connection is also equipped with a pressure reducing valve. The JVWCD supply is connected to the Lower and WTP pressure zones. Peak capacity through the connections is approximately 7,000 gpm.

CULINARY STORAGE FACILITIES

The Company has storage reservoirs in five of its nineteen culinary water pressure zones. Figure 3-1 shows how each of the storage facilities is connected within the Company's water system. Figure 3-1 also shows which pressure zones are capable of being fed by each storage reservoir. Table 5-3 summarizes the characteristics of each storage facility. Figure 5-1 shows the location of the storage facilities within the Company service area.



Zone Number	Zone Name
1	Lower Zone
2	K-Mart Zone
3	Walmart Zone
4	Hidden Valley Golf Zone
5	Water Treatment Plant Zone
6	Cove at Bear Canyon
7	1300 East Well Zone
8	South Mountain Gravity Zone
9	Burning Oak Zone
10	Aintree Cove Zone
11	South Mountain Pump Zon
12	South Mountain Country Club Zone
13	Canyon Vine Zone
14	Little Valley Zone
15	Vintage View Zone
16	Deer Run Zone
17	Adobe School Zone
18	Steep Mountain Zone
19	Fields of Draper Zone

Legend

Culinary System Pipes

- 4 Inch
- 6 Inch
- 8 Inch
- 10 Inch
- 12 Inch
- 14 Inch
- 16 Inch
- 18 Inch
- 20 Inch
- 24 Inch
- 30 Inch
- Culinary Storage Reservoirs
- Pressure Reducing Valve
- Culinary Pump Stations
- Culinary Wells
- Draper City Connections
- JVWCD Connections
- Pressure Zone Boundaries
- Culinary Service Area

NORTH:

SCALE:

1 inch = 2,500 feet

EXISTING CULINARY SYSTEM FACILITIES

DRAPER IRRIGATION COMPANY

2019 WATER MASTER PLAN

BOWEN COLLINS & ASSOCIATES

FIGURE NO.

5-1

P:\Water Pro\093-19-05 Culinary Master Plan\GIS\Figures\Figure 7-1 Existing Culinary System.mxd dschriner 4/21/2020

Table 5-3
Culinary Storage Facilities

Tank Name	Reservoir Location	Storage Volume (MG)	Diameter	Bottom Elevation (ft)	Overflow Level Above Bottom (ft)	Pressure Zone(s) Served by Tank(s)
WTP Tank 1	2558 E Wasatch Blvd Approx (WTP Zone)	1.0	101 ft	4,984.7	18.3	1300 E Well, HV Golf, K-Mart, Lower, Walmart, WTP
WTP Tank 2	2558 E Wasatch Blvd Approx (WTP Zone)	7.0	199 ft	4,972.6	30.5	
Cove at Bear Canyon Tank	2300 E 12300 S Approx (Cove at Bear Canyon Zone)	0.25	50 ft	5,166.0	14.0	Cove at Bear Canyon
South Mountain Tank	1420 E Rambling Rd (South Mountain Gravity Zone)	3.0	185 ft	4,856.0	15.0	Fields of Draper, So. Mtn. Gravity
Traverse Ridge Tank	1107 E 14697 S (South Mountain Country Club Zone)	3.0	140 ft	5,342.0	29.0	Adobe School, Aintree Cove, Burning Oak, Deer Run, So. Mtn. Country Club, So. Mtn, Pump, Steep Mtn.
Little Valley Tank	1430 E. Traverse Ridge R. (Little Valley Zone)	0.75	80 ft	5,663.6	20.4	Canyon Vine, Little Valley, Vintage View
Corner Canyon Tank 1	13496 S. Lower Corner Canyon (WTP Zone)	4.0	134 ft	4,919.3	38.7	1300 E Well, HV Golf, K-Mart, Lower, Walmart, WTP
Corner Canyon Tank 2	13496 S. Lower Corner Canyon (WTP Zone)	4.0	134 ft	4,919.3	38.7	
Total		**23.0**				

CULINARY BOOSTER PUMPING FACILITIES

Table 5-4 summarizes the characteristics of the booster pumps within the Company's water system. Due to the varied topography of the Company's service area and the locations of water sources, booster pumps are required to pump water between some pressure zones. All booster stations have onsite backup power or have connection capabilities to a portable generator in case of a power outage.

Table 5-4
Culinary Booster Pump Station Equipment

Booster Stations	Pressure Zone From	Pressure Zone To	Capacity (gpm)	Number of Pumps	Motor Type[1]	Emergency Backup Power
Cove at Bear Canyon	WTP	Cove at Bear Canyon	700	1 duty, 1 backup (40 HP)	Constant	No
South Mountain (To South Mountain Pump Zone)	WTP	South Mountain Pump	4,800	1 duty, 1 backup (250HP)	1 VFD	Stationary 500 KW
South Mountain (to Traverse Ridge Tank)[2]	WTP	South Mountain Country Club	2,600	1 duty, 1 backup (75HP)	1 VFD	Stationary 500 KW
Traverse Ridge	So. Mtn. Country Club	Little Valley	1,600	1 duty, 1 backup (100HP) 1 jockey pump (15HP)	Constant	Exterior quick connect for portable generator

[1] VFD = variable frequency drive. This type of control allows for finer adjustment of flow or pressure.
[2]Future South Mountain to Traverse Ridge Tank will include 2 duty and 1 backup, all 3 with VFDs and increase capacity by 1,000 gpm.

CULINARY DISTRIBUTION PIPING

Table 5-5 lists the culinary pipe diameters and corresponding lengths obtained from the Company's GIS data. Pipe materials include PVC, ductile iron, cast iron, and steel. Location and sizing of distribution pipes are shown in Figure 5-1.

Table 5-5
Culinary Distribution Piping

Diameter (inch)	Length (ft)	Length (miles)	Percentage
4	3,802	0.72	0.43%
6[1]	139,814	26.48	15.79%
8	479,318	90.78	54.14%
10	72,019	13.64	8.13%
12	108,768	20.6	12.29%
14	33,475	6.34	3.78%
16	19,430	3.68	2.19%
18	5,861	1.11	0.66%
20	11,088	2.1	1.25%
24	10,402	1.97	1.17%
30	1,373	0.26	0.16%
Total	**885,350**	**167.68**	**100%**

[1] Length excluded laterals to fire hydrants and fire lines.

CULINARY PRESSURE ZONES

The Company culinary water distribution system is divided into 19 major pressure zones as shown in Figure 5-1. Table 5-6 lists the approximate hydraulic grade setting and peak day demand for each pressure zone (along with the approximate percentage of the system demand in each zone based on 2018 peak day demands).

Table 5-6
Culinary Pressure Zone Summary

ID	Pressure Zones	Approximate Static Hydraulic Grade Line (ft)	Existing Peak Day Demand[1] (gpm)	Existing Percentage of Peak Day Demand (%)
1	Lower Zone	4,693 ft	4,607.1	38.60%
2	K-Mart	4,766 ft	533.6	4.50%
3	Walmart	4,891 ft	32.3	0.30%
4	Hidden Valley Golf	4,869 ft	631.4	5.30%
5	Water Treatment Plant	5,001 ft	1,169.7	9.80%
6	Cove at Bear Canyon	5,179 ft	190.7	1.60%
7	1300 East Well	4,784 ft	968.8	8.10%
8	South Mountain Gravity	4,870 ft	649.1	5.40%
9	Burning Oak	5,173 ft	159.7	1.30%
10	Aintree Cove	5,067 ft	122.6	1.00%
11	South Mountain Pump	5,067 ft	1,470.2	12.30%
12	South Mountain Country Club	5,370 ft	841.1	7.10%
13	Canyon Vine	5,450 ft	0.5	0.00%
14	Little Valley	5,682 ft	125.6	1.10%
15	Vintage View	5,484 ft	38.1	0.30%
16	Deer Run	4,925 ft	42.3	0.40%
17	Adobe School	4,918 ft	38.3	0.30%
18	Steep Mountain	5,142 ft	131.4	1.10%
20	Fields of Draper	4,753 ft	174.4	1.50%
-	**Total**	**-**	**11,927**	**100.0%**

[1]Estimated peak day demand distribution for 2018 based on water billing data.

CHAPTER 6
EXISTING PI WATER FACILITIES

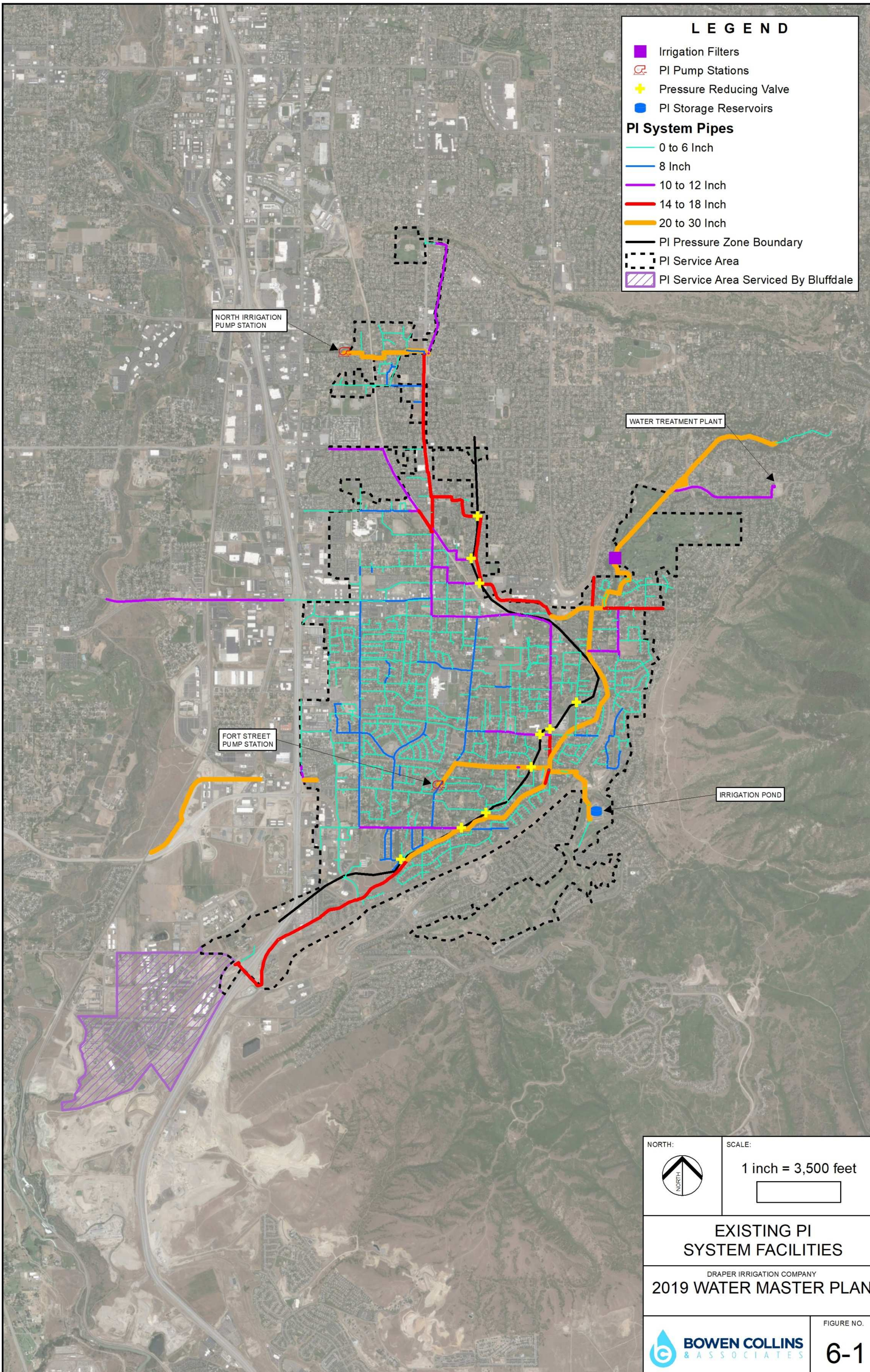
Draper irrigation Company's implemented a pressure irrigation (PI) water system in 1994 to replace flood irrigation practices. The primary goal of the PI water system is to reduce the burden on the culinary water system by replacing high-quality drinking water with lesser-quality water used primarily for irrigation of municipal, residential, and commercial landscaping. The Company has continued to expand its existing PI water pipelines to provide PI water to more users within the Company. As identified in the supply and demand portion of this master plan, additional expansion of the PI water system is critical to long-term water source supply needs within the Company. Table 6-1 summarizes the estimated number of irrigated acres served by the Company since 2001.

Table 6-1
Existing PI Water Service Area

Year	Annual Total PI Irrigation Production (acre-ft)	Estimated Irrigated Area[1] (acres)
2001	6,779	1,695
2002	4,772	1,193
2003	5,302	1,326
2004	4,459	1,115
2005	4,294	1,074
2006	5,821	1,455
2007	5,959	1,490
2008	5,646	1,412
2009	5,128	1,282
2010	5,259	1,315
2011	5,963	1,491
2012	6,707	1,677
2013	5,550	1,388
2014	5,764	1,441
2015	6,806	1,702
2016	5,305	1,326
2017	5,093	1,273
2018	5,593	1,398

[1]Estimated based on irrigation rate of 4.0 acre-ft/irrigated acre/year

The Company currently has approximately 3,175 active connections served by the existing irrigation system as identified in Figure 6-1. Figure 3-2 shows a schematic of how the sources, storage reservoirs, and pump station in the Company are connected.



P:\Water Pro\093-19-05 Culinary Master Plan\GIS\Figures\Figure 8-1 Existing PI System.mxd dschriner 3/26/2020

EXISTING PI SOURCES

Utah Lake, Jordan River & Canals

The Company uses its existing canal shares at a pump station on Fort Street on the East Jordan Canal. The Company also uses water from the Jordan River at its North Irrigation pump station. Both booster stations and their respective equipment are summarized in Table 6-2.

Table 6-2
East Jordan Canal and Jordan River Boosting Capacity

Booster Stations	Water Pumped From	Water Pumped To	Capacity (gpm)	Number of Pumps	Motor Type	Emergency Backup Power Available
Fort Street	East Jordan Canal	Irrigation Pond	13,500	2 duty (4,500 gpm and 2,250 gpm), 2 backup (4,500 gpm and 2,250 gpm)	Constant	No
North Irrigation	East Jordan Canal	Lower Zone	1,800	1 duty, 1 backup (1,800 gpm each)	2 VFDs	No

PI STORAGE FACILITIES

The Company has one existing PI storage reservoir located at 13610 S Corner Canyon. The existing reservoir has dimensions as summarized in Table 6-3. Figure 3-2 shows how the storage facility is connected within the Company's water system.

Table 6-3
PI Storage Facilities

Storage Facility Name	Reservoir Location	Storage Volume (MG)	Dimensions	Bottom Elevation (ft)	Overflow Elevation (ft)	Source
Irrigation Pond	13610 S Corner Canyon	15.0	Irregular	4456.0	4,470.5	Mtn. Sources / Fort St. Booster

PI DISTRIBUTION PIPING

Table 6-4 lists the reported pipe diameters and corresponding lengths in the Draper irrigation Company distribution system. Pipe materials include PVC, ductile iron, and steel. Location and sizing of distribution pipes are shown in Figure 6-1. For comparison, the active length of PI pipe is roughly 72 percent of the length of pipe in the culinary system.

Table 6-4
PI Distribution Piping

Diameter (inch)	Length (ft)	Length (miles)	Percentage
<=4	26,355	4.99	5%
6	304,126	57.60	57%
8	54,654	10.35	10%
10	14,995	2.84	3%
12	40,346	7.64	8%
14	15,633	2.96	3%
15	1,117	0.21	0%
18	16,596	3.14	3%
20	13,948	2.64	3%
24	14,469	2.74	3%
30	24,932	4.72	5%
Unknown	6,348	1.20	1%
Total	**533,519**	**96.05**	**100%**

PI PRESSURE ZONES

The Draper Irrigation Company PI distribution system currently only includes two pressure zones. Table 6-5 lists the approximate static hydraulic grade setting for each pressure zone along with the approximate service percentage of the zone based on 2018 peak day demands.

Table 6-5
PI Pressure Zone Summary

Pressure Zones	Approximate Static Hydraulic Grade Line (ft)	Existing Peak Day Demand[1] (gpm)	Existing Percentage of Peak Day Demand (%)
Upper	4,780 ft	4,593	25.90
Lower	4,665 ft	13,140	74.10

[1]Estimated peak day demand distribution for 2018 based on existing model demand distribution for the current PI use rate

`

CHAPTER 7
STORAGE EVALUATION

The purpose of this chapter is to evaluate the Company's water storage capacity. This chapter provides an overview of State rules and regulations pertaining to public water system storage facilities. As part of this evaluation, the size and location of existing storage reservoirs was analyzed to determine if the Company has sufficient storage to adequately meet peak demands and to provide emergency and fire flow storage.

STORAGE EVALUATION CRITERIA

Regulations regarding required system storage are found in Section R309-510-8 of the Utah Administrative Code. The first portion of the code outlines the types of storage required:

> "(1) General. Each public water system, or storage facility serving connections within a specific area, shall provide:
>
> > (a) equalization storage volume, to satisfy average day demands for water for indoor use and irrigation use,
> >
> > (b) fire flow storage volume, if the water system is equipped with fire hydrants intended to provide fire suppression water or as required by the local fire code official, and
> >
> > (c) emergency storage, if deemed appropriate by the water supplier or the Director."

Each of these storage components is discussed below for both culinary and PI water.

Culinary Water Storage

The State of Utah is in the midst of adopting new regulations for defining equalization storage with respect to drinking water (culinary water). Under these new regulations, system-specific source and storage requirements will be defined for each system. Under historic regulations, equalization storage requirements were defined in the code as follows:

> "(2) Equalization Storage.
>
> > (a) All public drinking water systems shall provide equalization storage. The amount of equalization storage varies with the nature of the water system, the extent of irrigation use, and the location and configuration of the water system.
> >
> > (b) Table 510-4 lists required equalization storage for indoor use. Storage requirements for non-community systems not listed in this table shall be determined by calculating the average day demands from the information given in Table 510-2.

Table 510-4
Storage Volume for Indoor Use

Type	Volume Required (gallons)
Community Systems	
Residential; per single resident service connection	400
Non-Residential; per Equivalent Residential Connection (ERC)	400
Non-Community Systems	
Modern Recreation Camp; per person	30
Semi-Developed Camp; per person	
a. with Pit Privies	2.5
b. with Flush Toilets	10
Hotel, Motel and Resort; per unit	75
Labor Camp; per unit	25
Recreational Vehicle Park; per pad	50
Roadway Rest Stop; per vehicle	3.5
Recreational Home Development (i.e., developments with limited water use); per connection (See Note 2 in Table 510-1)	400

(c) Where a drinking water system provides water for irrigation use, Table 510-5 shall be used to determine the minimum equalization storage volumes for irrigation. The procedure for determining the map zone and irrigated acreage for using Table 510-5 is outlined in R309-510-7(3).

Table 510-5
Storage Volume for Irrigation Use

Map Zone	Volume Required (gallons/irrigated acre)
1	1,782
2	1,873
3	2,528
4	2,848
5	4,081
6	4,964

Calculated Need for Drinking Water Equalization Storage. From this section of code, there are two important issues to highlight. The first is described in the following sentence:

> "The amount of equalization storage varies with the nature of the water system, the extent of irrigation use, and the location and configuration of the water system."

Staff at the Division of Drinking Water have interpreted this to mean that the need for equalization storage will vary between systems. This means that, where reliable water use data exists, the volume of equalization storage needed should be calculated based on actual water use patterns. Based on Company source production records, a demand pattern was calculated for the culinary system. Source production records included 15-minute data for the entire year of 2018 for flows entering the culinary system at the water treatment plant and 1300 East well. These are the only two places that flow enters the culinary system under normal operating conditions and provides the best representation of demand patterns from the data available.

Table 7-1 and Figures 7-1 and 7-2 show the indoor and indoor plus outdoor demand patterns for the Company. Indoor demand is considered to represent winter conditions in the system when outdoor irrigation is not taking place. Indoor demand was calculated using 15-minute flow data for the months of January, February, March, November, and December in 2018. Indoor plus outdoor demand represents summer months when the highest flows are observed in the system due to outdoor irrigation. Indoor plus outdoor demand was calculated using 15-minute flow data for the months of May through September in 2018.

The indoor demand pattern followed an expected trend of peaking in the middle of the morning and dropping below average overnight. As can be seen in the indoor plus outdoor Figure 7-2, water demands peak in the early morning hours when most people are irrigating their lawns. Demand then drops off significantly during the day as water use is primarily limited to relatively smaller indoor uses. It should be noted that the outdoor diurnal pattern for users who use the culinary system for both indoor and outdoor use are likely higher than shown in the table and figure below. This is because users who utilize the culinary system for indoor use and utilize the PI system for outdoor use will dampen the summer peak seen in the culinary system.

While demands vary significantly during the day, the same is not true for most water sources. It is usually most economical to size sources, major conveyance pipelines, and pump stations to produce water at a relatively constant peak day demand rate. Storage is then used to satisfy any demands above the rate of supply.

The patterns shown in Table 7-1 are for existing conditions. Indoor diurnal patterns are not expected to change at build-out. However, the outdoor plus indoor pattern for the culinary system is expected to trend towards the indoor pattern as more users switch to the PI system for irrigation use and reduce demand on the culinary system.

Table 7-1
Existing Culinary Demand Pattern

Hour	Indoor Peaking Factor	Outdoor + Indoor Peaking Factor
0	0.62	1.25
1	0.54	1.29
2	0.50	1.28
3	0.46	1.31
4	0.45	1.44
5	0.56	1.50
6	0.87	1.42
7	1.16	1.24
8	1.24	1.06
9	1.32	0.89
10	1.33	0.79
11	1.25	0.71
12	1.23	0.69
13	1.21	0.67
14	1.20	0.66
15	1.17	0.64
16	1.20	0.63
17	1.19	0.64
18	1.19	0.69
19	1.19	0.77
20	1.20	0.87
21	1.15	1.07
22	1.00	1.23
23	0.76	1.24
24	0.62	1.25

With this in mind, Figure 7-2 shows the difference between demand and supply throughout a peak day of demand during irrigation season, which is when the peak day normally occurs. During the hours of greatest demand, water from storage is used to meet demand in excess of supply (as shown in red). The peaking factors shown in Table 7-1 are in addition to the peak day factor described in Chapter 2. For example, a peaking factor of 1.25 in Table 7-1 represents a multiplier of 1.25 to peak day demand. During periods of lower demand, supply continues at its steady rate to refill storage reservoirs (as shown in blue) in preparation for peak demands the next day. Based on the estimated demand pattern and as shown in Figure 7-2, the required equalization storage for the Company was calculated to be approximately 15% of peak day demands. The equalization requirement based on average day demand is approximately 38.3% of peak day demands. Based on discussions with Company personnel and the State recommendations, average day demands were used to define required equalization storage. The 2018 average day demand of 6.6 million gallons was projected to grow to 6.7 million gallons in 2028 and 7.0 million gallons at build-out in 2050.

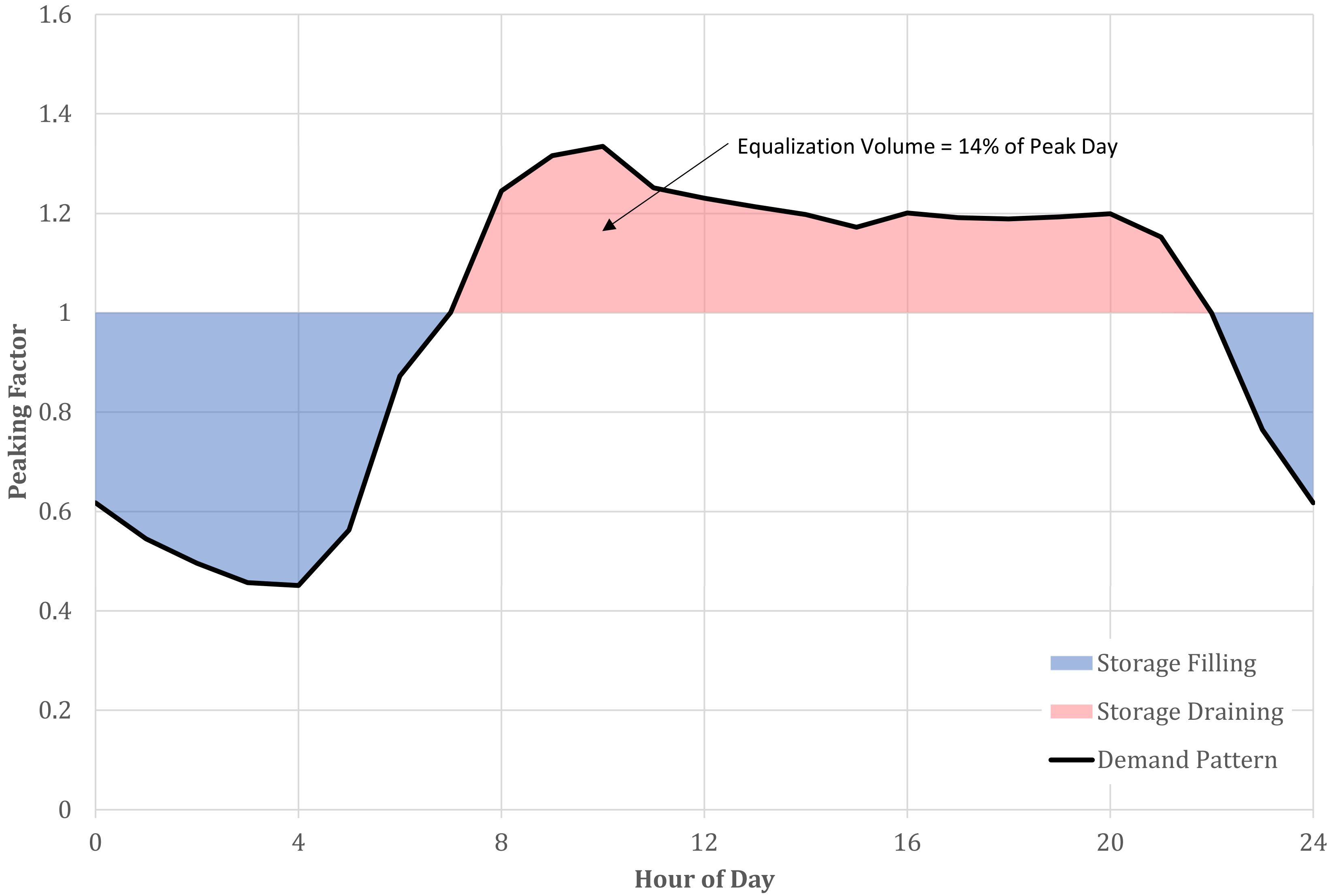


Figure 7-1
Existing Culinary Water Indoor Daily Demand Pattern

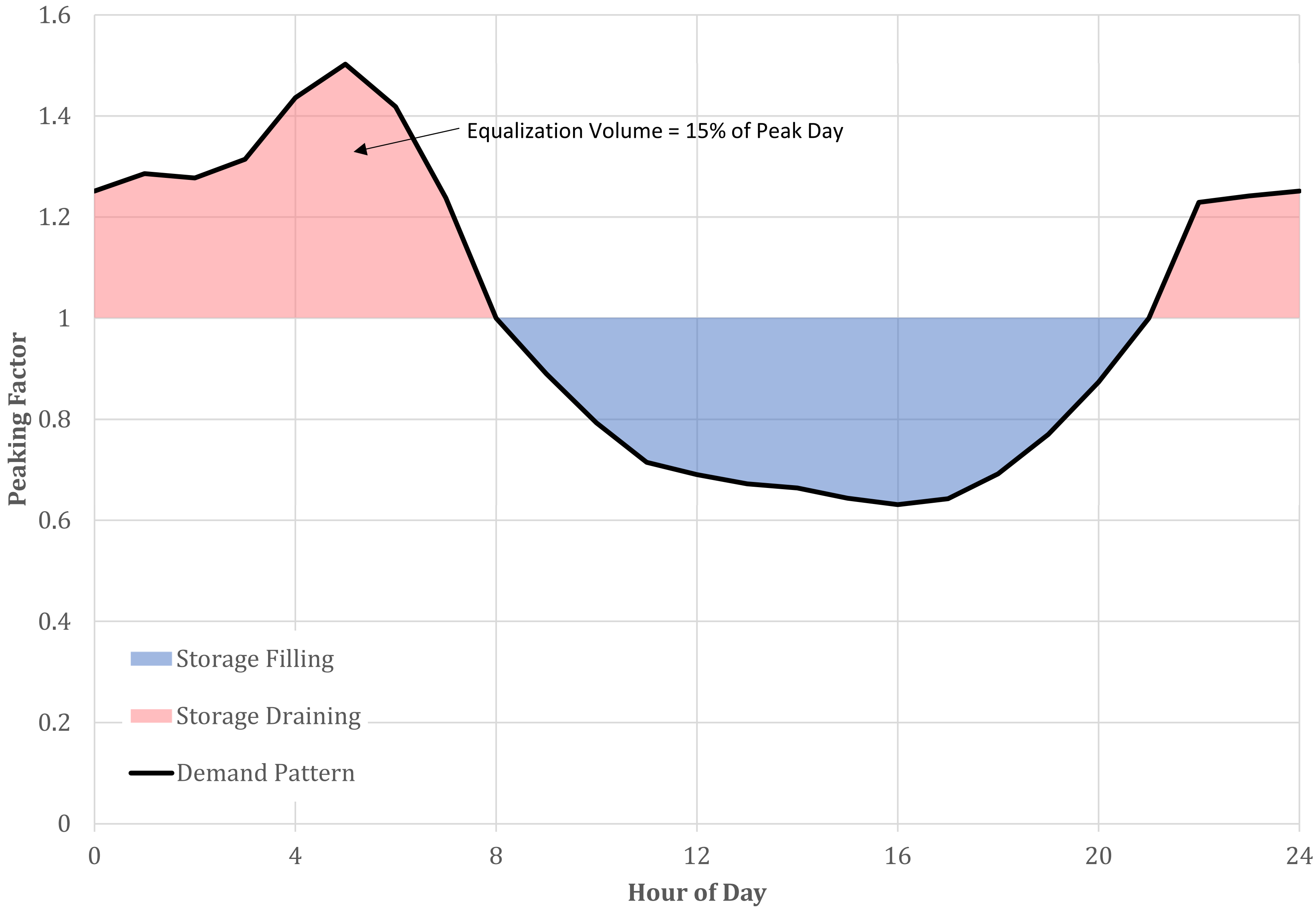


Figure 7-2
Existing Culinary Water Indoor plus Outdoor Daily Demand Pattern

Fire Flow Storage. Fire flow storage requirements are defined in State of Utah R309-510-8 code as follows:

"(3) Fire Flow Storage.

(a) Fire flow storage shall be provided if fire flow is required by the local fire code official or if fire hydrants intended for fire flow are installed.

(b) Water systems shall consult with the local fire code official regarding needed fire flows in the area under consideration. The fire flow information shall be provided to the Division during the plan review process.

(c) When direction from the local fire code official is not available, the water system shall use Appendix B of the International Fire Code, 2015 edition, for guidance. Unless otherwise approved by the local fire code official, the fire flow and fire flow duration shall not be less than 1,000 gallons per minute for 60 minutes."

As stated in the code, the primary authority responsible for establishing needed fire flows and fire flow storage is the local fire code official. The Draper City Fire Department is the fire marshal for the Company. In a recent ISO survey, the maximum fire flow requirements varies by development type and size and ranges from 1,500 gpm in predominantly residential areas to 4,000 gpm in commercial areas. WaterPro's service area is primarily residential with 1,500 gpm 2-hr duration flow and a resulting 180,000 gallon fire suppression storage requirement. The system has four pressure zones that cannot be fed by gravity from other tanks. Each of these four zones requires 180,000 gallons of fire storage (720,000 gallons total) in the following tanks: Cove at Bear Canyon, South Mountain, Traverse Ridge, and Little Valley.

The system also has a 4,000 gpm 4-hr fire flow requirement (960,000 gallons total) for a hospital in the Lower Zone that can be fed from multiple tanks including Corner Canyon Tanks and WTP Tank. All other areas in the system can access required fire storage from one or more of these tanks. The Walmart and Kmart Zones have a 4,000 gpm 2-hr fire flow requirement (480,000 gal) that is already stored as part of the hospital requirement. The total fire flow suppression storage requirement for the system is 1,680,000 gallons. These fire flow rates and storage volumes are based on consultation with Don Buckley the local Fire Marshal in the Draper City Fire Department.

Although not specifically outlined in the code, State Division of Drinking Water officials have historically allowed for fire flow for individual water pressure zones to come from storage within the zone itself or from storage in higher zones in the system. Table 7-2 outlines the storage requirements for each pressure zone based on connection types within the zone and the tanks associated with each pressure zone. This fire storage volume does not need to be stored in each zone but must be available in an emergency to flow to each zone. The largest storage requirement of 960,000 gallons for the hospital stored in Corner Canyon and/or WTP Tanks can satisfy all fire storage requirements in lower zones.

Table 7-2
Fire Flow Storage Requirements by Pressure Zone

Pressure Zone	Fire Flow Requirement (gpm)	Fire Flow Storage Requirement (gal) [1]	Fire Flow Primary Storage Tank [2]
1300 E Well	1,500	180,000	WTP / Corner Canyon
Adobe School	1,500	180,000	Traverse Ridge
Aintree Cove	1,500	180,000	Traverse Ridge
Burning Oak	1,500	180,000	Traverse Ridge
Canyon Vine	1,500	180,000	Little Valley
Cove at Bear Canyon	1,500	180,000	Cove at Bear Canyon
Deer Run	1,500	180,000	Traverse Ridge
Fields of Draper	1,500	180,000	South Mountain
HV Golf	1,500	180,000	WTP / Corner Canyon
Kmart	4,000	480,000	WTP / Corner Canyon
Little Valley	1,500	180,000	Little Valley
Lower	4,000	960,000	WTP / Corner Canyon
South Mountain Country Club	1,500	180,000	Traverse Ridge
South Mountain Gravity	1,500	180,000	South Mountain
South Mountain Pump	1,500	180,000	Traverse Ridge
Steep Mountain	1,500	180,000	Traverse Ridge
Vintage View	1,500	180,000	Little Valley
Walmart	4,000	480,000	WTP / Corner Canyon
WTP	1,500	180,000	WTP / Corner Canyon

[1]Storage requirement based on 2-hr flow duration. Pressure zone fire flow storage may satisfied from any tank able to feed that zone.
[2]The primary storage tank servicing the zone was defined by BC&A based on the hydraulic model. Some pressure zones can receive flow from storage tanks not listed in the table.

The storage tanks within the Company system have significant overlap and can feed multiple zones. Because of this we defined primary storage tank service zones for this analysis as shown in Table 7-2. Each tank that has multiple zones for fire flow only needs to have enough volume to serve one pressure zone at a time. This assumes that multiple fires are not taking place at the same time in different zones.

Emergency Storage. Emergency storage is the volume of water required to meet water demand during an emergency situation. Emergency storage requirements are defined in the State of Utah R309-510-8 code as follows:

"(4) Emergency Storage.

Emergency storage shall be considered during the design process. The amount of emergency storage shall be based upon an assessment of risk and the desired degree of system dependability.

> The Director may require emergency storage when it is warranted to protect public health and welfare."

It should be noted that no specific requirement is given for emergency storage in the code. The determination of required emergency storage is left largely to the entity designing and operating the water system.

For the Company, the most common water supply emergencies relative to storage analysis are power outages. During power outages, water supplies are unable to produce needed water. In the event of an extended Company-wide outage, all wells and the treatment plant would not be able to operate. While some water delivery during a power outage can be accomplished through auxiliary power to selected water system facilities, it is also wise to include some additional emergency water at storage reservoirs. This also gives system operators the benefit of a little extra buffer for system operations. The Company's water supply is also heavily dependent on water from its water treatment plant. If some or all of the treatment trains were to go offline unexpectedly, it would be difficult for the Company to meet demands.

Based on conversations with Company personnel and common practice in the industry, it is recommended that all zones include emergency storage adequate to supply the system during a 6-hour power outage during peak day demands (or roughly 25 percent of peak day demand). This results in an existing emergency storage need of 4.3 million gallons for existing conditions, 4.4 million gallons in 2028 and 4.6 million gallons at build-out in 2050.

Total Recommended Storage. The combined equalization/emergency storage required for the Company is approximately 63.3 percent of peak day demand or 10.9 million gallons (existing conditions). This can be compared against the State's minimum storage requirement based on average day demand (6.6 million gallons). The 6.6 million gallon minimum state requirement is for equalization storage only; but since the State does not specifically require emergency storage, this becomes the defacto minimum for all storage excluding fire flow storage which has been addressed separately. For the Company, it appears that the recommended volume with both equalization and emergency storage is adequate to meet State minimum requirements. In addition to the recommended equalization/emergency storage, 1.68 million gallons is required for fire flow throughout the entire system bringing the total recommended storage to 12.55 million gallons. Tables 7-3 to 7-5 show summaries of storage requirements for the culinary system in 10 years and at build-out under the current (2018) PI use rate scenario. This scenario produces the highest storage requirement for the system and is therefore the worst-case scenario for the culinary system.

Table 7-3
2018 Culinary Storage Facilities Evaluation

Primary Tank Service Area*	2018 Peak Day Demand (gpm)	Required Equalization Storage (MG)	Required Fire Flow Storage (MG)	Total Required Storage (MG)	Total Available Storage (MG)	Required Storage, Surplus or (Deficit) (MG)	Recommended Emergency Storage (MG)	Total Required plus Recommended Storage (MG)	Required plus Recommended Storage, Surplus or (Deficit) (MG)
WTP / Corner Canyon Tanks	7,943	4.38	0.960	5.34	16.00	10.66	2.86	8.20	7.80
Cove at Bear Canyon	191	0.11	0.18	0.29	0.25	(0.04)	0.07	0.35	(0.10)
South Mountai n Tank	824	0.45	0.18	0.63	3.00	2.37	0.30	0.93	2.07
Traverse Ridge Tank	2,806	1.55	0.18	1.73	3.00	1.27	1.01	2.74	0.26
Little Valley Tank	164	0.09	0.18	0.27	0.75	0.48	0.06	0.33	0.42
Total	**11,927**	**6.58**	**1.68**	**8.26**	**23.00**	**14.74**	**4.29**	**12.55**	**10.45**

*See Table 7-2 for a list of pressure zones in each tank's primary service area

Table 7-4
2028 Culinary Storage Facilities Evaluation

Primary Tank Service Area*	2028 Peak Day Demand (gpm)	Required Equalization Storage (MG)	Required Fire Flow Storage (MG)	Total Required Storage (MG)	Total Available Storage (MG)	Required Storage, Surplus or (Deficit) (MG)	Recommended Emergency Storage (MG)	Total Required plus Recommended Storage (MG)	Required plus Recommended Storage, Surplus or (Deficit) (MG)
WTP / Corner Canyon Tanks	7,962	4.46	0.96	5.42	16.00	10.58	2.91	8.33	7.67
Cove at Bear Canyon	185	0.11	0.18	0.29	0.25	(0.04)	0.06	0.35	(0.10)
South Mountain Tank	915	0.46	0.18	0.64	3.00	2.36	0.30	0.94	2.06
Traverse Ridge Tank	2,921	1.58	0.18	1.76	3.00	1.24	1.03	2.78	0.22
Little Valley Tank	161	0.09	0.18	0.27	0.75	0.48	0.06	0.33	0.42
Total	**12,143**	**6.70**	**1.68**	**8.38**	**23.00**	**14.62**	**4.37**	**12.74**	**10.26**

*See Table 7-2 for a list of pressure zones in each tank's primary service area

Table 7-5
2050 Culinary Storage Facilities Evaluation

Primary Tank Service Area*	2050 Peak Day Demand (gpm)	Required Equalization Storage (MG)	Required Fire Flow Storage (MG)	Total Required Storage (MG)	Total Available Storage (MG)	Required Storage, Surplus or (Deficit) (MG)	Recommended Emergency Storage (MG)	Total Required plus Recommended Storage (MG)	Required plus Recommended Storage, Surplus or (Deficit) (MG)
WTP / Corner Canyon Tanks	8,138	4.68	0.96	5.64	16.00	10.36	3.05	8.69	7.31
Cove at Bear Canyon	177	0.11	0.18	0.29	0.25	(0.04)	0.07	0.36	(0.11)
South Mountain Tank	1,012	0.49	0.18	0.67	3.00	2.33	0.32	0.98	2.02
Traverse Ridge Tank	3,234	1.65	0.18	1.83	3.00	1.17	1.08	2.91	0.09
Little Valley Tank	173	0.10	0.18	0.28	0.75	0.47	0.06	0.34	0.41
Total	**12,735**	**7.03**	**1.68**	**8.71**	**23.00**	**14.29**	**4.58**	**13.28**	**9.72**

*See Table 7-2 for a list of pressure zones in each tank's primary service area

Tables 7-3 to 7-5 show that the culinary system has more than adequate storage for all tank service areas except Cove at Bear Canyon. This is an isolated zone that has a booster station and tank servicing a single pressure zone. The zone does meet state minimum requirements of fire flow and equalization (15% of peak day demands), but when emergency (25% of peak day demands) and conservative equalization (38% of peak day demands) storage is added, the zone becomes slightly deficient. As the available storage in this zone meets all regulatory requirements, no storage related projects are recommended or desired by the Company at this time.

PI Water Storage

The State of Utah does not have any requirements for PI storage sizing. However, similar requirements for equalization storage would apply to sizing of PI facilities. 15-minute PI production data was used to determine a daily demand pattern.

Table 7-6 and Figure 7-3 show the demand patterns for the Company PI system. The demand pattern was calculated using 15-minute flow data for the months of May through September in 2018. PI water demands peak in the early morning hours when most people are irrigating their lawns. Demand then drops off during the day. Based on this pattern, equalization storage should be equal to at least 23% of peak day demands.

While demands vary significantly during the day, the same is not true for most water sources. It is usually most economical to size sources, major conveyance pipelines, and pump stations to produce water at a relatively constant peak day demand rate. Storage is then used to satisfy any demands above the rate of supply. The pattern shown in Table 7-6 is for existing conditions and is not expected to change in the future as more users transition from culinary to PI for irrigation use.

If emergency storage is provided at the same rate as culinary emergency storage, an additional 25% of peak day demand would be needed. Thus, total combined equalization and emergency storage volume are equal to the same volume as 48% of peak day of demand. This results in a total storage need of 15.4 million gallons for existing conditions, 14.2 million gallons in 2028 and 12.3 million gallons at build-out in 2050.

The evaluation summary of water storage facilities for existing and future conditions is shown in Table 7-7 for PI facilities. Note that source reliability and mixing storage are treated separately from equalization and emergency storage. The 100% PI use immediately scenario was used for this evaluation because it produces that highest storage requirement for the PI system and is therefore the worst-case scenario of the three future scenarios described in Chapter 2.

As shown in Table 7-7, DIC has a small (0.3 MG) PI storage deficiency in 2018 and is unable to meet 48% (equalization and emergency storage) of peak day demand using the criteria described above. Surplus storage becomes available in 2028 and 2050 as usage becomes more efficient with the implementation of meters on all PI connections. Based on discussions with Company personnel and due to the small size of the current storage deficit and the conservative nature of the storage evaluation, no new storage for the PI system is recommended at this time.

Table 7-6
Existing PI Demand Pattern

Hour	PI System Peaking Factor
0	1.54
1	1.54
2	1.54
3	1.54
4	1.59
5	1.58
6	1.47
7	1.20
8	0.94
9	0.76
10	0.67
11	0.61
12	0.56
13	0.53
14	0.53
15	0.53
16	0.52
17	0.54
18	0.59
19	0.65
20	0.76
21	1.04
22	1.32
23	1.44
24	1.54

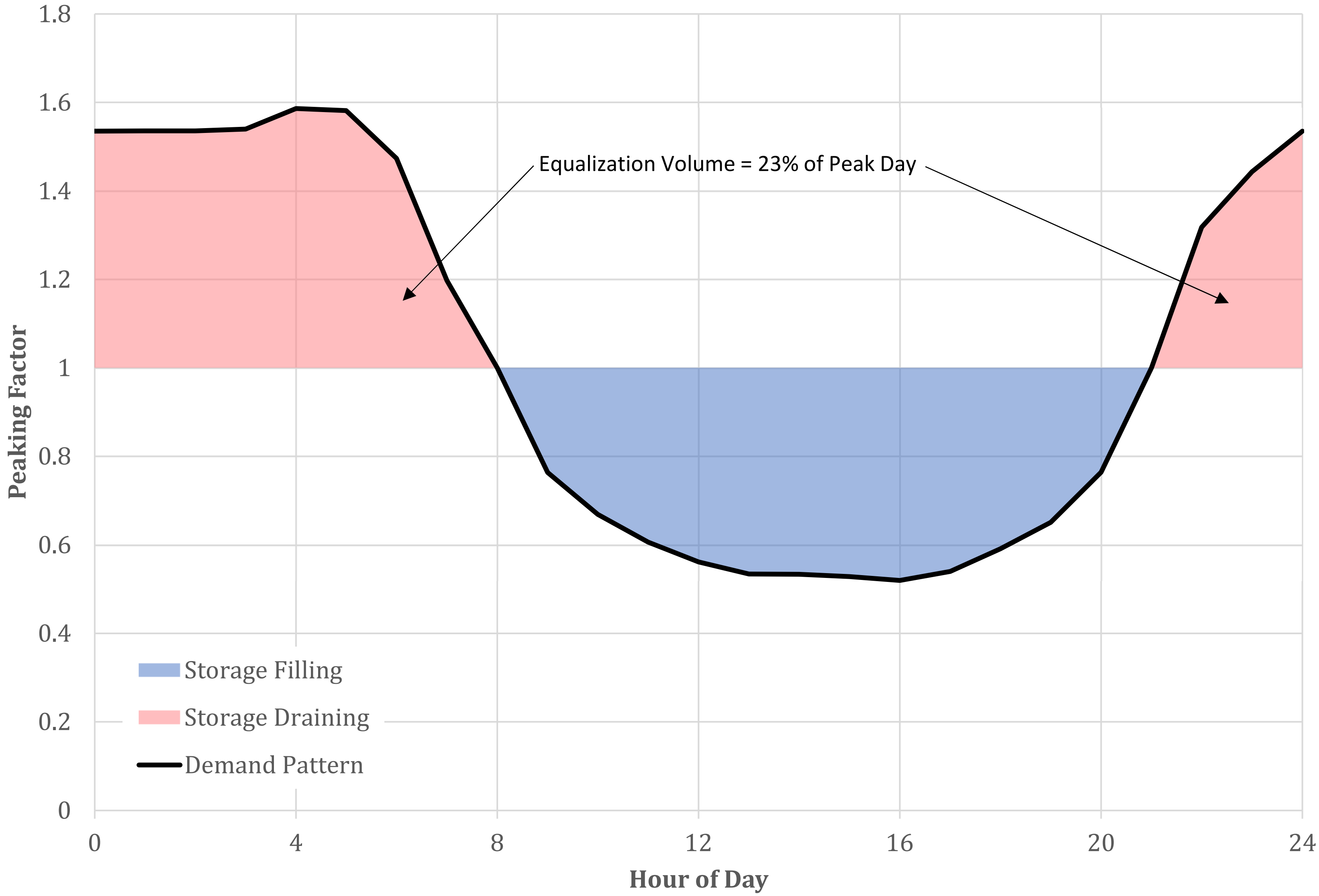


Figure 7-3
PI Water Demand Pattern

Table 7-7
PI Storage Evaluation of Existing Irrigation Pond

Year	Peak Day Demand (gpm)	Equalization Storage Requirement (MG)	Emergency Storage Requirement (MG)	Total Required Storage (MG)	Available Storage (MG)	Equalization Storage Surplus by Service Area (deficit) (MG)	Total Storage Surplus by Service Area (deficit) (MG)
2018	22,108	7.3	8.0	15.3	15.0	7.7	(0.3)
2028	20,600	6.8	7.4	14.2	15.0	8.2	0.8
2050	17,744	5.9	6.4	12.3	15.0	9.1	2.7

CHAPTER 8
BOOSTING EVALUATION

The purpose of this chapter is to evaluate the Company's pump station capacity to supply water throughout both of the Company's water systems.

CULINARY SYSTEM BOOSTING EVALUATION

Most of the Company's culinary water sources are delivered into the water treatment plant and then gravity fed throughout the system. However, a few pressure zones require boosting to move water to higher elevations. Pump stations are to be capable of supplying the peak day demand of the zones they service. Tables 8-1 to 8-3 show pressure zone peak day demands for culinary pressure zones along with available boosting capacities for the pump station servicing those zones. Zone demand is the total demand of all the zones fed from the boosting station including zones that pass through an additional boosting station. Only the current PI use rate scenario was evaluated for the culinary system because it represents the worst case/highest production requirement scenario for the boosting stations.

Table 8-1
Existing Culinary Peak Day Demand Booster Facilities Evaluation

Pump Station	Zones Supplied by Pump Station[1]	Zone Peak Day Demand (gpm)	Existing Pump Station Capacity (gpm)	Boosting Surplus Total (deficit) (gpm)
Cove at Bear Canyon Pump Station	Cove at Bear Canyon	191	700	509
South Mtn Pump Station (to Zone)	South Mtn Pump, Adobe School, Deer Run	1,551	4,800	3,249
South Mtn Pump Station (to Tank)	South Mtn Country Club, Burning Oak, Aintree Cove, Steep Mtn, Little Valley, Vintage View, Canyon Vine	1,419	2,600	1,181
Traverse Ridge Pump Station	Little Valley, Vintage View, Canyon Vine	164	1,600	1,436

[1]Only includes zones that are solely dependent on the pump station to obtain water

As shown in Tables 8-1 to 8-3, the current boosting capacities in the culinary system are adequate and do not require further expansion to convey projected production requirements. However, it is recommended that routine maintenance be implemented at all boosting stations to ensure proper function of the facilities. As discussed in Chapter 7, Cove at Bear Canyon is fed by a single pump station. This pump station should be equipped with a quick connect to allow operation using a portable generator.

Table 8-2
2028 Culinary Booster Facilities Evaluation

Pump Station	Zones Supplied by Pump Station[1]	Zone Peak Day Demand (gpm)	Existing Pump Station Capacity (gpm)	Boosting Surplus Total (deficit) (gpm)
Cove at Bear Canyon Pump Station	Cove at Bear Canyon	185	700	515
South Mtn Pump Station (to Zone)	South Mtn Pump, Adobe School, Deer Run	1,668	4,800	3,132
South Mtn Pump Station (to Tank)	South Mtn Country Club, Burning Oak, Aintree Cove, Steep Mtn, Little Valley, Vintage View, Canyon Vine	1,414	2,600	1,186
Traverse Ridge Pump Station	Little Valley, Vintage View, Canyon Vine	161	1,600	1,439

[1]Only listed zones that are solely dependent on the pump station to obtain water

Table 8-3
2050 Culinary Booster Facilities Evaluation

Pump Station	Zones Supplied by Pump Station[1]	Zone Peak Day Demand (gpm)	Existing Pump Station Capacity (gpm)	Boosting Surplus Total (deficit) (gpm)
Cove at Bear Canyon Pump Station	Cove at Bear Canyon	177	700	523
South Mtn Pump Station (to Zone)	South Mtn Pump, Adobe School, Deer Run	1,795	4,800	3,005
South Mtn Pump Station (to Tank)	South Mtn Country Club, Burning Oak, Aintree Cove, Steep Mtn, Little Valley, Vintage View, Canyon Vine	1,612	2,600	988
Traverse Ridge Pump Station	Little Valley, Vintage View, Canyon Vine	173	1,600	1,427

[1]Only listed zones that are solely dependent on the pump station to obtain water

PI SYSTEM BOOSTING EVALUATION

The Company's PI water system has no booster stations feeding from one pressure zone into another. All pump stations pumping into the pressure irrigation system are considered sources. For this reason, the PI boosting system was not evaluated. Instead, the source capacity to supply peak day demands was evaluated in Chapter 3.

CHAPTER 9
HYDRAULIC MODELS

The purpose of this chapter is to document the development of the Company's culinary and PI hydraulic water models. A hydraulic computer model is a digital representation of physical features and characteristics of the water system, including sources, pipes, valves, storage tanks, and pumps. Key physical components of a water system are represented by a set of user-defined parameters that represent the existing characteristics of the system. The computer model utilizes the digital representation of physical system characteristics in conjunction with input water demands to mathematically simulate operating conditions of a water distribution system. Computer model output includes pressures at each node, flow rate and velocities for each pipe in the water system, and water surface levels in storage tanks. There are several well-known computer programs for modeling water distribution systems. The Company's models have been developed as EPANET models and using InfoWater software developed by Innovyze. InfoWater provides a user-friendly GIS interface with the EPANET computation engine. The GIS interface allows for more efficient model evaluation of different scenarios.

CULINARY WATER MODEL

The culinary water model previously used by others for the development of the 2017 Culinary Water Master Plan was apparently based on an EPANET model and an approximation of the Company's water infrastructure. Because it was in the EPANET format, there was limited functionality of the model. Model assumptions and accuracy were unknown. Therefore, in preparation of the 2019 Water Master Plan, a new culinary model was constructed. The new model was developed using the Company's actual GIS data to recreate the culinary infrastructure. Water meter data, pump curves, system set points, and other updated information was used to create a more accurate model.

GIS Data for Infrastructure

The Company's most up-to-date GIS data was used to develop the basic infrastructure of the model. Pipes were imported to InfoWater with their associated properties such as diameter, length and material. Small diameters (less than 6 inches that were not main conveyance pipes) and short dead-end (pipe length of 100 feet or less) pipes were then filtered from the model to reduce the number of pipes. This reduction in pipe segments reduced the simulation time of the model without significantly decreasing the accuracy of the model. Junctions and elevations were added at pipe connections. Elevations were based on the most recent ground surface elevation data available from Utah Automated Geographic Reference Center (Utah AGRC).

Point shapefiles from the Company's GIS data were then used to add pressure reducing valves (PRVs), storage tanks, and other critical infrastructure to the model in appropriate locations. These elements were manually connected to the pipe network based on GIS information and discussions with Company personnel.

Demand Determination

Chapter 2 provides a detailed summary of the demands used within the model. The base demand assigned to a node represents average day demand with peaking factors of 2.61 and 4.96 being used for peak day and peak instantaneous model scenarios.

Demand Allocation

Demands were allocated throughout the model based on the 2018 monthly customer water meter data shapefile provided by the Company. The average monthly meter data flows were used in conjunction with the InfoWater demand allocator tool to spatially distribute average day demands to the junctions previously created. As part of that process, Thiessen polygons were generated around each junction to define which meters to associate with that junction. The percentage of flow for each meter relative to the total system flow within the monthly meter data was multiplied by the average day demands discussed in Chapter 2 to define the flow for each meter. Demands were then combined and assigned to their appropriate junction in the model.

System Characteristics

System characteristics of the model include tank, pump, and PRV information/settings. PRV size and setting information was added to the model based on information provided by the Company. Normal operating tank levels and tank geometry were provided by the Company and are shown in Table 9-1. These tank levels were used as a baseline and were manipulated to evaluate different model scenarios.

Table 9-1
Tank Model Properties

Tank	Capacity (MG)	Diameter (ft)	Max Depth (ft)
Treatment Plant Tank 1	1.0	101	18
Treatment Plant Tank 2	7.0	199	30
Cove of Bear Canyon Tank	0.25	50	15
South Mountain Tank	3.0	185	16
Traverse Ridge Tank	3.0	140	30
Little Valley Tank	0.75	80	20
Corner Canyon Tank 1	4.0	134	40
Corner Canyon Tank 2	4.0	134	40

Pump station capacities and pump curve information were provided by the Company and entered into the model. Pump station capacity and control settings are shown in Table 9-2.

Table 9-2
Pump Station Capacities and Control Settings

Pump Station	Maximum Capacity (gpm)	Control Object	On Level[3] (ft)	Off Level[3] (ft)
Cove at Bear Canyon	700	Cove at Bear Canyon Tank	10	14.5
South Mountain (to Pressure Zone)[1]	4,800	Pressure Zone Node	-	-
South Mountain (to Traverse Ridge Tank)	2,600	Traverse Ridge Tank	15	28.5
Traverse Ridge	1,600	Little Valley Tank	11	19
1300 East Well[2]	835	Pressure Zone Node	-	-

[1]Pump station has a VFD set to maintain 95 psi immediately downstream of the pump station
[2]1300 East Well is manually controlled by the Company
[3]Level is based on water depth in the controlling water tank

Calibration Method

After the model was functioning with appropriate geometric properties, demands and system characteristics, it was evaluated using actual fire flow tests to help calibrate the model. Twenty-five fire flow tests in 6 different pressure zones were provided by the Company to determine the accuracy of the model. Fire flow tests provide static and residual pressure while a measured amount of flow leaves the hydrant. The measured flow was added at the hydrant location in the model and the resulting residual pressure measured in the field was compared to the model results. The lower pressure zone contained 13 of the 25 fire flow tests and was therefore used to calibrate the model. Pipe roughness valves in the immediate vicinity of the fire flow tests were adjusted to try and attain model static pressures within 5 psi and residual pressures within 10 psi of field measured values.

Pressure differences ranged from 0 to 38 percent with the average being 10 percent difference. This means the model is functioning at an acceptable level to be considered calibrated. There are several unknowns to consider when comparing fire flow data to model results: tank levels, system wide demands and valve position. The variation is system conditions can make it difficult to exactly replicate field measurements with model results and therefore requires a tolerance for acceptable results.

Model settings during the calibration were set to represent conditions as close as possible to the time of year the test was taken. PRVs, pumps, and tank levels were set to their normal operating condition/setting as provided by the Company. Flows in the system were determined using a multiplier by month of the test. For example, if the test was in July a higher flow is expected in the system than test completed in December during lower system flows.

PI WATER MODEL

The PI water model previously used by others was apparently based on an EPANET model and an approximation of the Company's water infrastructure. Because it was in the EPANET format, there was limited functionality of the model. Model assumptions and accuracy were unknown. Therefore, in preparation of the 2019 Water Master Plan, the existing model was evaluated and modified based on the Company's GIS data. The EPANET model was imported to InfoWater to allow for GIS interface and expanded simulation options.

Existing Model Verification

The entire model was not rebuilt based on GIS data (as was the case for the culinary model). Instead BC&A was tasked to compare current GIS data to the existing model and identify areas of significant differences that could be updated in the model. The Company's most up-to-date GIS data was used to update pipe size and verify connectivity generally represented the current condition of the system. Several pipe diameters were updated and a few pipes were either added or deleted based on the GIS data. PRV settings were also verified with Company personnel and changed if provided data differed from model inputs.

Updated Demand

Chapter 2 provides a detailed summary of the demands used within the model. Average day, peak day and peak instantaneous system wide demand scenarios were added to the model. The base demand distribution within the model was not modified as part of the model update because meter use data is not currently available for the entire system (only part of the system is metered). After the Company has metered the entire PI system and has a few years of meter data, it is recommended that the demand distribution in the model be updated.

CHAPTER 10
DISTRIBUTION SYSTEM EVALUATION AND IMPROVEMENTS

The purpose of this chapter is to document the results of the culinary and PI distribution system evaluations based on hydraulic modeling.

MODEL SCENARIOS

The Company's culinary hydraulic model is setup to run steady state and extended state simulations. The PI hydraulic model is setup to run only steady-state simulations. The culinary water system performance was evaluated under the three operating conditions specified by the Division of Drinking Water (DDW). Model results for the three following scenarios have been documented to aid in evaluating system performance.

- No Demand (Static) – This scenario is used to identify potentially high system pressures during a theoretical time of no demands.
- Peak Day Demand –This scenario represents the average daily demands on the system during the peak usage day of the year. This scenario is primarily used with fire flows to identify areas that do not meet fire flow requirements. It can also be used to identify source and storage deficiencies within tank service areas to determine if sufficient production and conveyance capacity existing to fill and drain tanks properly during peak demands. Finally, the DDW has minimum pressure requirements (40 psi) that are to be evaluated during this condition. For the culinary water system, a peak day to average day peaking factor of 2.61 was used based on the data provided by the Company. A peak day to average day peaking factor of 2.06 was applied to the PI water system.
- Peak Instantaneous Demands – The purpose of this scenario is to identify existing pressure deficiencies as defined by the DDW (30 psi minimum) under peak instantaneous demand conditions. For the culinary water system, a peak instantaneous to peak day peaking factor of 1.9 was used based on the data provided by the Company. A peak instantaneous to peak day peaking factor of 1.52 was applied to the PI water system.

EVALUATION CRITERIA

The performance of the system was evaluated using the following criteria:

- **Culinary and PI pressure within the systems during static conditions** – The State of Utah requires that public water systems not exceed 150 psi at new connections added to the culinary system. The Company tries to maintain culinary pressures between 60 psi and 120 psi for most of the distribution system and only makes exceptions for areas with topography challenges that would require pressure zone reconfiguration to resolve. The Company targets a maximum PI pressure of 120 psi even though no state requirement exists.
- **Culinary pressure within the system during peak demands** - The State of Utah requires that a public water system maintain a minimum pressure standard of 30 psi during peak instantaneous demands and 40 psi during peak day demands. This is the minimum design standard the Company maintains. However, the Company tries to maintain pressures between 60 psi and 120 psi for most of the distribution system and only makes exceptions for areas with topography challenges that would require pressure zone reconfiguration to resolve.
- **Pressure within the system during peak day demands with fire flow –** The State of Utah requires that a public water system be capable of conveying required fire flow with a residual

pressure of 20 psi during peak day demand. Based on discussions with Company personnel, each existing fire hydrant in the GIS data supplied to BC&A was evaluated in the model on its capability to supply a 1,500 gpm fire flow with a 20 psi residual pressure. Areas incapable of meeting the 20 psi residual were identified as deficient.

- **Maximum pipe velocities –** While high instantaneous velocities (during peak instantaneous or peak day with fire flow simulations) in a pipeline are not generally as much of a concern to the system as low pressures, they can cause damage to pipes and potentially lead to pipe failure. Existing high velocities alone do not generally require improvements to eliminate the velocity issues, but indicate areas where additional conveyance improvements will have the most benefit. The model was evaluated under peak instantaneous scenario to identify velocity issues. Pipelines with velocities above 7 ft/sec indicated areas where additional conveyance improvements would be beneficial. Any pipeline which displayed a maximum velocity greater than 10 ft/sec was flagged as a deficient pipe.
- **PI pressure within the system during peak day demands** - For the PI water system, the Company would like to keep PI water pressures higher than culinary system pressures with a minimum not less than 50 psi during peak day demand. The target pressure the Company will ideally maintain within the PI system will be between 60 psi and 120 psi.

SYSTEM EVALUATION RESULTS

Existing Culinary Distribution Evaluation

The hydraulic computer model was used to simulate system conditions for the 2018 Static Demand, 2018 Peak Day Demands with Fire Flow and 2018 Peak Instantaneous Demands. Model results for critical model scenarios under existing demands are included in the following figures:

1. Figure 10-1 shows pressures for the 2018 Static Demand Scenario
   a. Based on the evaluation criteria, there are several locations within the system that exceed the maximum desired pressure of 120 psi. Some locations even exceed 150 psi during the simulation though none of the existing locations with elevated pressures are a concern for the system. Based on State of Utah requirements, all new connections that exceed 150 psi require pressure reducing valves on all mains and should be adhered to for any new development.
   b. Areas that have high static pressures are located in pressure zones (Little Valley, South Mountain Country Club, South Mountain Pump and Water Treatment Plant) that have a large change in elevation within the zone and are located along the base of the Wasatch Mountains.
   c. All areas shown in Figure 10-1 below 50 psi are not located at user connections. They are located near storage tanks or at PRV vault locations that are expected to have low pressures and do not result in system deficiencies.
2. Figure 10-2 shows pressures for the 2018 Peak Day Demand Scenario
   a. Based on the evaluation criteria, there are a few locations within the system that exceed the maximum desired pressure of 120 psi (similar to Static Demand Scenario). Some locations even exceed 150 psi during the simulation though none of the existing locations with elevated pressures are a concern for the system. Based on State of Utah requirements, all new connections that exceed 150 psi require pressure reducing valves on all mains.

b. Areas that have high static pressures are located in pressure zones (Little Valley, South Mountain Country Club, South Mountain Pump and Water Treatment Plant) that have a large change in elevation within the zone and are located along the base of the Wasatch Mountains.

c. All areas shown in Figure 10-2 below 40 psi are not located at user connections. They are located near storage tanks or at PRV vault locations that are expected to have low pressures and do not result in system deficiencies.

3. Figure 10-3 shows pressures for the 2018 Peak Instantaneous Demand Scenario

   a. All areas shown in Figure 10-3 below 30 psi are not located at user connections. They are located near storage tanks or at PRV vault locations, or at high points in the system that are expected to have low pressures and do not result in system deficiencies.

   b. Velocities greater than 7 ft/sec but less than 10 ft/sec are present in a few locations throughout the culinary water system during Peak Instantaneous Demands. However, DIC has other projects that are higher priority to complete in the near future but will continue to monitor these locations in the future.

   c. Two sections of pipe near the intersection of 13200 South and 1100 East have velocities of approximately 13 ft/sec. One other section of pipe in the southwest corner of the system along Rocky Knoll Lane had velocities of approximately 13.5 ft/sec. These locations exceed the 10 ft/sec maximum and are included in the list of recommended projects later in this Chapter.

4. Figure 10-4 shows the available fire flow in conjunction with 2018 Peak Day Demands

   a. There are a few areas of the distribution system that do not meet 1,500 gpm fire flow requirements. In general, most fire flow deficiencies are caused by one or more of the following concerns:

      i. High Elevation – Junctions near the upper end of pressure zones will have difficulty meeting fire flow requirements without large supply pipes and looping.

      ii. Dead-Ends – Dead end connections often have fire flow deficiencies because high velocities through a single pipe cause higher pressure loss. Dead-end connections frequently require oversized pipes to meet fire flow requirements unless the connection can be looped another way.

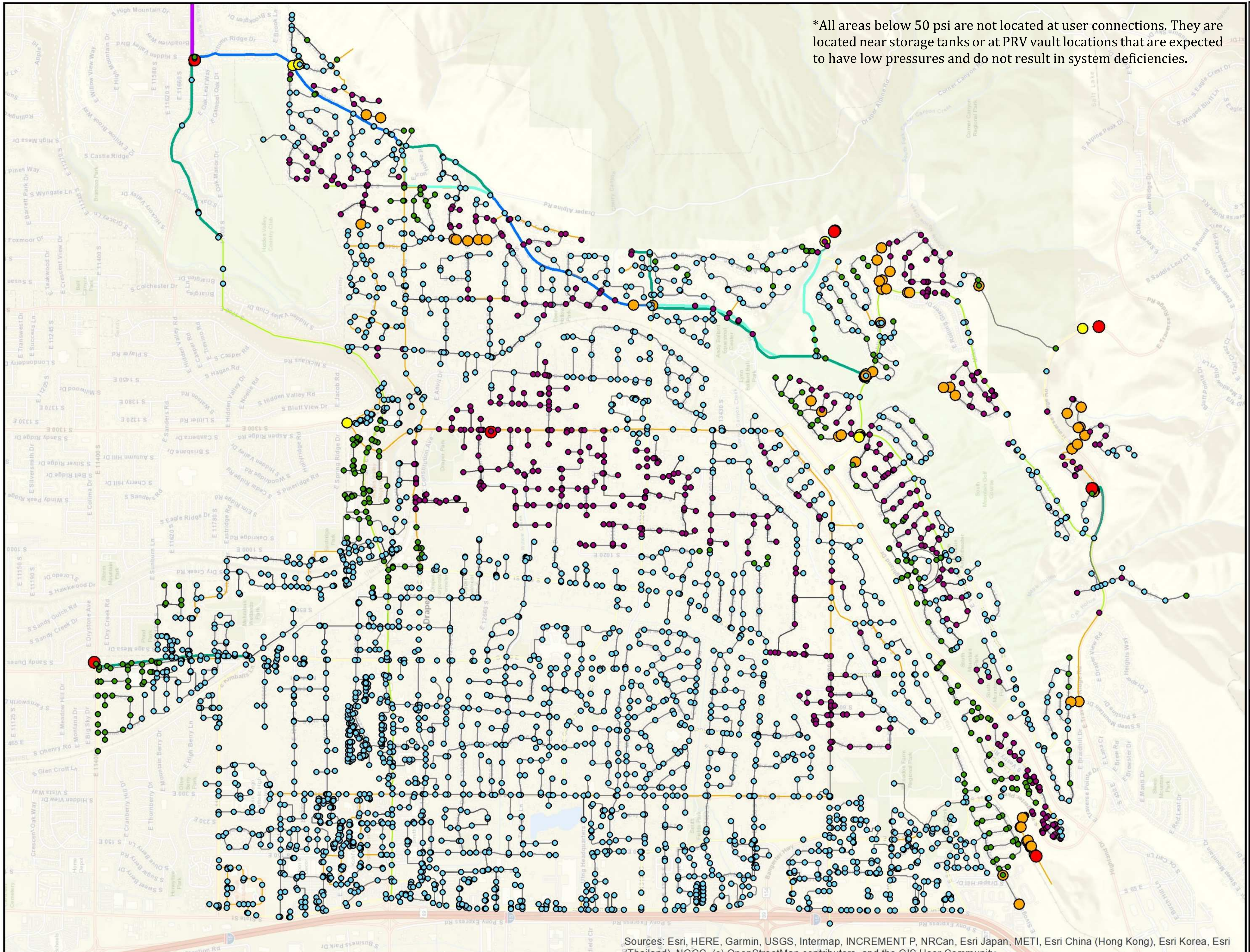
      iii. 4-inch and 6-inch Pipes – The Company has a few areas with 4-inch and 6-inch pipes that cannot meet current fire flow demand requirements of 1,500 gpm at the target flow velocity of 10 ft/sec. These lines were installed previously when fire flow requirements were approximately 500 gpm with 4-inch minimum line size and later with 1,000 gpm and 6-inch minimum line size. The lines are grandfathered under the previous fire flow requirements. DIC has plans to replace and/or eliminate these lines in future projects identified later in this chapter.

Existing PI Distribution Evaluation

The hydraulic computer model was used to simulate peak day demands on the PI system. Figure 10-5 shows the results for the peak day demand scenario. The following conclusions were drawn from the PI system evaluation of peak day demands:

1. Model results show the system is adequate to provide the targeted minimum 50 psi pressures except in a few cases.

2. All junctions below 50 psi are at elevations (relative to the irrigation pond) that prohibit them from providing a pressure of 50 psi even during the average day flow scenario. Two junctions have pressures less than 20 psi and have the same elevation restrictions as the other junctions under 50 psi. No projects are recommended to address these low-pressure issues because they would require significant system modifications and booster pumps and/or storage for a few connections.
3. Future projects to develop shallow groundwater wells and reuse water as sources will positively impact flows in the system in the near future by providing pumped flows into the lower zone.
4. All pipes in the system are under the target of 10 ft/sec during the peak day simulation.
5. Junctions between 40 and 60 psi are all in the upper pressure zone. Only 25% of these junctions are below 50 psi that means they are within 10 psi of the target pressure and could be deficient because of model uncertainty.
6. DIC has experienced large (approximately 40 psi) pressure fluctuations in the lower zone during peak day flows. Those fluctuations are not able to be replicated in the model. It is recommended that:
    a. Data monitoring of pressure fluctuations with portable pressure data loggers and flow meters continue to isolate specific locations and impacted areas
    b. DIC continue to install PI meters on all PI connections to collect spatially accurate water use data
    c. PI water model be updated with future GIS data and flow data from (a) and (b)
    d. Field tests/evaluations be completed on valves, meters, and impacted connections
    e. DIC plans to install PI meters with integrated pressure sensors at various strategic locations throughout the system. This will help further identify the locations and potential causes of these pressure fluctuations.



Legend

Static Pressure

- 0 to 30 psi
- 30 to 50 psi
- 50 to 80 psi
- 80 to 120 psi
- 120 to 150 psi
- 150+ psi

Water Lines Diameter

- 6" or Less
- 8"
- 10"
- 12"
- 14"
- 16"
- 20"
- 24"
- 30"

NORTH: NORTH

SCALE: 1 inch = 2,000 feet

CULINARY WATER EXISTING STATIC DEMAND

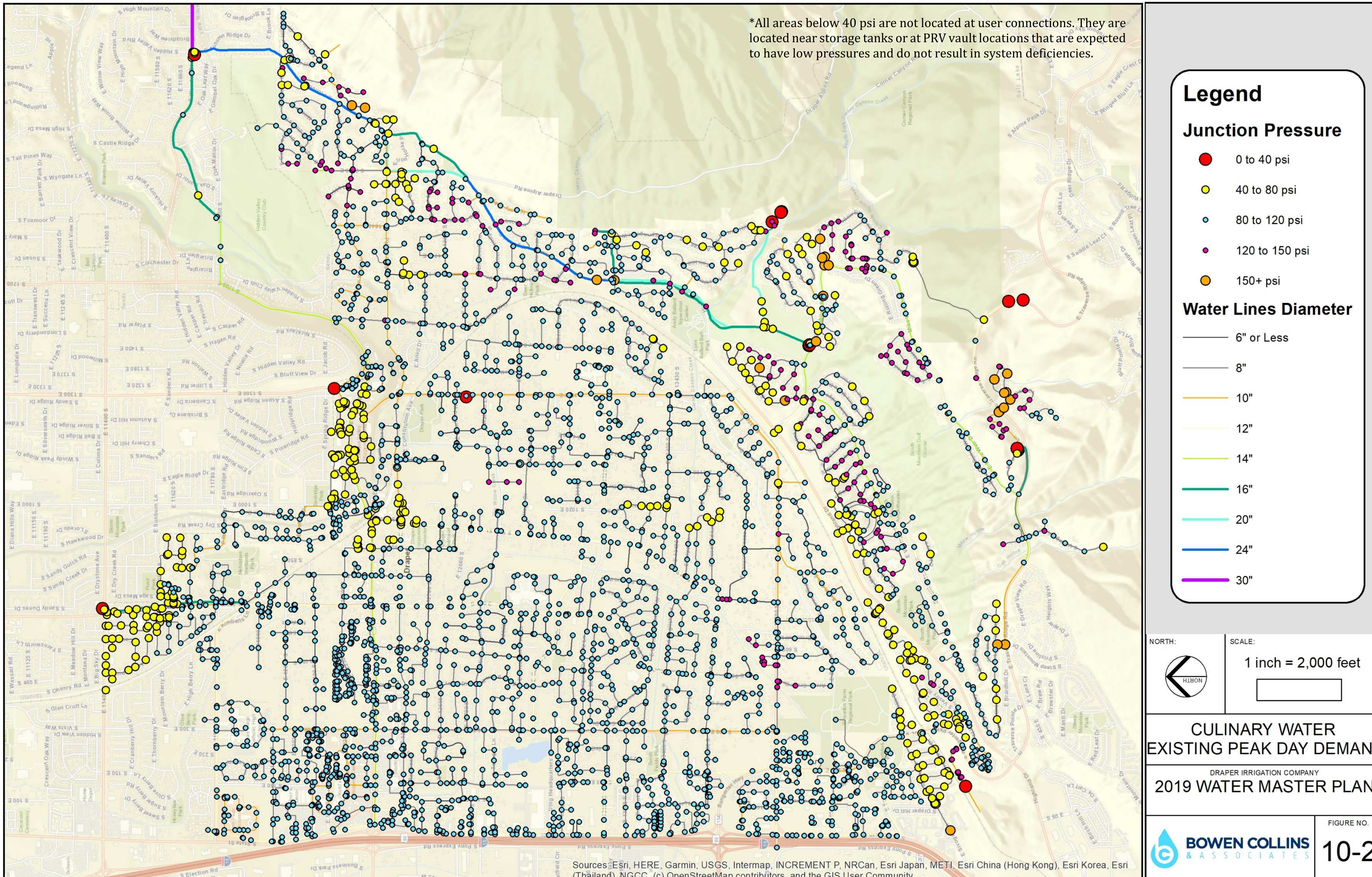
DRAPER IRRIGATION COMPANY

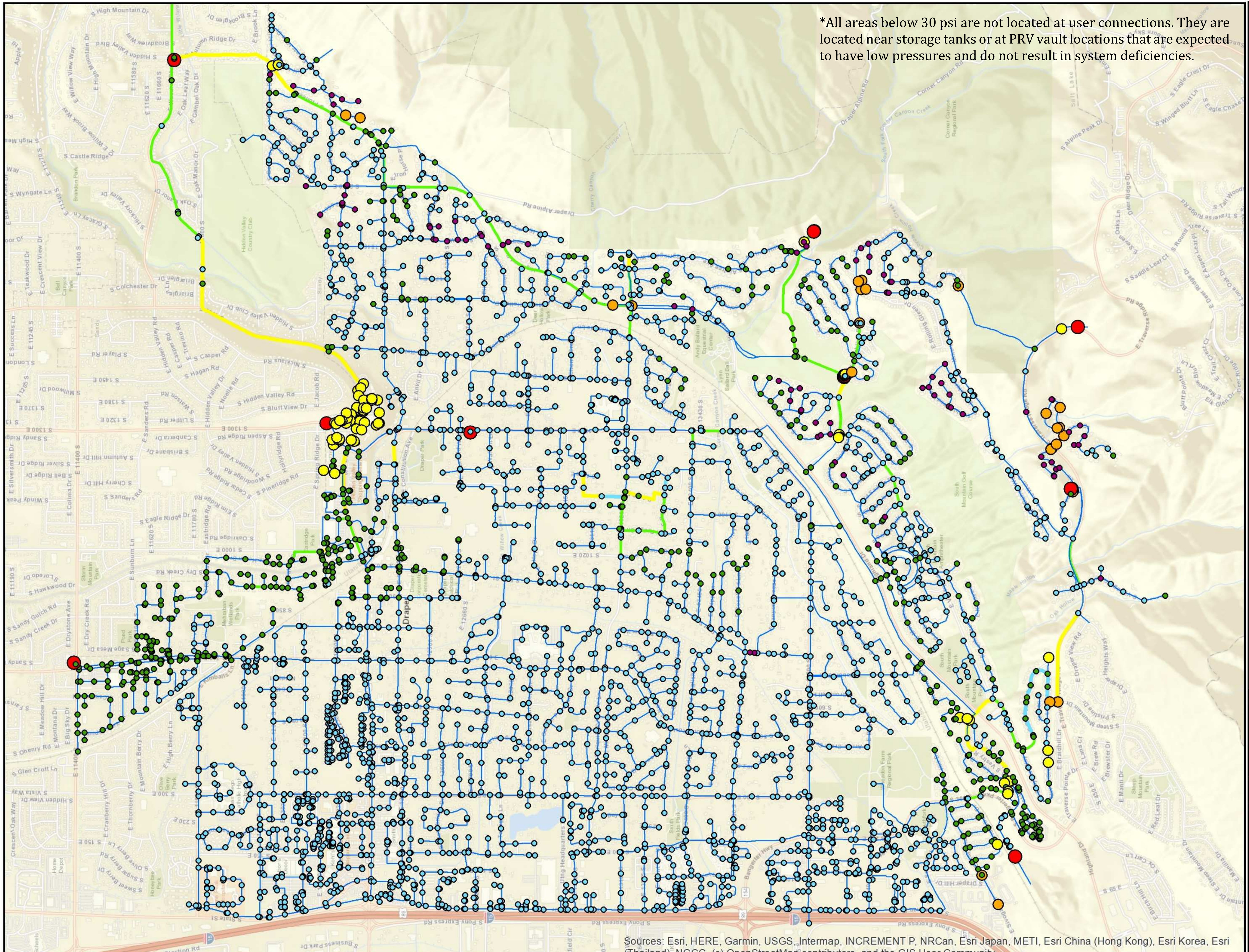
2019 WATER MASTER PLAN

BOWEN COLLINS & ASSOCIATES

FIGURE NO. 10-1

P:\Water Pro\093-19-05 Culinary Master Plan\GIS\Figures\Figure 11-1 Culinary Static Pressures.mxd dschriner 4/23/2020


*All areas below 40 psi are not located at user connections. They are located near storage tanks or at PRV vault locations that are expected to have low pressures and do not result in system deficiencies.
Legend
Junction Pressure
0 to 40 psi
40 to 80 psi
80 to 120 psi
120 to 150 psi
150+ psi
Water Lines Diameter
6" or Less
8"
10"
12"
14"
16"
20"
24"
30"
Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community
NORTH:
SCALE:
1 inch = 2,000 feet
CULINARY WATER
EXISTING PEAK DAY DEMAND
DRAPER IRRIGATION COMPANY
2019 WATER MASTER PLAN
BOWEN COLLINS & ASSOCIATES
FIGURE NO.
10-2
P:\Water Pro\093-19-05 Culinary Master Plan\GIS\Figures\Figure 11-2 Culinary Peak Day Pressures.mxd dschriner 4/23/2020



Legend

Junction Pressure

- 0 to 30 psi
- 30 to 50 psi
- 50 to 80 psi
- 80 to 120 psi
- 120 to 150 psi
- 150+ psi

Pipe Velocity

- 0 to 5 fps
- 5 to 7 fps
- 7 to 10 fps
- 10 to 18 fps
- 18+ fps

NORTH: NORTH

SCALE: 1 inch = 2,000 feet

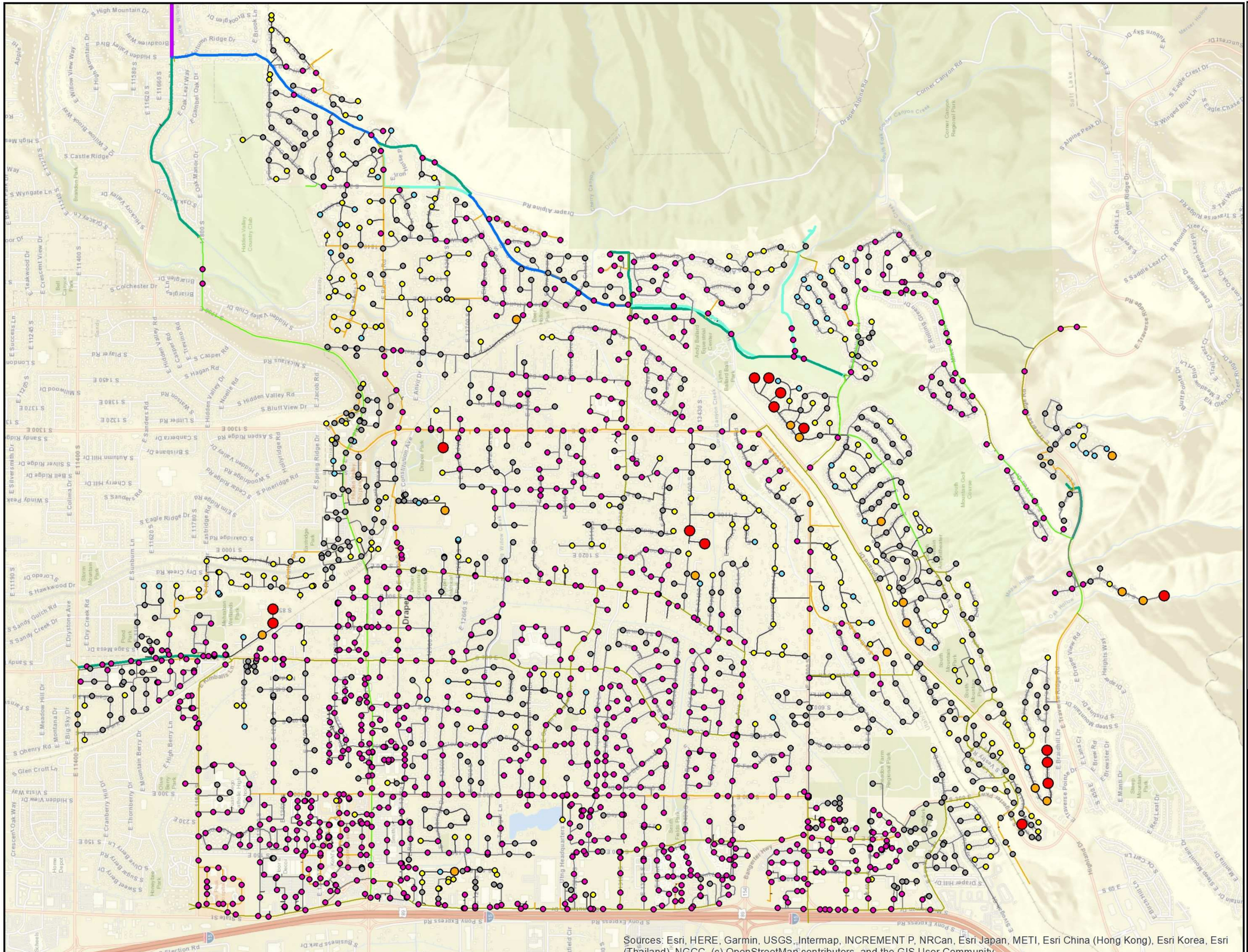
CULINARY WATER
EXISTING PEAK INSTANT DEMAND

DRAPER IRRIGATION COMPANY
2019 WATER MASTER PLAN

BOWEN COLLINS & ASSOCIATES

FIGURE NO. 10-3

P:\Water Pro\093-19-05 Culinary Master Plan\GIS\Figures\Figure 11-2 Culinary Peak Hour.mxd dschriner 3/25/2020



P:\Water Pro\093-19-05 Culinary Master Plan\GIS\Figures\Figure 11-3 Culinary Fireflow.mxd dschriner 4/23/2020

Legend

Junctions

Available Fire Flow at 20 psi

- 0 to 1,000 gpm
- 1,000 to 1,500 gpm
- 1,500 to 2,000 gpm
- 2,000 to 3,000 gpm
- 3,000 to 5,000 gpm
- 5,000+ gpm

Water Lines Diameter

- 6" or Less
- 8"
- 10"
- 12"
- 14"
- 16"
- 20"
- 24"
- 30"

NORTH: NORTH

SCALE: 1 inch = 2,000 feet

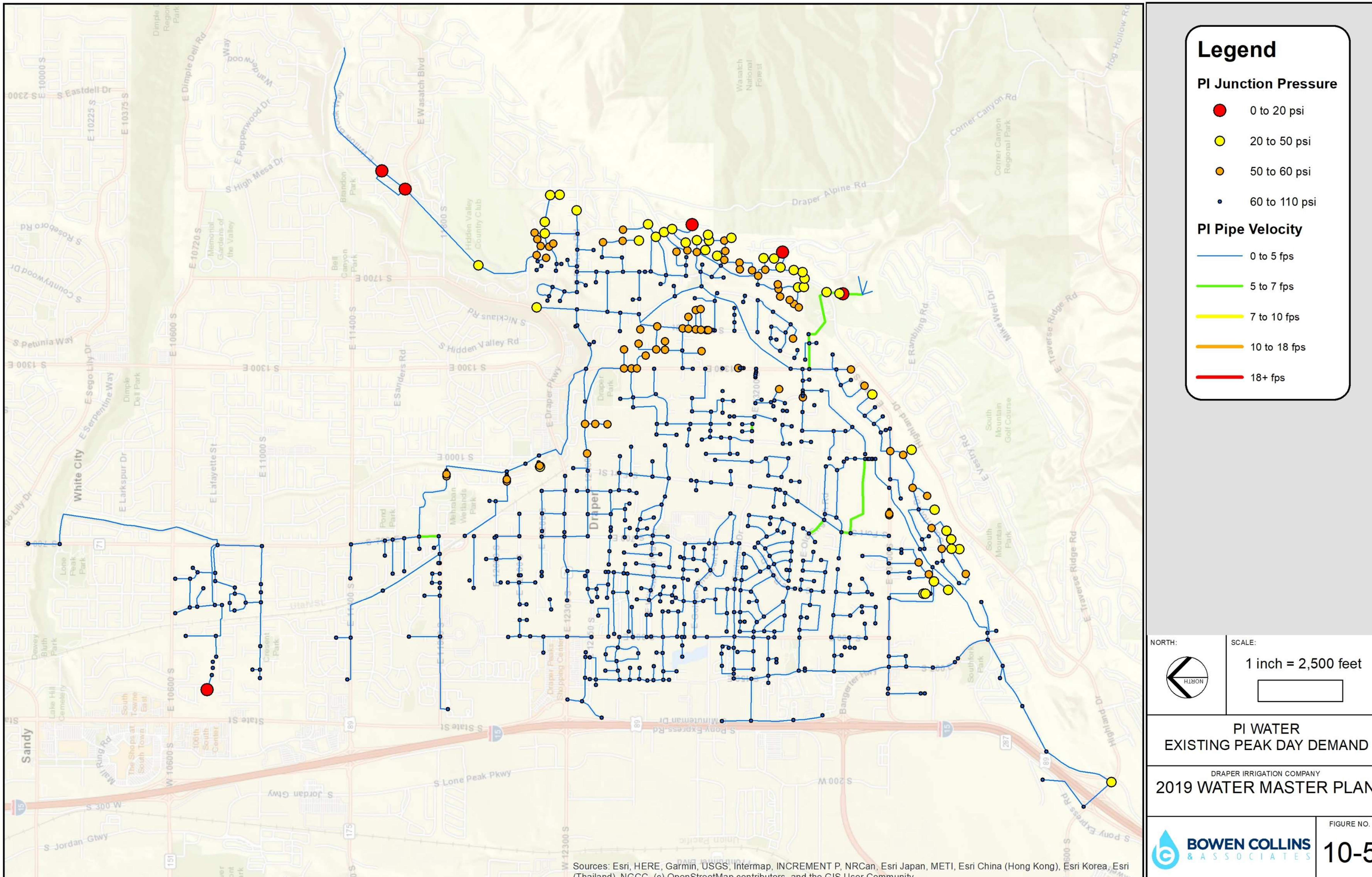
AVAILABLE FIRE FLOWS ON PEAK DAY OF DEMAND

DRAPER IRRIGATION COMPANY

2019 WATER MASTER PLAN

BOWEN COLLINS & ASSOCIATES

FIGURE NO. 10-4



P:\Water Pro\093-19-05 Culinary Master Plan\GIS\Figures\Figure 11-4 PI Peak Day.mxd dschriner 3/25/2020

CULINARY DISTRIBUTION IMPROVEMENTS

Table 10-1 shows a complete list of recommended improvements. These improvements are based on discussions with Company personnel and water modeling results. An electronic GIS file showing the locations of these recommended improvement projects is maintained by BC&A and shared with DIC for future reference and planning purposes.

Table 10-1
Overall List of Recommended Culinary Capital Improvement Projects

Project Number	Project Name/Description	Reason for Project
C1	Water Treatment Plant Membrane Upgrades	General System Maintenance
C2	Demolition of 500,000 Gallon Tank	General System Maintenance
C3	Highland Drive - New 10" PRV Vault connected to 24" Line	High Peak Day Pressures
C4	New 10" Meter/Modulating Valve Connection to Draper City at I-15 Stub	Redundancy
C5	Disconnect, Cap and Abandon 6" Line at 1162 E and Ranchero Dr	Maintenance Access
C6	Bore Under Tracks at 800 E and 11955 S	Fireflow, Redundancy
C7	Portable Generator for Traverse Ridge Pump Station and Valla de Villa Well Pump (approx. 300kW)	Redundancy
C8	Replace Existing 8" PRV with 12" PRV with 8” Bypass into Walmart Zone	Fireflow, Velocity
C9	New 8" Meter/PRV Connection to Sandy City	Redundancy
C10	New 2" Line and Booster Pump in Existing Corner Canyon Vault to Supply Steeple Chase	Redundancy
C11	Pioneer Rd - Upsize 8" to 10" Line from Tracks to 1300 E	Age, Upsize
C12	Pioneer Rd - Replace 10 " Line from 1745 E to 1840 E	Age
C13	1300 E - Replace 10" Line from 13400 S to 13800 S	Age
C14	800 E - Replace 8" Line from 12300 S to 12000 S	Age
C15	12100 S - Upsize 6" to 8" Line from 700 E to 500 E	Age
C16	12200 S - Replace 8" Line from 700 E to 600 E	Age, Upsize
C17	1840 E - Replace 10" Line from Pioneer Rd to 12200 S. Downsize Deadend 10" to 8" Line from 12200 S to 12100 S.	Age
C18	1700 E - Upsize 6" to 8" Line from Pioneer Rd to 12500 S	Age, Upsize
C19	12500 S - Upsize 6" to 8" Line from 1565 E to 1700 E	Age, Upsize

Project Number	Project Name/Description	Reason for Project
C20	Fort St - Upsize 6" to 8" Line from 13800 S to Stokes Ave & Canyon Breeze - Upsize 4" and 6" to 8" from Fort St to 970 E	Age, Upsize
C21	980 E – Switch Service Lines from 8” to 14” Main Line and Abandon 8” Main Line from Pioneer Rd to 12300 S	Age
C22	12300 S - Replace 8" Line from 800 E to 980 E	Age
C23	12700 S - Upsize 6" to 8" Line from 1565 E to 1700 E	Upsize
C24	13400 S - Upsize 4" and 6" to 8" Line from 1100 E to End of Cutler Cove	Age, Upsize
C25	850 E - Disconnect, Cap and Abandon 4" Line in Backyard. Complete After Project C20	Fireflow, Upsize
C26	Traverse Ridge Rd - Replace Existing 6" Draper City Connection with 12" Meter/Modulating Valve Connection	Maintenance Access
C27	Stokes Ave - Abandon Second Main Line from 500 E to 570 E	General System Maintenance
C28	Emergency Power Quick Connect on Cove at Bear Canyon Pump Station	Redundancy
C29	Traverse Ridge - Upsize 10" to 14" from Draper Heights Way to Steep Mountain Dr	Velocity (7+ fps)
C30	Rocky Knoll Lane - Upsize 8" to 12" from Steep Mountain Drive to Drive of Steep Mountain Zone	Velocity (10+ fps)
C31	Henry Day Rd/Vestry Rd - Upsize 12" to 14" from Vestry Road Roundabout to Debrian Way	Velocity (7+ fps)
C32	Running Bear Lane - Upsize 8" to 12" and 10" to 14" from Springdale Way to Private Yard Behind House	Velocity (7+ fps)
C33	1000 E - Upsize 8" to 10" from 1220 South to 12250 South	Velocity (7+ fps)
C34	Draper Parkway - Upsize 14" to 16" from Draper Gate Dr to 1150 East	Velocity (7+ fps)
C35	HV Golf Course - Upsize 14" to 16" from Relation Street to 1840 East	Velocity (7+ fps)
C36	2900 East - Upsize 24" to 30" from 11600 South to Cortina Crest Drive	Velocity (7+ fps)
C37	Rambling Road - Upsize 14" to 16" from Magic Wand to Fairway Knoll	Velocity (7+ fps)
C38	13200 South - Upsize 12" to 14" from 1185 East to 1020 East	Velocity (7+ fps)
C39	Vintage View Court Hydrants	Fireflow
C40	Maple Park Ct, Wild Maple Ct	Fireflow
C41	Haven Crest Rd	Fireflow
C42	Travel Drive	Fireflow

Project Number	Project Name/Description	Reason for Project
C43	Point Hills Cove	Fireflow
C44	Molasses Mill Dr	Fireflow
C45	New Saddle Rd	Fireflow
C46	Esther Ann Cir	Fireflow
C47	Vestry/Annie Lace Way	Fireflow
C48	Burning Oak Dr	Fireflow
C49	13400 South, Cutler Cove	Fireflow
C50	13450 South	Fireflow
C51	Minuteman Dr and 12500 South	Fireflow
C52	Constanza Way	Fireflow
C53	Iron Horse Pl	Fireflow
C54	Country Oaks Lane	Fireflow
C55	1130 East and Pioneer Rd	Fireflow
C56	800 East at 11955 South	Fireflow
C57	Canyon Vine Zone	Redundancy
C58	Little Valley Zone	Redundancy
C59	Vintage View Zone	Redundancy
C60	Burning Oak Zone	Redundancy
C61	Aintree Zone	Redundancy
C62	Steep Mountain Zone	Redundancy
C63	Deer Run Zone	Redundancy
C64	Kmart Zone	Redundancy
C65	Walmart Zone	Redundancy
C66	Cove at Bear Canyon Zone	Redundancy
C67	Adobe School Zone	Redundancy
C68	Cove at Bear Canyon Pump	Low Pressure (<50 psi)
C69	Grizzly Hollow Cove	High Pressure (150+ psi)

Project Number	Project Name/Description	Reason for Project
C70	Highland Drive and 13200 South	High Pressure (150+ psi)
C71	Sage Hollow Drive	High Pressure (150+ psi)
C72	Vestry Road	High Pressure (150+ psi)
C73	Rambling Road	High Pressure (150+ psi)
C74	Annie Lace Way	High Pressure (150+ psi)
C75	Vista Valley Drive	High Pressure (150+ psi)
C76	Steep Mountain Drive	High Pressure (150+ psi)

Table 10-2 and Figure 10-6 show culinary system improvements that are recommended to occur within the next 10-year planning period with estimated costs. These improvements are based on discussions with Company personnel and water modeling results. In Figure 10-6 information is color coded based on the improvement type as defined below:

- Redundancy – These improvements include a variety of projects that improve system redundancy by either adding waterline loops, extra pumps, portable generators, emergency connections, etc.
- General System Maintenance – These improvements include items such as treatment membrane replacement, removal of an abandoned tank, and abandoning of unnecessary piping once other recommended projects are completed.
- Year Fire Flow – These improvements include upsizing existing pipes/valves or installing new pipes/valves specifically to improve fire flow availability in the system.
- Upsize – These projects were identified by the Company and modeling based on pipe that needed to be upsized to accommodate increased flow requirements.
- Age – These projects were identified by the Company based on pipe age and deterioration

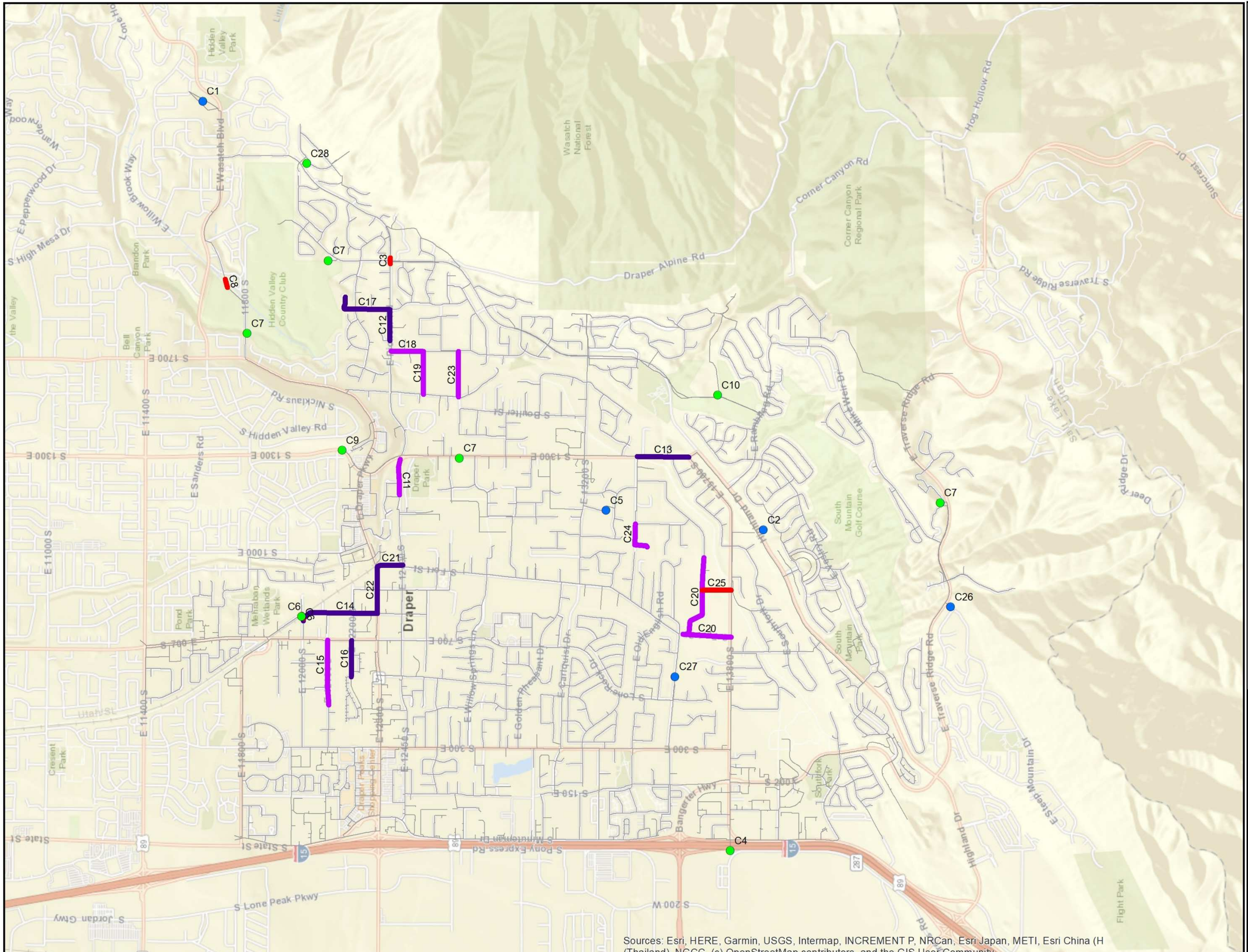
All costs presented herein should be considered to be Class 3 cost estimates based on the classifications described in the AACE International Recommended Practice No. 18R-97. AACE defines a Class 3 cost estimate as: having a level of project definition and engineering from between 10% and 40% with an end usage of a budget authorization or control purposes, with an expected cost estimate accuracy range of -20% to +30% of the costs presented. It is understood that we have no control over economic factors or unknown conditions that may have significant impact on the actual project costs. We cannot and do not warrant or guarantee that proposals, bids, or actual construction costs will not vary from the costs presented.

Table 10-2
Recommended Culinary Capital Improvement Projects to Implement in Next 10 Years

Project Number	Project Name/Description	Year to be Completed	Cost[1]	Reason for Project
C1	Water Treatment Plant Membrane Upgrades	2025	$1,600,000	General System Maintenance
C2	Demolition of 500,000 Gallon Tank	2028	$196,000	General System Maintenance
C3	Highland Drive - New 10" PRV Vault connected to 24" Line	2023	$237,000	High Peak Day Pressures
C4	New 10" Meter/Modulating Valve Connection to Draper City at I-15 Stub	-	-	General System Maintenance
C5	Disconnect, Cap and Abandon 6" Line at 1162 E and Ranchero Dr	2022	$23,000	General System Maintenance
C6	Bore Under Tracks at 800 E and 11955 S	2026	$194,000	Fireflow, Redundancy
C7	Portable Generator for Traverse Ridge Pump Station and Valla de Villa Well Pump (approx. 300kW)	2022	$160,000	Redundancy
C8	Replace Existing 8" PRV with 12" PRV with 8" bypass into Walmart Zone	2020	$109,000	Fireflow, Velocity
C9	New 8" Meter/PRV Connection to Sandy City	2020	$130,000	Redundancy
C10	New 2" Line and Booster Pump in Existing Corner Canyon Vault to Supply Steeple Chase	2022	$58,000	Redundancy
C11	Pioneer Rd - Upsize 8" to 10" Line from Tracks to 1300 E	2021	$264,000	Age, Upsize
C12	Pioneer Rd - Replace 10 " Line from 1745 E to 1840 E	2023	$216,000	Age
C13	1300 E - Replace 10" Line from 13400 S to 13800 S	2021	$310,000	Age
C14	800 E - Replace 8" Line from 12300 S to 12000 S	2022	$566,000	Age
C15	12100 S - Upsize 6" to 8" Line from 700 E to 500 E	2022	$383,000	Age
C16	12200 S - Replace 8" Line from 700 E to 600 E	2023	$231,000	Age, Upsize
C17	1840 E - Replace 10" Line from Pioneer Rd to 12200 S. Downsize Deadend 10" to 8" Line from 12200 S to 12100 S.	2023	$297,000	Age

Project Number	Project Name/Description	Year to be Completed	Cost[1]	Reason for Project
C18	1700 E - Upsize 6" to 8" Line from Pioneer Rd to 12500 S	2022	$205,000	Age, Upsize
C19	12500 S - Upsize 6" to 8" Line from 1565 E to 1700 E	2022	$253,000	Age, Upsize
C20	Fort St - Upsize 6" to 8" Line from 13800 S to Stokes Ave & Canyon Breeze - Upsize 4" and 6" to 8" from Fort St to 970 E	2020	$781,000	Age, Upsize
C21	980 E – Switch Service Lines from 8" to 14" Main Line and Abandon 8" Main Line from Pioneer Rd to 12300 S	2021	$263,000	Age
C22	12300 S - Replace 8" Line from 800 E to 980 E	2023	$289,000	Age
C23	12700 S - Upsize 6" to 8" Line from 1565 E to 1700 E	2021	$267,000	Upsize
C24	13400 S - Upsize 4" and 6" to 8" Line from 1100 E to End of Cutler Cove	2020	$146,000	Age, Upsize
C25	850 E - Disconnect, Cap and Abandon 4" Line in Backyard. Complete After Project C20	2022	$23,000	Fireflow, Upsize
C26	Traverse Ridge Rd - Replace Existing 6" Draper City Connection with 12" Meter/Modulating Valve Connection	-	-	General System Maintenance
C27	Stokes Ave – Abandon Second Main Line from 500 E to 570 E	2027	$67,000	General System Maintenance
C28	Emergency Power Quick Connect on Cove at Bear Canyon Pump Station	2025	$10,000	Redundancy

[1]All costs included in the above table are Class 3 level of accuracy as described earlier in this report. Costs were estimated based on current costs and projected forward based on assumed inflation rate of 3%.



Legend

- 10 Year Redundancy
- 10 Year General System Maintenance
- 10 Year Fireflow
- 10 Year Age and Upsize
- 10 Year Age
- Existing Culinary Pipes

NORTH:

SCALE:

1 inch = 2,500 feet

RECOMMENDED 10-YEAR CULINARY PROJECTS

DRAPER IRRIGATION COMPANY

2019 WATER MASTER PLAN

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FIGURE NO.

10-6

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PRESSURE IRRIGATION DISTRIBUTION IMPROVEMENTS

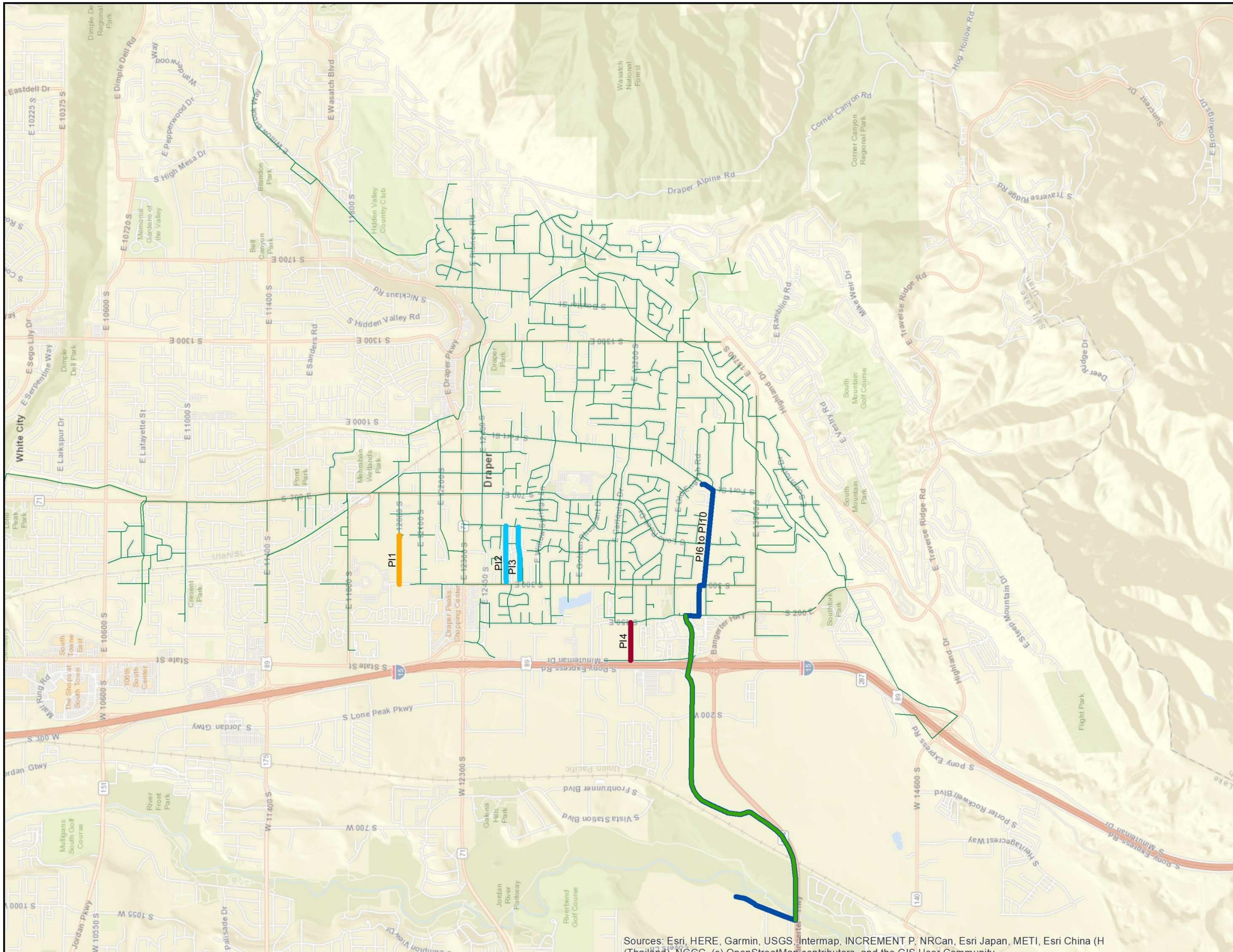
Table 10-3 and Figure 10-7 show the PI distribution improvements identified by Company personnel and determined to be a priority for the next 10 years. The projects are classified in the following groups:

- New Services – These improvements include expanding the existing system to provide PI service to new customers.
- Maintenance Access – These projects include relocating pipelines located in areas that are difficult to access for pipeline maintenance.
- Age – These projects were identified by the Company based on pipe age and deterioration.
- Metering – These projects include the installation of service meters on unmetered connections such that nearly the whole PI system is metered.
- Expand PI System Sources – These projects are needed to expand the current system to access new shallow groundwater and reuse water sources described in Chapter 3. These reuse/shallow groundwater projects and their costs were obtained from the 2018 Reuse and Shallow Groundwater Cost Feasibility Study completed by BC&A for the Company. The costs shown below reflect the Company's selection of Alternative 3 as presented in that study. The costs presented in that feasibility study were then adjusted for inflation when added to Table 10-3 depending on the timing of each phase.

Table 10-3
10-Year PI Distribution System Improvements

Project Number	Project Name/Description	Year to be Completed	Cost[1]	Reason for Project
PI1	12000 S - Install new 6" main from 300 E to 540 E	2026	$405,000	New Services
PI2	12600 S - Replace 6" Line from 300 E to 600 E	2026	$840,000	Maintenance Access
PI3	Cloverwood Cir and Clover Rd - Replace 6" Line	2027	$499,000	Maintenance Access
PI4	13200 S - Replace 6" Line from Minuteman to 150 E	2027	$316,000	Age
PI5	2019 PI Meter Project Costs (Phase 1, 2, 3)	2019, 2020, 2021	$1,345,000	Metering
PI6	Vancon Reuse Pipe Project	2019	$1,071,000	Expand PI System Sources
PI7	[2]Stand-Alone Reuse Project Well Investigation	2020	$200,000	Expand PI System Sources
PI8	[2]Stand-Alone Reuse Project Phase 1 Year 1	2024	$5,435,000	Expand PI System Sources
PI9	[2]Stand-Alone Reuse Project Phase 1 Year 2	2025	$16,793,000	Expand PI System Sources
PI10	[2]Stand-Alone Reuse Project Build-Out	2028	$10,439,000	Expand PI System Sources

[1]All costs included in the above table are Class 3 level of accuracy as described earlier in this report. Costs were estimated based on current costs and projected forward based on assumed inflation rate of 3%.
[2]See 2018 Reuse and Shallow Groundwater Cost Feasibility Study for detailed cost descriptions



Legend

- Age
- Installed Expand PI System Sources
- Expand PI System Sources
- Maintenance Access
- New Services
- Existing PI Pipes

NORTH:

SCALE:

1 inch = 3,000 feet

RECOMMENDED 10-YEAR
PI PROJECTS

DRAPER IRRIGATION COMPANY
2019 WATER MASTER PLAN

BOWEN COLLINS & ASSOCIATES

FIGURE NO.
10-7

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CHAPTER 11
CAPITAL IMPROVEMENT PLAN OVERVIEW

In coordination with Company personnel, a capital facilities plan has been developed to serve as a guideline for the budgeting and implementation of recommended system improvements over the next 10 years. The purpose of this chapter is to present a summary of recommendations regarding levels of funding for system maintenance, renewal, and capital improvement projects and reference specific capital improvement projects to be completed during the next 10-years.

CAPITAL IMPROVEMENT PLAN SUMMARY

The recommended capital improvements in the next 10 years for the Company's culinary water system are summarized in Table 10-2 and shown in Figure 10-6. The recommended capital improvements for the Company's PI water system are summarized in Table 10-3 and shown in Figure 10-7. The tables include a reason for each project along with the estimated construction cost for projects within the 10-year planning window. The tables include improvements to the conveyance systems, a new water reuse system, system redundancies, system rehabilitation, and other improvements. Routine rehabilitation and replacement of system components are not included in the table and should also be accounted for in future budgets. Other recommended projects that fall outside the 10-year planning period are listed in Table 10-1 and shown in GIS data files maintained by BC&A and shared with DIC.

RECOMMENDED CAPITAL IMPROVEMENT BUDGET

Part of establishing a 10-year capital improvement plan involves determining how much funding should be set aside each year for capital improvements. One way to identify a recommended level of funding is to consider system service life. As with all utilities, each component of a water system has a finite service life. If adequate funds are not set aside for regular system renewal, the collection system will fall into a state of disrepair and be incapable of providing the level of service that Company customers expect.

Based on the assumption that most water system components have an average service life of about 50 years, the Company should plan to spend about 2% of the total system value per year in order to prevent utilities from falling into disrepair. Future budgeting efforts should continue to carefully consider phasing in gradual replacement costs of existing system components. This will reduce the potential for having major unexpected projects and associated costs due to system pipeline and/or component failure.

10-YEAR CAPITAL IMPROVEMENT SCHEDULE

The 10-year capital improvement plan schedule with targeted years for each project is shown in Tables 10-2 and 10-3. These projects were prioritized through coordination with Company personnel to address the most important needs of the system while balancing available budget amounts.

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